

1 INTRODUCTION

1.1 Background

The Drainage Services Department (DSD) completed the “Stormwater Drainage Master Plan (DMP) Study in Tsuen Wan, Kwai Chung and Tsing Yi” in July 1999. In that Study it was identified that the drainage systems in Tsing Yi could meet the current flood protection standard in general, but not the drainage systems in Tsuen Wan and Kwai Chung. A series of drainage improvement works including the “Drainage Improvement in Tsuen Wan and Kwai Chung – Tsuen Wan Drainage Tunnel” (The Project) and the “Drainage Improvement in Tsuen Wan and Kwai Chung – Urban Drainage Improvement Works” were proposed, and subsequently DSD commissioned a Preliminary Project Feasibility Study (PPFS) for “Drainage Improvement in Tsuen Wan and Kwai Chung – Package A, Tsuen Wan Drainage Tunnel” which was completed in April 2000.

The PPFS concluded that the construction of a tunnel of an internal diameter of 6.5m and length 5.35km should be implemented to alleviate the flooding risk in Tsuen Wan and Kwai Chung. At the end of October 2002, Mott Connell Limited (MCL) was commissioned by the Drainage Services Department under Agreement No. CE 80/2001 (DS) to carry out the investigation and preliminary design for the “Drainage Improvement in Tsuen Wan and Kwai Chung – Tsuen Wan Drainage Tunnel” (The Project).

The primary objective of the Project is to develop an optimum preliminary design of the proposed tunnel and associated drainage structures based on the recommendations of the Preliminary Project Feasibility Study Report (PPFS), the Stormwater Drainage Master Plan Study in Tsuen Wan, Kwai Chung and Tsing Yi (DMP) and the results of the various investigations to be carried out under this Assignment. This Environmental Impact Assessment (EIA) is a key submission of the project and has been prepared in conjunction with other design teams including the drainage, geotechnical and landscape teams.

A plan showing the proposed drainage improvement works, which comprise a tunnel and associated intakes and outfall structures is provided as **Figure 1.1**. The alternative locations of the intakes I-2 and I-3 are shown in **Figures 1.2** and **1.3** respectively.

The scope of construction works for the tunnel development comprises:

- 5.13km drainage tunnel system between Kwai Chung and Yau Kom Tau (reduced from 5.35km during preliminary design);
- provision of three Intake locations:
 - i. Intake I-1: Kwai Chung, adjacent to the junction of Wo Yip Hop Road and Shing Mun Road;
 - ii Intake I-2: At Lo Wai, adjacent to Lo Wai Road;
 - iii Intake I-3: At Tso Kung Tam, about 350m off Route Twist.
- provision of Outfall O-1: Yau Kom Tau, underneath the existing Castle Peak Road; and
- provision of associated environmental mitigation measures.

In October 2002, DSD appointed Mott Connell Limited (MCL) to carry out the investigation, preliminary design and Environmental Impact Assessment (EIA) for the Drainage Improvement to Tsuen Wan and Kwai Chung – Tsuen Wan Drainage Tunnel (The Project). This report presents the findings of the Environmental Impact Assessment (EIA) which was carried out as an integral part of the Project and makes reference to other related documents and reports which were also prepared under the auspices of this Project.

The justification for the project as stated in the Approved PPFS document is reiterated below:

Justification for Project:

The study area, with a population in excess of 700,000, is currently served by an existing stormwater drainage system which has been in place for 30 years or more. The existing system is principally drained by large decked nullahs which are effectively large shallow culverts. The nullah invert at its outfall is invariably below sea level and large lengths of the nullahs are permanently submerged which leads to siltation and reduction of effective cross sectional area. The nullahs not only accept large flows from the upland catchment but also the ever-increasing runoff from the expanding urban area with increased impermeable surfaces.

Due to extensive urbanisation and rapid developments of the area including massive reclamation, there have been numerous modifications and extensions on a piecemeal basis to the existing stormwater drainage system including extension and decking of existing main nullahs. The system is unable to meet the current flood protection standards and flooding occurs during severe rainstorms. Hydraulic analyses undertaken in the DMP show that the trunk drains in the Tsuen Wan and Kwai Chung areas are grossly under-capacity. As a result, the areas have a flood protection level of between 10 to 20-year return period in general.

Intense rainfall events have led to the surcharge of the main nullahs in the past and have resulted in flooding. In one such storm event in the recent year (the 8th May 1997 storm which had been defined as a 20-year return period event), the storm caused the main nullahs to surcharge and flooding in Tsuen Wan and Kwai Chung.

