5 Fisheries Impact Assessment

5.1 Introduction

In accordance with Clause 3.4.4 and Appendix D of the EIA Study Brief No. ESB-282/2014, fisheries impacts that may arise from the improvement dredging works and operation of the Channel including operation dredging were predicted and assessed.

This Chapter of the EIA Report presents the results of the assessment of the potential impacts of the dredging works on existing fisheries resources, fishing operations and marine culture activities based on the fisheries baseline conditions and the water quality modelling results. Relevant fisheries sensitive receivers were also identified, stakeholder engagement activities would be arranged prior to project implementation to seek their views and foster their understanding on the proposed project works.

5.2 Environmental Legislation, Standards, Guidelines and Criteria

The following legislation and guidelines are applicable to the fisheries impact assessment for this Study:

- Environmental Impact Assessment Ordinance (Cap 499) – *Technical Memorandum on the Environmental Impact Assessment Process* (EIAO-TM), Annexes 9 and 17. Annex 9 recommends the criteria for evaluating fisheries impacts, while Annex 17 prescribes the general approach and methodology for the assessment of fisheries impacts that may arise from a project or proposal, to allow a complete and objective identification, prediction and evaluation of the potential impacts.
- Fisheries Protection Ordinance (Cap 171). This Ordinance provides regulations for the conservation of fish and other aquatic life and regulates fishing practices.
- Marine Fish Culture Ordinance (Cap 353). This Ordinance regulates and protects marine fish culture and other related activities.
- Water Pollution Control Ordinance (WPCO) (Cap 358). This Ordinance sets limits to water quality parameters in various water control zones.

5.3 Baseline Conditions

5.3.1 Study Area

According to the EIA Study Brief Clause 3.4.4.2, the Study Area for Fisheries Impact Assessment shall be the same as the Study Area for Water Quality Impact Assessment, i.e. the Southern and Western Buffer Water Control Zone (WCZ) as designated under the Water Pollution Control Ordinance and as shown in **Figure 3.1**. Special attention was given to the fishing ground, fisheries habitats, spawning and nursery grounds within the Study Area and the following Fish Culture Zones (FCZs):

- Lo Tik Wan FCZ and associated artificial reefs (ARs)
- Sok Kwu Wan FCZ
- Cheung Sha Wan FCZ
- Spawning grounds of commercial fisheries resources at south of Lamma (ERM, 1998)
- Nursery areas of commercial fisheries resources at Lamma Island (ERM 1998).

The locations of the fisheries sensitive receivers are shown in **Figure 5.1**.

5.3.2 Physical Environmental Background

The Project is situated in the West Lamma Channel near the Western Coast of Lamma Island. The baseline marine water quality of the Study Area based on the long term marine water quality monitoring between 1986 and 2015 by the Environmental Protection Department (EPD) at the representatives monitoring stations within the Western Buffer and Southern WCZs (EPD, 2015), are presented in **Table 3-6** to **3-7**. Details of the baseline water quality are presented in **Section 3.3.2**. Sediment quality investigation studies have been conducted prior to each of the historic dredging works in the Channel. Details of the baseline sediment quality are presented in **Section 3.3.3** and the past sediment quality testing results within the Channel are summarised in **Table 3-8**.

5.3.3 Fisheries Baseline

Baseline information on fisheries resources in the Study Area was collected by desktop review of available literature. This review included relevant fisheries baseline data presented in the comprehensive Port Survey 2006 conducted by the Agriculture, Fisheries and Conservation Department in 2006 (AFCD, 2016) and other relevant information available in other reports and publications, including but not limited to the following:

- Fisheries Resources and Fishing Operations in Hong Kong Waters, ERM (1998)
- Approved EIA for 1,800 MW Gas-fired Power Station at Lamma Extension (AEIAR-010/1999)
- Approved EIA for Lamma Power Station Navigation Channel Improvement (AEIAR-069/2003)
- Approved EIA for Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities (AEIAR-106/2007)
- Approved EIA for Providing Sufficient Water Depth for Kwai Tsing Container Basin and its Approach Channel (AEIAR-156/2010).
- Approved EIA for Outlying Islands Sewerage Stage 2 - upgrading of Cheung Chau and Tai O sewage collection, Treatment and Disposal Facilities (AEIAR-181/2013).

