8 Fisheries Impact

8.1 Introduction

This section presents an assessment of the potential fisheries impacts associated with the construction and operation of the Integrated Waste Management Facilities Phase 2 (I·PARK2 or the Project). Appropriate measures have been recommended, where necessary, to avoid/ minimize/ mitigate the potential impacts.

8.2 Environmental Legislation, Standards and Criteria

The relevant local legislation, standards and guidelines applicable to the assessment of fisheries impact include:

- Annex 9 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) - provides the criteria for evaluating the fisheries impacts of this Project.
- Annex 17 of the EIAO-TM – sets out the methodology for assessment of fisheries impacts, in order to provide objective identification, prediction and evaluation of potential fisheries impacts arising from the Project.
- Fisheries Protection Ordinance (Cap. 171) – promotes the conservation of fish and other forms of aquatic life within Hong Kong waters by regulating fishing practices to prevent detrimental activities to the fisheries industry. The authority may also make rules for the management and control of fishing in any fisheries protection area, including but not limited to the specification of any zone within any fisheries protection area and the prohibition of any fishing in the specified zone.
- Marine Fish Culture Ordinance (Cap. 353) – regulates and protects marine fish cultured by designating areas of fish culture zone, granting licenses, prohibiting unauthorised vessels and any deposition of chemicals or other substances which are likely to cause injury to fish in a fish culture zone.
- Water Pollution Control Ordinance (Cap. 358) – aims to control water pollution in waters of Hong Kong. Water Control Zones (WCZs) are designated with individual water quality objectives to promote the conservation and best use of those waters in the public interest.

8.3 Assessment Area

The fisheries impact assessment area is the same as the water quality impact assessment area including the Deep Bay Water Control Zone (WCZ) and North Western WCZ defined under the Water Pollution Control Ordinance (WPCO) as well as other area with potential fisheries

impacts found during the course of the EIA study and have a bearing on the environmental acceptability of the Project as presented in **Figure 8.1**.

8.4 Assessment Methodology

This fisheries impact assessment was prepared in accordance with the criteria and guidelines in Annexes 9 and 17 of the EIAO-TM as well as Clause 3.4.8 and Appendix G of the EIA Study Brief.

Fisheries baseline information including the data from the latest Agriculture, fisheries and Conservation Department (AFCD) Port Survey 2021, AFCD Annual Reports as well as other relevant information available in other Environmental impact Assessment (EIA) reports and publications was reviewed.

Special attention was given to the evaluation of any direct / indirect and on-site / off-site impacts on fisheries, such as loss or disturbance of fishing grounds, oyster culture activities in Deep Bay, fisheries production and operations, fisheries resources and habitats, spawning grounds, artificial reefs, as well as water quality deterioration at sensitive receivers, impingement and entrainment of fisheries resources at seawater intake points, thermal pollution and discharge of anti-foulants of the proposed seawater cooling system.

The extent and severity of indirect impacts from the Project were assessed with reference to the water quality modelling results. Mitigation measures were proposed, if required.

8.5 Description of the Environment

8.5.1 Capture Fisheries

8.5.1.1 Overview

In 2023, the capture fisheries industry of Hong Kong produced an estimated 87 000 tonnes of fisheries produce valued at about $2.4 billion. The industry consists of some 5 090 fishing vessels and about 10 240 local fishermen (AFCD 2024). The recent data on local capture fisheries industry are summarized in **Table 8-1**.

Table 8-1 Recent Figures of Hong Kong Capture Fisheries Industry

Parameter	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014
Fishing fleet size (No. of vessels)	5,090	5,080	5,170	5,040	5030	5050	5150	5160	4,150	4,500

Parameter	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014
Local fishermen engaged in capture fisheries	10240	10320	10510	10,150	10100	10200	10600	10800	9,170	9,400
Production (thousand tonnes)	87.0	77.0	112.0	116.0	123.0	124.0	127.6	142.8	162.0	160.8
Value of produce (HK$ million)	2,400	2,200	2,800	2,700	2800	2800	2600	2565	1,600	2,530

The latest AFCD Port Survey 2021 (AFCD 2022b) provides the most updated information on capture fisheries in Hong Kong waters. The overall fisheries production yields and overall number of operating fishing vessels recorded in the Port Survey 2021 are shown in **Figure 8.2** and **Figure 8.3**. The highest fisheries yields in Hong Kong of over 300 kg/hectare (ha) were obtained in southern waters (around Cheung Chau, Soko Islands, Shek Kwu Chau, Lamma Island and Po Toi), outside the assessment area.

The top ten fish families / groups of fish catch in Hong Kong waters are shown in **Table 8-2**.

