

# **Expansion of Sha Tau Kok Sewage Treatment Works**

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## **Executive Summary**

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**1. INTRODUCTION**

**1.1 Project Background**

1.1.1 The Drainage Services Department (DSD) is undertaking a project named Expansion of Sha Tau Kok Sewage Treatment Works, Phase 1 – Investigation, Design and Construction (the Project) under Agreement No. 63/2012(DS). The Project is to expand the treatment capacity of the existing Sha Tau Kok Sewage Treatment Works (STKSTW) from 1,660 m<sup>3</sup>/day to 10,000 m<sup>3</sup>/day in 2 phases. In June 2013, Black & Veatch Hong Kong Limited (B&V) was commissioned by DSD as the consultant for this project.

1.1.2 According to the Brief, the project programme is shown as below:

	Treatment Capacity (m <sup>3</sup> /day)		Tentative Year of Commissioning
	Increased by	Total	
Existing	-	1,660	-
Phase 1	3,340	5,000	2021
Phase 2	5,000	10,000	End 2030

1.1.3 The proposed expansion has been identified as a Designated Project (DP), hence it requires an Environmental Permit (EP) from the Director of Environmental Protection for construction and operation. In relation to this, DSD has prepared a Project Profile for Application for an Environmental Impact Assessment (EIA) Study Brief which has been submitted to the Environmental Protection Department (EPD) on 5 November 2012. The EIA Study Brief (No. ESB-253/2012) has been issued by EPD on 17 December 2012.

**1.2 Purpose and Nature of the Project**

1.2.1 The Project is to increase the capacity of STKSTW to cope with the forecast increase in sewage flow upon completion of sewerage under project “North District Sewerage, Stage 2 Part 2A – Pak Hok Lam Trunk Sewer and Sha Tau Kok Village Sewerage” in Sha Tau Kok areas, extensions of village sewerage in the areas planned by EPD, and the proposed housing developments in Sha Tau Kok Town.

1.2.2 The works for this Project in Sha Tau Kok mainly comprises of the following items and as shown in the Layout Plan of [Figure 2.1](#):

- a) Increase the treatment capacity of Sha Tau Kok Sewage Treatment Works (STKSTW) to 5,000 m<sup>3</sup>/day at Average Dry Weather Flow (ADWF) by 2021, with suitable allowance to cater for a further increase of treatment capacity to 10,000 m<sup>3</sup>/day at ADWF after 2030 in Phase 2;
- b) Construct a temporary sewage treatment plant (TSTP) with a capacity of 2,500 m<sup>3</sup>/day at ADWF;
- c) Demolish the existing Sha Tau Kok Sewage Pumping Station (STKSPS) and decommission the rising main between STKSPS and STKSTW;
- d) Construct approximately 520m long new gravity sewer; and
- e) Abandonment the existing submarine outfall and construct a approximately 1700m long new submarine outfall.

1.2.3 The following elements of the Project are classified as DPs under the *Environmental Impact Assessment Ordinance (Cap. 499)* (EIAO) and are addressed in this EIA Report:

- a) Schedule 2, Part I, Item F.2 (a) and (b)(i) - Sewage Treatment Works with an installed capacity of more than 5,000 m<sup>3</sup> per day; and a boundary of which is less than 200m from the nearest boundary of the an existing residential area; and
- b) Schedule 2, Part I, Item F.6 - a submarine outfall.

### **1.3 Purpose and Approach of the EIA Study**

1.3.1 The purpose of this EIA Study is to provide information on the nature and extent of environmental impacts arising from the construction and operation of the Project and its related activities. The location of the Project and the associated works are shown in [Figure 1.1](#). This information will contribute to decisions by the Director of Environmental Protection on:

- a) The overall acceptability of any adverse environmental consequences that are likely to arise as a result of the proposed Project;
- b) The conditions and requirements for the detailed design, construction and operation of the proposed Project to mitigate against adverse environmental consequences, as practicable; and
- c) The acceptability of residual impacts after implementation of the proposed mitigation measures.

1.3.2 The specific objectives of the EIA Study are described in Clause 2 of the EIA Study Brief, and the detailed requirements of the EIA Study are set out in Clause 3 of the EIA Study Brief. As specified in the EIA Study Brief, the EIA Study has addressed the key environmental issues associated with the construction and operation of the Project.

### **1.4 Justification for the Need of the Project**

1.4.1 The need of the Project is to meet the wastewater treatment demand of the future population for supporting the planned growth and development within the Sha Tau Kok area.

#### **Existing Conditions**

1.4.2 The existing STKSTW is inadequate to cope with the population growth and future development within the catchment. Moreover, the existing submarine outfall is inadequate to cope with the increased sewage flow in the future.

