INTRODUCTION

Background

1.1.1 The “Drainage Improvement in Northern New Territories – Package C” is one of the work packages recommended by the Drainage Services Department’s (DSD) Drainage Master Plan Study in the Northern New Territories (DMP Study). The Preliminary Project Feasibility Study (PPFS) completed in August 2001 under the DMP Study concluded that rapid developments in the study area have resulted in higher runoff and some existing drainage systems are inadequate in respect to flood protection capacities. Consequently, severe flooding occurs in these low-lying areas during heavy rainfall.

1.1.2 The proposed drainage improvements to be carried out involve the construction of the secondary and local drainage channels at Lung Yeuk Tau, Man Uk Pin and Loi Tung in the Indus Basin and, Lin Ma Hang in the Ganges Basin. The purpose of the proposed works is to alleviate recurring flooding problems in Lung Yeuk Tau, Man Uk Pin, Loi Tung and Lin Ma Hang areas by improving the secondary and local stormwater drainage systems in accordance with the recommendation of the DMP Study.

1.1.3 The proposed drainage improvement works (the Project), which are Designated Projects (DP) under the Environmental Impact Assessment Ordinance (EIAO), are assessed in an Environmental Impact Assessment (EIA) Report. The Project is DP under the EIAO by virtue of I.1(b) of Schedule 2, Part I of the EIAO with specific Designated Project Elements as listed below:

(i) Drainage channels at Man Uk Pin (MUP03, MUP04A, MUP04B and MUP05) that discharge into an area within 300m from the nearest boundary of an existing “Conservation Area” land used zoning [Item I.1(b)(vii) of Schedule 2 of EIAO].

(ii) Drainage channel at Lung Yeuk Tau (LYT04) that discharges into an area within 300m of an existing site of cultural heritage, the Entrance Tower of Ma Wat Wai at Ma Wat Wai, Lung Yeuk Tau [Item I.1(b)(ii) of Schedule 2 of EIAO].

(iii) Drainage channel at Lin Ma Hang (LMH01) that discharges into an area within 300m of a planned site of specific scientific interest (SSSI), Lin Ma Hang Stream, at Lin Ma Hang [Item I.1(b)(i) of Schedule 2 of EIAO].
1.2 Purpose of the EIA

1.2.1 The proposed works are Designated Projects (DP) under Schedule 2 Part I of the EIAO and require an environmental permit under the EIAO for its construction and operation. An application for an EIA Study Brief under section 5(1) of the EIAO was submitted by DSD, the Applicant, on 9 May 2002 with a Project Profile (No. PP-168/2002). Pursuant to section 5(7)(a) of the EIAO, the Director of Environmental Protection (the Director) issued an EIA Study Brief (ESB-103/2002) in June 2002 to the Applicant to carry out an EIA study.

1.2.2 The purpose of the EIA study is to provide information on the nature and extent of environmental impacts arising from the construction and operation of the proposed works and related activities taking place concurrently, and to contribute to decisions on the overall environmental acceptability of the Project.

1.2.3 The EIA provided an assessment of the potential environmental impacts associated with the Project, in relation to the issues specified in the EIA Study Brief No. ESB-103/2002 including air quality, noise, water quality, waste management, ecology, landscape & visual and cultural heritage.

1.3 Project Location and Scope

1.3.1 The drainage improvement works comprise the construction of drainage channels and associated works to improve the secondary and local drainage systems in Lung Yeuk Tau, Man Uk Pin, Loi Tung and Lin Ma Hang areas of the Northern New Territories.

1.3.2 The original proposed improvement to drainage channel LYT04 in Lung Yeuk Tau involves the construction of an open channel along the existing drainage box culvert which lies underneath the existing access road. The proposed open channel is to increase the conveyance of flow from upland catchment to the tributary of Ma Wat Channel near Ma Wat Wai so as to alleviate local flooding near Shung Him Tong. During public consultation in early 2006, the villagers of Shung Him Tong objected the original proposal of an open channel along private land. The design of LYT04 was changed from an approximately 100m long open channel to a similar length drainage box culvert underneath the existing access. Based on the revised scope and design of the LYT04, the proposed improvement works do not fall within the meaning of ‘drainage channels’ under Category I in Schedule 2 of the EIAO. Therefore the proposed works of LYT04 is not regarded as DP under the EIAO.
1.3.3 In summary, the scope of EIA study covers the Designated Project (MUP03, MUP04A, MUP04B, MUP05 and LMH01) in Man Uk Pin and Lin Ma Hang areas. The locations the DP channels are shown in Figure 1.