Table 8-2 Top Ten Families / Groups of Fish Catch in Hong Kong Waters

Rank #	Family / Group *	Common Name of Fish Catch
1	Clupeidae	Sardine, Shad
2	Mugilidae	Mullet
3	Sciaenidae	Croaker
4	Carangidae	Scad, Jack
5	Siganidae	Rabbitfish
6	Sparidae	Seabream
7	Mixed crab	Crab
8	Mixed squid	Squid
9	Polynemidae	Threadfin
10	Scorpaenidae	Scorpionfish, Common rockfish

Source: AFCD Port Survey 2021 (AFCD 2022b)

\# Ranking is based on the estimated weight of production of each family/group of fish catch.

* Other families/groups of common fish catch include Platycephalidae (flathead), Cynoglossidae (tongue sole), Muraenesocidae (conger-pike eel), mixed shrimp and Scombridae (mackerel), etc.

To assess the changes in fisheries resources after the implementation of the trawl ban and other relevant fisheries management measures, AFCD initiated the monitoring of local fisheries resources in 2010. Demersal fisheries surveys using stern and shrimp-trawlers were conducted

in four areas of Hong Kong (i.e. north-eastern, south-eastern, south-western and north-western waters) from 2010 to 2015 (AFCD 2017). The main commercial families of fisheries resources recorded in the North-Western (NW) water (covering the assessment area including the Deep Bay and North Western WCZs) during the demersal fisheries surveys are presented in the following table.

Table 8-3 Main Commercial Families in North-Western (NW) Water of Hong Kong

Rank#	NW
Shrimp Trawl Surveys	
1	Penaeidae
2	Sciaenidae
3	Platycephalidae
4	Portunidae
5	Clupeidae
6	Leiognathidae
7	Cynoglossidae
8	Squillidae
9	Polynemidae
10	Synodontidae
Stern Trawl Surveys	
1	Clupeidae
2	Sciaenidae
3	Engraulidae
4	Leiognathidae
5	Carangidae
6	Stromateidae
7	Penaeidae
8	Portunidae
9	Trichiuridae
10	Polynemidae

Consolidated ranking based on the biomass of each family collected in the surveys

8.5.1.2 Deep Bay WCZ

According to the fisheries survey conducted in 2016 and 2017 (CLP 2018), waters near outer Deep Bay showed relatively low biomass and species richness of fisheries resources with moderate abundance. Dominant fish species recorded in outer Deep Bay include *Sillago sihama* and *Terapon jarbua* of high and low commercial value respectively.

In 2021, low fisheries production yields of no more than 50 kg/ha were recorded in majority of the Deep Bay water including the water around the Tsang Tsui Ash Lagoon (TTAL) (where

the Project site is located). The overall number of operating fishing vessels in the waters around TTAL was >100 to 200 of moderate level (AFCD 2022b).

8.5.1.3 North Western WCZ

Fisheries surveys were conducted in 2013 under the EIA for Expansion of Hong Kong International Airport into a Three-Runway System (AAHK 2014). Most of the survey data obtained in the northern Chek Lap Kok waters showed a moderate fisheries yield of no or low commercial value (e.g. *Thryssa kammalensis*, *Sardinella albella*, *Temnopleurus toreumaticus*, *Leiognathus brevirostris*, *Alepes djedaba*, *Nematalosa nasus* and *Rhizoprionodon acutus*). The fisheries survey data obtained at Sha Chau and Lung Kwu Chau Marine Park (SCLKCMP) generally showed high fisheries yield of medium to high commercial value (e.g. *Nematalosa nasus*, *Valamugil cunnesius*, *Ilisha elongate, Pampus argenteus* and *Collichthys lucidus*) (AAHK 2014).

The literature review conducted under the EIA for Expansion of Hong Kong International Airport into a Three-Runway System covered the fisheries survey data collected from 2006 to 2013 under the Environmental Monitoring and Audit (EM&A) for Contaminated Mud Pit (CMP) at Sha Chau. The EM&A data from 2006 to 2013 showed that catches collected near the CMP to the north of Lantau Island as well as in the waters near Lung Kwu Chau were dominated by species of low or no commercial value (e.g. *Turritella spp.*, *Charybdis spp.*) in terms of both abundance and yield (AAHK 2014). Fisheries data collected near the CMP and Lung Kwu Chau from 2006 to 2022 were also analysed under the EM&A for Disposal Facility to the East of Sha Chau (CEDD 2022), which showed that there were no differences in the composition or abundance of demersal fisheries resources in the surveyed areas over the reporting period from 2006 to 2022 (CEDD 2023). Thus the fisheries resources in the surveyed areas remained to be of low or no commercial value.

According to the fisheries survey conducted in 2016 and 2017 (CLP 2018), waters near Sha Chau and Lung Kwu Chau showed relatively low biomass and species richness of fisheries resources with moderate abundance. Dominant fish species recorded near Sha Chau and Lung Kwu Chau include *Johnius belangerii* of low commercial value (CLP 2018).

