

# 11 Fisheries

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## 11.1 Legislation, Standards and Guidelines

**11.1.1.1** The local relevant regulations, legislation and guidelines for the assessment of fisheries impacts including the following:

- The Environmental Impact Assessment Ordinance (EIAO) (Cap. 499) and the associated Technical Memorandum (TM);
- Fisheries Protection Ordinance (Cap. 171) and its subsidiary legislation, the Fisheries Protection Regulations;
- Marine Fish Culture Ordinance (Cap. 353) and its subsidiary legislation;
- Marine Parks Ordinance (Cap. 476); and
- Water Pollution Control Ordinance (Cap. 358) and its subsidiary regulations and statements.

**11.1.1.2** Annex 17 of the TM-EIAO sets out the general approach and methodology for assessments of fisheries impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation of the potential fisheries impacts. Annex 9 recommends the criteria that can be used for evaluating fisheries impacts.

**11.1.1.3** Destructive fishing practices such as the use of explosive, toxic substances, electricity, dredging, suction and trawling devices for the purpose of fishing are detrimental to fisheries and the marine ecosystem and are prohibited under the Fisheries Protection Ordinance (Cap 171).

**11.1.1.4** Marine fish culture is protected and regulated by the Marine Fish Culture Ordinance (Cap. 353) which requires all marine fish culture activity to operate under licence in designated fish culture zones.

**11.1.1.5** Under the Marine Parks Ordinance (Cap. 476), fishing activities, including commercial fishing, inside Marine Parks are restricted, and can be conducted only with a permit issued by the Authority.

**11.1.1.6** Water Pollution Control Ordinance (Cap. 358) aims to control water pollution in the waters of Hong Kong. According to the Ordinance and

its subsidiary legislation, Hong Kong waters are divided into ten water control zones (WCZ). Water control zones are designated with individual water quality objectives to promote the conservation and best use of those waters in the public interest. Corresponding statements of Water Quality Objectives (WQO) are stipulated for different water regimes (marine waters, inland waters, bathing beaches subzones, secondary contact recreation subzones and fish culture subzones) in each of the WCZ.

## 11.2 Requirements of EIA Study Brief

### 11.2.1 Assessment Area

**11.2.1.1** As stated in Section 3.4.12.2 of ESB-303/2017, the assessment area for the purpose of the fisheries impact assessment shall be the same as the assessment area for Water Quality Impact Assessment. This shall be extended to include other areas if they are also found being impacted by the construction or operation of the Project during the course of the EIA study.

### 11.2.2 Assessment Approach

**11.2.2.1** It is stated in Appendix J of the EIA Study Brief that existing information regarding the assessment area shall be reviewed. Based on the review results, the assessment shall identify data gap and determine if there is a need for field surveys to collect adequate and updated baseline information. If field surveys are considered necessary, the assessment shall recommend appropriate methodology, duration and timing for such surveys.

**11.2.2.2** The terms of the Fisheries Impact Assessment (FIA) as required in the Appendix J of the EIA Study Brief are as follows:

- (i) description of the physical environmental background;
- (ii) description and quantification as far as possible of existing fisheries activities (e.g., capture fisheries, aquaculture, shellfish farming, collection, etc.);
- (iii) description and quantification as far as possible of the existing fisheries resources (e.g., major fisheries projects and stocks, etc.);

- (iv) identification of parameters (e.g., water quality parameters) and areas (e.g., breeding/spawning grounds, nursery grounds, reefs) that are important to aquaculture activities;
- (v) identification and quantification as far as possible any direct/indirect, onsite/offsite impacts on aquaculture activities / resources (e.g., water quality deterioration of fishing grounds/fish culture zones caused by the Project, reduction of catch/productivity);
- (vi) evaluation of cumulative impacts on aquaculture due to other planned and committed concurrent development projects at or near the assessment area;
- (vii) proposals of practicable mitigation measures with details on justification, description of and programme feasibility as well as staff and financial implications including those related to subsequent management and maintenance requirements of the measures; and
- (viii) review for the need of monitoring during the construction and operation stages of the Project and, if necessary, proposal for a monitoring and audit programme.

### 11.2.3 Key Fisheries Issues

**11.2.3.1** A number of fisheries sensitive receivers are identified in the vicinity of the Project Site and/or the assessment area. These include:

- Fishing grounds for capture fisheries (i.e. coastal waters) within 500m distance;
- Potential sites for Fisheries Protection Areas at Tolo Channel and Long Harbour;
- Nursery grounds;
- Aquaculture sites; and
- Artificial reefs (ARs).

**11.2.3.2** The existing information on commercial fisheries resources and fishing operations in the waters of the assessment area and its vicinity shall be reviewed. Based on the review results, the assessment shall identify data gaps and determine if there is a need for field surveys to collect adequate fisheries baseline information. The FIA will follow Annexes 9 and 17 of the TM-EIAO, in which the general approach and methodology for assessments of fisheries impacts, and the criteria that can be used for evaluating fisheries impacts are stipulated.

## 11.3 Methodology for Baseline Establishment

### 11.3.1 Literature Review Methodology

**11.3.1.1** Existing information about the fisheries baseline conditions within the assessment area were reviewed. Relevant information was reviewed, including previous EIA studies, research studies, consultancy studies, and Agriculture, Fisheries and Conservation Department (AFCD) data. The review focused primarily on the Project Site and secondarily on the assessment area. It aimed to collect fisheries data, to establish the fisheries baseline conditions, and to identify practices, areas and species of potential fisheries importance which may be affected by the Project for incorporation into the assessment.

**11.3.1.2** This review included but was not limited to the following:

- Port Survey 2006;
- Port Survey 2016/17;
- Project Profile for Sediment Removal at Yim Tin Tsai, Yim Tin Tsai East Fish Culture Zones and Shuen Wan Typhoon Shelter;
- Development of a Bathing Beach at Lung Mei, Tai Po, EIA report;
- AFCD latest annual report and website;
- LegCo Paper. 2012. LC Paper No. CB(2)1134/11-12(01) Bills Committee on Fisheries Protection (Amendment) Bill 2011. Follow-up on Matters arising from the Bills Committee Meeting on 10 February 2012; and
- Other relevant reports from government and private sectors.