Under the study, the hydraulic performance of the drainage system in the Study Area was assessed, with drawings highlighting the parts of the drainage system with hydraulic deficiencies under various rainstorm return periods in accordance with the Stormwater Drainage Manual (SDM). The DMP study revealed that under the current development levels all the trunk drains and few branches in Tsuen Wan and Kwai Chung do not meet the current SDM standard. The Tsing Yi drainage system was found to meet the current flood protection standard in general.

Subsequently, improvement options to alleviate flooding problems in Tsuen Wan and Kwai Chung were developed and evaluated. Based on these improvement options, flood extent maps were compiled to determine the extent of flooding which will occur in the existing system and compare that with the amount of flooding which will occur if different improvement options are implemented.

A benefit-cost analysis was also undertaken to compare the various capital schemes by defining the anticipated cost of the proposed options and the benefit (i.e. the reduction in flood losses) which will be derived from the proposed schemes. The key objective of the benefit-cost analysis was to recommend the best and most cost-effective option to solve the flood problems in the study area on a long-term basis.

The benefit-cost analysis concluded that the tunnel option would provide the best benefit-cost of the options considered. The results of the analysis revealed that the cost of potential damages caused by flooding would be about 1.6 times the cost of the proposed tunnel works.

In addition, although flood damage can be quantified in monetary terms, flooding can also result in situations involving intangible costs. Flooding may induce potential long-term risks or adverse effects on the life and well being of the community. It may also tarnish Hong Kong's international image. These intangible costs concerning quality of life, social and community benefit, environment and reputation are equally important and must be taken into account in the decision making.

The DMP study therefore recommended a drainage tunnel system for the study area on a long-term basis. This project has been justified on technical and economic grounds.

The DMP study indicated that flooding of the urban drainage system are directly related to the runoff flows from the upland catchment, and that this amount of flooding will be significantly reduced if the above tunnel is constructed.

With the tunnel system, the flood protection level of trunk drains in most of the Tsuen Wan and Kwai Chung areas will be improved to a 200-year return period and it entirely avoids works in the trunk drains in developed urban areas of heavy traffic and congested underground utilities.

A Value Management Workshop involving a cross section of government departments has been conducted in April 1999 where a group consensus was reached that the tunnel option was the best solution for the areas' flooding problem.

Consequences of not proceeding :

Results of the hydraulic performance analyses conducted under the DMP Study show that much of the urban areas in Tsuen Wan and Kwai Chung are currently subject to risk of flooding during very heavy rainstorms.

It should be noted that the location, extent and possible depth of flooding will be very much dependent on many highly variable factors such as distribution of rainfall intensity during a heavy rainstorm event; gullies and stormwater inlets that may become blocked by rubbish; the extent of ground saturation; silting of drains from previous heavy rainstorms; adverse effects on drainage patterns by landslides etc. However, certain locations have been identified as being at very high risk of flooding. For example, during a rainstorm of about a 20-year return period, there is a possibility that flooding up to a depth of about 0.3m may occur in area bounded by Castle Peak Road, Tsuen Wan Road and Texaco Road North in Tsuen Wan district; and localized area in Kwai Chung. Flooding may well be deeper in other locations along Kwai Chung Road from Kwai Fong to Sheung Kwai Chung.

Localised flooding may also occur at isolated locations in other areas. In addition, stormwater overflowing from trunk drains in steep roads may flow over the road surface with such a high velocity that it would be hazardous to life and limb. Examples include Cheung Wing Road and Kwok Shui Road.

During an even more severe rainstorm of, say, a 50-year return period, both the extent and depth of flooding would obviously increase, particularly in Cheung Wing Road towards Kwai Chung Road down to Kwai Foo Road and adjacent streets and in Lei Pui Street and Wai Tsuen Road where there is the potential flood depths of about 1 metre.

In summary, with the existing drainage system at its current capacity levels, there is the risk of flooding during very heavy rainstorms in many of the urban areas in Tsuen Wan and Kwai Chung. The potential consequences of such flooding include:

1. Risk to life and limb
2. Damage to property
3. Nuisance to the public
4. Disruption to normal economic activity
5. Disruption to traffic
6. Psychological stress
7. Loss of reputation

If the project does not proceed, then these risks to the community will continue.

There are no simple, small-scale works that could be implemented to reduce these risks. The only effective solution to provide adequate flood relief is to implement all the proposed works items included in this project. Even then, there may still be some localised flooding upto about 0.1m deep in Tsuen Wan, Kwai Chung and Tsing Yi during extreme rainfall events. To eliminate this residual flooding would require very much more substantial and disruptive works in these areas and the benefits achieved would not be worthwhile.

From the foregoing it was concluded that the form of the works would be less disruptive, and have less environmental impact and disturbance. On this basis the project proceeded as described in the following section.