5.3.3.1 Fishing Operation

As indicated in the result of the latest Port Survey conducted by AFCD in 2006, the Study area was of moderately low to moderate usage by fishing vessels (50 - 400 vessels per grid), with areas of relatively high level of fishing activities at southern Lamma and Po Toi (400 – 700 vessels per grid). The Project area is within moderate fishing operation (100 – 400 vessels per grid). Distributions of fishing operation within the Study Area are shown in **Figures 5.2 – 5.4**.

Types of fishing vessels operating within the Study Area included shrimp trawler, hang trawler, gill netter, long liner, hand liner, purse seiner, sampan and miscellaneous crafts, with sampans being the dominant fishing vessels. Since 31 December 2012, Hong Kong has implemented trawl ban, therefore, shrimp

trawler and hang trawler are no longer operating within Hong Kong waters. Fishing operations in the Project area are mainly small scale with vessels less than 15 metres in length, as indicated in **Figure 5.4**. The type of fishing vessels operating in the Project area excluding the trawlers, are presented in **Table 5-1.** Sampan is the dominant fishing vessel with 100 – 400 vessels per grid operated within the Project area.

Table 5-1: Fishing Operations within the Project area

Type of Fishing Vessel	Vessels per grid
Gill Netter	10 – 50
Long Liner	10 – 50
Hand Liner	≤ 10
Purse Seiner	10 – 50
Sampan	100 – 400
Miscellaneous Craft	10 – 50

Source: Port Survey 2006 (AFCD, 2016) (Trawlers that already ban in Hong Kong for capture fisheries are excluded)

5.3.3.2 Capture Fisheries

The local fishery industry provides a major source of fish supply to local consumption. In 2015, the total fisheries production is estimated to be 145,193 tonnes (AFCD, 2016). The highest yields of local fisheries production were mainly derived from the eastern, south-eastern and north-eastern waters.

Table 5-2: Summary of Hong Kong Capture Fisheries Industry over the past 8 years

Parameters	2015	2014	2013	2012	2011	2010	2009	2008
No. of Vessel	5,050	4,500	3,988	3,992	4,026	3,902	3,659	3,754
Local fishermen engaged in capture fisheries	10,500	9,400	8,800	8,800	8,500	8,200	7,600	8,000
Production (tonnes)	145,193	160,789	170,129	155,230	170,720	168,000	159,000	158,000

Source: AFCD, 2016.

In the proposed dredging area at Western Lamma Island, the adult fish production is in moderate (200 – 400 kg/ha) to moderately high production (400 – 600 kg/ha) (**Figure 5.5** refers). No fish fry production was reported within the Project area by the AFCD Port Survey 2006.

Shrimps were the main caught in the proposed dredging areas with a production of >60kg/ha. It is similar to the southern Lamma Island waters. Other fisheries species caught were of moderate to low production. Productions of Croakers in the proposed dredging areas was 20-60kg/ha, whilst Squid and Scad (family Carangidae) were 20-40kg/ha. Crab and Rabbitfish were caught in the proposed dredging areas with a production of 10-20kg/ha. Anchovy (family Eugraulidae), Mullet (family Mugilidae), Seabream (family Sparidae) and Sardine (family Clupeidae) were 10kg/ha or less.

As recorded in the Port Survey 2006 there was no fish fry production recorded in the proposed dredging areas. The nearest area with relatively higher density of fish fry was Eastern area of Lamma Island as

indicated in **Figure 5.6**. Fry fishing for the Rabbit Fish was once actively conducted in Sok Kwu Wan (Maunsell, 2003). In the past, Sok Kwu Wan was also identified as a nursery area with high abundance of juvenile fish (ERM, 1998).