**11.3.1.3** Port Survey is a comprehensive survey routinely conducted by AFCD to collect data on fisheries production and fishing operations in Hong Kong waters. A uniform grid of 720 ha cell size was overlaid on Hong Kong's waters and the information related to fisheries (e.g. production, vessel number) was presented in several categories. The fisheries resources within the assessment area were evaluated based upon the information from both Port Survey 2006 and Port Survey 2016/17. The results of Port Survey 2016/17 are available on the AFCD website.

**11.3.1.4** Project Profile for Sediment Removal at Yim Tin Tsai, Yim Tin Tsai East Fish Culture Zones and Shuen Wan Typhoon Shelter – The scope of the Project is to remove the sediments at the Yim Tin Tsai and Yim

Tin Tsai (East) Fish Culture Zones in order to improve the fish culture marine environment, as well as to carry out maintenance dredging at the Shuen Wan Typhoon Shelter to allow vessels to berth within the shelters at low tide and to enhance navigational safety. Preliminary fisheries impact assessment was carried out.

**11.3.1.5** The approved Development of a Bathing Beach at Lung Mei, Tai Po (2007), involved development of a bathing beach at Lung Mei to the north-east of the Project Site. Marine / intertidal works were involved, but no fisheries survey was conducted for the EIA. The fisheries baseline information for assessment was compiled from literature review.

**11.3.1.6** AFCD's latest annual report 2016/2017 and website provide the most updated information on the development and trend in Hong Kong fisheries. The latest annual fisheries production is also provided.

**11.3.1.7** LegCo Paper. 2012. LC Paper No. CB(2)1134/11-12(01) discussed the protection of marine and fisheries resources in Hong Kong, covering the assessment area of present study. An artificial reef programme and fisheries protection areas are defined.

**11.3.1.8** Other relevant studies include:

- Fisheries Resources and Fishing Operations in Hong Kong Waters (ERM 1998); and
- Consultancy Study on Fisheries and Marine Ecological Criteria for Impact Assessment (CCPC 2001).

**11.3.1.9** The validity of the information compiled during the literature review was assessed before being adopted into the present FIA study.

## **11.4 Description of Existing Fisheries Baseline Conditions**

### **11.4.1 Fisheries Sensitive Receivers**

**11.4.1.1** Fishing grounds cover most of the open waters in Tolo Harbour and Tolo Channel within the assessment area, except for shipping fairways, Fish Culture Zones, and Typhoon Shelters.

**11.4.1.2** Besides the fishing grounds in Tolo Harbour and Tolo Channel, the following sites of fisheries importance are located within or adjacent to the assessment area (Figure 11.1):

- Yim Tin Tsai Fish Culture Zone;
- Yim Tin Tsai (East) Fish Culture Zone;
- Yung Shue Wan Fish Culture Zone;
- Lo Fu Wut Fish Culture Zone;
- Nursery grounds of commercial fisheries resources;
- ARs in Hoi Ha Wan Marine Park and Long Harbour areas; and
- Potential fisheries protection areas at Tolo Channel and Long Harbour.

## **11.4.2 Capture Fisheries**

**11.4.2.1** The fishing industry of capture fisheries makes an important contribution to Hong Kong in maintaining a steady supply of fresh marine fish to local consumers. In 2017, it produced an estimated 127,600 tonnes of capture fisheries valued at about HK\$ 2,600 million (Information from AFCD website, 2018).

**11.4.2.2** AFCD Port Survey provides the most comprehensive information on capture fisheries in Hong Kong waters, including fishing operations and fisheries production.

**11.4.2.3** The Port Survey consisted of an interview programme. In Port Survey 2006 and 2016/17, about 36% of the local fishing fleet which accounted for all homeports (places at which local fishing vessels are based) and vessel types was interviewed (AFCD website, 2018). Particulars such as vessel length, type and homeport of the fishing vessels were recorded and information about their fishing operations and fisheries production in Hong Kong waters was collected during the interviews.

**11.4.2.4** In Port Survey 2016/17, grid cells were categorised into one of 6 classes, in accordance with their overall adult fish production, viz. >0-

-50 kg/ha; >50-100 kg/ha; >100-200 kg/ha; >200-300 kg/ha; >300-400 kg/ha; and >400-600 kg/ha. As reported in Port Survey 2016/17, in Tolo Harbour and Tolo Channel, areas of moderate fisheries production included the waters between the waters to the east of Ma Shi Chau and the Tolo Channel, where the adult fish fisheries production reached >200-300 kg/ha. The fisheries production of the grid cell adjacent to the Project Site however was ranked as low (>50-100 kg/ha) (Figure 11.2).

**11.4.2.5** In Port Survey 2016/17, the fishing operation in grid cells was categorized into 6 classes, viz. > 0-50 vessels; >50-100 vessels; >100-200 vessels; >200-400 vessels; >400-600 vessels; and >600-800 vessels. In Tolo Harbour and Tolo Channel, the distribution of fishing operations varied with vessel scale. For sampans, the distribution was even, with the majority of the grid cells within Tolo Harbour and Tolo Channel having >200-400 vessels (regarded as moderate), and the cell just outside the Project Site having >100-200 vessels (regarded as moderate) (Figure 11.3a). About >0-50 other types of fishing vessels operated in most of the areas inside Tolo Harbour and Tolo Channel and the area just outside the Project Site (Figure 11.3b). The fisheries production of sampans were even within Tolo Harbour and Tolo Channel, most of the grid cells having >100-200 (regarded as moderate) (Figure 11.4a). For other types of fishing vessels, the fisheries production was concentrated within Tolo Channel (>100-200 kg/ha, regarded as moderate) (Figure 11.4b). While in the vicinity of the Project Site, the fisheries production of both large and small fishing vessels was low (>50-100 kg/ha and >0-50 kg/ha for sampans and other types of fishing vessels, respectively).

