

9 FISHERIES IMPACT

Introduction

- 9.1 This section presents the findings of the assessment of potential impacts on fisheries arising from the proposed Project, including a description of baseline conditions, evaluation of potential impacts and recommendation of mitigation measures, where appropriate.

Environmental Legislation, Standards and Guidelines

- 9.2 Guidelines and criteria for assessment of fisheries impacts in Hong Kong is set out in the EIAO TM. These criteria provide for identification, prediction and evaluation of potential fisheries impacts.
- 9.3 Other legislation which applies to fisheries and is relevant to fisheries assessment includes:
- Fisheries Protection Ordinance (Cap. 171) – It promotes the conservation of fish and other forms of aquatic life within the waters of Hong Kong and regulates fishing practices to prevent activities detrimental to the fishing industry.
 - Marine Fish Culture Ordinance (Cap. 353) – It designates, regulates and protects fish culture zones (FCZs) from injury to fish and pollution of waters.
 - Water Pollution Ordinance (Cap. 358) – It sets limits to water quality parameters in various Water Control Zones.

Assessment Methodology

- 9.4 As stated in Clause 3.4.6.2 of the EIA Study Brief, the Assessment Area for fisheries impact assessment shall be the same as for water quality impact assessment, i.e. Northwestern, Western Buffer (including the Ma Wan Fish Culture Zone (FCZ)), Southern, Victoria Harbour, Eastern Buffer and Junk Bay Water Control Zones (WCZs).
- 9.5 Baseline information on fisheries in the Assessment Area was elucidated via a desktop review of the existing extensive literature. The review included relevant fisheries baseline data presented in Agricultural Fisheries and Conservation Department (AFCD) Port Survey 2001/2002 and incorporated the information available in other reports and publications. The comprehensive literature and fisheries surveys provide information to fill in identified data gaps for this EIA study. Therefore, no information gap is identified and no further field surveys are required for this EIA study. A list of the key relevant literature is presented at the end of this section.
- 9.6 The fisheries impact assessment follows Annex 9 of the EIAO TM which sets out the criteria for evaluating fisheries impact and Annex 17 which denotes the guidelines for fisheries impact assessment
- 9.7 The Assessment Criteria used for the evaluation of fisheries impact included the following:
- **Nature of the impact:** whether the impacts are permanent, irreversible or long term.
 - **Size of affected area:** this includes fisheries habitats, fishing grounds, or mariculture zones and takes into consideration whether the area constitutes a high proportion of the total area of fishing grounds or aquaculture sites.
 - **Loss of fisheries resources/ production:** includes capture fisheries and aquaculture production in relation to overall resources or production in Hong Kong.
 - **Destruction and disturbance of nursery and spawning grounds:** disturbance or destruction of nursery and spawning grounds of commercially important species.
 - **Impact on fishing activity:** numbers of fishermen or fishing vessels with a high dependence on the affected area
 - **Impact on aquaculture activity:** numbers of aquaculturists or mariculture (fisheries culture) zones that are affected.

Description of the Environment

- 9.8 In Hong Kong, marine-based commercial fishing operations are classified as capture or culture fisheries. According to AFCD (2006), in the year 2004, an estimated 167,500 tonnes of fisheries produce valued at \$1,600 million was produced with about 10% of the total catch coming from waters inside Hong Kong. The industry now consists of some 4,630 fishing vessels and some 9 500 fishermen working abroad. Main fishing methods include trawling, long-lining, gill-netting and purse-seining with the majority of the total catch obtained through trawling.
- 9.9 Culture fisheries activities, on the other hand, include 26 FCZs located in various sheltered embayment across the HKSAR and occupy about 209 ha of sea area. Typically, fish farms are relatively small scale, family-run operations consisting of one or two rafts with an average size of about 260m². In 2005, there were 1,090 licensed operators at these FCZs. The annual production in 2004 by the marine fish culture industry was about 1,540 tonnes of fish valued at HK\$79 million catering for about 9% of local demand for live marine fish (AFCD 2006)

