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1. INTRODUCTION

1.1 Project Background

1.1.1 The Drainage Master Plan Studies for the Yuen Long, Kam Tin, Ngau Tam Mei and Tin Shui Wai Drainage Basin (YLDMP) were completed in 1998. The majority of the improvement works in Yuen Long and Kam Tin recommended under the YLDMP Study have been completed. Since completion of the DMP Studies, there were changes in developments within the areas and new development proposals and town planning studies were commissioned. In addition, some new flooding complaints were received at the upstream areas of the drainage basins, indicating that further improvement to the drainage systems was required.

1.1.2 Drainage Services Department (DSD) commissioned the "Review of Drainage Master Plans in Yuen Long and North Districts – Feasibility Study" (**DMP Review Study**) in 2008 so that the new development scenarios could be incorporated and the effectiveness of the previously recommended works could also be assessed. The DMP Review Study completed in end 2011 identified that some areas in Yuen Long District could not meet the required flood protection level according to the latest land use changes and future developments taking into account various factors, including sedimentation at the downstream main channels, mangrove growth at river estuaries, updated extreme sea level statistics at Tsim Bei Tsui and projected Climate Change impacts, in the hydraulic analysis. To account for the severity and extent of possible flooding and the works implementation time, the DMP Review Study proposed drainage improvement works in Yuen Long District.

1.1.3 Atkins China Ltd (ACL) was commissioned by DSD in November 2013 to undertake an Investigation, Design and Construction Consultancy entitled "Agreement No. CE 22/2013 (DS) Drainage Improvement Works in Yuen Long, Stage 1 – Investigation, Design and Construction" (hereinafter called the Assignment). The Project comprises construction of drainage improvement works to four villages (namely Sung Shan New Village, Tai Wo, Lin Fa Tei and Ha Che) including landscaping, waterscaping, utilities diversion, temporary traffic arrangements and any other works incidental to the completion of the Project.

1.1.4 An Environmental Impact Assessment (EIA) Study Brief (ESB-279/2014) for four villages namely Ha Che, Tai Wo, Lin Fa Tei and Sung Shan New Village which is a designated project was issued by the Environmental Protection Department (EPD) on 14 October 2014. According to the Study Brief, an Executive Summary is required for these four villages.

2. PROJECT DESCRIPTION

2.1 Location and Description of the Project

2.1.1 The works of this project includes investigation, design and construction of drainage improvement works to four villages: Sung Shan New Village, Tai Wo, Lin Fa Tei and Ha Che, including landscaping, waterscaping, utilities diversion, temporary traffic arrangements and any other works incidental works.

2.1.2 The site location plan is shown in **Figure 1.1** and the site specific works for the four villages are described below and shown in **Figures 1.2, 1.3, 1.4A, 1.4B, 1.5A and 1.5B.**

Sung Shan New Village

2.1.3 It is proposed to carry out the upgrading works along 610m of the existing stream. The cross section of the proposed rectangular channel with width ranging from 7.5m to 8.0m varies in height (3m to 5m) along the stream to suit the existing site constraints by optimizing the hydraulic capacity but minimizing the land resumptions. Pedestrian crossings will be re-provided along the proposed works. The proposed works at Sung Shan New Village are shown in **Figure 1.2**.

Tai Wo

2.1.4 It is proposed to provide a 290m long of rectangular channel with 1m wide of various height at Tai Wo to suit the existing site constraints by optimizing the hydraulic capacity but minimizing the land resumptions and discharging to the existing channel at the west. The proposed channel height is ranging from 1.5m to 3.1m. The proposed works at Tai Wo are shown in **Figure 1.3**.

Lin Fa Tei

2.1.5 A 150m long and 2m wide rectangular channel of height of approximately 1.7m is proposed to intercept part of the surface runoff from the hillside and connect to the upstream of Shui Tsan Tin stream which will then be upgraded to a proposed rectangular channel with width ranging from 2.4m to 4.8m wide with total length of approximately 780m along the original alignment to suit the existing site constraints by optimizing the hydraulic capacity but minimizing the land resumptions. The proposed channel height at the south of Lin Fa Tei is approximately 3.7m. The 240m long 2m wide rectangular channel of various height downstream of Lin Fa Tei channel is proposed to be deepened along original alignment. Part of the flow will be diverted to the proposed 1650mm dia. storm drain underneath Kam Sheung Road. Pedestrian and vehicular crossings will be re-provided along the proposed works. The proposed works at Lin Fa Tei are shown in **Figures 1.4A and 1.4B**.