**11.4.2.6** AFCD conducted a monitoring of local fisheries resource to assess the changes in fisheries resources after the implementation of the trawl ban and other relevant fisheries management measures. Surveys were conducted at various stations across four areas in Hong Kong, i.e. north-eastern, south-eastern, south-western and north-western waters. Among these areas, the area of north-eastern waters covered Tolo Channel. From the survey data between 2010 and 2015, the catches were mainly contributed, either in terms of abundance or biomass, by a number of commercial species from various families, including Carangidae, Clupeidae, Engraulidae, Gerreidae, Leiognathidae, Penaeidae, Platycephalidae, Polynemidae, Portunidae, Sciaenidae, Siganidae, Soleidae, Sparidae, Squillidae, and Trichiuridae.

**11.4.2.7** Fisheries baseline information was reviewed based on the Project Profile for Sediment Removal at Yim Tin Tsai, Yim Tin Tsai East Fish Culture Zones and Shuen Wan Typhoon Shelter, and the approved Development of a Bathing Beach at Lung Mei, Tai Po. The fisheries baseline information were mostly made reference to Port Survey 2006 and Port Survey 2001/2002, respectively. No fisheries surveys were conducted.

### **11.4.3 Nursery Grounds and Artificial Reefs**

**11.4.3.1** The Tolo Channel from Whitehead to outer Tolo Channel was identified as an important nursery ground for commercial fisheries resources during a fisheries consultancy study in Hong Kong (Figure 11.1) (AFCD 1998). It supported fish of high commercial value such as *Chrysophrys major*, *Rhabdosargus sarba*, *Sparus* spp., *Metapenaeopsis palmensis* and *Lutjanus* fry. The shortest separation distance between the nursery ground and the Project Site is over 4 km.

**11.4.3.2** Embayments, especially those with mangroves and intertidal mudflats are considered to be important spawning and breeding grounds for marine organisms, including species of commercial value (PlanD 2000). The nearest natural embayment is Ting Kok, which is sheltered by Sam Mun Tsai headland.

**11.4.3.3** Artificial reefs (ARs), a fisheries resource enhancement measure, are considered to be sites of fisheries importance as they enhance the fisheries resources in the area. ARs were deployed within Hoi Ha Wan Marine Park between 1998 and 2003, a total of 9,530 m<sup>3</sup> of ARs were deployed. The distance between Hoi Ha Wan Marine Park and the Project Site is over 13 km. In Long Harbour, 33,000 m<sup>3</sup> of “Boat with Tyre/Quarry rock” type ARs were deployed in 2002-2003, while 420 m<sup>3</sup> of biofilters were deployed in 2004.”

### **11.4.4 Culture Fisheries**

**11.4.4.1** As there are no fishponds in the vicinity of the Project Site, pond fish culture is not an issue for this FIA and is not further discussed. Rather, this FIA focuses on mariculture. Mariculture is marine fish culture and involves rearing of marine fish from fry or fingerlings to marketable size in cages suspended by floating rafts usually in sheltered coastal areas. The species cultured have changed gradually over recent years depending on the availability of imported fry mainly



from Mainland, Thailand, Philippines or Indonesia. Common species under culture include green grouper, brown-spotted grouper, giant grouper, Russell's snapper, mangrove snapper, gold lined seabream, and star snapper (Information from AFCD website, 2017).

**11.4.4.2** Marine fish culture is protected and regulated by the Marine Fish Culture Ordinance (Cap. 353), which requires all marine fish culture activities to operate under licence in designated FCZs. Currently, there are 26 FCZs (Figure 11.5) occupying a total sea area of 209 ha with some 938 licensed operators. In 2017, the estimated production from local marine fish culture was about 1,004 tonnes (valued at HK\$ 78 million), which supplied about 6 percent of local demand for live marine fish (Information from AFCD website, 2018).

**11.4.4.3** Water quality within Marine FCZs is regulated under the WPCO and its supporting regulations and statements. Within Fish Culture Subzones, dissolved oxygen concentration should not drop below 5 mg l<sup>-1</sup> for 90% of the sampling occasions during the year; values should be calculated as a water column average (arithmetic mean of at least 3 measurements at 1 metre below surface, mid-depth and 1 metre above seabed). In addition, the concentration of dissolved oxygen should not be less than 2 mg l<sup>-1</sup> per litre within 2 metres of the seabed for 90% of the sampling occasions during the year, and the annual geometric mean of *E. coli* should not exceed 610/100 ml.

**11.4.4.4** Four fish culture zones are located within Tolo Harbour and Tolo Channel. Yim Tin Tsai is the one located nearest to the Project Site, it is about 700m distance from the Project Site. The navigation distance between the Project Site and Yim Tin Tsai (East), Yung Shue Au, Lo Fu Wat were about 6km, 9km and 10km, respectively (Figure 11.1).

## **11.4.5 Potential Fisheries Protection Area**

**11.4.5.1** Two potential sites for fisheries protection areas (FPA) designated under the Fisheries Protection Ordinance (Cap 171) cover most of Tolo Channel (outside the land-based Project Site, but likely within assessment area) (Figure 11.1) and Long Harbour (likely outside assessment area), although the location, boundary and management measures of FPAs have not yet been confirmed. The aim of FPA is to protect fish fry, juvenile and spawning fish, help to restore fisheries resources in Hong Kong waters and promote the sustainable development of fisheries in the long run. The impact to the water

bodies will be minimized as far as possible during construction to achieve compliance with the Water Quality Objectives.

## 11.4.6 Fisheries Importance

**11.4.6.1** The importance of fisheries resources within the assessment area are addressed based on the baseline information provided above. Fishing areas within Tolo Harbour and Tolo Channel are of moderate to high fisheries production generally when compared with other waters in Hong Kong. However, the fishing grounds just outside the Project Site are of low fisheries production. The Tolo Channel from Ma On Shan to outer Tolo Channel was identified as an important nursery ground of commercial fisheries resources, but it is over 4 km from the Project Site. There is about 700m distance from the Project Site to the nearest fish culture zone.