2. PROJECT DESCRIPTION

2.1 Description of the Project

2.1.1 The Project comprises the construction of drainage channels and associated works to improve the secondary and local drainage systems in the Man Uk Pin, Loi Tung (MUP03, MUP04A, MUP04B & MUP05) and Lin Ma Hang (LMH01) areas. The scale of the Project is shown below.

### Table 1
Scale of Proposed Drainage Works

<table>
<thead>
<tr>
<th>Channel</th>
<th>Proposed Works</th>
<th>Extent of Works</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Approximate Length</td>
</tr>
<tr>
<td>MUP03</td>
<td>U-channel (Diameter = 0.6m)</td>
<td>150m</td>
</tr>
<tr>
<td></td>
<td>Drainage pipe (Diameter = 0.6m)</td>
<td>12m</td>
</tr>
<tr>
<td></td>
<td>Box culvert connecting MUP05</td>
<td>28m</td>
</tr>
<tr>
<td></td>
<td>Trapezoidal channel with gabion walls and mattress lining</td>
<td>93m</td>
</tr>
<tr>
<td></td>
<td>Re-provision of crossings</td>
<td>One footbridge</td>
</tr>
<tr>
<td>MUP04A</td>
<td>Trapezoidal channel with gabion walls and mattress lining</td>
<td>163m</td>
</tr>
<tr>
<td></td>
<td>Drainage pipes (Diameter = 1.95m)</td>
<td>21m</td>
</tr>
<tr>
<td></td>
<td>Re-provision of crossings</td>
<td>Two vehicular bridges</td>
</tr>
<tr>
<td>MUP04B</td>
<td>U-channel (Diameter = 0.9m)</td>
<td>58m</td>
</tr>
<tr>
<td></td>
<td>Drainage pipes (Diameter = 1.35m)</td>
<td>138m</td>
</tr>
<tr>
<td>MUP05</td>
<td>Trapezoidal channel with gabion walls and mattress lining</td>
<td>287m</td>
</tr>
<tr>
<td></td>
<td>Trapezoidal channel with gabion walls and mattress lining</td>
<td>54m</td>
</tr>
<tr>
<td></td>
<td>Two-stage channel with existing natural river bed retained</td>
<td>554m</td>
</tr>
<tr>
<td></td>
<td>Trapezoidal channel with gabion walls and mattress lining</td>
<td>69m</td>
</tr>
<tr>
<td></td>
<td>Box culvert</td>
<td>50m</td>
</tr>
<tr>
<td></td>
<td>Re-provision of crossings</td>
<td>Five footbridges, four vehicular bridges</td>
</tr>
<tr>
<td>LMH01</td>
<td>Gabion channel and localised bank improvement</td>
<td>190m</td>
</tr>
<tr>
<td></td>
<td>Re-provision of crossings</td>
<td>Three vehicular bridges</td>
</tr>
</tbody>
</table>
Notes:
Other ancillary works include provision of inle t/outlet pipes, box culverts, maintenance ramps & accesses, re-provision of crossings and final landscaping works.

2.2 Channel Design

2.2.1 The proposed alignment generally follows the alignment of existing watercourses which is in line with the DMP Study to minimize resumption of private land and disturbance to the adjacent ground.

2.2.2 Reference has been made to the government’s technical circulars on protection of natural streamcourses and DSD Practice Note on Environmental Considerations for River Channel Design. The concept of ‘avoidance’ has been incorporated into the design to protect ecologically important streams such as streamcourse in Lin Ma Hang and upstream part of the streamcourse in Loi Tung. For the other streamcourse with ecological significant, ‘Two-stage channel’ design with natural river banks and beds retained has been proposed. Other environmental friendly design such as the use of gabion banks and mattress lining which will encourage accumulation of sediments and eventually recolonisation of the channel bed by benthic community, are also adopted.

2.2.3 Environmental benefits and dis-benefits of various alternative drainage design options along with various other constraints were carefully evaluated before deriving the proposed design.

2.3 Justifications and Benefits of the Project

2.3.1 The DMP Study investigated the need to improve secondary and local drainage systems to alleviate flooding in the study area. The proposed Project is expected to contribute to the relief of the present drainage problems that have repeatedly led to severe flooding in the study area resulting in danger to life, economic loss and disruption to everyday life.

2.3.2 The current standard of protection of the watercourses is very low, with the majority having a protection standard of 1 year or less. These watercourses were highlighted in the DMP Study as having insufficient channel capacity leading to localized flooding. Upon completion of the Project, the standard of protection will be increased to 1 in 10 years for village development.

2.3.3 The villagers in the Man Uk Pin and Lin Ma Hang areas of the Northern New Territories will be directly benefited by the proposed drainage improvement.