Capture Fisheries

- 9.10 According to the "AFCD Port Survey 2001-2002", annual catches of adult fish within the Assessment Areas were highly varied from place to place with range of 0-1000 kg/ha. In the Northwestern Water Control Zone (WCZ), the adult fish catch was about 100-200 kg/ha, with a 200-400 kg/ha of fish caught in the Sha Chau and Lung Kwu Chau Marine Park. In the Western Buffer WCZ, most areas were in the range of 100-200 kg/ha with an exception near Ma Wan of 200-400 kg/ha. In Victoria Harbour WCZ, the adult fish catch ranged from 50-400 kg/ha, with more catch towards the eastern side of Victoria Harbour. In the Junk Bay WCZ, the annual catches of adult fish were 100-400 kg/ha; in the Southern Waters WCZ, the catches were higher than other WCZs within the Assessment Area. Areas along Lamma Island had catches around 400-600 kg/ha, while catches of 600-1000 kg/ha were found near Cheung Chau, Po Toi and Penny Bay. In the Eastern Buffer WCZ, the adult fish caught was about 200-400 kg/ha. In comparison with other fishing grounds across Hong Kong annual catches of adult fish within the Assessment Area are therefore considered to support low to moderate adult fish production, except the Southern Waters WCZ which supports high adult fish production.
- 9.11 According to the "AFCD Port Survey 2001-2002", fry production in the Assessment Area, used as grow-out stock by mariculturists, is very limited. Latest figures indicated that the fry caught in the Assessment Area were at low density of 0-50 tails/ha. Only a very small portion of the Assessment Area located near the western side of Kau Yi Chau and western side of Hei Ling Chau that had a density of 50-100 tails/ha and no fry production was recorded from the rest of the Assessment Area.
- 9.12 The scale of fishing operations in terms of number of fishing vessels operating in the Assessment Area varied from place to place. The number of fishing vessels considered as moderate-high (400-700 vessels) per year was recorded included in the areas near the Sha Chau and Lung Kwu Chau Marine Park, Ma Wan, Siu A Chau, Kau Yi Chau, Lamma Island and Tung Lung Chau. High fishing operation with the number of fishing vessels falling in the range of 700-1000 vessel was recorded in the Po Toi and Cheung Chau water. Moderate scale of fishing operations (100-400 vessels) was recorded in the waters along the coast of Lantau, Sha Chau and Lung Kwu Chau Marine Park, Junk Bay WCZ, part of Eastern Buffer WCZ and eastern side of Victoria Harbour. Other areas in the Assessment Area including the southern part of the Western Buffer WCZ and western part of the Victoria Harbour WCZ is considered to have low scale fishing operation which the number of vessels falls below 100.
- 9.13 The most common catches in Hong Kong fisheries in Assessment Area include:
- most of the Assessment Area has low-moderate (20-40 kg/ha) of sardine, but high near Kau Yi Chau (>60 kg/ha);
 - Croaker generally ranged from (10-40 kg/ha) but high in Sung Kong, Beaufort Island, Po Toi and Cheung Chau.
 - Rabbit fish of low-moderate catches were found in Tsing Yi, Sung Kong, Beaufort Island, Po Toi, Cheung Chau and Lamma Island, but high in Tung Lung Chau around 60 kg/ha or more.
 - Scad, the catch generally ranged from low to moderate, but moderate (40-60 kg/ha) in Po Toi.

- Shrimp, the catch ranged from low to moderate, but high in Cheung Chau, west of Lamma Island and Sung Kong, Beaufort Island, Po Toi Island.
- Anchovy, the catches ranged from low to moderate in the Assessment Area.
- Crab, moderately high catches were made from Cheung Chau and Silver Mine Bay, other areas in the Assessment Area were considered as low (<20 kg/ha) to moderate.
- Seabream catches generally ranged from low to moderate, but moderately high in Kau Yi Chau and eastern side of Sung Kong;
- Threadfin bream catches generally were low, but high in Sung Kong, Beaufort Island, Po Toi; lastly for squid catches generally ranged from low-moderate but high in Sung Kong, Beaufort Island and Po Toi.