5.3.3.3 Spawning Ground

For the Project area, it lies within south Lamma that had previously been identified as spawning grounds and nursery areas of commercial fisheries resources. The key fish and crustacean species recorded in the south Lantau spawning ground were *Leiognathus brevirostris* (ponyfish), *Johnius belengeri* (croaker), *Nibea diacanthus* (croaker) and *Metapenaeus joyneri* (prawn) (ERM, 1998, 2006). Spawning grounds are of fisheries importance and hence would be considered as fisheries sensitive receivers in this study. Spawning period of most commercial species recorded in Hong Kong was between June and September while the spawning period of most of the crustacean species, including *Metapenaeus joyneri* was found to be from April to November (ERM, 2006).

5.3.3.4 Nursery Areas

The nursery areas in south Lantau was previously identified in 1998 as an important habitat area for a number of commercial juvenile fish and crustacean species including *Oratosquilla anomala*, *Siganus oramin* and *Collichthys lucida.* Juvenile fish species have been recorded in all seasons (ERM, 2006). Juveniles were reported close to shore and to the south of the existing Lamma Power Station between March and September (Hyder Consulting, 2003). Kau Yi Chau was identified in the 2003 approved EIA report for Lamma Power Station Navigation Channel Improvement as a fish fry nursery area, but no fish fry production had been reported by the AFCD Port Survey 2006 (**Figure 5.6**). The 2003 approved EIA report also identified suitable nursery areas for fish from Tit Sha Long to Ha Mei Tsui. Nursery areas are of fisheries importance and hence would be considered as fisheries sensitive receivers in this study.

In summary, fisheries resources within the proposed dredging areas are of moderate production for capture fisheries. The proposed dredging areas also located within the spawning ground and nursery areas of commercial fisheries resources.

5.3.3.5 Artificial Reefs

Within the study area, eight units of biofilters with a total volume of 330 m^3 were deployed in 2008 at Lo Tik Wan Fish Culture Zone (FCZ) in the Southern WCZ with the objective of enhancing habitat quality and marine resources. ARs were considered as sites of fisheries importance in other approved EIAs and hence would be considered as fisheries sensitive receivers in this study. The Cape D'Aguilar Marine Reserve also lies within the Southern WCZ, but as it is located far away from the Project area (> 10 km away), it is not considered as a fisheries sensitive receiver for this Project.

5.3.3.6 Culture Fisheries

In Hong Kong aquaculture includes marine fish culture, pond fish culture and oyster culture. In 2016 production from the aquaculture sector was 3,703 tonnes valued at $152 million which was 3 per cent in weight and 6 per cent in value of the total fisheries production. The estimated production of marine fish culture fisheries in 2016 was about 1,031 tonnes valued at $86 million, which catered for about 5 per cent of local demand for live marine fish (AFCD, 2016). Most of the licensed farms are small, family-based and consist of one to two rafts with average total area of around 290 m^2. Common marine fish species under culture in Hong Kong recently include green grouper, brown-spotted grouper, giant grouper, Russell's snapper, mangrove snapper, goldlined seabream and star snapper depending on the availability of imported fry. There is no aquaculture activities within the 500 m Assessment area, and the closest FCZs are in Lok Tik Wan and Sok Kwu Wan, which are >5 km and >7 km from the nearest dredging boundaries respectively. Cheung Sha Wan FCZs located further away from the Project area (>10 km away).

5.3.3.7 Summary of Fisheries Baseline Conditions

The fisheries baseline information was collected based on available literature and reports, which covered fisheries production, resources and activities within the Project area and Study area. The proposed improvement dredging area is regularly used by ocean-going vessels delivering coal to LPS for power generation from its coal-fired units since 1981. According to the AFCD port survey, the area in adjacent to the Navigation Channel is an important fishing ground for small fishing sampans with moderate fisheries production by value and weight.

The fisheries information collected from desktop review was considered as sufficient for the prediction and evaluation of fisheries impacts and therefore no fisheries field surveys were considered necessary.