Ha Che

2.1.6 Approximately 600m of the existing stream is proposed to be upgraded to a rectangular channel of various width and depth along the original alignment to suit the existing site constraints by optimizing the hydraulic capacity but minimizing the land resumptions. The proposed channel width is ranging from 3m to 6.5m, while the proposed channel height is ranging from 1.8m to 3.1m. For the bottleneck at Fan Kam Road, it will be improved by additional twin 1500mm dia. drains located to the south of the existing twin 1500mm dia. drains. A portion of stream of about 170m

long (adjacent to Fu Hing Garden) will be upgraded to 3.5 to 4.5m wide rectangular channel of various height. Pedestrian and vehicular crossings will be re-provided along the proposed works. The proposed works at Ha Che are shown in **Figure 1.5A and 1.5B**.

2.2 Need for the Project

2.2.1 Currently, the four villages are susceptible to flooding in the existing drainage system. Under the "Review of Drainage Master Plans in Yuen Long and North Districts – Feasibility Study" (**DMP Review Study**) commissioned by DSD in 2008, it was identified that some areas in Yuen Long District could not meet the required flood protection level according to the latest land use changes and future developments. This includes taking into account of various factors, including sedimentation at the downstream main channels, mangrove growth at river estuaries, updated extreme sea level statistics at Tsim Bei Tsui and projected Climate Change impacts in the hydraulic analysis. To account for the severity and extent of possible flooding, the DMP Review Study proposed drainage improvement works in the Yuen Long District. DSD carried out a further review on the proposed works under the Project and it was considered feasible to improve the existing drainage condition for the four villages in Yuen Long. The proposed drainage improvement works aims to alleviate the flooding spots in the villages.

2.2.2 In addition to improving the flood situation in the villages, the proposed landscaping works of the channels will revitalize the channels in terms of visual and landscape treatment for public enjoyment and blending into the environment.

2.3 Consideration of Alternative Construction Methods and Sequences of Work

Proposed Underground Drainage Pipes

2.3.1 The proposed works for underground drainage pipes would be implemented by open cut method as far as practicable, due to its cost effectiveness in the improvement in proposed drainage works. The proposed works would be carried out on a section-by-section basis to minimize period of nuisance to the nearby sensitive receivers during construction.

2.3.2 In open-cut method, temporary traffic management will be carried out on a section-by-section basis to minimize period of nuisance to the village traffic. Upon the completion of utility survey and inspection pits to ensure no existing utilities would clash with the proposed works, ground excavation will take place between the time periods 7am and 7pm. No construction noise permit would be required. For excavation greater than 1.2m, sheetpiles with struts and wales will be constructed as temporary support adjacent to the slope. Underground pipes would be laid after the completion of pipe bedding and then backfilled with soil.

2.3.3 In trenchless method, the insertion pit and receiving pit would be constructed for the trenchless pipe sections. The proposed pipes would be constructed by pipe jacking method.

Proposed Channels

2.3.4 The area for the proposed widening and deepening of channels will be excavated. Upon the completion of excavation, fixing of reinforcement bars would be carried out on site for the structures of the proposed rectangular channels and concreted. The *Aquilaria Sinensis* (seedling) in Sung Shan New Village will be protected and

retained during construction.

2.4 Construction Programme

2.4.1 The proposed drainage improvement works are planned to commence in 2022 with a view to completing all the proposed works in 2025.

3. SUMMARY OF ENVIRONMENTAL IMPACT ASSESSMENT FINDINGS

3.1 Air Quality

3.1.1 With proper implementation of good site practices stipulated in the Air Pollution Control (Construction Dust) Regulation and with the adoption of construction machineries and non-road vehicles meeting the prescribed emission standards and requirements specified in the Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation, no adverse air quality impacts associated with the proposed drainage improvement works is anticipated.