Culture Fisheries

- 9.14 Hong Kong production in 2004 totaled 1,540 tonnes. The fish species commonly cultured in FCZs include green grouper, brown-spotted grouper, giant grouper, Russell's snapper, mangrove snapper, red snapper, cobia and pampano.
- 9.15 Within Assessment Area, there are six FCZs located at Ma Wan, Cheung Sha Wan, Tung Lung Chau, Po Toi, Sok Kwu Wan and Lo Tik Wan are identified for this Project (see [Figure 5.1](#)).
- 9.16 In the past, growing out operations were common practice where fish fry of commercially valuable species were caught from the wild, then reared in sea cages until the fish attained a marketable size. Consequently, there used to be intensive seasonal collection of wild fry from local waters for mariculture, especially for high-value species like the red pargo (*Pagrus major*) during February and March, with surplus fry exported to supply the grow-out industries in Japan and China (AFCD 1998).
- 9.17 Capture of wild fish fry appears to be much reduced in scale over the last few years and only persists in north eastern waters, such as Mirs Bay and Tolo Harbour (based on personal communications with local fishermen). Fry are mostly imported from the Mainland, Taiwan, Thailand, Philippines or Indonesia. Local fish farmers also favour imported fry because of their greater disease resistance and lower mortality rates in contrast to high mortalities often encountered with local caught wild fry.
- 9.18 In recent years, there has also been a trend away from growing out procedures towards the holding of imported reef fishes in temporary cages, the so-called "fish hotels". This results in imported live reef food fish species such as the valuable humphead wrasse, green wrasse, leopard coral grouper, and humpback grouper. As the fishes in FCZs operations are often reef or reef-associated species that normally inhabited clear, oceanic waters, their enclosure in sea cages means they cannot move away from any unfavourable conditions, thus they may be particularly vulnerable to adverse water quality changes, such as low dissolved oxygen (DO) or high levels of suspended solids.

Fisheries Resources

- 9.19 The Assessment Area covers six WCZs. Two WCZs of Southern Waters and Eastern Buffer, especially the areas in Cheung Chau, South Lantau Island, Lamma Island, Po Toi, Sung Kong Island, Beaufort Island and Tung Lung Chau experience relatively high levels of fishing activity and produce high yields compared with the eastern waters (AFCD 1998). Areas near the Sha Chau and Lung Kwu Chau Marine Park and Ma Wan in the Western Buffer WCZ also support high fisheries resources. While others areas in the Assessment Area including the Western Buffer and Victoria Harbour WCZs are not considered as fisheries important habitats.
- 9.20 Surveys undertaken in the western side of Hong Kong Island, such as the "Green Island Development Studies" by Territory Development Department (2000) to provide supplementary information for Assessment Area, have shown that fisheries production value is generally low in area near Green Island, both in terms of adult fish and fry Production.
- 9.21 Surveys conducted at Tung Lung Chau from July to August 2002 for "HATS EEFS WP9, 2004" concluded that species richness along Tung Lung Chau area was low of which ponyfishes predominating.

