

EXECUTIVE SUMMARY

1. INTRODUCTION

1.1 Background to the Study

1.1.1 Surface water falling within the northern catchments of Hong Kong Island is now being intercepted by a series of existing drainage pipes and culverts running through the urban area and is ultimately discharged at several locations into Victoria Harbour via the northern coastline of Hong Kong Island. The existing system is already under capacity. Flooding and hazardous overload water flows can occur in extreme conditions. However, much of the catchment¹ is outside the urban area and the objective of the drainage improvement scheme studied here is to intercept surface water before it enters the urban area and direct it to an outfall on the west-side of Hong Kong Island. This will reduce the flows into the lower catchment and reduce flooding frequency in the urban area.

1.1.2 The study under Agreement No. CE91/95 identified a tunnel alignment running from a tunnel portal close to the site of the Haw Par Mansion in Tai Hang and following a sinuous route beneath urban areas in Jardines Lookout and Mid Levels ([Figure 1](#)). A discharge portal at the west end of Hong Kong Island at Pokfulam, north of the Cyberport site was identified. Intakes are identified on drainage paths intersecting the alignment to intercept flows and direct them to the tunnel. It is envisaged that the tunnel would be formed using two tunnel boring machines (TBM) from each of the portals. Since a portion of the proposed tunnel route is encroaching into Pok Fu Lam, Lung Fu Shan, Tai Tam and Aberdeen Country Parks, the project is classified under Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO) (Cap. 499) as designated project. The investigation under Agreement No. CE 25/2002 (DS) commenced in October 2002 and includes this EIA Study.

1.2 Purpose and Scope of EIA

1.2.1 The proposed drainage tunnel is a Designated Project (the Project) under Schedule 2 of the EIAO (Cap. 499) and requires an environmental permit under the EIAO for its construction and operation.

1.2.2 An Environmental Impact Assessment (EIA) Study has been undertaken for the Project to provide information on the nature and extent of potential environmental impacts arising from the construction and operation of the proposed Project and related activities taking place concurrently, and to contribute to decisions on the overall environmental acceptability of the Project.

1.2.3 The EIA provides a detailed assessment of the potential environmental impacts associated with the Project, in relation to the issues specified in the EIA Study Brief No. ESB-070/2001, including air quality, noise impact, water quality, marine and terrestrial ecology, fisheries, waste management, landscape and visual impact, cultural heritage implications and hazard to life.

¹ The catchment is enclosed by the ridgelines running between Jardines Lookout in the east through Mount Butler, Mount Cameron, Mount Gough and the Peak.

2. PROJECT DESCRIPTION

2.1 Location and Scale of Project

2.1.1 The proposed 10.5km long drainage tunnel is located in North Hong Kong. It stretches from Tai Hang in the east to the Cyberport in the west. It utilises 35 drop shafts to collect and divert upland runoff to the east-west running stormwater tunnel via a series of connecting adits between the drop shafts and the main tunnel. The diverted runoff will be conveyed via the tunnel to the sea at the western portal, which is located just to the north of Cyberport.

2.2 Construction and Operational Activities

2.2.1 The construction period for the whole Project is about 55 months. The major activities involved during the construction phase of the Project are excavation of tunnels, drop shafts and adits. The main tunnel is proposed to be constructed by tunnel boring machines from each portals. The adits connecting main tunnel and intakes is proposed to be excavated by either blasting or mechanical method, depending on the ground conditions and the proximity of sensitive receivers. It will take about 43 months to complete the main tunnel and adit construction. The raising boring method or reversing circulation method is proposed to be adopted for intake shaft construction. The period of construction for each intake shaft is proposed to be about 8 months but 12 months for the deepest intake shaft. Majority of the excavation material is proposed to be transported via the two tunnel portals for disposal off site. The average production rate of excavation spoil is about 500 m³ per day at both portals (one at each end of the main tunnel).

2.2.2 During the operation phase, the main on site activities are the operation and maintenance work of the main drainage tunnel, adits, intake structures and the ancillary facilities.

2.3 Project Programme

2.3.1 The construction of the Project is scheduled for commencement in mid 2007 for completion in end 2011.

3. ENVIRONMENTAL IMPACTS

3.1 Potential environmental impacts associated with the construction and operation phases of the proposed Project are summarized below:

Noise Impact

3.2 Potential construction noise impact is assessed for the Representative Noise Sensitive Receivers (NSR) at all of the intakes and both portals of the proposed drainage tunnel. The assessment results indicate that the noise level at most of the intakes and both portals will exceed relevant standard and noise mitigation measures will be required to reduce the construction noise impact to acceptable levels. Mitigation measures include adoption of quiet equipment, restriction of operation period, provision of temporary noise barriers and full noise enclosures at stockpile areas at Eastern Portal and covered conveyor systems for transportation of excavation spoil from the tunnel at both tunnel portals.