5.4 Identification and Evaluation of Potential Fisheries Impacts

The Section identified and evaluated the potential short and long-term impacts on both capture and culture fisheries, during the construction and operation (including operation dredging) phase of this Project, in accordance with Condition 3.4.4.3 of the EIA Study Brief No. ESB-282/2014.

5.4.1 Construction Phase

Impacts to fisheries resources and fishing operations are expected to occur during the improvement dredging works. These impacts are predicted to be confined within the dredging area and may occur through the following events:

5.4.1.1 Loss of Fishing Ground

Potential impacts on fisheries include the temporary loss of fishing ground and fisheries resources along the dredging area at the existing seabed level reaching approximately -16.5 mPD after dredging. The estimated dredging sediment volume is up to 3.2 million m^3. The areas within the Channel were moderately

used by fishing vessels. Nevertheless, moderate number of fishing sampans operated within the project area with moderate fisheries production might be affected due to the project. The temporary loss of fisheries production is around 200-600 kg/ha. It is estimated that a total area of up to 262 ha of fishing ground will be temporary affected, affecting around 52.4 to 157.2 tonnes of fisheries production temporary which constitutes 0.03 – 0.1% of total fisheries production in Hong Kong. However, the dredging activities will be controlled under the proposed dredging rate with a maximum of 5 dredgers operated concurrently within the works area in phases. Based on other dredging works of similar nature in Hong Kong, one dredger may occupy an area of 200 m x 200 m (i.e. 4 ha/ dredger) including anchorage area, therefore, a maximum of 20 ha of fishing ground be temporary affected in each phase. The total area of up to approximately 262 ha of fishing ground, which is about 0.16% of the total Hong Kong marine waters of approximately 1,649 km^2 (or 164,900 ha) of total Hong Kong marine waters (EPD, 2015) that available for capture fisheries will be temporary lost. In view of the small portion of Hong Kong water to be temporarily affected by the project, no unacceptable adverse impacts on fisheries due to temporary loss of fishing ground and fisheries resources are anticipated.

Around 210 ha of the Project area within the previously identified spawning and nursery grounds of commercial fisheries resources will be affected due to dredging activities. Due to temporary, reversible and short term nature of the project, the impact on the temporary loss of spawning and nursery grounds of commercial fisheries resources are considered as minor.

5.4.1.2 Disruption of Fishing Operation

The proposed dredging works may potentially cause an impact on fishing activities. Those fishing vessels operating in the western waters of Lamma Island may be temporarily affected by the proposed dredging area and its vicinity. However, the major dredging areas are located in existing Lamma Power Station Navigation Channel, which were regularly used by ocean-going vessels. Moreover, the areas to be dredged will be confined and vessel speeds for construction vessels will be restricted, thus further reducing the impact on fishing operation in the vicinity due to the dredging activities. As fishing operations in the Project area are mainly small scale with vessels less than 15 metres in length. Based on the AFCD port survey, around 100-400 vessels per grid (grid of 720 ha cell size was used) will be affected (**Figure 5.4**). It is estimated that with 262 ha of project area, around 36 – 146 vessels will be temporary affected. This estimation is based on worst case scenario assuming dredging activities happen simultaneously in all the four dredging area, which is very unlikely to occur. As mentioned above, the dredging activities will be controlled under the proposed dredging rate with a maximum of 5 dredgers operated concurrently within the works area in phases. Therefore, a maximum of 20 ha of project area be temporary affected in each phase and the actual number of vessels being affected will be much less than the estimated value. For the fishing sampans operated within the Project area, they are considered less sensitive to disturbance due to their high maneuvering ability and other fishing grounds could still be utilized. Therefore, the potential impact on fishing operation is considered as temporary and short-term. No unacceptable adverse impact on fishing operation is anticipated.

5.4.1.3 Indirect Impact of Deterioration of Water Quality

The key potential water quality impacts arising from construction activities of the Project include the suspended solids (SS) release due to dredging activities and the release of contaminants and/or impact on dissolved oxygen due to disturbance of sediment.

