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1. INTRODUCTION

1.1 Background

- 1.1.1 Cheung Chau, with a population of around 23,000, is currently supplied with treated water from Silver Mine Bay Water Treatment Works on Lantau via two submarine water mains, 10” (about 250mm) and 500 mm in diameter, across Adamasta Channel. Treated water is normally provided by the 500 mm diameter main, with the 10” main serving as emergency backup.
- 1.1.2 Laid in 1963, the existing 10” submarine water main providing partial emergency back up fresh water supply to Cheung Chau is approaching the end of its design life of 50 years. Repairs would be uneconomical and take a long time given the difficulty of the task and the condition of the main. To improve the reliability of water supply to Cheung Chau, it is necessary to strengthen the emergency back up by replacing the existing 10” submarine water main with a new 500 mm diameter submarine water main.
- 1.1.3 The project proponent, Water Supplies Department, will implement the improvement works – “Improvement of Fresh Water Supply to Cheung Chau” (hereinafter referred to as “the Project”).
- 1.1.4 The Project is a designated project under Item Q.1, Part I, Schedule 2 of the Environmental Impact Assessment (EIA) Ordinance (EIAO) (Cap. 499) as part of the works will be carried out within the Lantau South Country Park.
- 1.1.5 In accordance with the EIAO, an EIA report is required to be prepared to meet the requirements of the EIA study brief (ESB-187/2008) and the Technical Memorandum on EIA Process (EIAO-TM). An Environmental Permit will need to be obtained for the implementation of the Project under the EIAO.
- 1.1.6 An EIA study has been undertaken to provide information on the nature and extent of environmental impacts arising from the construction of the Project and related activities taking place concurrently and to contribute to decisions on the overall acceptability of the Project.
- 1.1.7 This Executive Summary provides the key findings of the EIA study, including assessment of potential environmental impacts from the construction of the Project and recommendations for mitigation measures to comply with environmental legislation and guidelines.

2. PROJECT DESCRIPTION

2.1 Location and Description of the Project

2.1.1 The Project is located in the southeastern coast of Chi Ma Wan Peninsula at South Lantau, in the northwestern coast of Cheung Chau near Tai Kwai Wan and the Adamasta Channel.

2.1.2 The Project is to construct and operate a new submarine water main across Adamasta Channel from Lantau to Cheung Chau to replace the existing 10” submarine water main, which is serving as emergency back up, to improve the reliability of water supply to Cheung Chau. The Project will comprise the following:

- (i) Laying of a submarine water main of approximately 1,400 m in length and 500 mm in diameter across Adamasta Channel;
- (ii) Construction of landfall and associated works within Lantau South Country Park, Lantau Island; and
- (iii) Construction of landfall and associated works near Tai Kwai Wan, Cheung Chau.

2.1.3 The general location of the Project is shown *Figure 1*. Details of the landfall location at Cheung Chau and Lantau are shown in *Figures 2 and 3* respectively.

2.2 Water Main Design

2.2.1 A number of options for improving the adequacy and reliability of water supply to Cheung Chau have been investigated and evaluated.

2.2.2 Environmental benefits and dis-benefits of various alternative water main design, alignment, landfall location and construction method along with various other constraints were carefully evaluated before deriving the recommended option. In particular, it was considered that conventional trenching or dredging methods for submarine pipe laying are not preferred as it has the potential to cause deterioration in water quality with subsequent secondary impacts on marine ecology and fisheries resources.

2.2.3 The concepts of “avoidance” and “minimization” have been considered in the design to avoid marine works activities and disturbing the seabed with a view to reduce water quality, ecological and fisheries impacts. The works area at Cheung Chau has been fine-tuned to avoid encroachment or disturbance to the rocky shore habitat, Coastal Protection Area as well as retaining as much trees as possible. Likewise, works at the Lantau landfall has been minimized as far as possible to

reduce potential impact on Lantau South Country Park.

2.3 Recommended Option

2.3.1 Based on the evaluation, the recommended option is to install a 500 mm diameter polyethylene (PE) pipe within a steel casing across Adamasta Channel by Horizontal Directional Drilling (HDD) technique. HDD is a form of trenchless technology of entirely land-based drilling works. No dredging and disturbance of the seabed will be required during construction.

2.3.2 HDD involves drilling a pilot hole and then progressively enlarging the hole using reamers until the required diameter is achieved. After reaming, the pipeline is pulled and/or pushed into the hole. The drilling process utilizes drilling fluid (usually bentonite) to remove the cuttings from the bore and to stabilize the hole during construction.