1.4.3 The existing submarine outfall is discharging near-shore of Starling Inlet. The discharge point is close to the nearby fish culture zone. A new submarine outfall and hence a new discharge point would be required to facilitate the increase in sewage flow and to improve the dilution of effluent by water current.

#### **Purpose of the Project**

1.4.4 The Project is to increase the capacity of STKSTW to cope with the forecast increase in sewage flow upon completion of sewerage under project "North District Sewerage, Stage 2 Part 2A – Pak Hok Lam Trunk Sewer and Sha Tau Kok Village Sewerage" in Sha Tau Kok areas, extensions of village sewerage in the areas planned by EPD, and the proposed housing developments in Sha Tau Kok Town.

1.4.5 A new outfall is required for the Project to provide sufficient capacity for discharging the increased treated effluent to Starling Inlet.

#### **Environmental Benefits of the Project**

1.4.6 The environmental benefits of the Project include the following:

- a) Improve treatment to produce effluent with better quality;

- b) Provide more treatment capacity within the existing plant site;
- c) Cover the treatment facilities and provide odour treatment to improve air quality;
- d) Incorporate environmental enhancements in the new treatment facilities, including renewable energy, energy-efficient electrical and mechanical equipment, greening, water saving measures, etc.;
- e) Locate the discharge point of the new submarine outfall away from sensitive receivers, including the fish culture zones and the identified species of conservation importance; and
- f) Demolish STKSPS to make the land available for other beneficial purposes.

1.4.7 Without the proposed Project, the existing capacity of STKSTW is expected to be fully committed in early 2019 based on the flow-build-up derived from the latest planning data and village sewerage programme. The existing STKSTW will suffer from insufficient capacity to cope with the increase in sewage flow and loads in the future, and consequently deteriorate the coastal water quality. Sewage collected from the villages sewerage system will not receive treatment before discharge since STKSTW do not have sufficient capacity to cope with the sewage flow from the extended villages.

1.4.8 With the proposed Project, STKSTW will have sufficient capacity to cope with the increased sewage flow in the future for the existing catchment and sewage collected from the extensions of different villages sewerage projects. As such, the Project is essential to secure sewage treatment services for the Sha Tau Kok Area.

**2. PROJECT DESCRIPTION**

**2.1 Project Components and Project Layout**

2.1.1 **Table 2.1** presents a summary of the project details. The site area of the proposed expansion of STKSTW will be approximately 4,950 m<sup>2</sup>, with a 524m of gravity collection sewerage system along Shun Hing Street. A maximum total dredging volume of 3,040m<sup>3</sup> of marine sediments will be generated from the construction of diffuser for the submarine outfall. The preliminary layout plan for this Project is presented in [Figure 2.1](#).

**Table 2.1 Summary of Project Description**

Details	Preliminary Design Information
<b>Submarine Utilities</b>	
Excavated Sediment volume ( <i>in situ</i> volume)	
• Diffuser	3,040 m <sup>3</sup>
Length of Submarine Utilities (m)	
• Outfall	~ 1.7 km
<b>Expanded Sha Tau Kok Sewage Treatment Works</b>	
Site area	4,950 m <sup>2</sup>
Footprint of above-ground structure	1,740 m <sup>2</sup>
Dimension of above-ground structure	73m (L) x 24m (W)
Building height	Ranged 10m -19m
Site Coverage	35%
Gross Floor Area	5,700m <sup>2</sup>
<b>Temporary Sewage Treatment Plant</b>	
Footprint of above-ground structure	774 m <sup>2</sup>
Dimension of above-ground structure	47m (L) x 18m (W)
Building height	10m
<b>Gravity Sewer</b>	
Excavation volume	4,620 m <sup>3</sup>
Length of the gravity sewer	524 m

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**2.2 Site Location and History**

2.2.1 It is evident from the historic aerial photographs that the proposed Site is located on fill. In early 80's, the proposed Site was in the coastal area. Between 1986 and 1989, reclamation was being carried out at the proposed Site. The STKSTW was also constructed during the same period.

2.2.2 For the STKSPS, the area was in the coastal area with houses. Between 1986 and 1989, reclamation was being carried out at the proposed Site. The area for the STKSPS was also constructed during the same period.

2.2.3 Based on available aerial photographs between 1989 and 2013, there were no observable change in STKSTW, STKSPS and the Starling Inlet area.

2.2.4 According to the historic aerial photographs, the proposed discharge location near Ah Kung Au is a part of Starling Inlet from 1969.