In 2021, the marine water around Lung Kwu Chau (to the south of Deep Bay WCZ) has a low fisheries production yields of >50 to 100 kg/ha. Moderate fisheries production yields of <100 to 200 kg/ha were recorded in the waters around Sha Chau (to the further south). The overall number of operating fishing vessels of >200 to 400 of moderate level was recorded in the waters around SCLKCMP (AFCD 2022b).

8.5.1.4 Summary

The Project site and its vicinity are located within Deep Bay WCZ. The important spawning

ground for commercial fisheries resources in North Lantau is located over 4.5 km away from the Project site. Literature review showed that Deep Bay WCZ supports a low fisheries yield. Fish species of both low and high commercial value were previously recorded in outer Deep Bay. North Western WCZ generally supports low tomoderate fisheries yield where the recorded fish species ranged from no commercial value to high commercial value.

8.5.2 Ichthyoplankton and Fish Post-larvae Resources

Based on the report of Fisheries Resources and Fishing Operations in Hong Kong (AFCD 1998), the North Lantau water was identified as the important spawning ground for commercial fisheries resources where *Leiognathus brevirostris* (ponyfish), *Lateolabrax japonicus* (seabass/ perch) and *Clupanodon punctatus* (gizzard shad), etc. are examples of fish species previously recorded in the area. The important spawning ground for commercial fisheries resources in North Lantau is located over 4.5 km away from the proposed works of this Project as shown in **Figure 8.1**.

Ichthyoplankton and fish post-larvae surveys were carried out in this spawning ground in May to August 2013 (AAHK 2014), which however showed that the ichthyoplankton and fish-post larvae densities in this spawning ground were low. A total of 27 families were recorded, and the dominant ichthyoplankton and fish post-larvae families in terms of abundance were Clupeidae, Gobiidae, Ambassidae, Blenniidae and Engraulidae, accounting for about 97% of the total sample.

A more recent Ichthyoplankton and fish post-larvae survey programme covering the assessment area were undertake from November 2016 to July 2017 (CLP 2018). The survey programme covers 12 survey sites including 2 survey sites in Outer Deep Bay and Sha Chau and Lung Kwu Chau (SCLKC) respectively. Though the survey results showed that the mean density of ichthyoplankton was higher in Outer Deep Bay, Sha Chau and Lung Kwu Chau, Tai O, Peaked Hill, Cheung Chau Southeast and West Lamma than Fan Lau Kok, South of Soko Islands and Cheung Chau South, the overall level of ichthyoplankton in the survey sites was considered low in general. In addition, the mean density of fish post-larvae was at moderate level in Outer Deep Bay, while fish post-larvae density in Sha Chau & Lung Kwu Chau and Cheung Chau South was higher than other surveyed sites. However, the overall level of fish post-larvae resources in the survey sites was considered low in general. A total of 22 and 18 families were recorded in Outer Deep Bay and SCLKC respectively and dominated by species from the families Ambassidae, Leiognathidae and Engraulidae.

In summary, the results of available fisheries survey data indicated that the marine water in the assessment area including the Outer Deep Bay and North Lantau supported a relatively low abundance of ichthyoplankton and fish post-larvae of mainly low value commercial pelagic species.

8.5.3 Culture Fisheries

Culture fisheries include marine culture, pond culture and oyster culture. No pond culture and marine culture are located within the assessment area.

Culture of oyster has been practised along the intertidal mud flat of Deep Bay for at least 200 years. Despite the long-established oyster farming practice on the Deep Bay mudflats, there are no gazetted oyster farming locations in Hong Kong. Approximately 14,000 oyster rafts were recorded in Deep Bay in 2023, which spread along the shore of Deep Bay from Tsim Bei Tsui to Tsang Tsui. The extent of oyster culture activities and the designated mariculture subzone within the assessment area are shown in **Figure 8.1**.

Oyster production in 2023 as recorded by AFCD was about 96 tonnes (meat only) valued at $13 million.

8.5.4 Artificial Reefs

Artificial Reefs (ARs) are effective in promoting the growth and development of various marine organisms which in turn provide food, protection and shelter for fish. The Government has deployed some 180,000 cubic metres of ARs at suitable locations including marine parks, and important fish spawning and nursery grounds in Port Shelter and Long Harbour (AFCD 2022a). The closest marine park, where the ARs are located, is Sha Chau and Lung Kwu Chau Marine park, which is over 8 km away from the Project works as shown in **Figure 8.1**.

8.6 Sites of Fisheries Importance

Based on the review of available information, three sites of fisheries importance are identified in the assessment area, which are considered as fisheries sensitive receivers as shown in **Figure 8.1** and listed as follows.