2.3.3 After making landfall, the land-based main (500mm diameter ductile iron pipe) will be connected to the existing land main.

2.3.4 Key Project design / requirements include:

- The main staging area and launching site where most of the construction activities will occur will be located in a headland at Tai Kwai Wan, Cheung Chau. All the drilling fluid containment, handling, recycling and treatment systems, storage areas as well as wastewater treatment facilities will be located in the launching site at Cheung Chau.
- In order to avoid impacts to Lantau South Country Park, works at the reception site in Ha So Pai, Lantau will be minimised as much as possible. A temporary demountable working platform will be erected to provide a suitable working area in retrieving the pipe from a small exit pit and connecting to the existing land main to minimize impacts to the nearby rocky shore habitat.
- Forward reaming and pipe pushing from Cheung Chau will be employed to minimise the works at Lantau. Water instead of bentonite will be used as the drilling fluid during the final boring process at Lantau.
- To minimise potential visual impact of the landfall and exposed main at Lantau after construction, boulders / rocks will be used to shield these features and to blend in with the surrounding coastal environment.

2.4 Justifications and Benefits of the Project

- 2.4.1 With the existing 10” submarine main in service for over 46 years and approaching the end of its service life, repairs would be uneconomical and take a long time given the difficulty of the task and the condition of the main. Moreover, the supply through this 10” submarine main alone can only partially meet the demand of Cheung Chau for treated water. To improve the reliability of water supply to Cheung Chau, it is necessary to strengthen the emergency back-up by replacing the existing 10” submarine water main with a new 500mm diameter submarine water main.
- 2.4.2 The proposed Project will provide a secure and reliable water supply to Cheung Chau. All the residents of Cheung Chau as well as tourists visiting Cheung Chau will be directly benefited by the proposed Project.

2.5 Continuous Public Involvement

- 2.5.1 Public consultation with the Green Groups, Rural Committee, Islands District Council and fishermen/mariculture association were undertaken during the course of the EIA study. Overall, there were no objections to the design of the Project.

2.6 Project Programme

- 2.6.1 The construction programme of the Project will likely commence in early 2012 for completion in early 2014.

3. SUMMARY OF THE EIA STUDY

3.1 Key Environmental Issues

3.1.1 The construction activities for the HDD works involve site clearance and preaprartion in the works area, drilling within bedrock layer across Adamasta Channel, pipe installation / connection and site reinstatement. The construction activities for the land-based water main laying works involve surface breaking, excavation, laying of pipe, backfilling and surface reinstatement. Majority of the construction works will occur in Cheung Chau. All these activities have the potential to impact on the existing environment.

3.1.2 The key environmental issues assessed in the EIA study are:

- Water Quality;
- Ecological Impact;
- Fisheries Impact;
- Cultural Heritage Impact;
- Construction Waste Management; and
- Construction Noise.

3.1.3 Mitigation measures have been recommended to mitigate potential adverse impacts from the construction of the Project.

3.1.4 The completed water main is to convey treated water from Lantau to Cheung Chau. No operational phase impact is expected.

3.2 Water Quality Impact

3.2.1 With the use of HDD technique in laying the submarine water main, there will be no marine works and no impact to the seabed. The preferred construction option of using HDD will significantly reduce potential water quality impacts to the sensitive receivers within the marine waters of the Southern Water Control Zone.

3.2.2 The construction works could impact the water bodies through silt-laden site runoff, inadvertent release of drilling fluids, runoff from workshops & depot, sewage effluent from the construction workforce and discharge of chlorinated water during sterilization of the water main. These impacts can be readily mitigated by provision of suitable temporary site drainage systems with treatment facilities, installation of drilling fluid recycling and treatment systems, implementation of the recommended good site management practices and proper sewage collection and disposal systems.

3.2.3 Water quality monitoring is recommended during the construction phase to check for compliance with permissible water quality limit levels and effectiveness of the proposed mitigation measures.

3.2.4 With the implementation of the recommended mitigation measures, no adverse residual water quality impact is expected during construction phase of the Project. Overall, the residual water quality impact is considered acceptable with respect to the EIAO-TM and Water Pollution Control Ordinance.

3.3 Ecological Impact

3.3.1 The Project has avoided and minimized much of the ecological impacts by adopting the HDD construction method in laying submarine water main. Works at Lantau has been minimized to avoid impacts to Lantau South Country Park.