## 11.4.7 Need for Field Survey

**11.4.7.1** The fisheries baseline information provided above is adequate. It provides quantitative data for Tolo Harbour and Tolo Channel, including the waters near Project Site. Thus there is no significant information gap on fisheries baseline conditions within the assessment area and therefore no fisheries surveys will be proposed for the study.

## 11.5 Assessment Methodology

### 11.5.1 Assessment Criteria

**11.5.1.1** Impacts were assessed assuming no mitigation. The construction and operational phase impacts on fisheries resources are assessed individually, then cumulatively, in combination with other existing, committed and proposed developments.

**11.5.1.2** The significance of fisheries impacts was evaluated based primarily on the criteria set forth in Annex 9 of the TM-EIAO:

- Nature of impact;
- Size of affected area;
- Loss of fisheries resources/production;
- Destruction and disturbance of nursery and spawning grounds;
- Impact on fishing activity; and

- Impact on aquaculture activity.

**11.5.1.3** Impacts are generally ranked as "minor", "moderate" or "severe", although in a few cases a ranking of "insignificant" (less than "minor") may be given. The ranking of a given impact varies based on the criteria listed above. Wherever possible, significance of fisheries impacts is quantified to allow ready appreciation of relative significance.

**11.5.1.4** Besides adverse impacts, potential beneficial influences brought by the Project were also considered in the assessment. The assessment concluded whether the mitigation measures envisaged could alleviate any negative impacts of the Project and its components to within acceptable levels. The acceptability of the overall residual impacts was determined.

**11.5.1.5** Cumulative impacts from concurrent projects (during both the construction and operational phases) were evaluated. Planned/on-going development projects in Tolo Harbour and Tolo Channel, in particular those that would likely to have cumulative fisheries impact during both the construction and operational phases of the Project were considered, and the potential cumulative fisheries impacts were assessed. The cumulative construction phase impacts might include cumulative water quality deterioration (in particular suspended sediments). The cumulative operational phase impacts such as changes of water quality, if any, in Tolo Harbour and Tolo Channel.

**11.5.1.6** The assessment also evaluated the need for fisheries monitoring and audit and prescribed in details any required EM&A programme in accordance with the EIA Study Brief.

## **11.6 Fisheries Impact Evaluation**

### **11.6.1 Construction Phase – Direct Impacts**

**11.6.1.1** The Project will be land-based. Given that neither marine works nor construction phase marine traffic will be required, there will be no permanent or temporary loss of marine waters, and hence no permanent or temporary loss of fishing ground within the assessment area.

**11.6.1.2** No direct impacts on fishing ground, fisheries habitats or aquaculture sites are anticipated during the construction phase. Direct impacts to nursery grounds of commercial fisheries resources, ARs, potential fisheries protection areas) and fishing operation are also not anticipated.

## **11.6.2 Construction Phase – Indirect Impacts**

### Site Runoff

**11.6.2.1** As the Project Site is located along the coastline, during the construction phase, the marine waters in the vicinity of the Project Site would potentially be impacted by surface runoff if it is not properly controlled, especially during rainstorms. The surface runoff might be polluted by:

- Wheel washing water;
- Wastewater from building construction, site facilities and road works
- Acid cleaning, etching and pickling wastewater; and
- Accidental chemical spillage.

**11.6.2.2** Elevated suspended solids levels caused by site runoff (if without proper control) could increase the suspended solids load in water bodies, and could decrease dissolved oxygen levels. Lower oxygen levels would affect stationary fisheries resources, whilst mobile species would tend to temporarily avoid the area. The result could be a temporary reduction in abundance of fisheries resources and/or change in distribution.

**11.6.2.3** As mentioned in **Section 2.5**, water storage tanks with a total volume of 30,000 m<sup>3</sup> will be constructed in phases underneath the future access road (which runs along the seafront and leads to the ancillary facilities) during site formation works. Primarily designed for the operation phase storage of turf area surface runoff, these water storage tanks, once any of them are constructed, would also serve to store site runoff during construction phase. A temporary drainage system would be installed around the site perimeter to intercept all construction runoff and divert it to the water storage tanks. Construction site surface runoff collected by the storage tanks will undergo sufficient sedimentation before discharge to Tolo Harbour. If the water storage tanks are not available for sedimentation at the time of working due to

site conditions, conventional sedimentation tank should be provided accordingly.

**11.6.2.4** Hence, together with the implementation of mitigation measures/precautionary measures stated in the water quality chapter to prevent site run-off to Tolo Harbour, the chance of sediments from construction site runoff being released to marine waters will be very low, and the potential impact on fisheries (including fishing ground and fish culture zones, and also those vastly distant including nursery grounds of commercial fisheries resources, ARs and potential fisheries protection areas) due to construction site runoff to marine waters is therefore considered Minor.

#### *Runoff during Modification of Open Channel*

**11.6.2.5** As water extraction from an existing open channel is one option to source water for irrigation of the golf course, local modifications and excavation to the existing open channel will be required. If not properly controlled, the excavated materials, waste water, chemicals or other construction materials may enter the watercourse and give rise to water quality impact in Tolo Harbour. Even without implementation of mitigation measures, the affected area from the indirect water quality impact is expected to be localized, small scale and in the vicinity of the works area. To prevent adverse water quality impact, the open channel modification works would be scheduled for completion during the dry season as far as practicable when the flow is low, and the mitigation measures/precautionary measures stated in the water quality chapter will be followed (i.e. **Section 6.4.3.4**). Sequencing of works should be duly planned to minimise water quality impacts. Dewatering of the construction works area shall be conducted prior to the construction works if necessary. Silt removal facilities should be adopted to treat the wastewater from dewatering operation prior to discharge. After completion of the construction works, the works area shall be cleaned up before receiving any water flow or connecting to any existing watercourses. The impacts would be transient, and the potential fisheries impact due to the runoff is considered Minor.