1.2 Project History

In the July 1999, report on the “Stormwater Drainage Master Plan (DMP) Study in Tsuen Wan, Kwai Chung and Tsing Yi”, it was identified that drainage systems in Tsing Yi would be adequate to meet current flood protection standard in general, however drainage systems in Tsing Yi and Kwai Chung were not capable of achieving such standards.

The DMP recommended a series of drainage improvement works including the “Drainage Improvement in Tsuen Wan and Kwai Chung – Tsuen Wan Drainage Tunnel” (The Project)

and the “Drainage Improvement in Tsuen Wan and Kwai Chung – Urban Drainage Improvement Works”. A Preliminary Project Feasibility Study (PPFS) for “Drainage Improvement in Tsuen Wan and Kwai Chung – Package A, Tsuen Wan Drainage Tunnel” was undertaken and completed in April 2000 which provides the justification for the Project in its current form (i.e. tunnel and intakes).

The reasons for choosing the Recommended Option in the DMP were:

“The proposed tunnel is considered as the preferred option. The benefit-cost analysis undertaken for the major improvement options considered concluded that the tunnel option will be the cheapest to implement and the most effective in reducing flooding and flood damage costs, and will have the best value for money. Consequently, it was concluded that the tunnel option would provide the highest savings in flood damages over the construction costs of the works. The Value Management Workshop which involved a cross section of government departments also concluded that the tunnel option was the most cost-effective solution of government departments also concluded that the tunnel option was the most cost-effective solution for the areas’ flooding problem. In addition, the tunnel option would offer the following advantages:

- The characteristics of the large upland catchments in Tsuen Wan and Kwai Chung makes the interception of stormwater runoffs from the areas using the tunnel particularly effective in reducing flooding.
- Additionally, topography of the catchment areas allows for gravity flow in the tunnel system; therefore, no pumping is required.
- The tunnel entirely avoids the need to enlarge the main nullahs in urban areas; therefore, traffic disruptions and conflicts with congested underground utilities are significantly reduced.
- Due to the proposed location of the tunnel and the underground nature of the works, environmental-related issue arising from the tunnel works will be minimized and will be confined to the excavation works at the intake and outlet structures.
- Land requirements for the drainage tunnel will not be extensive and will be confined to the surface works at the intake and outlet structures. Only government lands are selected and no private land needs to be resumed.

The proposed urban drainage improvement works is considered to be necessary in supplement to the tunnel to resolve local hydraulic and structural deficiencies of the drainage system at these locations. These works are small in scale and will not cause excessive environmental and traffic disruptions.”

The aforementioned reports provided the basis for the Adoptive Review which was carried out by Mott Connell Ltd, and reported upon in 2003. The Adoptive Review presented a review of the scope and recommendations of the PPFS report as well as the findings, conclusions and recommendations of the Final Report of the DMP study.

Following the Adoptive Review, an Options Selection Study was conducted as part of the present commission. The Options Selection Study investigated alternative alignments for the drainage tunnel as well as possible locations for the associated intake/outfall structures, the objective being to determine the most favourable tunnel/intake/outfall option in order to

divert runoff into Rambler Channel bypassing Tsuen Wan urban area through an outfall located to the south of Yau Kom Tau.

The Options Selection Study also examined the possibility of maximising the upstream collection of runoff to increase the flood protection level of the urban area without the requirements of carrying out substantial drainage upgrading works in the congested urban area.

The Options Selection Study has also investigated the possibility of intercepting discharges into the existing box culvert along Kwan Mun Hau Street/ Luen Yan Street/ Ma Tau Pa Road to resolve local drainage issues. Another issue which was investigated was the opportunity of using the proposed tunnel to resolve the frequent flooding around the area of Belvedere Garden.

1.3 Environmental Impact Assessment Ordinance

This Project is a “designated project” (DP) under Schedule 2 (Part 1 Q.1) of the *Environmental Impact Assessment Ordinance (EIAO) (Cap. 499)* and an environmental permit (EP) issued under the EIAO is required for Project construction and operation.

In order to apply for an Environmental Permit an EIA must be undertaken in accordance with the requirements of the Study Brief issued by EPD in May 2001, under reference ESB-069/2001. Reference can be made to the full requirements of the Study Brief which is contained in **Appendix A**. In addition to the Study Brief the issues identified in the DMP Study, PPFS, Adoptive Review Report and Project Profile have also been taken into account.

The EIA has been conducted in accordance with the Study Brief, the Project Profile (No. PP-120/2001) and the criteria in the relevant sections of the Technical Memorandum on the EIA Process of the EIAO (hereinafter referred to as the TM). The EIA has identified, described, predicted and evaluated potential environmental impacts, mitigation measures and will consider the impacts of any feasible alternatives. The alternative options for the scheme as a whole are also contained in the report along with the justification for the Project.