- 9.22 Findings from “(Put O Ang, Jr. *et al*, 2005) Biological Monitoring in Sha Chau and Lung Kwu Chau Marine Park. Final Report submitted to the Agriculture, Fisheries and Conservation Department, HKSAR” for fish surveys in artificial reef located near Sha Chau pointed out that the mean number of fish caught in each sampling period (4 sampling) between October 2003 and September 2004 was 66.75 from gill netting and 25 from hand-lining. The artificial reef was deployed in March 2000 in west of the Sha Chau. Put O Ang, Jr. *et al* (2005) commented that an increase in fish abundance and diversity around the artificial reef site was detected. Of particular note was a significant increase in the number of commercially significant species at the artificial reef such as *Otolithes ruber*. The presence of suitable rocky/hard habitat above the artificial reef site indicated that recruitment to the reef was progressing well. Put O Ang, Jr. *et al* (2005) also suggested that the recruitment of fish species to the reef was well. The reef may have potential ecological value habitat in the future. No relevant information is available for other artificial reef located near Chek Lap Kwok International Airport. Locations of the two artificial reefs are shown in [Figure 5.1](#).
- 9.23 The “Hydrodynamic and Water Quality Modeling Services For Potential New Waste Disposal Sites – Final Water Quality and Hydrodynamic Assessment Report” by Environmental protection Department (EPD) (2003) suggested that Soko Islands, Pak Tso Wan, Nam Tam Wan, Lamma Island, South Lantau Island, North Po Toi Island, Sung Kong Island, Waglan Island, Nai Tau and Sok Ku Wan are considered as fishery spawning/ nursery ground. Most of the areas occur in the Southern WCZ and part of Northwestern WCZ, the conclusion is similar to Section 8.20.
- 9.24 However, the western side of Victoria Harbour WCZ did not support high catch of fisheries. Within Western Buffer WCZ, Ma Wan is only the FCZ support high fisheries resources, while the entire area within Western Buffer WCZ did not support high fisheries catches.
- 9.25 “The Study of Fisheries Resources and Fishing Operations in Hong Kong Waters” (AFCD, 1997), identified spawning grounds in Hong Kong including; Waglan Island, South Lamma Island, South Cheung Chau and Northern Lantau Island waters. The nearest spawning grounds at South Lamma Island and South Cheung Chau are over 14 km away from the SCISTW outfall.
- 9.26 Important nursery areas can also be identified from the main areas of fry collection for the mariculture industry. Fry collection in recent years has been much reduced in scale and the latest interview studies (AFCD, Port Survey, 2001-2002), report that fry collection only occurs in a few areas. These areas are mostly eastern inshore waters, such as Crooked Harbour, Double Haven, Long Harbour and Port Shelter, which are over 40 km away from the SCISTW outfall.

Identification of Environmental Impacts

Construction Phase

- 9.27 The Project will involve minor construction works within the existing Stonecutters Island Sewage Treatment Works (SCISTW). No loss of habitats nor nursery and spawning grounds is anticipated from the Project. Therefore no impacts on marine fisheries are expected during the construction phase. This issue is not addressed further in this Section.

Operation Phase

- 9.28 As discussed in Section 5, the key water quality issue of this Project would be the effect of disinfected sewage effluent discharged from the SCISTW. Key parameters of concern would include total residual chlorine (TRC) and chlorination by-products (CBPs), *E. coli*, and dissolved oxygen (DO). The formation of TRC and CBPs in the Project effluent would be due to chlorination and dechlorination of the sewage effluent. The changes of *E. coli* in the Project would be a result of the effectiveness of proposed disinfection. The potential oxygen depletion impact would be related to the dechlorinating agent.
- 9.29 There may be direct impacts from TRC and CBPs which are toxic and persistent in nature and could cause formation of mutagenic/carcinogenic and toxic by products within organisms which would pose ecological risks to fisheries (Monarca *et al.*, 2000). Other potential direct impacts may cause mortality and sub-lethal toxicity to fisheries. The potential impacts of acute and chronic toxicity to

fisheries resources (categorized as marine life in Section 7) from the disinfected effluent are addressed in detail under the Ecological Risk Assessment in Section 7.

- 9.30 *E. coli* contains many strains. Not all strains are toxic in nature to marine organisms. There are pathogenic strains which would potentially adhere to the gill surface and cause mortality of fish species (Yin *et al.*, 2006). Some of the fishes would become aggressive when they are stimulated by pathogens (Efthimiou *et al.*, 1994). However, not all the marine organisms would suffer from adverse impacts by pathogenic strains. From the *in-vitro* essay, most fisheries resources including crustacean species would induce anti-bacterial enzyme or chemicals within their haemolymph, cephalothorax, exoskeleton and gills as a body defence against pathogenic strains of *E.coli*. (Hang *et al.*, 2002).
- 9.31 If dissolved oxygen reaches critically low levels marine organisms may suffocate and die. If levels of DO are reduced to a low but sub-lethal level many organisms can survive by increasing their ventilation rate and volume. However the increase in oxygen consumption rate is metabolically demanding and would reduce the energy available for other vital processes (Valverde *et al.*, 2006).