#### *Sewage from Workforce*

**11.6.2.6** Temporary sanitary facilities will be provided on-site for construction workers. Therefore, no adverse water quality impact to fisheries

(including fishing ground and fish culture zones, and also those vastly distant including nursery grounds of commercial fisheries resources, ARs and potential fisheries protection areas) from sewage is anticipated.

#### *Marine Traffic*

- 11.6.2.7** Construction materials and machinery will be delivered to the Project Site via land transport. No construction vessels or construction marine traffic is anticipated and thus there will be no disturbance of fishing activities or fishing vessels due to construction marine traffic.

#### *Accidental Spillage of Chemicals*

- 11.6.2.8** During construction, there might be application of some chemicals, such as fuel, oil, solvents and lubricants from maintenance of construction machinery and equipment. If accidental spillage occurs, it might cause pollution in the nearby water bodies, and potentially affect fish culture zone and capture fisheries resources. The water quality assessment of the present EIA has proposed mitigation measures to avoid adverse impacts of chemical spillage, including best practices of chemical storage (such as storage under a covered area), provision of secondary containment, locating any maintenance activities and workshops with chemicals usage away from watercourses on hard standings within a bunded area, installation of sumps and oil interceptors as appropriate, provision of spill kits and training for the staff for handling spillage (see **Section 6.4.3**). With the implementation of these mitigation measures, adverse water quality impact is not anticipated, and thus there would be no significant impact on fisheries.

### **11.6.3 Operational Phase – Direct Impacts**

- 11.6.3.1** The Project is land-based, thus there will be no loss of marine waters within the assessment area. There will be neither marine works such as maintenance dredging nor marine traffic for the Project during operational phase.
- 11.6.3.2** No direct impacts on fishing ground, fisheries habitats and aquaculture sites, and no direct impact on fishing activity are anticipated during the operational phase.

## 11.6.4 Operational Phase – Indirect Impacts

### *Residual Agrochemicals*

**11.6.4.1** According to the outline of Turfgrass Management Plan (TMP) in **Section 2.7**), agrochemicals including fertilizers, fungicides, insecticides and herbicides will be applied to the turf area during the operational phase. Since not all agrochemicals will be totally absorbed, consumed or decayed during the course of application, there will be residual agrochemicals on the turf grass area which may later potentially be carried away by the surface runoff, and may subsequently enter Tolo Harbour. As the presence of residual agrochemicals in particular fungicides and insecticides in marine water could be a threat to marine life, there is potential adverse impact to fisheries sensitive receivers in the vicinity if significant levels of residual agrochemicals enter the marine waters from the Project Site.

**11.6.4.2** Although potentially harmful to non-target organisms, fungicides and insecticides proposed for the present Project (Fungicides – Daconil and Bayleton; Insecticides – Chlorpyrifos and Fipronil; see **Section 2.7** the outline of the Turfgrass Management Plan) are selected from a list of pesticides approved for use in Hong Kong by AFCD, and are commonly applied in other golf courses in Hong Kong including Kau Sai Chau public golf course. The criteria of residual fungicides and insecticides are determined in the Water Quality Assessment of the EIA study with reference to the available ecotoxicity data in the corresponding Material Safety Data Sheet (MSDS) (see **Section 6**).

**11.6.4.3** To reduce the water quality and fisheries impacts by the residual agrochemicals in turf grass area runoff, special considerations have been taken on various aspects of the design and operations of the future golf course, including the design of the golf course drainage system including the collection system, water storage tanks and outfall location, the selection of agrochemicals, and the daily operation of the turf grass management (including the practices on agrochemical application).

**11.6.4.4** For the collection system, it is designed to minimize the chance of surface runoff overflow (i.e. directly overflow from the turf grass area to Tolo Harbour) by diverting all the turfgrass area runoff to the water storage tanks via drain system. Besides, perimeter channel along the Project Site perimeter (the seaward side) will also be provided to

further prevent surface overflow. The whole collection network is designed avoid surface overflow based on the 1 in 50 year return period.

**11.6.4.5** For the water storage tanks, the surface runoff from turf grass areas, landscape areas and the access road will be collected by the surface channel and drained to the water storage tanks of a total volume of 30,000 m<sup>3</sup>. They have optimized the capacity, which can cater for the surface runoff to minimize the need to bypass to Tolo Harbour during most of the rainfall events and thus retain as much runoff as practicable to avoid the discharge of residual agrochemicals. Most of the residual agrochemicals will be flushed into the water storage tanks during the first flush from raining. The concentration of residual agrochemicals in the runoff would generally be much higher during the first flush but would be decline after raining for a period of time as most of the residual agrochemicals have been carried away by the first flush. During heavy and prolonged rainfall events, sufficient amount of runoff has run through the turf area to bring residual agrochemicals into the tanks before the water storage tank is full. Bypass of runoff to Tolo Harbour will only occur when the tank is full and at that time the concentration of residual agrochemicals in the runoff should not be of significant level, and thus no residual water quality impact is anticipated to aquaculture sites and capture fisheries resources, and also those vastly distant including nursery grounds of commercial fisheries resources, ARs and potential fisheries protection areas) from the runoff or the residual agrochemicals.

**11.6.4.6** After entering the tanks via surface drains, the runoff together with residual agrochemicals would be stored in the tanks and pumped for irrigation of the golf course when needed.

**11.6.4.7** The concentration of residual agrochemicals in water storage tanks would also be gradually diluted as rainfall is being diverted into the tanks, or when water from other sources (e.g. the water from WSD and the off-site channel) enter the tanks. Detailed calculations are shown in water quality chapter, in which reference was made to the calculation adopted for the Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung EIA Study, and a conservative approach was adopted by assuming the concentration during the first flush, rather than the diluted concentration, against the criteria (in reality the concentration of residual agrochemicals would generally be higher during the first flush but would be much lower in the following



runoff and thus after draining to the tanks the stored runoff in the water storage tanks will be diluted by the subsequent rainfall). According to the calculation results, the concentration of residual fungicides and insecticides in water storage tanks will be very low and in compliance with the proposed criteria (see **Section 6**). Even if the stored turf area runoff enters the surrounding coastal waters, no unacceptable adverse water impact to aquaculture sites and capture fisheries resources, and also those vastly distant including nursery grounds of commercial fisheries resources, ARs and potential fisheries protection areas) from the residual agrochemicals such as fungicides and insecticides is anticipated.