**2.3 Project Programme**

2.3.1 The tentative implementation schedule for the Project is presented below.

**Table 2.2 Key Dates of Implementation Programme**

<b>Item</b>	<b>Tentative Date</b>
Approval of Application for Permission under Section 16 of the Town Planning Ordinance	Nov 2016
Tender Gazette	Jan 2017
Commencement of Construction	May 2017
Completion of Construction	Dec 2022

**2.4 Consideration of Alternative Treatment Level, Design, Layout, Outfall Alignment, Construction Methods and Sequence of Works**

2.4.1 An assessment was conducted to investigate the environmental considerations of alternative treatment level, design, layout, outfall alignment, construction methods and sequence of works for this Project. Alternatives considered were as follows:

- a) Alternative treatment level: Secondary treatment level has been considered for STKSTW, which is capable of removing biodegradable organic matter, suspended solids and total nitrogen for compliance with the Water Quality Objectives of Mirs Bay Water Control Zone. The treatment method can fulfil the Project requirements without causing adverse water quality and ecological impact.
- b) Alternative treatment process: Three secondary treatment processes have been investigated, which are Membrane Bioreactor (MBR), Moving Bed Bioreactor with Dissolved Air Floatation (MBBR+DAF) and Sequencing Batch Reactor (SBR). Compared with MBBR and SBR, MBR can provide the best effluent quality within the same footprint. MBR is thus adopted as the preferred treatment process for the expansion of STKSTW
- c) Alternative new locations for new treatment facilities: Three expansion options have been investigated, which is utilizing new site for construction of TSTP, expansion within the existing site and utilizing the existing police operation base for expansion. Compared to utilizing extra land, expansion within the existing footprint create less environmental impacts since the footprint is far from residential area.
- d) Alternative submarine outfall alignment: Two discharge locations have been considered, one is discharging in the vicinity of the existing outfall discharge location and one is discharging further away in the water near Ah Kung Au. Preliminary modelling results showed that compliance with Water Quality Objectives of Mirs Bay Water Control Zone maybe difficult if discharging in the vicinity of the existing outfall discharge location and hence discharging in the water near Ah Kung Au is preferred.
- e) Phased installation for different flow projections: Single phase and phased installations for E&M works have been considered. Phased installation is preferred so as to avoid the amount of idled equipment which will increase the energy consumption for maintenance.
- f) Alternative designs to avoid or minimize emergency discharge: Different precautionary measures have been investigated, such as dual power supply, backup generator, standby equipment, provision of onsite storage and tanker away. Tanker away is not preferred because large number of tankers required will cause additional air quality and noise impact to the nearby residential area. It is proposed to provide dual power supply, standby equipment and provision of onsite storage for minimizing the risk of emergency discharge.

- g) Other considerations: Considerations have also been given to the demolition of Sha Tau Kok Sewage Pumping Station and new sewer alignment. It is considered to demolish the STKSPS and replace it with a gravity collection system along Shun Hing Street.

2.4.2 The preferred scenario of the proposed expansion of STKSTW is presented in [Figure 2.1](#). The selection of the preferred alternative has brought about a series of environmental benefits to the Project, including:

- a) Limit the footprint to 5,000m<sup>2</sup> for the construction works to the existing STKSTW site. This is far from residential area and comparatively less environmental impacts will be created.
- b) Provide the best effluent quality within a small footprint.
- c) Odour, noise and visual impacts to surrounding sensitive receivers can be minimized.
- d) Fewer sensitive receivers are immediately affected (Sha Tau Kok Chuen, Sha Tau Kok Recreation Ground and Police Operation Base) during construction and operation in comparison to the other option.
- e) Safeguard water quality at Starling Inlet.
- f) Can achieve the Water Quality Objectives of Mirs Bay Water Control Zone
- g) Proposed outfall located further away from Sha Tau Kok Fish Culture Zone
- h) Reduce extent of land required for construction and hence reduce the environmental impacts to nearby sensitive receivers
- i) Reduce the amount of idle equipment which increase energy efficiency
- j) Reduce use of chemicals required for the maintenance of the idle equipment
- k) No significant impact to the marine ecology in comparison to the dredging method. Approximately 3,040m<sup>3</sup> sediment will be removed.

### **3. ENVIRONMENTAL IMPACTS**

The potential environmental impacts associated with the Project are summarised in the following sections.