Evaluation of Environmental Impacts

- 9.32 The potential changes in concentration of TRC, CBPs, DO and *E coli*. have been predicted by the water quality modeling in Section 5. The results show that a small increase in TRC, CBPs and a small decrease in DO occurs, but this is localized around the existing SCISTW outfall (refer to figures in Section 5, 5.22-5.31, for changes in TRC and CBPs and 5.34-5.35 for changes in DO). The results show that *E coli*. reduction is confined to the Western Buffer and Victoria Harbour WCZs. Therefore, the assessment below and presented in **Table 9.1** focus only on fisheries resources and the Ma Wan FCZ present in the potentially impacted zones, i.e. Victoria Harbour and Western Buffer WCZs. No impacts on fisheries resources outside the impacted zone are expected.
- 9.33 As discussed in details in Section 5, the dispersal of TRC and CBPs in the disinfected effluent would be localized at the existing SCISTW sewage outfalls. The level of TRC would be lower than 0.001 mg/L, within the assessment criteria of 0.008 mg/L. The detailed acute and chronic effects of TRC and CBPs on fish are assessed in Section 7 and no significant adverse impact is anticipated.
- 9.34 With the implementation of the Project, the levels of *E. coli* would be significantly reduced and there would be improvement to water quality in the Western Buffer WCZ and western Victoria Harbour WCZ. In the intermediate operation stage of HATS (in year 2013), the south of Tsing Yi Island and western Victoria Harbour WCZ would have *E coli* levels reduced from over 50000 numbers per 100mL (without disinfection facilities) to 1000-5000 number per 100mL (with disinfection facilities). In the ultimate year operation stage of HATS, the south of Tsing Yi Island and Western Victoria Harbour *E. coli* levels would be reduced from over 500-5000 number per 100mL (without disinfection facilities) to less than 180 number per 100mL (with disinfection facilities). The reduction in *E. coli* levels by the Project would have a positive impact on fisheries.
- 9.35 At Ma Wan FCZ situated in the impact area, water quality modeling predicts *E.coli* levels would comply with the WQO of 610 counts per 100 ml under all assessment scenarios, therefore no adverse impact is expected on this FCZ. With the ADF, by 2009, the water quality at the FCZ would be improved, with a reduction in *E. coli* levels from 509 to 171 and 324 to 90 (Geometric mean, no./100ml) in the wet and dry season respectively (for details refer to Appendix 5.5). By 2020 there would be a reduction in *E. coli* levels from 240 to 15 and 249 to 17 (Geometric mean, no./100ml) in the wet and dry season respectively (for details refer to Appendix 5.7).
- 9.36 A review of literature on the effects of residual chlorine discharges on fisheries resources has been conducted and provides data which can be used as a benchmark to evaluate potential impacts. Work on the toxic effects of residual chlorine on fish eggs and larvae has indicated that abnormal development may occur if residual chlorine is present at concentrations of 0.31 to 0.38 mg L⁻¹ (Morgan and Prince, 1977). However, behavioural studies have indicated that adult fish will avoid areas where concentrations of residual chlorine in the water exceed 0.035 mg L⁻¹ (Grieve *et. al.*, 1978).