**11.6.4.8** Among the agrochemicals, as mechanical methods of removing turf grass weeds (hand weeding) will be the primary means of control of weeds, herbicides is only occasionally required, and the application of herbicides will not be a regularly scheduled practise to the entire golf course, but will be spot spraying to selected areas. Therefore, the amount of residual herbicides in the runoff will be insignificant and that in the water storage tanks is also insignificant.

**11.6.4.9** Fertilizers proposed for the golf course mainly contain inorganic nutrients including nitrogen and phosphorus. Increased nutrients in the water bodies induce growth of phytoplankton and could result in oxygen depletion of the water bodies. In the marine environment, increased nutrients can cause harmful algal blooms that produce dangerous toxins that can kill fisheries resources. Caged fishes in Fish Culture Zones can also be affected.

**11.6.4.10** The residual concentration of nutrients in water storage tanks were predicted by using the nutrient absorption rates predicted for Kau Sai Chau. According to the results shown in the water quality chapter, the concentrations of total inorganic nitrogen (TIN) and total phosphorus (TP) fall within the ranges of TIN and TP recorded in the EPD water quality monitoring data at Station TM3 in the Tolo Harbour and Channel Water Control Zone (WCZ). These concentrations will comply with the criteria at sources even if the collected runoff would be bypassed. The concentration are also below the annual mean of TIN and TP in the monitoring data. No unacceptable adverse water quality impact is anticipated from the residual fertilizers in the collected runoff inside the water storage tanks.

**11.6.4.11** Concentrations of residual agrochemicals from the proposed golf course will be very low and will be in compliance with the proposed criteria. The residual agrochemicals will be flushed into the water storage tanks during first flush from raining. The proposed water storage tanks can accommodate most of the average rainstorm events. Only for very rare cases of extreme weather events (tropical cyclones or red/black rainstorm events) or prolonged rainfall, would there be excessive surface runoff. This would only occur after the proposed water storage tanks have received and retained the residual agrochemicals carried by the first flush. As the concentration of residual agrochemicals in the runoff would generally be much higher during the first flush but would decline after raining for a period of time. When the water storage tanks are full, the turfgrass area would be flushed for a long duration and most of the residual agrochemicals have been carried away into the water storage tanks by the previous runoff. The turfgrass surface would not have significant residual agrochemicals and the following runoff which needs to bypass the water storage tanks would not have significant agrochemicals. Hence, no unacceptable levels of residual agrochemicals are expected to enter Tolo Harbour, and the impact on fishing grounds, fisheries habitats and aquaculture sites is ranked as Insignificant.

**11.6.4.12** For the outfall location, it has been duly situated to allow an optimum distance from the adjacent WSRs. It is proposed to be located away from the adjacent WSRs (see Figure 6.2). The location of outfall is proposed to be away from the Fish Culture Zones which are located to the east of the Project Site.

#### Sewage

**11.6.4.13** During operation, there will be sewage generated from the guests and staff using the proposed ancillary facilities and other associated facilities within the golf course, such as the ancillary facilities and other associated facilities. A new sewer will be provided to collect and convey the sewage flows generated from the golf course development to the existing sewer system. It is proposed that the sewage generated from the Project would be conveyed to Tai Po Sewage Treatment Works (TPSTW). With proper treatment in TPSTW, it is anticipated that the treated sewage would meet statutory requirements and thereby there would be no adverse water quality impacts. As such, unacceptable impacts on fisheries (including fishing ground and fish culture zones, and also those vastly distant

including nursery grounds of commercial fisheries resources, ARs and potential fisheries protection areas) are not anticipated.

**11.6.4.14** There will be one proposed Sewage Pumping Station (SPS) located within the Project Site collecting and conveying the sewage flows generated from the Project to the TPSTW for treatment. To prevent the occurrence of emergency bypass at the SPS, contingency measures would need to be considered in the planning and design of the SPS, including dual feed power supply, backup power supply, and standby pumps. Sewage tanker vehicles could also be considered to remove sewage from the SPS to existing public sewer manhole located in front of main entrance of golf development on Ting Kok Road during emergency case. These could prevent the emergency bypass from the SPS. Details of the mitigation measures are discussed in **Section 6.5.3.3**. Moreover, as the proposed SPS will only serve the Proposed Development, it would be feasible to stop the sewage flows to the SPS when malfunctions. During that period, the operation of some facilities of the proposed development could be temporarily suspended, and portable toilets could be considered for temporary services. With the above design and operation provision as contingency measures, the risk of failure of SPS is considered to be negligible. Therefore, no adverse fisheries impact arising from the emergency bypass from the SPS is anticipated.

## 11.6.5 Summary of Fisheries Impact Evaluation

**11.6.5.1** Summary of fisheries impacts are evaluated according to the criteria in Annex 9 of the TM-EIAO and are summarized in **Table 11.1**.

**Table 11.1** Evaluation of fisheries impact

Evaluation Criteria	Shuen Wan Golf Course
Nature of impact	All works would be land-based. No marine works is involved in the Project. No permanent or temporary loss of fishing grounds, fisheries habitats and aquaculture sites are predicted for the construction or operational phases. With implementation of the mitigation measures, the chance of indirect water quality impact from site runoff during construction phase will be very low. The potential impact due to runoff or drainage channel modification works to marine waters is considered Minor. The potential impact due to runoff with residual agrochemicals during operational phase is also considered insignificant due to the implementation of water storage tanks and the drainage system to collect runoff. Sewage generated during the