- 3.3 Due to the proximity of some NSRs to the works site, slight noise exceedances of relevant standard at several intake shaft locations are expected even after all possible mitigation measures including the use of quieter construction plant, re-scheduling the sequences of works, provision of noise barriers and adoption of different construction methods have been exhausted to minimise the noise impacts. Unavoidable residual impacts are predicated at six intake shaft locations, namely BR7(P), E7(P), E5(A)(P), W5(P), W8 and W12. The noise limit exceedance levels range from 1dB to 6dB mainly arising from surface breaking and rock drilling activities. The expected exceedance periods at each respective sites are less than 1 week (surface breaking) and 1 month (rock drilling) respectively. It is anticipated that residual impacts would be transient and localized even with the adoption of the best practical mitigation measures on site.
- 3.4 Public support is essential for successful implementation of the project. To maintain an effective communication channel with the public, a 24-hour hotline system will be established by the Contractor to receive any enquiry and complaint lodged by the public in respect of the project. Upon receipt enquiry/complaint, the Contractor will investigate the causes of the incident and take the appropriate action to rectify the situation. Periodic news letters will also be distributed to the nearby residence, advising them the current progress, the schedule of works in future, the potential environmental impacts arising from the works and the corresponding mitigation measures.
- 3.5 By considering that the construction of the proposed drainage tunnel is already a means with least disruption to the public in alleviating the flooding problem in Northern Hong Kong Island, the short duration of the sensitive receivers experiencing the residual impacts is considered acceptable. During the operation phase, noise impacts are not expected from the proposed drainage tunnel.

Water Quality Impact

- 3.6 The water quality impacts during the construction phase include turbid runoff from excavation activities, chemical spillage and wastewater generation on site. With the implementation of the good site management and housekeeping practices, unacceptable water quality impacts during construction are not anticipated. Some of the recommended measures are listed as below:
- provide and maintain a well designed drainage system on site;
 - handle and dispose of wastewater with care to avoid contaminating the water resources (such as effluent generated from site is diverted to proper wastewater treatment device for treatment and disposal);
 - appropriate control of chemicals (such as provision of oil interceptors and no stockpile of excessive chemicals);
 - provide adequate sewerage facilities for site workers (such as provision of chemical mobile toilets); and
 - install silt curtains outside the works area during construction of temporary pier and outfall structures.
- 3.7 The water quality impact from the outfall of the proposed drainage tunnel during the operation phase in 2012 has been quantitatively assessed using a Particle Dispersion Model to simulate spreading, sedimentation and re-suspension of particulate matter to the marine sensitive receivers. The key sensitive receivers during the operation phase of the

proposed drainage tunnel are the seawater intakes, fish culture zone and sites of ecological interests within the study area.

- 3.8 A water quality model is developed to assess the water quality impact during the operation of the tunnel. 1 in 2 years and 1 in 50 years rain storm events are chosen for the simulation to represent the reasonable frequency and typical scenarios that may happen in Hong Kong respectively. The modelling results indicate that the predicted concentrations of suspended solids (SS), *E. coli* and salinity would generally satisfy the Water Quality Objectives (WQOs)/ambient water quality for 1 in 2 and 1 in 50 years rain storm events for all identified ecological sensitive sites and fish culture zones.
- 3.9 Notwithstanding the above, short term operation impact due to the SS is predicated at the planned WSD's Cyberport seawater intakes. The planned seawater pumping station could incorporate sensors to detect the SS level and increase its storage capacity to cater for situation when the seawater pump is shut down during SS exceedance. To alleviate the impact at sources, bar racks at the entrance of the intake structure and sand trap at the bottom of the intake shaft would be installed to collect debris, boulders and coarse sand. The sand trap will be most effective at low flow condition. Cleaning operation will be carried out in the watercourses above the intakes and within the tunnel system before the onset of every wet season to remove leaves and floating debris. A marine vessel may also be employed to collect leaves and floating debris flushing out from the tunnel on as needed basis. With the implementation of these recommended mitigation measures, residual impact is considered acceptable.