#### **3.1 Air Quality**

- 3.1.1 The air quality impact assessment has examined construction and operation phase impacts of the Project in accordance with the criterial and guidelines stated in the *EIAO – TM Annex 4* and Air Pollution Control Ordinance (APCO) (Cap. 311).
- 3.1.2 In accordance with the EIA Study Brief *Section 3.4.2.2* of the Project, the Study Area for the air quality impact assessment is generally defined by a distance of 500m from the boundary of the Project Site. A total of 8 ASRs were identified.
- 3.1.3 Potential air quality impacts arising from construction activities have been considered. With implementation of standard construction practices and mitigation measures, no unacceptable impact on ASRs during the construction phase is anticipated.
- 3.1.4 Potential odour impacts from the operation of the TSTP and STKSTW have been quantitatively assessed. With the proper implementation of the proposed plant design, provision of adequate ventilation and appropriate deodorization systems, the predicted maximum odour concentrations at the identified ASRs would comply with the odour criterion stipulated in the *EIAO-TM*. Hence, adverse air quality impact arising from the operation phase of the Project is not anticipated.



- 3.1.5 With the implementation of good management practices and proper odour control measures, no unacceptable residual impacts have been predicted to occur during the construction and operation phases. Regular site inspections and audits will be undertaken during the construction phase to verify that proposed mitigation measures are being implemented. During the operation phase, commissioning test for the TSTP and STKSTW is recommended to be conducted prior to their operation to ascertain the effectiveness of the odour control measures at the TSTP and STKSTW during their operation. Odour patrol is also proposed during the period of maintenance of the deodorization system for TSTP and STKSTW.

## **3.2 Noise**

- 3.2.1 The potential impacts of noise caused by construction and operation activities of this Project have been assessed in the EIA Report. The impacts have been identified and analysed to be in compliance with the criteria and guidelines stated in the *EIAO-TM Annexes 5 and 13* respectively.
- 3.2.2 In accordance with the EIA Study Brief *Section 3.4.3.2* of the Project, the Study Area for the noise assessment includes all areas within 300 m from the Project Boundary. A total of 8 NSRs were identified.
- 3.2.3 A construction noise assessment has been undertaken to predict the noise levels at the representative NSRs due to the construction of the Project. Practicable mitigation measures, including no construction works during restricted hours, use of quiet construction plant / quiet construction method, temporary noise barriers and good site practices, have been recommended. With the implementation of the recommended mitigation measures, the predicted construction noise levels at all NSRs comply with the noise criteria during the daytime period. Therefore, no noise impact is expected to arise from the construction activities. Also, no cumulative impact or residual impact is anticipated. Regular noise monitoring at NSRs as part of the EM&A programme during the construction stage is recommended.
- 3.2.4 Potential noise impact from the operation of the TSTP and expanded STKSTW has been assessed. The predicted fixed plant noise levels at the representative NSRs due to the operation of the TSTP and STKSTW are well within the relevant noise criteria.

## **3.3 Water Quality**

- 3.3.1 The water quality impact assessment has examined construction and operation phase impacts of the Project in accordance with the criteria and guidelines stated in the *EIAO - TM Annexes 6 and 14*, and applicable assessment standards/ criteria. The assessment, utilising mathematical computational models, has examined the potential impacts caused by marine works during construction phase and effluent discharge during operation phase.
- 3.3.2 Trenchless method by Horizontal Direction Drilling will be adopted as the preferred option for the construction of the proposed submarine outfall to reduce potential impacts of the marine dredging works on water quality, marine ecology and fisheries of Mirs Bay.
- 3.3.3 The adoption of cofferdam construction of sheetpiling is considered in the modelling. Since the sediment removal at outfall structure would be conducted in dry condition after cofferdam construction is completed and the inside of the cofferdam be drained, no sediment release into the water column would be expected from the sediment removal under this Project. Sediment release from sheetpiling for the installation and removal of cofferdam is therefore considered

the only source of sediment release and was assessed under this Study. The estimated volume of sediment being disturbed in sheetpiling is 27m<sup>3</sup>. Working hours are assumed to be 12 hours per day with a maximum rate of sheetpile installation / removal of 4m<sup>3</sup>/day (i.e. 0.333m<sup>3</sup>/hr). Modelling assessment results indicated that the construction phase water quality impact from SS elevation, DO depletion as well as nutrient and contaminant release from marine construction works for cofferdam at submarine outfall would be minimal. Potential water quality impacts from land-based construction activities have also been assessed and found to be minimal. Appropriate site measures and standard practices are recommended. Water quality monitoring and audit exercise for sheetpiling activities is also recommended to ensure protection to nearby water quality sensitive receivers (WSRs).