Evaluation Criteria	Shuen Wan Golf Course
	operational phase will be conveyed to the Tai Po Sewage Treatment Works for treatment, and emergency bypass will be prevented by the design of the SPS.
Size of affected area	No direct loss of fishing grounds, fisheries habitats and aquaculture sites is anticipated. No unacceptable indirect water quality impact on fishing grounds, fisheries habitats and aquaculture sites is anticipated.
Loss of fisheries resources / production	No direct loss of fishing resource / production is expected. Indirect water quality impacts from different sources are expected to be either not anticipated, insignificant, or minor with the implementation of mitigation measures.
Destruction and disturbance of nursery and spawning grounds	As the Project Site is away from any nursery and spawning grounds, there will be no destruction or disturbance of nursery or spawning grounds. Given the long distance from the Project Site to the nursery/spawning ground and the control of water quality through the provision of the water storage tanks and other water quality mitigation measures, no indirect impact to nursery or spawning grounds is predicted.
Impact on fishing activity	No impact to fishing activity is predicted because no marine works is involved.
Impact on aquaculture activity	As no marine works is involved, there will be no direct impact or disturbance to the aquaculture sites. As mitigation measures, including the provision of the water storage tanks, will be implemented, no unacceptable water quality impact is expected to the Yim Tin Tsai and Yim Tin Tsai (East) FCZ which is located about 700m away from the Project Site, and emergency bypass will be prevented by the design of the SPS, no significant impact on aquaculture activity is anticipated.

## 11.7 Cumulative Impacts

### 11.7.1 Concurrent Projects

**11.7.1.1** In order to assess cumulative impacts, a review of best available information at the time of preparing this EIA report has been

conducted to identify a number of other projects that are undergoing planning, design, construction and/or operation within the construction and/or operational period for the proposed development and a list of the concurrent projects identified at this stage is provided in **Table 2.12** of **Section 2** of this EIA report. These include Shuen Wan Landfill Restoration Contract, Food Waste Pre-treatment Facilities for Food Waste / Sewage Sludge Anaerobic Co-Digestion Pilot Trial in Tai Po Sewage Treatment Works, Upgrading of Sewage Pumping Stations and Sewerage along Ting Kok Road, Columbarium Development at Shuen Wan Landfill, Tai Po, and Development of a Bathing Beach at Lung Mei, Tai Po.

**11.7.1.2** Among the concurrent projects, most except “Development of a Bathing Beach at Lung Mei, Tai Po” would not cause water quality impacts and therefore are not relevant to fisheries. The Lung Mei Beach project is more than 3 km from the Project Site and will most likely be would completed their marine works before the commencement of Project construction. Such projects are therefore not relevant to cumulative water quality and fisheries resources. Cumulative impacts on fisheries are not likely.

## **11.7.2 Cumulative Impacts during Construction Phase**

**11.7.2.1** As there will be no marine works or marine traffic, the Project will not contribute to the cumulative fisheries impacts from the concurrent projects during construction phase. Surface runoff generated during construction phase will be avoided by implementation of recommended water quality mitigation measures. Hence, unacceptable cumulative impacts to fisheries resources are not anticipated.

## **11.7.3 Cumulative Impacts during Operational Phase**

**11.7.3.1** Excess surface runoff will only be bypassed when there is extreme prolonged rainfall. With the implementation of the water quality mitigation measures, it is anticipated that the water quality impacts generated would be localized and there would be no adverse water quality impacts or cumulative fisheries impact during operational phase.

## 11.8 Mitigation Measures

### 11.8.1 Considerations for Impact Avoidance

#### Avoidance of Marine Works

**11.8.1.1** The Project would not involve marine works and traffic. Hence, potential impact on fishing operations and fisheries resources will be avoided.

**11.8.1.2** Since Tolo Harbour contains ecological and fishery resources which are marine based and hence are particularly sensitive to water quality, it is very important that the Project shall not cause any adverse water quality impacts on Tolo Harbour.

**11.8.1.3** The current design has adopted the following approaches to avoid fisheries impacts during the construction period.

- No modification of the existing seawall;
- No marine dredging works on existing seabed; and
- No need for construction barges.

### 11.8.2 Considerations of Impact Minimisation

#### (1) Retention of Construction Site Runoff

**11.8.2.1** To reduce the potential water quality impact due to construction site runoff, good site practices as described in Practice Note for Professional Persons on Construction Site Drainage, Environmental Protection Department, 1994 (ProPECC PN 1/94) should be implemented where applicable to avoid potential adverse water quality impacts.

**11.8.2.2** As mentioned in **Section 2.5**, water storage tanks with a total volume of 30,000 m<sup>3</sup> will be constructed in phases underneath the future access road (which runs along the seafront and leads to the ancillary facilities) during site formation works. Primarily designed for the operational phase storage of surface runoff, from the Project Site to minimize bypass during raining these water storage tanks, once any of them are constructed, would also serve to temporarily store site runoff during construction phase. During the construction phase, a temporary drainage system would be installed around the site perimeter as per the requirements stated in the water quality chapter, to intercept all

construction runoff and divert it to the water storage tanks. Construction site surface runoff collected by the storage tanks will undergo sufficient sedimentation before discharge to Tolo Harbour.

**11.8.2.3** Other mitigation measures stated in the water quality chapter such as dikes or embankments for flood protection, silt/sediment traps, and oil interceptors should be implemented.

#### (2) Works Programme to Minimise Site Runoff

**11.8.2.4** Construction works should be programmed to minimize surface excavation works during the rainy season (April to September). All exposed earth areas should be completed and vegetated as soon as possible after earthworks have been completed. If excavation of soil cannot be avoided during the rainy season, or at any time of year when rainstorms are likely, exposed slope surfaces should be covered by tarpaulin or other means.

**11.8.2.5** All construction materials at temporary storage areas should be covered with tarpaulins or similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system.

**11.8.2.6** During modification of the open channel, precaution measures and water quality mitigation measures shall be implemented to prevent adverse water quality impacts to the surrounding environment (see **Section 6.4.3**).