2.3.4 The layout plans of the proposed DP channels are shown in Figures 2 to 5.
2.4 Continuous Public Involvement

2.4.1 Public consultation including site meetings with the Green Groups, Sha Tau Kok Rural Committee, North District Council and village representatives were undertaken during the course of the EIA study. Overall, there were no objections to the final design and the relevant village representatives and Rural Committees supported the proposed Project as it would bring relieve to the flooding in the area and the proposed works are environmentally acceptable.

2.5 Project Programme

2.5.1 The construction programme of the Project will commence in end 2007 for completion by mid 2011.

3. SUMMARY OF THE EIA STUDY

3.1 Air Quality Impact

3.1.1 The air quality impact assessment has identified Air Sensitive Receivers (ASRs) within the Study Area. Potential works that may cause potential construction dust nuisance is also identified. Mitigation measures, as required by Air Pollution Control (Construction Dust) Regulation, are also highlighted. Provided that all the necessary mitigation measures are implemented, residual construction dust impact at nearby representative sensitive receivers is expected to comply with the Air Quality Objectives.

3.2 Construction Noise Impact

3.2.1 The use of powered mechanical equipment during the construction phase of this drainage project is expected to create noise nuisance, due to the close proximity between the works areas and noise sensitive receivers. Assessment indicates that such noise impacts can be mitigated to acceptable levels by appropriate measures, including the use of quiet plant, temporary noise barriers, restricting concurrent usage of equipment and the implementation of good site practices. The contractor will be required to implement these measures when powered mechanical equipment is used during the construction phase. With these mitigation measures in place, adverse residual noise impact would not be expected from the construction works.
3.3 Water Quality Impact

3.3.1 The current condition of the water bodies in the Study Area is relatively poor in the lower stretches with many of the streams receiving a variety of polluting inputs including livestock waste, and domestic wastewater from local villages.

3.3.2 The construction of the channels could adversely impact the water bodies through silt-laden site runoff, disturbance of stream sediment during excavation, concreting works, runoff from workshops & depot and increased sewage and wastewater resulting from the additional workforce on site. These impacts can be readily mitigated through the construction of a suitable drainage system with silt traps, good site management practices, careful working practices during excavation of the stream and proper sewage collection and disposal system. With the implementation of these measures, no adverse residual water quality impact from construction work is expected.

3.3.3 The major operational impacts are a net increase in pollutant loadings to Inner Deep Bay due to the removal of vegetation from channel banks. This vegetation acts as a natural pollutant trap and filter and this naturally occurring process will be removed. The impacts can be mitigated through the incorporation of gabions, grasscrete or similar vegetated areas into the drainage channel design. These channels will require regular maintenance to ensure effective functioning and prevent the excessive built-up of sediments. The routine maintenance of the channel may pose potential impacts if it is not properly executed. By following the recommended good practice guides during maintenance works, no adverse residual water quality impact during operation phase is expected.

3.4 Waste Management

3.4.1 Construction and demolition materials will inevitably be produced during the construction phase of the Project. Waste generated during construction works includes site clearance / demolition materials, excavated materials, chemical waste and general works waste. Waste types, quantities and timing have been estimated as far as possible and mitigation measures have been proposed in terms of avoidance-minimisation-reuse-recycling-disposal hierarchy. Potential for reuse of inert construction & demolition material (public fill) within the Project will be rigorously explored in an effort to minimise off-site disposal.

3.4.2 Provided that there is strict control of construction and demolition materials generated from construction works and that all arisings are stored, handled, transported and disposed of in accordance with the recommended mitigation measures, potential impact is not expected. The recommended waste management measures can be enforced by incorporating them into an
environmental management plan as part of the contract document.

3.4.3 Waste generated during operational maintenance is expected to be minimal. Proper waste management practices similar to those for construction impacts have been recommended.

3.5 Ecological Impact

3.5.1 The proposed works at MUP03 and MUP04B would have no significant ecological impacts even in the absence of mitigation measures because they are existing roadside concrete lined drainage systems.

3.5.2 Proposed works at LMH01 were predicted to have minor construction phase impacts on fauna of conservation importance in the absence of mitigation. However, these can be fully mitigated by restricting works to the dry season between November and March in the coming year and implementing site management practices. With these measures in place potential impacts are considered to be very small and acceptable.

3.5.3 Proposed works at MUP04A were predicted to have low to moderate permanent adverse impacts on a stream and adjacent area of long-inactive agricultural land. However, all impacts will now be avoided by not channelising the upper section of this stream.