- 3.3.4 The discharge of effluent from TSTP and the expanded STKSTW is the main environmental concern for the Project operation. As the total pollution loading from TSTP would not exceed the baseline scenario, no unacceptable water quality impact would be expected from the operation of TSTP. Modelling assessment has been conducted to predict the potential change in water quality impact from the expanded STKSTW. The worst case discharge condition (maximum average dry weather flow with maximum effluent concentration) has been modelled, taking into account the pollution loading from background sources including the Fish Culture Zones, dry weather load from drainage system and rainfall-related loading. Modelling results indicate compliance of DO, TIN, UIA and *E.coli* level in all WSRs under the operation of the expanded STKSTW. Whilst an increase in SS level is predicted in most WSRs under the operation of the expanded STKSTW, these WSRs (mangrove and horseshoe crab habitats) are considered not sensitive to SS as the organisms within experience changes in water quality from tidal fluctuation. Change in SS level is predicted at all WSRs which are sensitive to SS. No unacceptable water quality impact would be expected from the operation of the expanded STKSTW.
- 3.3.5 For construction phase, marine water quality monitoring at selected WSRs is recommended for installation, maintenance and removal of sheetpile. Site audit would also be conducted throughout the marine and land-based construction under this Project. For operation phase, marine water quality monitoring at selected WSRs is recommended for the first year of (1) interim operation of the TSTP, (2) operation of phase 1 expansion of the STKSTW and (3) operation of phase 2 expansion of the STKSTW. Monitoring of effluent quality would also be required for WPCO permit requirement. The specific monitoring requirements are detailed in the Environmental Monitoring and Audit (EM&A) Manual associated with the EIA Report.
- 3.3.6 The potential change in water quality of an emergency discharge from the TSTP and the expanded STKSTW is transient and reversible. Nevertheless, a number of precautionary measures have been taken into account in the design to minimize the risk of discharge of untreated or incompletely-treated sewage into the marine water of Starling Inlet under emergency situation.
- 3.4 Waste Management and Land Contamination**
- 3.4.1 The potential impacts to waste management caused by construction and operational activities of this Project have been assessed in this EIA Report. The impacts have been identified and analysed to be in compliance with the criteria and guidelines stated in the *EIAO-TM Annexes 7 and 15* respectively. Legislative requirements and assessment criteria relevant to the waste management assessment have also been presented.

- 3.4.2 The waste arisings during the construction and operation phases include excavated material, construction and demolition material, marine sediments from dredging works, general refuse from daily operations, chemical waste from maintenance of plant and equipment and sludge from the expanded STKSTW. The quantity, quality and timing of these waste arisings have been identified. It is estimated that the quantities of inert C&D materials to be generated from the demolition of the existing facilities of the STKSTW, construction of TSTP and expanded STKSTW, construction of submarine outfall, construction of gravity sewers, and demolition of existing STKSPS are approximately 3,552 m<sup>3</sup>, 42,305 m<sup>3</sup>, 3,216 m<sup>3</sup>, 4,597 m<sup>3</sup> and 91 m<sup>3</sup>, respectively. Approximately 11,109 m<sup>3</sup> of inert C&D materials will be reused in the Project. The total quantity of marine sediments generated from the construction of diffuser will be approximately 3,040 m<sup>3</sup>. Approximately a total of 42,652 m<sup>3</sup> of inert C&D materials will be disposed to public fill reception facilities and 275 m<sup>3</sup> of non-inert C&D materials will be disposed at designated landfill. With good site practices, the potential environmental impacts associated with the storage, handling, collection, transport and disposal of the identified waste arisings from the Project will be within acceptable limits set out in the *EIAO-TM*. No adverse waste management impacts are anticipated.
- 3.4.3 With the use of HDD, the need for sediment excavation during construction of the new submarine outfall can be significantly reduced. Nonetheless, localised excavation of a small seabed area (3,040 m<sup>3</sup>) will be necessary to facilitate the construction of the diffuser for the new submarine outfall. Sediment sampling and testing results indicated the excavated sediment is Category L sediment which should be disposed of as Type 1 – Open Sea Disposal. The location of marine disposal site should be sought with MFC/CEDD. The Contractor shall obtain a marine dumping permit in accordance with the Dumping at Sea Ordinance (DASO). The Contractor should provide separate submissions (e.g. sediment sampling and testing plan / sediment quality report) to EPD / DASO authority when applying for the marine dumping permit under the DASO.
- 3.4.4 Operation of the sewage treatment works will generate sludge, screenings, worn membrane filters, chemical waste and general refuse. With the implementation of the recommended mitigation measures, no unacceptable impact due to waste management is expected during operational phase.
- 3.4.5 A review of the past and present land use of the Project site area was conducted. Based on desk-top review and site walkover, the presence of contaminated land is not expected.