- 9.37 The discharge standard for Total Residual Chlorine (TRC) in the chlorinated/dechlorinated (C/D) HATS effluent would be 0.2mg/L^1 , which means the TRC concentration in undiluted C/D HATS effluent would be lower than the TRC concentration that may induce toxic effects on fish eggs and larvae (0.31 to 0.38 mg L^{-1}). Near field water quality modelling has predicted the minimum dilution factor of effluent at the ZID to be 34 to 47 in various project scenarios, such dilution of discharged effluent further reduces the TRC concentration in seawater.
- 9.38 Furthermore, concentrations of residual chlorine have been shown to diminish rapidly with time and distance from the discharge point (Mattice and Zittel, 1976) and therefore sensitive receivers further from the diffuser site such as Ma Wan FCZ and spawning/nursery grounds at South Cheung Chau and South Lamma Island will not be impacted. From the above, it can be concluded that fish larvae and eggs would not be affected by residual chlorine in the diluted C/D HATS effluent.
- 9.39 Toxicity data of chlorination by-products (CBPs) on fish larvae and eggs is limited to date. Chemical analysis conducted under this EIA Study revealed that only 8 and 5 of the 34 documented potential CBPs were detected in the C/D CEPT effluent and secondary treated effluent respectively. According to the water quality impact assessment, the presence of the detected CBPs in the seawater would be very low, with concentrations of less than $1\mu\text{g/L}$ which would comply with the available marine water quality standards that were developed to protect aquatic biota.
- 9.40 In view of the predicted low concentration increase of CBPs in only a small localized area at SCISTW and compliance with available marine water quality standards, it is considered that fish larvae and eggs would not be affected by CBPs in diluted C/D HATS effluent. Juvenile fish are also not expected to be affected as the nearest nursery/spawning grounds (South Lamma Island and South Cheung Chau) are over 14 km away.
- 9.41 It is concluded that residual chlorine and CBPs in discharged C/D HATS effluent would not adversely impact fisheries resources.
- 9.42 The predicted oxygen depletion levels at the SCISTW outfall was highest in the wet season at 0.028 mg/L , in the initial and intermediate operation years of HATS. It would be expected that the actual levels would be smaller as it was predicted as a worst case scenario. Also this depletion of oxygen was measured in a $120\text{m} \times 140\text{m}$ grid cell, in the adjacent cell oxygen depletion is less than half this figure so oxygen depletion should be considered insignificant. Such slight decrease in DO level localized at the SCISTW outfall would not pose significant impacts to fisheries in Western Buffer and Victoria Harbour WCZs or at Ma Wan FCZ.
- 9.43 No adverse fisheries impacts are anticipated, considering the reasons below:
- Improvement in water quality with reduction in E coli levels in Western Buffer WCZ and western Victoria Harbour WCZ;
 - Localized and small changes in TRC, CBP and DO at around the existing SCISTW outfall;
 - No unacceptable ecological risk on fisheries in relation to acute and chronic effects, which is supported by the whole effluent toxicity test (WETT) results (presented in Section 7) indicating that C/D CEPT and C/D secondary treated effluent do not induce acute toxicity to fish species *Lutjanus malabaricus*, which is a common species for the local mariculture industry and has a wide geographic distribution in Hong Kong. In view that no acute toxicity was imposed to fish species continuously exposed to C/D effluent during the toxicity testing period, the caged fishes at water quality sensitive receivers including Ma Wan FCZ, which would be exposed to greatly diluted C/D effluent from HATS, would not be adversely affected by the discharged effluent;
 - Western Buffer WCZ and western Victoria Harbour WCZ does not support high catch of fisheries;
 - Water quality objectives met at Ma Wan FCZ
- 9.44 The potential human health impact due to consumption of seafood affected by the discharged C/D

¹ As mentioned in Section 5 of the EIA report, chemical analysis was conducted to determine the concentration of TRC in C/D CEPT effluent from SCISTW and secondary treated effluent from Tai Po/Shatin Sewage Treatment Works. The maximum TRC concentration detected in C/D CEPT effluent and C/D secondary treated effluent was 0.1mg/L and $<0.02\text{mg/L}$ respectively, which were lower than the discharge standard.

HATS effluent has been assessed and the detailed human health risk assessment is presented in Section 6 of the EIA Report. The potential effect of contaminant accumulation has also been considered and addressed in the human health risk assessment.

- 9.45 The fisheries impact evaluation is summarized in **Table 9.1** according to EIAO TM Annex 9 criteria.