SS occur naturally in the marine environment by wave action and vertical flux of water current. Fish have evolved adaptation to tolerate changes in SS, i.e. flushing water through their gills or simply moving to less turbid waters. Sediment plumes as a result of dredging activities during construction phase can increase the SS concentrations in the receiving water body. Effects of SS on fisheries resources could be lethal or sub-lethal through reduction in survivorship, growth rate and reproductive potential due to stress incurred by the need to constantly flush out deposited material. High SS level may clog gill structure of fish and cause physical damage and hinder transfer of oxygen. Fish egg and larval fish (fry) are more susceptible to deleterious impacts from sedimentation through smothering and clogging of their respiratory systems. Adult fish are more likely to move away when they detect certain SS level and therefore less sensitive to the effects from SS.

Increase in SS in water column combining with a number of other physical or biotic factors would reduce dissolved oxygen (DO) in water column. Elevated SS reduces light penetration, lowers the photosynthetic rate of phytoplankton and so lowers the rate of oxygen production in water column. Also, the release of inorganic substances from the dredged sediments may cause eutrophication and algal bloom. Oxidation of dead algae may use up some of the oxygen in the water. If oxygen levels are depleted to low levels, fish, especially those in early life stages may be unable to tolerate such conditions and suffer hypoxia-induced mortality and / or stress including reduced feeding and growth rate.

Dredging activities can agitate the sediments and result in release of these contaminants into the marine water, thus affecting the ambient marine water quality. The release of sediment contaminants into the water column also consumes DO in the ambient water, which can adversely affect WSRs such as fish culture zones.

For this study, a ‘backwards’ modelling approach has been adopted to determine the maximum allowable SS release from the dredging activities and the associated maximum allowable dredging rates for each working zone within the Project area. After that, a ‘forwards’ model has been adopted to verify the result. According to the ‘forwards’ model, the maximum SS Elevation at all Fish Culture Zones comply with the WQO criterion (see **Table 5-3**). The Maximum DO depletion is also negligible according to the modelling result that the predicted DO concentration with project works are not worst than the baseline values in all Fish Culture Zones (see **Table 5-4**). Therefore, no unacceptable adverse impacts on all fish culture zones (and biofilters deployed within the zone) are anticipated as the water quality impact due to SS release and DO depletion arising from the dredging activities of the Project is negligible.

The water around south Lamma was considered as spawning and nursery grounds of commercial fish species (ERM, 1998). According to the water quality modelling result, the maximum depth average SS elevation at all WSRs comply with the WQO criterion (see **Table 3.23**) and the maximum DO depletion is negligible (see **Table 3.28**). Therefore, no unacceptable adverse impacts on the spawning and nursery

grounds within or in immediate vicinity are anticipated as the water quality impact due to SS release and DO depletion arising from the dredging activities of the Project is considered insignificant.

Table 5-3: Predicted Cumulative Depth Average Maximum SS Elevation at Fish Culture Zones

WSR	Dry Season					Wet Season				
	Criteria (mg/l)	Dredging Location (Zone)				Criteria (mg/l)	Dredging Location (Zone)			
		A	B	C	D		A	B	C	D
F1	3.1	0.1	0.1	0.1	0.0	2.2	0.1	0.0	0.0	0.0
F2	2.1	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0
F3	4.5	0.0	0.0	0.0	0.0	3.1	0.0	0.0	0.0	0.0

Note: F1: Lo Tik Wan Fish Culture Zone; F2: Sok Kwu Wan Fish Culture Zone; F3: Cheung Sha Wan Fish Culture Zone.

Table 5-4: Calculated Changes to Depth Average DO Concentration at WSRs due to the Project

WSR	Criteria (mg/L)	Baseline DO (mg/L)		Grab Dredger		TSHD	
				Calculated DO at WSR (mg/L)		Calculated DO at WSR (mg/L)	
		Dry	Wet	Dry	Wet	Dry	Wet
F1	>5	5.7	4.3	5.7	4.3	5.7	4.3
F2	>5	5.6	4.6	5.6	4.6	5.6	4.6
F3	>5	5.6	5.0	5.6	5.0	5.6	5.0

Note: F1: Lo Tik Wan Fish Culture Zone; F2: Sok Kwu Wan Fish Culture Zone; F3: Cheung Sha Wan Fish Culture Zone.