### **3.5 Ecology**

- 3.5.1 The EIA has described the potential terrestrial and marine ecological impacts associated with the construction and operation of the Project at Sha Tau Kok. The purpose of the assessment is to evaluate the acceptability of predicted impacts to terrestrial and marine ecological resources and sensitive receivers as per the criteria and guidelines stated in the *EIAO-TM Annexes 8 and 16* respectively. Findings of literature review and dedicated baseline field surveys have provided information for the evaluation of species of conservation interest and ecological importance of various habitats within the Study Area as well as in the Project Site.
- 3.5.2 The field surveys showed that approximately 40% of the Study Area consists of man-made habitats (i.e. developed area and artificial seawall) with low ecological value. The Project Site (except the proposed outfall) is entirely located within the developed area.

- 3.5.3 A total of 13 habitat types were identified within the Study Area. They are terrestrial habitats (i.e. woodland, shrubland, abandoned agricultural land/low-lying grassland, marsh, mangrove, pond, stream/river and developed area) and coastal habitats (i.e. artificial seawall, rocky shore, mudflat, sandy habitats, subtidal benthic habitat within Study Area of Sha Tau Kok and in Starling Inlet). All of the habitats are of low to moderate-low ecological values, except for woodland, marsh, mangrove and mudflat. The A Chau Site of Special Scientific Interest (SSSI) and coastal habitats including mangrove stands, sandflats and mudflats at Sha Tau Kok Hoi are the recognized ecologically important / sensitive sites located within the Study Area.
- 3.5.4 Regarding species of conservation interest, three flora species, one mammal species, sixteen bird species, five butterfly species, one odonate species, one aquatic fauna, one horseshoe crab species and one seagrass species from mudflat habitat were recorded during the field baseline surveys. None of these species were found within the Project works Site (both land and marine).
- 3.5.5 Construction impacts to marine ecological resources have largely been avoided by optimizing the length and alignment of the submarine outfall to avoid key ecologically sensitive areas, and by applying the trenchless method for installing submarine outfall and through proper planning design and execution of the works (i.e. optimisation of project construction schedule/ sequence, using good engineering/ industry practice, timely completion of construction works to reduce impact duration, etc.). It is anticipated that habitat loss would be minimal, about 0.18 ha only.
- 3.5.6 Increased human activities and disturbances due to the Project construction have the potential to affect Great Egret's usage of the Night Roosting Site. These potential impacts are expected to be low, due to its small scale, temporary nature of construction activities and with the implementation of recommended measures (restriction of working hours). Hence, no construction activities will be undertaken within an area of 100m from the Night Roosting Site after 16:00 under normal working hours (i.e. 16:00 to 07:00 of the following day). In addition, strong artificial lighting should not be used in the area at night to avoid disturbance to the roosting ardeids. Clear signs should be erected on site to alert all site staff and works regarding the requirements.
- 3.5.7 For marine ecological impact, habitat loss of subtidal soft bottom habitat which is of low ecological value (within the Project footprint) will also arise from marine construction activity for installing the submarine outfall and there will be potential burial of benthic organisms. The selection of trenchless method will avoid direct impacts to subtidal soft bottom habitats which are of low to moderate ecological value. Intertidal and subtidal habitats will be impacted temporarily due to changes in water quality arising from marine construction works. Since the sediment removal at outfall structure would be conducted in dry condition after cofferdam construction is completed and inside of the cofferdam be drained, no sediment release into the water column would be expected from the sediment removal under this Project.
- 3.5.8 The EIA sets out mitigation measures to reduce ecological impacts, such as regular checks in the work site boundaries to ensure they are not breached and that damage does not occur to surrounding areas. With the implementation of the proposed mitigation measures, no adverse residual impact due to the land-based and marine-based construction of proposed STKSTW and submarine outfall is anticipated.