3.2 Noise

3.2.1 The potential noise impacts due to the proposed drainage improvement works at Sung Shan New Village, Tai Wo, Lin Fa Tei and Ha Che have been evaluated. Whilst the Contractor may prefer to use different construction methods, types and numbers of Powered Mechanical Equipment (PME), the assumed tentative construction schedule and plant inventory are representative and provide a conservative noise assessment of reference value.

3.2.2 With adopting the quiet PMEs, temporary noise barrier and good site practices as stipulated in the Code of Practice on Good Management Practice to Prevent Violation of the Noise Control Ordinance (Cap. 400) (for Construction Industry) to minimize the construction noise impacts, construction noise levels at the representative NSRs will fully comply with the relevant noise criteria.

3.3 Ecology

3.3.1 The potential ecological impact from the proposed drainage improvement project at Yuen Long has been evaluated in accordance with the applicable Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM). The project will cover four village areas, namely Sung Shan New Village, Tai Wo, Lin Fa Tei and Ha Che, and a total no. of 14 habitat types and 41 species of local or global conservation interest has been delineated and identified within the 500m Study Area of each work site. Because most of the work site is adjacent to populated village and hence bordered by man-made or heavily disturbed habitats, only a few natural or semi-natural habitats and species of conservation interest will be directly or indirectly affected by the project, including the riverine habitats, one protected plant species (*Aquilaria sinensis*), as well as two species of endemic freshwater crab which has been categorised as "endangered" (*Somanniathelphusa zanklon*) and "vulnerable" to extinction (*Cryptopotamon anacoluthon*) by the International Union for Conservation of Nature and Natural Resources. The drainage improvement work which involve widening and deepening of the existing watercourses in Ha Che and Lin Fa Tei will unavoidably destroy their habitat and potentially affect the local population of these two species in the Kam Tin area. As a whole for the proposed Project which cover a length of ~2800m watercourse, the ecological impact from the potential permanent loss of 2110 m long semi-natural watercourse habitat and 25m long channelized watercourse are considered to be minor to moderate and moderate respectively. All recognised sites of conservation importance including Tai Lam Country Park and Lam Tsuen Country Park are avoided under the project.

3.3.2 A range of mitigation measures related to good site management and construction practice, as well as scheduling of the staged work program have been recommended to avoid or minimize the ecological impact to the valuable ecological

resources within or in the vicinity of the work areas. As there is no conflict between *Aquilaria sinensis* and the proposed works within the site boundary of the works, this tree species within the vicinity will be protected and retained during construction. Translocation of the two endemic crab species to area protected from anthropogenic disturbance and development pressure within the Kam Tin Valley, has been recommended before the commencement of the construction work. Implementation principle and guidelines has been suggested in this assessment and the detail processes including any monitoring requirement will be detailed in a "Freshwater Crab Translocation Plan" to be prepared by an Ecologist for Agriculture, Fisheries and Conservation Department approval.

3.3.3 Furthermore, the reinstatement of the widened channels has provided an opportunity to restore the ecological functions provided by the disturbed riverine habitat, and a range of hardscapes and greening approach have been suggested to enhance the ecological quality of the restored habitat, including those suitable for the recolonization of the two endemic crab species. A "Habitat Creation and Management Plan" collaborated by an engineer, ecologist and landscape architect has been recommended to detail the restoration process and monitoring strategy of the reinstate riverine habitat.

3.3.4 Nevertheless, it should be noted that the widened channels are open habitat and its riparian zone and the flora and fauna that could be established or colonised within the work site is subject to the habitat quality of the adjacent areas including the water quality in the watercourse upstream and downstream of the widened channels, and the potential anthropogenic disturbance nearby. Accordingly, the effectiveness of the habitat restoration should be evaluated on the spectrum and breadth of the ecological functions performed by the restored habitat.

3.3.5 Finally, with the implementation of the mitigation measures recommended in this assessment, there will be no residual ecological impact from the project and off-site mitigation measures would not be required.

3.4 Water Quality

3.4.1 Key issues in terms of water quality would be related to excavation works for the construction phase of the proposed drainage improvement works. To minimize potential impacts on water quality during the channel construction, the excavation would be carried out in dry condition (even in wet season) by diverting the stream flow from upstream by a temporary drainage channel with a temporary sheet piles, earth bund or barrier, so that the works area will remain dry for later excavation and widening works.