The specific objectives of the EIA Study are listed in the Study Brief (Item 6.3.11.2) (ESB-069/2001), as follows:

- (a) to describe the proposed Project and associated works together with the requirements for carrying out the proposed Project;
- (b) to identify and describe the elements of the community and environment likely to be affected by the proposed Project and/or likely to cause adverse impacts to the proposed Project, including both the natural and man-made environment;
- (c) to identify and quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;
- (d) to identify any potential impacts from point and non-point pollution sources on the identified water systems and sensitive receivers, in particular water gathering grounds, during the construction and operation stages;

- (e) to identify and quantify any potential losses and damage to flora, fauna and wildlife habitats;
- (f) to identify any potential impacts to the historical, archaeological and cultural resources within the study area and propose measures to mitigate these impacts;
- (g) to propose the provision of infrastructure or mitigation measures so as to minimise pollution, environmental disturbance and nuisance during construction and operation of the Project;
- (h) to identify, predict and evaluate the residual (i.e. after practicable mitigation) environmental impacts and the cumulative effects expected to arise during the construction and operation phases of the Project in relation to the sensitive receivers and potential affected uses;
- (i) to identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the Project which are necessary to mitigate these environmental impacts and reducing them to acceptable levels;
- (j) to investigate the extent of secondary environmental impacts that may arise from the proposed mitigation measures and to identify constraints associated with the mitigation measures recommended in the EIA Study, as well as the provision of any necessary modification;
- (k) to design and specify the environmental monitoring and audit requirements, if required, to ensure the implementation and the effectiveness of the environmental protection and pollution control measures adopted; and
- (l) to consider feasible alternatives with a view to avoiding or minimising the potential environmental impacts to sensitive uses, and to compare the environmental benefits and dis-benefits of each of the different options and to provide reasons for selecting a preferred option and to describe the part environmental factors played in the selection.

1.4 Documents Reviewed

Particular attention has been given to the following documents when undertaking this EIA Assignment :

- Final Preliminary Environmental Review, Preliminary Project Feasibility Study for the Reconstruction and Improvement of Tuen Mun Road (potential interfacing project; it is required for the cumulative impact assessment);
- Final Preliminary Environmental Review Report, Feasibility Study on Modernization of Tsuen Wan Water Treatment Works;
- DMP Study in Tsuen Wan, Kwai Chung & Tsing Yi – Final Report; Volume 1 - Main Report & Summary of Recommendations; Volume 2 - Hydraulic Assessments; Volume 3 - Structural and Condition Assessments; Volume 4 - Project Appraisal; Volume 5 - Miscellaneous Items;
- Preliminary Project Feasibility Study Report for Drainage Improvement in Tsuen Wan, Kwai Chung and Tsing Yi – Package A: Tsuen Wan Drainage Tunnel;

- The computer models including the Macro-Model, Micro-Model and Overland Flow Model produced under the DMP study;
- Working Papers (WP) and Technical Notes for the DMP study in Tsuen Wan, Kwai Chung & Tsing Yi; WP1 - Hydraulic Design Criteria; WP2 - Reservoir and Catchment Overflows Analyses; WP3 - Model Approach and Schematics; WP4 - Asset Inventory and Management System Functional Description; WP5 - Review of DMP Strategies; WP6 - Structural Performance Assessment; Technical Note - Physical Hydraulic Model; Technical Note No.2 - Model Verification; Interim Report (Feb. 1998); and
- Supplementary Report to the Interim Report (Flood Extent).

1.5 Inter-Relationship with Other EIA Studies

A number of previous, ongoing and proposed EIAs, feasibility and engineering studies are relevant to the Project including:

- EIA-062/2001 Demolition of Kwai Chung Incineration Plant Civil Engineering Department (Atkins China Ltd., 2001); and
- EIA-025/1999 Route 9 between Tsing Yi and Cheung Sha Wan Major Works Project Management Office, Highways Department (Atkins China Ltd., 1999).

1.6 References

Environmental Impact Assessment Ordinance (Cap. 499).

Maunsell Consultants Asia Ltd, (1999) *Stormwater Drainage Master Plan Study in Tsuen Wan, Kwai Chung and Tsing Yi*, Unpublished Report.

Maunsell Consultants Asia Ltd (2000) *Preliminary Project Feasibility Study for Drainage Improvement in Tsuen Wan and Kwai Chung – Package A, Tsuen Wan Drainage Tunnel*, Unpublished Report.

Mott Connell Ltd. (2003) *Agreement No. CE5/2002 (DS) Drainage Improvement in the Northern New Territories – Package B Investigation, Design and Construction: Adoptive Review Report*, Unpublished Report.