- Important spawning ground of commercial fisheries in North Lantau water over 4.5 km away from the Project site.
- Artificial reefs in the Sha Chau and Lung Kwu Chau Marine Park over 8 km away from the Project site.
- Area of oyster culture activities granted or to be granted in Deep Bay (which overlaps with the traditional oyster production area and the mariculture subzone) over 120 m from the Project site.

8.7 Identification and Evaluation of Potential Impacts

8.7.1 Construction Phase

8.7.1.1 Loss of Fisheries Habitat and Fishing Ground

Direct loss of fisheries habitat and fishing ground would arise from the seawall modification / construction of the new berthing facility for I·PARK2. The proposed marine works are however minor in scale. The fishing ground to be affected is small of about 4.4 ha (including a permanent loss of 1.8 ha and a temporary construction works area of 2.6 ha).

The fishing ground affected by the seawall modification / berth construction is confined in close proximity to the artificial shore of Middle Ash Lagoon and West Ash Lagoon, which supports low fisheries production. The affected fishing ground represents a very minor portion of the total fishing area in Hong Kong. The loss of fishery production due to the loss of fishing ground would be negligible as compared with the total fishery production in Hong Kong.

Fishing activities in the affected area also constitutes only a very minor proportion of total fishing operations in Hong Kong in terms of vessel number. The total number of fishing operation recorded in the affected area is >100 – 200. More than 100 number of these fishing operation were using sampan and ≤50 number of these fishing operations were using other types of fishing vessels (AFCD 2022b).

No important nursery or spawning area nor site of fisheries importance would be directly affected by the Project construction works. No adverse direct fisheries impact is anticipated during the construction phase.

8.7.1.2 Disturbance of Fisheries Habitat due to Deterioration of Water Quality

8.7.1.2.1 Land-based Construction

As detailed in **Section 5.5.1.9**, the Project construction including the pilling activities for foundation construction would not affect the permeability of the existing geological structures of the Middle Ash Lagoon. All Pulverized Fuel Ash (PFA) would be retained in the lagoon and would not be disposed of into the marine environment. No PFA leaching or PFA release is anticipated from the Project construction.

Discharge from land-based construction works of the Project (including wastewater generated from construction activities, construction site run-off, accidental chemical spillage, sewage effluent from construction workforce, etc.) may cause a temporary increase in water pollution level, if uncontrolled. With the implementation of appropriate measures to control run-off and wastewater from the construction site, as well as the adoption of the relevant guidelines and good site practices for handling and disposal of construction discharges (recommended under

the water quality impact assessment in **Section 5.8**), no unacceptable impacts on water quality and fisheries due to water quality deterioration by land-based construction works would arise.

8.7.1.2.2 Marine Construction

Water quality deterioration would arise from the seawall modification / construction of new berthing facility for I·PARK2. Details of potential water quality impacts arising from the marine construction works are presented in **Section 5.5.1.7** and **Section 5.7.1.6**.

Discharge of Contaminants due to Deep Cement Mixing

The non-dredged method, namely Deep Cement Mixing (DCM), will be adopted for construction of the foundation of the new berth. The DCM involves injecting controlled volumes of cement into the underlying materials whilst simultaneously mixing the cement with the *in-situ* materials to improve their strength. The DCM method enables *in-situ* stabilisation of the underlaying sediments without excavation, dredging, shoring or dewatering, and thus there is less exposure of wastes to the water environment. By placing the sand blanket layer on top of the DCM works areas before the DCM treatment as proposed in the construction design, release of fines and cement slurry from the DCM operation and the associated water quality impact would be negligible.

The DCM method has been proven and adopted in Hong Kong. Recent DCM applications include the foundation of breakwater and seawall around the artificial island for development of Integrated Waste Management Facilities Phase 1 (I·PARK1) at Shek Kwu Chau. Marine water quality monitoring was conducted under the I·PARK1 during the DCM trials held in July, September, October and December 2018 and the full-scale DCM conducted within the period from February 2019 to October 2020 [1]. Salinity, pH, DO, turbidity, temperature, SS and total alkalinity were monitored in locations close to the DCM operation, at representative WSRs and control stations further away. The monitoring has demonstrated that there were no adverse water quality impacts associated with the DCM at locations close to the DCM operation, at representative WSRs and control stations. Fluctuations of the measured values observed during the monitoring period were investigated to be independent of the site activities and not attributable to the DCM works. The scale of DCM works proposed under this Project is minimal as compared to the seawall construction for I·PARK1. Based on the past monitoring results, no adverse water quality impact is expected from the small-scale DCM works for I·PARK2. Adverse fisheries impact due to the proposed DCM works of this Project is not anticipated.