3.4.2 With implementation of recommended appropriate mitigation measures, the construction works for the proposed drainage improvement works would not be anticipated to result in unacceptable impacts on water quality.

3.4.3 Water quality monitoring and audit should be carried out to detect any deterioration of water quality during the construction phase

3.4.4 During operation of the Project, the drainage improvement works would not produce extra point sources or non-point source pollution loading. The new alignments of the drainage would provide widened sections to alleviate flooding during heavy rainfalls.

3.4.5 In order to avoid adverse pollution from first flush during rainstorm, regular maintenance debris clearances are recommended, perfectly before rainstorm

events. Maintenance desilting may be necessary for the proposed channel to remove excessive silts, vegetation, debris and obstruction. Desilting should be carried out during period of low flow.

3.5 Waste Management

3.5.1 The construction activities associated with the proposed works will mainly generate a variety of wastes including construction and demolition materials, chemical waste and general refuse. With the implementation of good site practice and recommended mitigation measures, there would be no adverse environmental impacts.

3.6 Land Contamination

3.6.1 According to review in historical land use, relevant spillage accident records of EPD and Fire Services Department and site appraisal, all identified potentially contaminated sites were located outside works area boundary and no sign of migration of contaminant was observed. Therefore, contamination potential arising from the Project works is not anticipated. Further site investigation for this Project is considered not necessary.

3.7 Landscape & Visual

3.7.1 The proposed drainage developments at the locations studied will see some change in the landscape and visual amenity of the project sites, although the works generally involve upgrading of the existing channels rather than constructing a totally new drainage elements, the assessed landscape and visual impacts are referenced to the existing context.

3.7.2 The design of the drainage proposals have sought to be as sensitive as possible, given the functional requirements, to the existing landscape setting. The landscape and visual mitigation proposals are centred on the use of natural watercourse bedding in wider channels in coordination with channel and embankment greening as well as the provision of tree and shrub planting along the channel edges to integrate with groups of retained trees to form a narrow landscape buffer. Since the development proposals are low in height this planting will screen low-level views (the majority of the existing Visually Sensitive Receivers (VSR) are low-level) and integrate the proposals within the existing landscape framework.

3.7.3 Given the proposed design of the proposals, the likely impacts on landscape resources and Landscape Character areas during the design year (Year 10) will range from slight adverse to insubstantial. Although the visual impact assessment suggest a slight /moderate adverse impact at year 10 for one VSR (VSR-9 at Lin Fa Tei) the majority are within the range Slight to Insubstantial. However, owing to the rural nature of the existing setting, the more significant impacts to views are only available to a relatively few people. It should also be noted that the works are an opportunity to make visual improvements and that slight and slight / moderate beneficial impacts are also predicted at locations where aesthetic treatments to structures and the introduction of greenery to areas currently lacking managed vegetation can provide improvements to the visual resources in the longer term.

3.7.4 In accordance with the criteria and guidelines for evaluating and assessing impacts as state in Annex 10, Clause 1.1(c) of the EIAO-TM, overall, it is considered that the residual landscape and visual impacts of the proposed development are acceptable with mitigation at all four villages during the construction and operation phases.

3.8 Cultural Heritage

3.8.1 The proposed drainage works are generally not expected to impact on archaeology during the construction and operational phases with the exception of an area within Lin Fa Tei Site of Archaeological Interest (SAI) near the previous findings of wooden remains. It is recommended that an Archaeological Survey be undertaken for proposed intercept drain works area near the previous findings prior to the construction phase by a qualified archaeologist who obtains a licence under the Antiquities and Monuments Ordinance (Cap. 53). The scope and methodology of the Archaeological Survey should be agreed with Antiquities and Monuments Office (AMO) prior to implementation. Tentatively and subject to agreement with AMO, a fieldscan, where possible, twenty auger tests and four 5 by 1m narrow trenches are proposed to further assess the archaeological potential of the area. If significant remains are uncovered, the AMO should be notified and mitigation and/or an appropriate way forward should be formulated and implemented in agreement with AMO.