3.5.4 Proposed works at MUP05 were predicted to have moderate and adverse impacts on a natural streamcourse with natural bed, banks and riparian corridor. Substantial design changes in terms of ‘Two-stage channel’ with natural stream banks and beds retained which are in accordance with the advice contained in ETWB and DSD Technical Circulars and DSD Practice Note have been adopted. These environmental friendly channel designs along with site management measures and tree planting will significantly reduce the predicted impacts to an acceptable level.

3.5.5 With these avoidance, minimization and mitigation measures in place, all adverse ecological impacts of the project on MUP05 would be eliminated or reduced to low and acceptable level. Low adverse impacts on riparian vegetation are unavoidable but would be fully mitigated in time and are considered acceptable in the overall context of the project.
3.6 Landscape and Visual Impact

Landscape Impact

3.6.1 The landscape impacts on the landscape resources and character of MUP03, MUP04A, MUP04B and MUP05 are predicted to range from negligible to moderate, mainly due to the loss of the existing trees separating the existing road and channel sides. The retention of at least one natural riverbank side and the existing riverbed in MUP05 and minimizing the works at MUP04A have reduced the landscape impact largely. The incorporation of landscape mitigation measures through retention of natural riverbed and banks, tree planting alongside channels, the planting of embankment and toe zone plant mixes would lessen the landscape impacts to negligible to slight.

3.6.2 The landscape impacts on the landscape resources and character of LMH01 are predicted to range from slight to negligible adverse. The incorporation of landscape mitigation measures through planting of embankment plant mixes would lessen the landscape impact to negligible overall. Demolishing and reconstruction of vehicular crossing is expected to have a slight positive impact on Residential Rural Fringe through the improved access.

Visual Impact

3.6.3 The unmitigated visual impact of the Project on Visual Sensitive Receivers (VSRs) at MUP05 is predicted to be significant adverse, due to the loss of the roadside and drainage channel trees and surrounding vegetation and the partial widening of the existing channel, in close proximity to the residential amenities such as a recreational park. However, in the other areas of MUP05, MUP04A, MUP04B and MUP03, the unmitigated visual impacts are negligible or slight.

3.6.4 The unmitigated visual impact of the Project on VSRs at LMH01 is predicted to be negligible and slight adverse. The demolishing and reconstruction of vehicular crossings may have beneficial visual impacts as the newly constructed crossings are expected to be more visually acceptable.

3.6.5 It is predicted that, through the incorporation of the proposed mitigation measures, adverse visual impacts can be further reduced to negligible to slight in most cases. For MUP05, sufficient screen tree planting alongside the channel and embankment planting are expected to reduce the visual impacts after mitigation to slight adverse impacts.

3.6.6 Overall, the drainage improvement in the Project within a flat disturbed landscape is considered to be acceptable with the implementation of mitigation measures recommended in the EIA.
3.7 Cultural Heritage Impact

3.7.1 The proposed drainage works will have no adverse impact on archaeological resources in either the construction or operational phases. The majority of built heritage features recorded in the survey will also not be adversely impacted. Potential impacts to a stone terrace wall were identified only for the construction phase of the project in the Lin Ma Hang Study Area and appropriate mitigation measures have been proposed to negate the identified impacts. No operational phase impact on the built heritage features is expected.

3.8 Environmental Monitoring and Audit

3.8.1 Mitigation measures have been recommended in the EIA Report to mitigate potential adverse impacts from the construction and operation phases of the Project. Based on these recommendations, Environmental Monitoring and Audit (EM&A) requirements have been established.

3.8.2 An EM&A programme will be set up and implemented to ensure compliance with the mitigation measures recommended in the EIA Report, to assess the effectiveness of the recommended mitigation measures, and to identify any further need for additional mitigation measures or remedial measures.

3.8.3 To ensure that the environmental performance of the works meet all relevant legal and contractual requirements, the contractor will be required to prepare and implement an Environmental Management Plan, which details the approach that the contractor is to adopt in managing and controlling potential environmental impact from construction activities for this Project.
OVERALL CONCLUSIONS

4.1.1 Based on the findings of the EIA Study, the Project would not cause any adverse environmental impacts to the concerned Conservation Area (for MUP03, MUP04A, MUP04B and MUP05) and the planned SSSI i.e. Lin Ma Hang stream (for LMH01). The residual impacts during construction are considered acceptable. Residual operational phase impacts will also be acceptable.

4.1.2 In summary the EIA concludes that there are no unacceptable environmental impacts associated with the construction and operation of the proposed secondary channels (MUP03, MUP04A, MUP04B, MUP05 and LMH01) provided that all the legislation, guidelines and recommended mitigation measures are followed. The EIA has fully met the requirements of the Technical Memorandum on EIA Process and the EIA Study Brief.

END OF TEXT