[1] Website of EM&A data for FEP-01/429/2012/A / EP-429/2012/A - Development of the Integrated Waste Management Facilities Phase 1 (https://www.epd.gov.hk/eia/english/register/index7/fep1772017_content.html)

Elevation of Suspended Solids

The proposed sand blanket laying work would potentially cause a release of fines into the water column. Possible high Suspended Solids (SS) levels in marine water may clog the gill structure of fish and cause physical damage and reduce survival, reproduction and growth rates. These effects could be lethal or sub-lethal. Capture fish resources including any adult fish are more likely to move away when they detect increase in SS level and therefore less sensitive to the effects from SS elevation.

Lethal response had not been observed in adult fish at SS level less than 125 mg/L, and sublethal effects were only reported at levels exceeded 90 mg/L (Alabaster 1984, Çınar 2017, DSD 2016 and DSD 2022). However, the recommended SS value based on international marine water quality objective guidelines for the ecosystem protection was 50 mg/L (AFCD 2001). The Water Quality Objective (WQO) for SS elevation is available from the Water Pollution Control Ordinance (WPCO), which is defined as 30% increase from the ambient SS level. The WQO for SS elevation is conservatively adopted as the assessment criteria for fisheries sensitive receivers. Details are presented in **Section 5.6.2.2.2**.

The possible SS elevation caused by the sand blanket laying work was quantitatively assessed by mathematical modelling. Based on the modelling results as presented in **Table 5-17** and **Table 5-18**, the maximum SS elevations predicted at the traditional oyster production area (F1), mariculture subzone (F2), area of oyster culture activities granted or to be granted in Deep Bay (O1 to O3) and important spawning ground for commercial fisheries resources (F3) are less than 1 mg/L under the mitigated scenario. The predicted SS increases are considered minor and complied well with the WQO.

The ARs in Sha Chau and Lung Kwu Chau (SCLKC) Marine Park is located over 8 km from the small-scale sand blanket laying works. The water quality impact at ARs is assessed with reference to the model results for SCLKC Marine Park (E3) as presented in **Table 5-17** and **Table 5-18**. The predicted SS elevations at SCLKC Marine Park (where the ARs are located) are less than 0.1 mg/L Full SS compliance is predicted at the ARs.

As shown in the contour maps of SS elevations in **Appendix 5G**, the sediment plume is considered localized and confined near the marine works area of the Project.

Oxygen Depletion

Dispersion of SS may release sediment-bounded pollutant into the water column. Readily-biodegradable organic compounds could be taken up by micro-organism and result in depletion of dissolved oxygen (DO). 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.

An assessment of DO depletion during sand blanket laying was conducted (see **Section 5.7.1.6.2**). The maximum DO depletion at the traditional oyster production area (F1), mariculture subzone (F2) and important spawning ground for commercial fisheries resources (F3) was estimated to be 0.003 mg/L under the mitigated scenario. The transient DO depletion of 0.003 mg/L would cause negligible impact upon the fisheries resources. The maximum DO depletion at area of oyster culture activities granted to be granted in Deep Bay (O1 to O3) was estimated to be 0.0108 mg/L under the mitigated scenario and the resulted DO levels (i.e. ambient level minus maximum depletion) fully complied with the WQO.

The DO depletion at ARs caused by the sand blanket laying is assessed with reference to the model results for SCLKC Marine Park (E3) as presented in **Section 5.7.1.6.2**. The predicted DO depletion at SCLKC Marine Park (where the ARs are located) are less than 0.0001 mg/L Full DO compliance is predicted at the ARs.

Summary

No unacceptable fisheries impact due to the water quality deterioration is predicted from the marine construction work of this Project.

8.7.1.3 Increase in Marine Traffic

Construction vessels are estimated to be only about 1 or 2 round trips per day. The proposed marine construction site and its vicinity are located within an existing navigation channel with high background level of marine traffic. A small increase in vessel activity associated with the small-scale marine construction of this Project is expected to have negligible impact on fishing activity.

8.7.1.4 Underwater Sound Generated from Marine Construction Activities

Intermittent sounds, which occur during construction activities such as placing of sand blanket by grab dredger and marine vessel movement, may have an impact on fisheries resources. Potential effects of increased underwater sound include physiological stress, avoidance and injury (at high pressure levels). The level of impact is however dependent upon background sound, number of fish present, type of species affected, proximity of fish to the sound source, attenuation properties of seabed sediments and hearing capabilities of the species affected, etc.

Most marine invertebrates do not possess air-filled space and thus it is generally considered that sound would have limited physiological or behavioural effects on marine invertebrates, except if they are located within a few metres of the sound source. Therefore underwater sound generated from marine works is expected to have negligible impact on marine invertebrates in the assessment area.