3.8.2 Furthermore and as a precautionary measure, the AMO should be informed immediately in case of discovery of antiquities or supposed antiquities in the course of excavation for any of the proposed drainage improvement works outside of the area identified for archaeological survey, so that appropriate mitigation measures, if needed, can be timely formulated and implemented in agreement with AMO.

3.8.3 Three graded historic buildings are located in proximity of the proposed works; Lee Tat Bridge (Grade 3) in Shui Tsan Tin at 13.3m, Lan Fong Study Hall (Grade 3) in Chuk Hang at 57.7m, and St. John's Chapel (Grade 2) in Cheung Po at 46.4m from works boundary and require mitigation measures during the construction phase.

4. SUMMARY OF ENVIRONMENTAL OUTCOME

4.1 Estimated Population Protected from Various Environmental Impacts

4.1.1 With the adoption of the recommended mitigation measures during construction phase, the potential environmental impacts associated with the Project will be minimised to acceptable levels. There would be no adverse residual environmental impacts to the noise and air sensitive receivers in the vicinity of the Project.

4.2 Environmentally Sensitive Areas and Species with Conservation Concern Protected

4.2.1 With the consideration of various alternative design and construction methods, the Project will avoid or minimise the impact to environmentally sensitive areas. Moreover, the *Aquilaria Sinensis* (seedling) in Sung Shan New Village will also be protected and retained.

4.3 Key Environmental Problems Avoided

4.3.1 Key issues in terms of water quality would be related to excavation works for the construction phase of the proposed drainage improvement works. To minimize potential impacts on water quality during the channel construction, the excavation would be carried out in dry condition (even in wet season) by diverting the stream flow from upstream by a temporary drainage channel with a temporary sheet piles, earth bunds or barriers, so that the works area will remain dry for later excavation and widening works.

4.3.2 Noise levels exceedance at the representative NSRs during construction phase is anticipated for unmitigated scenario. With adopting the quiet PMEs, temporary noise barrier and good site practices, no exceedance of the construction noise criteria is anticipated.

4.4 Environmental Benefits of the Environmental Protection Measures Recommended

4.4.1 The environmental benefits of environmental protection measures are listed below:

- Air quality: Implementation of good house-keeping and dust suppression measures such as water spraying would avoid/minimize dust emissions during construction phase.
- Noise: Implementation of temporary noise barriers and quieter plant would reduce the construction noise impact to the neighbouring noise sensitive receivers.
- Water quality: Implementation of good site practices to avoid/minimize polluted site runoff from the Project to neighbouring water sensitive receivers.
- Waste management: Implementation of waste reduction and good management control could minimize environmental implication from on-site waste storage.
- Ecology: The Project will involve drainage channel widening and will not

encroach to any ecological sensitive areas. Only a few natural or semi-natural habitats and species of conservation interest will be directly or indirectly affected by the project. With the implementation of the mitigation measures, there will be no residual ecological impact.

- Landscape and visual: Landscape and visual impacts are acceptable with the implementation of mitigation measures.

- Land contamination: All identified potentially contaminated sites were located outside works area boundary. Therefore contamination potential arising from the Project works is not anticipated.

- Built Heritage and Archaeology: The alignments of drainage channel widening and new drainage culverts will avoid/minimize direct and indirect impacts to built heritage and archaeology.

5. ENVIRONMENTAL MONITORING AND AUDIT REQUIREMENT

5.1.1 An Environmental Monitoring and Audit (EM&A) Manual and an Environmental Mitigation Implementation Schedule (EMIS) have been prepared to monitor and audit the relevant air quality, noise, water quality, waste management, land contamination, landscape and visual and cultural heritage impacts. Event and action plan for the potential environmental impacts has been formulated and stated in the EM&A Manual.

6. CONCLUSION

6.1.1 Upon completion of the proposed channel widening and new drainage culvert works, there will be reduction of flood risk around Sung Shan New Village, Tai Wo, Lin Fa Tei and Ha Che. The EIA study concludes that with incorporation of the recommended mitigation measures and proper implementation of the EM&A programme, the Project will not impose adverse impacts on the neighbouring environment during construction and operational phases.