Ecological Impact

Terrestrial Ecology

- 3.10 Major habitats recorded within the study area include natural woodland, shrubland, fung shui woodland, urban plantation and stream/nullah. The proposed tunnel portal and intake structure construction would cause a permanent loss of 0.16 ha of woodland, 0.70 ha of urbanised/disturbed land, 0.04 ha of shrubland habitats and 85 m of natural stream. The temporary habitat loss would include 0.53 ha of woodland, 1.56 ha of urbanised/disturbed land, 0.11 ha of shrubland, 91 m of natural stream, and 384 m of nullah.
- 3.11 Direct impacts to terrestrial habitats would be limited in area and scattered among intake points and all outside the country park areas. Impacts of loss of urbanised/disturbed and shrubland habitat are considered minimal and minor respectively due to the limited ecological values of these habitats. As the losses of woodlands and natural streams are also of limited size and scattered, the construction impacts are ranked as minor and minor to moderate respectively. Compensation planting will be provided to compensate the woodland loss (1.5:1). Mitigation for the loss of stream habitat would be implemented to provide living space within the modified stream section at Eastern Portal for aquatic communities to develop as well as access to natural stream section.
- 3.12 The intake structures are designed to intercept the excess flow in the existing streams into the drainage tunnel during heavy rain storm events. During the normal circumstances, base flow in the affected stream is kept to maintain the ecological environment.

- 3.13 The drainage tunnel will be underground and the operation will not pose any observable impact to the surrounding habitats and the associated flora and fauna. The potential operation impact on habitat and terrestrial and aquatic fauna are ranked as minor.
- 3.14 As this project will cause limited terrestrial ecological impacts, with mitigation measures recommended the ecological impacts are considered acceptable.

Marine Ecology

- 3.15 A literature review of existing ecological conditions in the assessment area was supplemented by intertidal and subtidal field surveys of marine ecological resources at the outfall of western portal. The ecological values of the artificial intertidal and subtidal habitats are low. Construction of stilling basin will result in a permanent loss of about 50m² artificial intertidal habitat. The impact of the project works on these habitats is concluded to be low.
- 3.16 The construction of the outfall and stilling basin will also result in some loss of subtidal muddy bottom habitat. However, the size is small (approximate 625 m²) and the ecological value is low. No hard or soft coral colony was found during the survey and the affected area supported very little biota. This habitat loss is not expected to have a significant negative impact on the marine ecology. Residual impacts on habitat loss are acceptable.
- 3.17 Based on the water quality model simulation, the water quality impacts due to the operation discharge is predicted to be limited to a narrow strip along the western coast of Hong Kong Island. For all modelled scenarios (flood and ebb tide, 1 in 2 year and 1 in 50 years storm events), no exceedance to the WQO (suspended solids, *E. coli* and salinity concentrations) is identified at any of the recognized sites e.g. coral of marine conservation importance or coral sites. The construction and operation of the Project has no significant impacts on Chinese White Dolphin and Finless Porpoise, as their activity range lies in the areas to the west of and south of the project area respectively. A well-planned program of site practices should be able to maintain the marine ecology impacts in acceptable level. Therefore, specific ecological monitoring during both the construction and operation phases will not be needed.

Fisheries

- 3.18 Approximate 440m² shallow sea area would be occupied by the temporary berthing point. The construction period for the proposed drainage tunnel will be about 4 years. Thus, the area occupied by the berthing point would not be available for capture fisheries activities during this period. After completion of the tunnel construction works, the temporary berthing point will be removed.
- 3.19 A stilling basin will be constructed on the shore while a permanent armor rock panel (approximate 625m²) will be placed on the existing seabed just outside the outlet of the stilling basin. No dredging works will be carried out or needed during construction.
- 3.20 The 2000/2001 Port Survey identified that the catch arising from capture fisheries within the study area around the outfall area were the lowest in Hong Kong in terms of adult fish production and the value of production. There are only less than 50 fishing vessels

operated within the area, among them, less than 10 are over 15 m length. No fish fry collection has been recorded.

- 3.21 Due to low fisheries production, catch value and the small size of fishing ground being affected, no adverse impacts on fisheries would be anticipated. Moreover, as construction phase water quality impacts are considered short-term and localised in nature, no severe impacts to the marine communities in any Fish Culture Zone (FCZ) or Kong Sin Wan is expected. Mitigation measures for water quality during the construction phase have been detailed in the EIA report to ensure the construction impacts are under control.
- 3.22 The operation phase effluent would have limited impacts on marine water quality. However, the predicated results of the water quality model indicate that the magnitude of the changes in water quality and the extent of the affected area by the operation discharge are very limited and no exceedance to the WQO (suspended solids, *E. coli* and salinity concentrations) will occur on the water quality results at any of the FCZ. The impacts on fisheries resources and fish culture zones are not expected during operation phase of the proposed drainage tunnel.

Air Quality Impact

- 3.23 The construction dust impact assessment has identified the construction works that have potential to generate dust impact to the nearby Air Sensitive Receivers. The transportation of earth material for both portals is likely to be the dominant dust generation during the excavation of the construction stage. With implementation of the recommended dust suppression measures and backed up by a proper designed EM&A programme, the construction of Project is expected to comply with the Hong Kong Air Quality Objectives.