Fish, however, can detect underwater sound vibrations through two ways, the lateral line system and the inner ear for species containing air-filled swim bladders. Anthropogenic underwater sounds associated with the vessels for this Project such as barges, tung boats and dredger, may be audible to most fish species. The existing waters at and in the vicinity of the Project site is subject to relatively high levels of marine traffic by similar types of vessels. It is therefore expected that fish in the existing waters are habituated to a relatively high background level of underwater sound, and a small increase in vessel activity associated with the small-scale marine construction of this Project is not anticipated to result in adverse impacts on fisheries resources, and hence is expected to have negligible impact on fishing activity.

8.7.1.5 Overall Impact

The evaluation of construction phase fisheries impacts from the Project is summarized in **Table 8-4**. The overall fisheries impact during the construction phase is considered Minor.

Table 8-4 Potential Fisheries Impact during Construction Phase

Potential Impact	Nature of Impact	Size of Affected area	Loss of Fisheries Resource / Production	Destruction and Disturbance of Nursery and Spawning Grounds	Impact on Fishing Activity	Impact on Aquaculture Activity	Overall Impact Significance	Mitigation Measures Required
Loss of fisheries habitat and fishing ground	Impact during the construction phase	The affected area is about 4.4 ha (including a permanent loss of 1.8 ha and a temporary construction works area of 2.6 ha).	The affected area has a low level of fisheries production. The loss of fisheries resource / production is considered negligible.	No important spawning nor nursery ground is identified in the marine construction works area. No direct loss of important nursery and spawning grounds.	The affected area has a moderate level of fishing operation. In view of the small size of affected area, impact on fishing activity would be minimal.	No aquaculture activity is identified in the proposed marine construction works area. There would be no direct impact on aquaculture activity.	Minor	No fisheries specific mitigation measure is required.
Disturbance of fisheries habitat due to deterioration of water quality	Temporary impact during the construction phase.	The water quality changes would be localized in close vicinity of the proposed construction works areas.	Avoidance by fish is expected, Loss of fisheries resources or production would be negligible.	Full water quality compliance is predicted at the recognized important spawning ground in North Lantau. No recognized nursery ground is identified in the assessment area. There would be no unacceptable adverse impact on nursery and spawning grounds.	The water quality changes would be localized with negligible impact on fishing activity.	Full water quality compliance is predicted at water areas related to oyster culture activities. There would be no unacceptable adverse impact on aquaculture activity.	Minor	Water quality mitigation measures recommended in **Section 5** would further minimize the water quality changes and the associated impact on fisheries. No fisheries specific mitigation measure is required.
Increase in marine traffic	Temporary impact during the construction phase.	The instantaneous area affected by the vessels (of only 1 or 2 round trips per day) would be negligible.	Increase in marine traffic would be limited. Loss of fisheries resources or production would be negligible.	No important spawning nor nursery ground is identified in the affected water. No destruction nor disturbance to nursery and spawning ground would arise.	The increase in marine traffic would be limited with negligible impact on fishing activity.	No additional impact on aquaculture activity would arise due to the limited increase in marine traffic	Negligible	No fisheries specific mitigation measure is required.
Underwater sound generated from marine construction activities	Temporary impact during the construction phase.	The affected area would be localized in close vicinity of the proposed construction works area.	Avoidance by fish is expected, Loss of fisheries resources or production would be negligible.	Underwater sound is expected to have negligible impact on important spawning ground in North Lantau of at least 4.5km away. No important nursery ground is identified in the assessment area	Underwater sound induced by the Project would be negligible as compared to the existing background level with negligible impact on fishing activity.	Due to the small scale of works, underwater sound is expected to have negligible impact on aquaculture activity (or oyster culture activities) in Deep Bay.	Negligible	No fisheries specific mitigation measure is required.

8.7.2 Operational Phase

8.7.2.1 Loss of Fisheries habitat and Fishing Ground

Due to the seawall modification / construction of the new berthing facility of I·PARK2, there will be a permanent loss of fisheries habitat and fishing ground along the shore of the Middle Ash Lagoon and West Ash Lagoon. The affected area is however very small of about 1.8 ha with low fisheries production.

The affected fishing ground represents a very minor portion of the total fishing area in Hong Kong. The loss of fishery production would be negligible as compared with the total fishery production in Hong Kong.

The overall number of operating fishing vessels in the waters around TTAL in 2021 was recorded to be of moderate level. Fishing activities in the affected area constitutes only a very small proportion of total fishing operations in Hong Kong in terms of vessel number, and most of the vessels operating there were sampans. The impact on fishing activity due to this Project would be minimal.

No important nursery or spawning area nor site of fisheries importance would be directly affected by the Project. No adverse direct fisheries impact is anticipated during the operational phase.