### **3.6 Fisheries**

- 3.6.1 The EIA has described the impacts to fisheries resources and fishing operations associated with the construction and operation of the Project. The purpose of the assessment was to evaluate the predicted impacts to fisheries resources and fishing operations as per the criteria and guidelines stated in the *EIAO-TM Annexes 9 and 17* respectively.
- 3.6.2 A literature review of baseline information on commercial fisheries resources and fishing operations surrounding the waters of the proposed Project has been undertaken. Sensitive receivers including Fish Culture Zones at Sha Tau Kok, Ap Chau, Kat O, O Pui Tong, Sai Lau Kong and Wong Wan (at least 1.17 km away from the diffuser of the proposed submarine outfall), recognized spawning and nursery ground of commercial fisheries at northeast waters (at least 2 km away from the diffuser of the proposed submarine outfall) and artificial reefs at Yan Chau Tong Marine Park and O Pui Tong (at least 5.88 km away from the diffuser of the proposed submarine outfall) have been identified. The potential fisheries sensitive receivers are located at least 1.17km from the diffuser of the proposed submarine outfall. However, the assessment of water quality impacts demonstrated that these areas will not be significantly affected.
- 3.6.3 During construction of the Project, direct impacts arising from the proposed marine works include temporary loss of approximately 1 ha of fisheries habitat and fishing ground. Given the small size of the fishing ground and temporal nature (within 27 months) of the marine works, no significant direct impacts on fishing operations are expected to occur. Indirect impacts to fisheries resources related to perturbations to key water quality parameters are also expected to be insignificant as the predicted changes in water quality are short term and localised to immediate vicinity of the works area. Marine construction works have been designed to reduce potential impacts on the water quality which will, in turn, reduce impacts on fisheries resources.
- 3.6.4 There will be loss of 0.0412 ha of fishing ground during operation due to the installation of diffuser erected above the seabed. Given the small size and low fisheries importance of the area being lost, unacceptable operational phase impacts to fisheries resources and fishing operations are not expected to occur. Unacceptable impacts from discharge of treated sewage are not anticipated to occur. Compliance with the relevant discharge standards to control water quality impacts to within acceptable levels is also expected to control impacts to fisheries resources. No additional fisheries-specific mitigation measures are required during operation.
- 3.6.5 Monitoring activities designed to detect and mitigate any unacceptable impacts to water quality during construction phase are also expected to protect against unacceptable impacts to fisheries. All of the potential construction and operational fisheries impacts identified are deemed acceptable.
- 3.6.6 As a good practice, it is recommended to establish a communication plan as a precautionary approach to inform the mariculturists, relevant stakeholders (e.g. Sha Tau Kok District Rural Committee) and relevant government departments (e.g. AFCD, EPD, MD) of the emergency discharge situation at STKSTW such that appropriate response actions can be formulated.

### **3.7 Landscape & Visual**

- 3.7.1 The EIA has described the landscape and visual impacts associated with the construction and operation of the Project as per the criteria and guidelines stated in the *EIAO-TM Annexes 10 and 18* respectively.

- 3.7.2 A landscape and visual impact assessment (LVIA) has been conducted for the Project.
- 3.7.3 The key sources of impacts include: site clearance for the new STKSTW site, works for the new permanent STKSTW / TSTP, removal of existing trees, construction activities for associated minor works of demolition of the existing STKSPS and construction of a new gravity sewer along the vehicular access of Shun Hing Street at Sha Tau Kok.
- 3.7.4 A total of 55 LRs, 7 LCAs and 16 VSRs are identified in the baseline study. Those LRs, LCAs and VSRs which are potentially to be affected by the proposed project are listed below:
- *LR6.10 - Trees surrounding Sha Tau Kok Sewage Treatment Works*
  - *LCA4 - Boundary Crossing Facilities Landscape*
  - *LCA5 - Sha Tau Kok Rural Township Landscape*
  - *VSR R1 - Residents in Block 42 – 45 of Sha Tau Kok Chuen*
  - *VSR R2 - Residents in Ha Tam Shui Hang*
  - *VSR R3 - Residents in Muk Min Tau*
  - *VSR R4 - Residents in Block 13-15 of Sha Tau Kok Chuen*
  - *VSR R5 - Residents at 3-17 Shun Lung Street*
  - *VSR R6 - Residents of Public Housing Development at Shun Hing Street*
  - *VSR O1 - Workers/Officers in Sha Tau Kok Fire Station*
  - *VSR O2 - Police Operation Base*
  - *VSR O3 - Workers of Sha Tau Kok Fish Culture Zone*
  - *VSR T1 - Motorists on Sha Tau Kok Road*
  - *VSR T2 - Marine users on Starling Inlet*
  - *VSR RE1 - Recreational Users of Sha Tau Kok Chuen Area*
  - *VSR RE2 - Recreational Users of Sha Tau Kok Promenade Sitting-out Area (1)*
  - *VSR RE3 - Recreational Users of Land Use Zoning REC(1)*
  - *VSR RE4 - Recreational Users at Yim Liu Ha*
  - *VSR RE5 - Recreational Users of Sha Tau Kok Promenade Sitting-out Area (2)*
- 3.7.5 A tree survey was conducted in LR6.10 and a total of 126 trees were recorded. According to the preliminary findings, majority of the trees (108 trees, 84%) can be retained in-situ while a small portion of trees (18 trees with total DBH 3.1m, 16%) requires removal due to unavoidable conflicts. Under the preliminary proposal, 31 heavy standard trees (of total DBH of 3.1m) will be provided for tree compensation. The compensation ratio will be 1:1.72 and 1:1 for tree number and total DBH respectively. Hence, there will be no net loss of trees in terms of both quality and quantity.
- 3.7.6 During the course of developing the proposed project and assessing the landscape and visual aspects, a series of mitigation measures are carefully considered in the project design for impact avoidance, impact minimisation and landscape and visual enhancement as far as practical. Recommended mitigation measures include preservation of existing trees, proper control of site construction activities, transplantation of existing trees, suitable design of the expanded STKSTW, compensatory planting and amenity enhancement.
- 3.7.7 After assessment, LR(LR6.10), LCA(LCA5) and VSRs (R1, R2, R4, R5, R6, O1, O2, O3, T2, RE1, RE1, RE2, RE3, RE4, RE5) will receive slight adverse impact with mitigation measures during the construction period. All others (LCA4, R3, T1) will receive insubstantial impact with mitigation measures during the construction period.