3.3.2 Ecological resources recorded within the 500m study area included plantation, grassland/shrubland, developed area, sandy shore, rocky shore, artificial seawall, marine waters and its associated flora and fauna species. Apart from plantation and hard-substrate seabed which had low to moderate ecological values, other habitats had low ecological values. Species of conservation interest recorded within the study area included three flora and ten fauna species (including bats, birds, hard corals and other fauna). The Project will not lead to any direct or indirect impacts to these species.

3.3.3 The Project would only affect small sizes of a few low value habitats including rocky shore, plantation and developed areas. The overall ecological impact is ranked as minor and the residual impact is considered acceptable with respect to EIAO-TM.

3.3.4 Besides good site practices, no other major mitigation measures for ecology is required. With the regular site inspection performed by the Environmental Team, no specific ecological monitoring programme is needed.

3.4 Fisheries Impact

3.4.1 Literature review has been conducted to establish the fisheries baseline condition of the assessment area and assessment of potential impacts conducted in accordance with the EIAO-TM requirements. With the use of the HDD technique in laying the submarine water main, there will be no marine works and no impact on the seabed. The Project would not directly affect fisheries resources and fishing activities significantly.

- 3.4.2 Potential indirect water quality impacts from site runoff and wastewater discharge on capture fisheries, fish spawning and nursery grounds and mariculture in the Southern Water Control Zone are considered insignificant with the implementation of water quality mitigation measures. Apart from water quality mitigation measures, no specific fisheries mitigation is required and the residual impact is acceptable. Water quality monitoring programme at various locations including the Cheung Sha Wan Fish Culture Zone is recommended during the construction phase to ensure no adverse water quality impact is arising from the works.

3.5 Cultural Heritage Impact

- 3.5.1 The findings of the Terrestrial Archaeological Investigation and Marine Archaeological Investigation indicate that the Study Area of the proposed water main has no archaeological potential, and no impacts on archaeological deposits are expected. There is no need for any further investigation or mitigation measures.

3.6 Construction Waste Management

- 3.6.1 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, used bentonite, 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.
- 3.6.2 Potential for reuse of inert construction and demolition material (public fill) within the Project (or within Cheung Chau) will be explored throughout the course of the Project in an effort to minimise off-site disposal.
- 3.6.3 Provided that there is strict control of construction and demolition materials generated from the 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 mitigation measures can be enforced by incorporating them into the waste management requirements as part of the Environmental Management Plan. Environmental audit will be necessary to ensure the implementation of proper waste management practices during construction.
- 3.6.4 Overall, the residual waste impacts of the Project are considered acceptable with respect to the EIAO-TM and Waste Disposal Ordinance.

3.7 Construction Noise Impact

- 3.7.1 The use of powered mechanical equipment during the construction phase of the Project is expected to create noise nuisance, due to the close proximity of 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 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 measures in place, no residual noise impact is expected from the construction works and it will comply with the EIAO-TM daytime construction noise standard.
- 3.7.2 Noise monitoring is recommended at selected noise sensitive receivers during the construction period to check for compliance with permissible noise standards and effectiveness of the proposed mitigation measures.

4. ENVIRONMENTAL MONITORING AND AUDIT

- 4.1.1 Mitigation measures have been recommended in the EIA report to mitigate potential adverse impacts from the construction of the Project. Based on these recommendations, Environmental Monitoring and Audit (EM&A) requirements have been established.
- 4.1.2 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.
- 4.1.3 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 the Contractor is to adopt in managing and controlling potential environmental impact from construction activities for this Project.
- 4.1.4 Impacts on water quality and noise will be monitored and audited during construction phase. Impacts on waste management and ecology during construction will be audited through site inspection.

5. OVERALL CONCLUSION

- 5.1.1 The main objective of the Project is to provide a secure and reliable water supply to Cheung Chau by constructing a new submarine water main across Adamasta Channel from Lantau to Cheung Chau.
- 5.1.2 Based on the findings of the EIA Study, the Project would not cause any adverse environmental impacts to the concerned Lantau South Country Park, Coastal Protection Areas at Cheung Chau, fish spawning and nursery grounds, fisheries resources, marine habitats, Cheung Sha Wan Fish Culture Zone and other sensitive receivers in the Study Area. The residual construction phase impacts are considered acceptable with respect to EIAO-TM and relevant ordinance requirements.
- 5.1.3 Overall this EIA concludes that there are no unacceptable environmental impacts associated with the construction of the Project 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