8.7.2.2 Impingement and Entrainment of Fisheries Resources

The proposed desalination plant and seawater cooling system of the Project would require seawater intakes. The proposed seawater intakes of the Project would be located at the modified seawall of the Project site.

The proposed seawater intakes may adversely affect the fisheries resources due to impingement and entrainment. Impingement may cause physical damage to fisheries resources due to collision with the screening system of the intake and would mainly affect juvenile fish species that are large enough to be retained by the intake screens. Entrainment would mainly affect small fish, fish larvae, crustaceans and fish eggs, which are small enough to pass through the intake screen mesh. Adult fish is considered less susceptible to impingement and entrainment since they usually swim at higher velocities and are more capable to counteract the intake velocity and actively move away.

The rate of seawater intake of this Project would be 4,000 m^3 per day for the proposed desalination plant and 1.1 M m^3 per day (annual average) for the proposed seawater cooling system. Direct impact due to impingement and entrainment of fisheries resources is possible in particular upon any juvenile fish, fish larvae, crustaceans and fish eggs nearby.

However, no recognized nursery and spawning ground for commercial fisheries resources are located in outer Deep Bay where the proposed seawater intakes are located. The proposed seawater intakes would be installed at the artificial seawall of TTAL where the ichthyoplankton and fish larvae resources would be limited. The marine area of the proposed intake locations and nearby water supports low level of capture fisheries production. As presented in **Section 8.5.2**, past literature suggested that the densities for fish larvae and eggs in the assessment area were in general low. The closest recognised important spawning ground for commercial fisheries resources at North Lantau is over 4.5 km away and would not be affected by the seawater inflow of this Project. Considering the low productivity in ichthyoplankton and fish larvae near the seawater intake, any potential impact on local fisheries resources due to impingement and entrainment of this Project is considered minor.

8.7.2.3 Change of Water Quality and Hydrodynamics Regime

8.7.2.3.1 Discharges from Desalination and Seawater Cooling Systems

Introduction

The key water quality concern would be the discharges from the proposed desalination plant and seawater cooling system of the Project.

The proposed desalination plant will provide freshwater supply to the I·PARK2. Brine is an unavoidable product of the desalination process and would be discharged into the marine water via the seawall outfall.

The proposed seawater cooling system would abstract seawater for exchange of the heat from the low-pressure steam generated in incineration processes. The spent cooling water would also be discharged back into the sea via the seawall outfall.

Chlorine will be used as an anti-fouling agent for the proposed desalination and seawater cooling systems. Sodium Metabisulphite (SMBS) may be dosed and used for dechlorination in the proposed seawater intake and outfall systems as required.

These seawall outfall discharges could have negative effects on the surrounding marine environment and its fisheries resources due to the increased salinity / temperature, as well as the presence of Total Residual Chlorine (TRC) in the outfall discharges. Excess salinity and temperature increases could inhibit the growth and reproduction of fisheries resources. TRC is also potentially toxic to fish.

The SMBS is decayable and non-toxic to aquatic life (refers to **Section 5.5.2.2.3**). SMBS is a reducing agent and therefore the key concern would be its potential contribution to an increase in Chemical Oxygen Demand (COD) and possible Dissolved Oxygen (DO) depletion the water column.

TRC

TRC is subject to continuous decay once they are dosed in the seawater intake and outfall systems and will continue to decay after it is discharged into the marine environment. Based on the water quality modelling results presented in **Section 5**, the predicted TRC levels at all identified fisheries sensitive receivers, with consideration of other background discharges in the assessment area, were negligible. The maximum TRC levels predicted at the fisheries sensitive receivers including representative oyster farming locations in Deep Bay (F1, F2, O1 to O3) and the important spawning ground for commercial fisheries resources in North Lantau (F3) were 0.0016 mg/L (4-day average) and 0.0105 mg/L (1-hour average), which complied with the assessment criteria of 0.0075 mg/L and 0.013 mg/L respectively.

The model contour maps in **Appendix 5H-1** showed that the mixing zone for mean TRC level caused by the Project and other concurrent discharges would be localized.

Temperature and Salinity

The predicted temperature elevations and salinity changes at the fisheries sensitive receivers were also minor. The maximum increases in daily temperature range at representative oyster farming locations (F1, F2, O1 to O3) and the closest boundary of the important spawning ground for commercial fisheries resources (F3) were 1.1 °C, which complied with the WQO of no more than 2 °C. The maximum salinity changes predicted at the fisheries sensitive receivers are no more than 3%, which are also well below the WQO of no more than 10%.

The average plume sizes of temperature rise as presented in **Appendix 5H-2** were highly localized. The average salinity changes are well within the respective WQO in areas close to the Project discharges (**Appendix 5H-3**).