#### (3) Collection and Retention of Residual Agrochemicals and Runoff

**11.8.2.7** During operational phase, a collection system, conveying the runoff to the water storage tanks, designed to withstand rainstorms of a 50-year return period will be installed. The surface runoff from turfgrass and landscaped areas will be collected by surface channels and diverted to the proposed water storage tanks, which have a total volume of 30,000 m<sup>3</sup>, to store the surface runoff from the Project Site, especially the first flush runoff from turf area after raining, to prevent the discharge of residual agrochemicals into Tolo Harbour and to minimize the bypass of runoff. In fact, this 30,000m<sup>3</sup> volume is the maximum size given the site constraints on engineering issues. Since the Project Site was once a landfill site, excavation or heavy loading is not allowed for most of the site due to the ex-landfill waste bodies underneath. The

location of water storage tanks is thus limited to the area along the eastern side of the Project Site. Having considered the available space and site constraints, the volume of the proposed water storage tanks is optimized to 30,000m<sup>3</sup>. It is anticipated that adverse water quality impacts can be minimized with the proposed water storage tanks and collection system.

#### (4) Environmentally Conscious Turfgrass Management Plan

**11.8.2.8** The future TMP will set out the management practices which could significantly reduce the amount of agrochemical application and thus the residual agrochemicals.

**11.8.2.9** The amount of herbicides to be applied will be minimised through the implementation of the future TMP. Mechanical methods (hand weeding) of removing turfgrass weeds will be the primary means of weed control. Application of herbicides to the turf area will not be a regularly scheduled practise, and spot spraying will be adopted only when necessary.

**11.8.2.10** Furthermore, the TMP will also take into account the weather conditions. When prolonged rainfall is forecasted, the application of agrochemicals in the golf course will cease.

#### (5) Utilisation of Runoff for Irrigation

**11.8.2.11** As the water storage tanks have dual purposes on storage of surface runoff as well as storage of water from different water sources to cope with irrigation demand, an outline management plan for the water storage plan (Water Management Plan) has been formulated. The Water Management Plan will provide outline for daily management practices on the water storage and usage, so as to prepare the storage capacity in time to cope with rainfall events, including lowering the irrigation storage during rainy season, suspension of water extraction from off-site open channel, and fully consuming stored water when prolonged rainfall is forecasted. As stated in **Section 6.5.2**, with the optimised water storage tanks and those management practices in place, the number of days with bypass events have been significantly minimized. And the bypass events would mainly occur during extreme weather events (tropical cyclones and/or red/black rainstorm events) or prolonged rainfall. In both cases, there would be sufficient time or amount of runoff to carry the residual agrochemicals to the water



storage tanks by the first flush. Furthermore, the concentrations of agrochemicals in the water storage tanks would be insignificant and would comply with the standards even inside the tanks as shown by Water Quality assessment. Even though, only additional runoff will be bypassed when the tanks are full.

**11.8.2.12** For the location of outfall, it has been duly considered to allow an optimum distance from the adjacent fisheries sensitive receivers. It is proposed to be located away from the adjacent Fish Culture Zones which are located to the east of the Project Site. (see **Figure 6.2**).

### **11.8.3 Impact Mitigation**

**11.8.3.1** With the avoidance of marine works and minimization of water quality impacts through work programme and water storage tank design, the impacts might relate fisheries resources have been mostly prevented or controlled. No specific mitigation for fisheries impacts is required.

## **11.9 Residual Impacts**

**11.9.1.1** No loss of fishing grounds is anticipated from the Project during construction or operational phases. With the implementation of the aforementioned mitigation measures, no adverse residual fisheries impacts are anticipated.

## **11.10 EM&A for Fisheries**

**11.10.1.1** Site inspections during construction phase shall be carried out to monitor any malpractice leading to deterioration of water quality in the surrounding marine waters which could, in turn, affect fisheries resources. During both construction and operational phases, the proposed water quality monitoring programme stated in Water Quality Chapter also included the closest FCZ (i.e. Yim Tin Tsai FCZ).

## **11.11 Conclusion**

**11.11.1.1** The assessment area for the FIA included areas within 500m from the boundary of the Project and the works of the Project, the Tolo Harbour and Channel Water Control Zones as designated under the

Water Pollution Control Ordinance (Cap. 358), and the water sensitive receivers outside the 500m boundary but in the vicinity of the Project.

**11.11.1.2** Information from literature has been incorporated, which provided sufficient fisheries information within the assessment area.

**11.11.1.3** The importance of fisheries resources within the assessment area are addressed based on the baseline information described above. Fishing areas within Tolo Harbour and Tolo Channel are generally of moderate fisheries production when compared with other waters in Hong Kong. However, the fishing grounds just outside the Project Site are of low fisheries production. The Tolo Channel from Whitehead to outer Tolo Channel was identified as an important nursery ground for fish and shrimp but it is over 4 km from the Project Site. Yim Tin Tsai FCZ is the nearest FCZ to the Project Site and it is about 700m distant, and is not anticipated to be affected with the implementation of mitigation measures. Because there will be no marine works or marine traffic for the Project, no direct impacts to fisheries resources or fishing operations are expected during construction phase. Construction site runoff will be retained using the water storage tanks to avoid indirect impact on marine water quality and in turn on fisheries resources including fish culture zones. With the approaches for avoidance and minimization of impacts, and the proper design of drainage system, water storage tanks, and outfall location to address the potential impacts from residual agrochemicals, no unacceptable fisheries impacts on fishing grounds, spawning and nursery grounds, and fisheries and mariculture activities due to construction and operation of the Project are anticipated.

**11.11.1.4** Since no unacceptable fisheries impact is anticipated, no fisheries-specific mitigation measures are required.

## 11.12 References

- [11-1] AFCD 2017. AFCD website
- [11-2] CCPC, City University of Hong Kong 2001. Agreement No. CE 62/98 - Consultancy Study on Fisheries and Marine Ecological Criteria for Impact Assessment. Prepared for Agriculture, Fisheries and Conservation Department, HKSAR Government
- [11-3] AFCD 1998. Fisheries Resources and Fishing Operations in Hong Kong Waters
- [11-4] PlanD 2000. Study on Sustainable Development for the 21st Century: Environmental Baseline Survey on Terrestrial Habitat Mapping and Ranking Based on Conservation Value. Final Report to the Planning Department