- 3.7.8 At Day 1 of operation, VSRs (R1, R2, O1, O2, O3, T2, RE1, RE3 and RE4) will receive slight adverse impact with mitigation measures. All other receivers (LR6.10, LCA4, LCA5, R3, R4, R5, R6, T1, RE2, RE5) will receive insubstantial impact with mitigation measures.
- 3.7.9 At Year 10 of operation, LR6.10 will receive slight beneficial impact with full establishment of mitigation measures during the operation period. The reason for the slight beneficial impact experienced by the LR6.10 is that there will be a net gain of tree planting area (increased to 0.42ha from original 0.31ha) and overall planting area (increased to 0.45ha from original 0.31ha). VSR T2 would experience slight negative mitigated impacts during the operation phase, which is considered within acceptable range due to the low sensitivity in nature of the travelling type VSR, the glimpse duration of view and its panoramic quality of views over the Starling Inset seascape. All other receivers (LCA4, LCA5, R1, R2, R3, R4, R5, R6, T1, O1, O2, O3, RE1, RE2, RE3, RE4, RE5) will experience insubstantial impact with full establishment of mitigation measures during the operation period.
- 3.7.10 With the implementation of the recommended mitigation measures, the significance of impacts on the following LR will be slight beneficial. According to Annex 10, Clause 1.1 (a) of the *EIAO - TM*, the overall impact on this LR is considered **beneficial**:
- LR6.10 - Trees surrounding Sha Tau Kok Sewage Treatment Works
- 3.7.11 With the implementation of the recommended mitigation measures, the significance of other receivers will be either slight adverse (VSR T2) or insubstantial. The overall landscape and visual impacts are therefore considered **acceptable with mitigation measures**, according to Annex 10, Clause 1.1 (c) of the *EIAO - TM*.

### **3.8 Cultural Heritage**

- 3.8.1 The EIA has described the cultural heritage impact associated with the construction and operation of the Project as per the criteria and guidelines stated in the *EIAO-TM Annexes 10 and 19* respectively.
- 3.8.2 The Built Heritage Survey and Assessment has been carried out within the extent of the Project. The Survey has identified a series of historic buildings, comprising 11 historic buildings at Ha Tam Shui Hang and 27 historic buildings at Sha Tau Kok. No declared monuments are identified in the Survey.
- 3.8.3 All the identified historic buildings at Ha Tam Shui Hang are located over 150 metres away from the nearest Project site; all the identified historic buildings at Sha Tau Kok except STK-HB1, the Tin Hau Temple, are located at least 80 metres away from the proposed works. The current Tin Hau Temple is a concrete modern structure rebuilt at this location in 1992 and it has a distance of 4 metres to the nearest Project site. As a result, mitigation measures are proposed for the construction works in order to preserve the Tin Hau Temple from any damage caused by the construction activities. Mitigation measures include provision of a 10m buffer zone between the works area for open cut section of the proposed sewer and the Tin Hau Temple, undertaking condition survey and vibration impact assessment (and vibration and settlement monitoring during construction if necessary) for the Tin Hau Temple and provision of a protective covering to the Tin Hau Temple.

**3.9 Environmental Monitoring & Audit**

3.9.1 Environmental monitoring and audit requirements have been identified and recommended to ensure the effectiveness of the recommended mitigation measures. These requirements are specified in the EM&A Manual. The monitoring requirements cover the area of odour, noise, water quality and ecology. Regular site audits throughout the construction and operation of the Project have also been recommended.

**4. OVERALL CONCLUSION**

4.1.1 The environmental impact assessment (covering air quality, noise, water quality, waste management, ecology, fisheries, landscape and visual impact and cultural heritage) has concluded that no unacceptable environmental impacts are envisaged as a result of the construction and operation of the Project, provided that the recommended mitigation measures are implemented.

4.1.2 Recommendations for an environmental monitoring and audit programme have been prepared to ensure the effectiveness of the recommended mitigation measures.