Cultural Heritage Impact

- 3.24 A total of 4 graded historical buildings were found within 50 m of the proposed works areas associated with the Project. These include: (a) Haw Par Mansion, the boundary wall and gateway of the Haw Par Mansion, Tai Hang Road (b) Hop Yat Church, Bonham Road, (c) Catholic Cathedral of the Immaculate Conception, Caine Road and (d) Former Explosives Magazine of the Victoria Barracks, Justice Drive, Admiralty.
- 3.25 The proposed works will not directly impact any of the buildings/structures. However, it may have indirect impacts to the boundary wall and gateway of the Haw Par Mansion and at the former Explosives Magazine. Recommendations have been made to mitigate these potential impacts including conduction of condition survey, provision of buffer zone and erection of protective fencing to separate the buildings from the works areas, and monitoring of the buildings/structures during construction phase. All mitigation measures should be undertaken and be in place before works commence.

Waste Management Impact

- 3.26 A large quantity of excavated spoil will be produced during the construction phase of the proposed drainage tunnel. It is estimated that a total of about 185,100 m³ and 337,000 m³ of spoil will be transported via Eastern portal by trucks and Western portal by barge respectively. Most of this material will not be re-used on site due to the project constraints and must be disposed of to a designated public filling area. Other waste material will

comprise concrete, wood formwork, steel poles, chemical waste, wheel washing waste and general refuse. A waste management strategy is described and responsibilities for implementation and management of the waste management procedure are identified.

Landscape and Visual Impact

- 3.27 The landscape and visual impact assessment mainly focused in the areas for the intake and outlet structures at Eastern and Western portals of the proposed drainage tunnel. Trees are the primary landscape resources in the study area and tree preservation is the prime consideration during the design stage. Tree felling would be limited to the absolute minimum and would only be considered if there is no alternative. To compensate the loss of vegetation and trees, woodland mix planting (10,187m²), amenity planting (1,059m²) and trees (minimum 121 nos.) will be provided for the Project. There will be no impact to the Country Parks as all of the proposed temporary and permanent works for the portals and intake shafts are outside any of the Country Parks boundary.
- 3.28 During construction, the work site will be fenced off by decorative screen hoarding. The landscaping/reinstatement works at each works site will be carried out immediately after completion of the construction works. The proposed mitigation measures would minimize any adverse impact during construction and operation phases. It is predicted that the proposed improvement works would have limited landscape and visual impact.

Hazard to Life

- 3.29 Blasting works will be required for construction of a series of adits linking the main tunnel and the intake structures. No overnight storage of explosive for this project is required. Therefore, assessment of the hazard to life is not necessary according to the Study Brief (No. ESB-070/2001).

Environmental Monitoring and Audit

- 3.30 Environmental monitoring and audit requirements for the construction phase are described in terms of the monitoring locations, period of time, frequency and standards against which the monitoring results should be compared to determine compliance. The monitoring programme covers aspects on air, noise and water quality. Site audit would be carried out to check its compliances of the air, noise, water quality, waste management, ecology, fisheries, landscape and visual and cultural heritage mitigation measures during the construction phase. During the initial operation phase, ground water monitoring will be carried out for a year to confirm the steadiness of the ground water table. An Implementation Schedule of the relevant mitigation measures for the works is included in the EIA report. Details of the programme are presented in a separate Environmental Monitoring and Audit Manual.
- 3.31 The reporting of monitoring data on website will be used during construction phase which would facilitate the rapid and effective communication of local residents/sensitive receivers nearby to resolve any problems in respect of environmental impacts to the project.

4. CONCLUSIONS

- 4.1 The EIA study has been completed in accordance with the requirements of the Study Brief No. ESB-070/2001 under EIAO. A drainage tunnel alignment between Tai Hang and Cyberport has been proposed which has the least impact on the environment while avoidance or minimization of environmental impact underpinning the entire process of options selection. The drainage tunnel has been designed to minimize environmental and ecological impacts and minimize waste generation.
- 4.2 The EIA has predicted that the Project, after adoption of appropriate mitigation measures, will have unavoidable residual impacts of airborne construction noise at some intake locations for a short duration of construction period (i.e. less than 1 week for surfacing breaking and 1 month for rock drilling); and short-term exceedance of suspended solid level at seawater intakes near the Western outlet area after occasional heavy rainstorm during operation phases. Environmental Monitoring and Audit mechanisms have been recommended to monitor and audit the implementation and efficiency of the recommended mitigation measures to ensure compliance with required standards during the construction and operation phases.
- 4.3 The conclusion of the EIA is that no insurmountable environmental impacts will result from implementation of the Project.