5.4.2 Operation Phase

5.4.2.1 Operation Dredging

During operation phase, improvement dredging will be required periodically (anticipated to be once every 4 to 10 years for a volume of up to approximately 2.9 million m^3 for worst case scenario) to maintain the required depth of the Channel. The potential water quality impacts associated with this recurring improvement dredging is the same as that for construction phase. The change in bathymetry of the Channel may also affect existing hydrodynamics and flows in the surrounding areas, though it should be noted that similar changes have occurred in the past due to historical improvement dredging works at the Channel. Aside from the aforementioned, no other potential impacts due to recurring improvement dredging is anticipated given that the nature of the operation phase water quality impacts will be the same as that for construction phase. Similar to the impact during construction phase, there will be no unacceptable adverse impacts on the loss of fishing ground, loss of spawning and nursery grounds of commercial fisheries resources, disruption of fishing operation and the deterioration of water quality at fish culture zones and associated biofilters deployed.

Table 5-5: Evaluation of Potential Fisheries Impacts during Construction Phase

Parameter	Loss of Fishing Grounds	Disturbance to Fishing Operations	Deterioration of Marine Water Quality
Nature of Impact	Temporary loss of fishing ground; reversible and short term during construction period.	Temporary and short-term during the construction phase.	Temporary and short-term during the construction phase.
Size of Affected Area	Up to around 262 ha of seabed will be dredged, with a maximum of 20 ha be affected in each phase of works.	Up to around 262 ha of seabed will be dredged, with a maximum of 20 ha be affected in each phase of works..	Up to around 262 ha of seabed will be dredged, with a maximum of 20 ha be affected in each phase of works..
Loss of Fisheries Resources/ Production	Constitutes a small proportion of total fisheries resources / production in Hong Kong (around 200-600 kg/ha)	Around 36 to 146 fishing vessels operate at the Project area which constitutes a small proportion of total fisheries resources / production in Hong Kong	Loss of fisheries resources constitutes a small proportion of total fisheries resources / production in Hong Kong
Destruction and Disturbance of Nursery and Spawning Grounds	Around 210 ha of the Project area lies within south Lamma, which had previously been identified as spawning and nursery grounds of commercial fisheries resources. The impact significance of the loss of nursery and spawning ground is minor due to its temporary, reversible and short term nature.	There would be no adverse impact to fishing operation in the nursery and spawning ground due to its temporary, reversible and short term nature.	The dredging method and rate adopt would not cause adverse impact on the spawning and nursery ground due to the deterioration of water quality.
Impact on Fishing Activity	The dredging areas are located in the existing Lamma Power Station Navigation Channel which are moderately used by fishing vessels.	The dredging areas are located in existing Lamma Power Station Navigation Channel which are moderately used by fishing vessels.	Impacts to fishing activities in the area due to indirect disturbance of water quality are expected to be localised and in short-term.
Impact on Aquaculture Activity	No direct impact on culture fisheries is anticipated as no FCZ is within the proposed dredging area.	No direct impact on culture fisheries is anticipated as FCZs are far away from the proposed dredging area.	No significant impact on marine fish culture activity is identified due to compliance of SS elevation and no significant change in DO level.

Table 5-6: Evaluation of Potential Fisheries Impacts during Operation Phase

Parameter	Impact due to improvement dredging during operation phase
Nature of Impact	The impact is similar to the construction phase impact, which is temporary, reversible and short term.
Size of Affected Area	Up to around 262 ha of seabed will be dredged, with a maximum of 20 ha be affected in each phase of works.
Loss of Fisheries Resources/Production	Around 36 to 146 of fishing vessels operated at the Project area which only constitutes a small proportion of total fisheries resources / production in Hong Kong (around 200-600 kg/ha).
Destruction and Disturbance of Nursery and Spawning Grounds	Around 210 ha of the Project area lies within south Lamma, which had previously been identified as spawning grounds and nursery areas of commercial fisheries resources. The impact significance on the loss of nursery and spawning ground is minor due to its temporary, reversible and short term nature.