Table 9.1 Potential fisheries impacts during the operation phase of the Project

Potential impacted WCZs	Western Buffer WCZ	Victoria Harbour WCZ
Nature of impact	Small and localized reduction of DO. Small localized increase of TRC and CBP within ecological risk criteria. Water quality improvement with reduction of <i>E.coli</i> levels. The change would be long term and permanent.	Small and localized reduction of DO. Small localized increase of TRC and CBP within ecological risk criteria. Water quality improvement with reduction of <i>E.coli</i> levels. The change would be long term and permanent.
Size of affected area	Changes of DO, TRC and CBP levels would be in a small localized area around the existing SCISTW outfall. Reduction in <i>E coli</i> would cover the Western Buffer WCZ.	Changes of DO, TRC and CBP levels would be in a small localized area around the existing SCISTW outfall. Reduction in <i>E coli</i> would cover the western Victoria Harbour WCZ.
Loss of fisheries resources / production	Low. The catch fisheries are low in the Western Buffer WCZ within the impacted area. Ecological Risk Assessment in Section 7 concluded that there would be insignificant risk to fisheries.	Low. The catch fisheries are low in the western Victoria Harbour WCZ nearer to the impacted area. Ecological Risk Assessment in Section 7 concluded that there would be insignificant risk to fisheries.
Destruction and disturbance of nursery and spawning ground	No, as no fisheries nursery and spawning ground recorded within this WCZ.	No, as no fisheries nursery and spawning ground recorded within this WCZ.
Impact of fishing activity	Low. Number of fishing vessels supported relatively low compared with other WCZs in Hong Kong.	Low. The potential impacted areas within this zone would be western part of Victoria Harbour which supported relatively low number of fishing vessels compared with other WCZs in Hong Kong.
Impact on aquaculture activity	Low. Adverse impact on the Ma Wan FCZ is not expected, with compliance of WQO as indicated in the water quality impact assessment in Section 5.	No FCZ in this WCZ.
Overall impact	Low	Low

Mitigation of Environmental Impact

- 9.46 The existing SCISTW outfall location was chosen at an area with low fisheries value to avoid adverse impacts on key fisheries resources. As discussed above there would be no adverse fisheries impacts from the proposed disinfection and therefore no mitigation measures would be required.

Evaluation of Residual Impacts

- 9.47 Based on the above assessment, no residual impact from the Project on fisheries resources is anticipated.

Environmental Monitoring and Auditing

- 9.48 Environmental monitoring and auditing requirements relevant to protection of fisheries are covered in the water quality assessment and Ecological Risk Assessment in [Section 5](#) and [Section 7](#) respectively.

Conclusions

- 9.49 A 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.
- 9.50 The water quality impact modeling results in Section 5 indicated that the potential impact zone would be restricted to the Victoria Harbour and Western Buffer WCZs including Ma Wan FCZ. No impacts on fisheries outside of this zone are expected.
- 9.51 The existing SCISTW outfall location was chosen at the area with low fisheries resources. No adverse fisheries impacts, including fish larvae and eggs are anticipated, considering the reasons below:
- Improvement in water quality with reduction in E coli levels in Western Buffer WCZ and western Victoria Harbour WCZ;
 - Localized and small changes in TRC, CBP and DO at around the existing SCISTW outfall;
 - No unacceptable ecological risk on fisheries in relation to acute and chronic effects, which is supported by the whole effluent toxicity test results indicating that C/D CEPT and C/D secondary treated effluent do not induce acute toxicity to fish species *Lutjanus malabaricus*, which is a common species for the local mariculture industry and has a wide geographic distribution in Hong Kong. In view that no acute toxicity was imposed to fish species continuously exposed to C/D effluent during the toxicity testing period, the caged fishes at water quality sensitive receivers including Ma Wan FCZ, which would be exposed to greatly diluted C/D effluent from HATS, would not be adversely affected by the discharged effluent;
 - Western Buffer WCZ and western Victoria Harbour WCZ does not support high catch of fisheries;
 - Water quality objectives met at Ma Wan FCZ
- 9.52 As there would be no adverse fisheries impacts from the proposed disinfection no mitigation measures would be required. Environmental monitoring and auditing requirements relevant to fisheries protection are covered in the Water Quality Assessment and Ecological Risk Assessment.

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