Parameter	Impact due to improvement dredging during operation phase
Impact on Fishing Activity	The dredging areas are located in existing Lamma Power Station Navigation Channel which were moderately used by fishing vessels.
Impact on Aquaculture Activity	No direct impact on culture fisheries is anticipated as the FCZs are far away from the proposed dredging area. No unacceptable adverse impacts on aquaculture activities are anticipated as the water quality impact due to SS release and DO depletion arising from the dredging activities of the Project is negligible.

5.5 Mitigation of Adverse Environmental Impacts

Mitigation measures recommended in the Water Quality Impact Assessment chapter (refer to **Section 3.8**) for minimizing water quality impacts will also minimize any adverse environmental impact to fisheries. Therefore, no fisheries-specific mitigation measures are required during the proposed dredging works.

5.6 Cumulative Impacts

The potential cumulative impacts of changes in water quality on fisheries due to this Project and concurrent projects described in **Section 2.7** of this Study were assessed in **Section 3.5.3**. With reference to the water quality modelling results, the cumulative impacts especially for the elevation of SS levels would be minimal for all the FCZs and spawning and nursery grounds. The implementation of water quality mitigation measures including closed grabs and cage-type silt curtain (for the grab dredger method) could further reduce the SS level to minimal. Therefore, no unacceptable cumulative impact on fisheries is expected from these projects.

5.7 Evaluation of Residual Impacts

No adverse significant residual impact due to the proposed dredging works is expected after the implementation of the migration measures to control water quality impacts.

5.8 Environmental Monitoring and Audit Requirements

Although it is anticipated that there will be no unacceptable adverse impacts on aquaculture activities, three water quality monitoring stations representing Lo Tik Wan, Cheung Sha Wan and Sok Kwu Wan Fish Culture Zones are recommended during the marine works for both construction phase and each operation phase recurrent improvement dredging, to detect and check for any deterioration in water quality (refer to Section 2.5 of the EM&A Manual). Stakeholder engagement activities will also be arranged with relevant fishermen and mariculturists prior to project implementation and each operation phase recurrent dredging to seek their views and foster their understanding on the proposed project works.

With the implementation of the recommended water quality mitigation measures and water quality monitoring during construction and operation phases (recurrent dredging), no adverse impact on fisheries is anticipated, thus fisheries specific monitoring is considered not necessary. The implementation of the water quality mitigation measures should be checked as part of the environmental monitoring and audit

procedures during the construction and operation phases (recurrent dredging) as presented in the EM&A Manual.

5.9 Conclusion

Reviews of existing information on capture and culture fisheries within the proposed dredging area and Study Area has been undertaken. For capture fisheries, the findings showed that the Project area is of moderate used by fishing vessels, which only constitutes a small proportion of total fisheries production in Hong Kong. The Project area is within spawning grounds and nursery areas of commercial fisheries resources in south Lamma. For culture fisheries, there are no aquaculture activities within the 500 m Assessment area.

Impacts to capture fisheries due to temporary loss of fishing ground and short term disruption of fisheries operation are predicted to be minor due to the short-term and small-scale nature of the works. No adverse impact to the nursery and spawning ground is anticipated due to temporary, reversible and short term nature of the Project. For this study, a 'backwards' modelling approach has been adopted, which estimated the maximum dredging rates which would ensure no unacceptable environmental impacts. The results were then verified with a 'forwards' model taking into account concurrent projects. The modelling result proved that there would be no significant adverse indirect fisheries impact caused by the deterioration of water quality.

With proper implementation of good site practices and mitigation measures for water quality, as well as water quality monitoring recommended above, it is expected that residual impacts associated with water quality change are negligible and no specific fisheries monitoring is required.

5.10 References

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