Oxygen Depletion

Any residual SMBS in the Project effluent is decayable and non-toxic. It is however a reducing agent and may cause a Dissolved Oxygen (DO) depletion in the water column. The potential DO depletion caused by the discharge of any residual SMBS was quantified in **Section 5.7.2.1.5**.

The background 10th percentile DO level at the area of oyster culture activities granted or to be granted in Deep Bay (O1 to O3) and important spawning ground of commercial fisheries resources (F3) ranged from 4.29 mg/L to 4.56 mg/L. The DO depletion caused by the SMBS at F3 and O1 to O3 was estimated to range from <0.001 mg/L to 0.0059 mg/L. The resulted DO levels at F3 and O1 to O3 would comply with the WQO of ≥4 mg/L.

The background 10th percentile surface DO level at the traditional oyster production area (F1) and mariculture subzone (F2) was 4.73 mg/L, which already exceeded the WQO of ≥5 mg/L.

The DO depletion caused by the SMBS discharge at F1 and F2 was estimated to be about 0.002 mg/L. The magnitude of DO depletion is considered insignificant as compared to the background DO level. It should be noted that any SMBS discharge would be subject to continuous decay in the marine water and this decay effect has not been considered in the estimation above. The DO depletions caused by the SMBS discharge are expected to be negligible at these distant receivers (F1 and F2) of over 1.5 km away.

Potential Impact on ARs

The ARs in SCLMCMP are located further away of over 8 km from the Project discharges. The predicted TRC, temperature elevations, salinity changes and DO depletion at the ARs are expected to be even lower than the level predicted at the closest boundary of the important spawning ground for commercial fisheries resources in North Lantau.

Summary

Full water quality compliances are predicted at all the identified fisheries sensitive receivers. The impact on fishing activity and fisheries resources due to the proposed effluent discharges would be minor. No unacceptable fisheries impact due to the water quality deterioration is predicted during the operational phase.

8.7.2.3.2 Hydrodynamics Impact

The proposed brine and heated cooling water discharges together with the changes of coastline configuration due to the seawall modification / proposed berthing facility of I·PARK2 may change the hydrodynamic regime in Outer Deep Bay. Significant changes of the hydrodynamic conditions may affect the dispersion of pollutants and the water quality in the assessment area. Hydrodynamics modelling was carried out to address the potential impact. The change of coastline configuration due to the seawall modification / new berthing facility together with all the Project discharges were incorporated / input into the model for cumulative assessment. Based on the cumulative hydrodynamics modelling results presented in **Section 5**, the predicted flow regime and hydrodynamics conditions are similar before and after the I·PARK2 implementation. No unacceptable adverse fisheries impact with respect to the hydrodynamics change would occur.

8.7.2.4 Maintenance Dredging

Under the current operation, most of the municipal solid waste (MSW) is delivered to the West New Territories (WENT) Landfill via marine route. This marine route passes through the seafront of the I·PARK2 site. During the operational phase of I·PARK2, MSW will be delivered to I·PARK2 using the same marine route. Maintenance dredging of the existing marine route to facilitate navigation of waste delivery vessels to and from the proposed berthing facility may be required on an as-needed basis subject to the seabed level, which would be similar to

the current operation associated with the WENT Landfill. As only very infrequent maintenance dredging is required to maintain the water depth along the existing marine route, the associated water quality impact would be minor. The same maintenance dredging operation was also proposed and assessed under the approved EIA for WENT Landfill Extensions (WENTX), which concluded that the associated water quality impact would be acceptable. Since the maintenance dredging work is an existing operation, any future maintenance dredging during the I·PARK2 operation would not create any additional water quality impact. The water quality impacts would be similar to those under the existing baseline scenario. No additional fisheries impact would arise from the maintenance dredging of I·PARK2.

8.7.2.5 Accidental Leakage During Delivery of Waste or Ash

The waste / ash will be placed in containers that are sealed to prevent spillage of the contents during transportation. The containers shall be in good condition and free from damage or any other defects. Similar to the existing baseline situation, spillage or leakage during the waste / ash delivery is not expected during the operational phase. Marine delivery of waste or ash would not cause any fisheries impact.

8.7.2.6 Overall Impact

The evaluation of operational phase fisheries impacts from the Project is summarized in **Table 8 5**. The overall fisheries impact during the operational phase is considered Minor.

Table 8-5 Potential Fisheries Impact during Operational Phase

Potential Impact	Nature of Impact	Size of Affected area	Loss of Fisheries Resource / Production	Destruction and Disturbance of Nursery and Spawning Grounds	Impact on Fishing Activity	Impact on Aquaculture Activity	Overall Impact Significance	Mitigation Measures Required
Loss of Fisheries habitat and fishing Ground	Long term impact during operational phase	The affected area is about 1.8 ha.	The affected area has a low level of fisheries production. The loss is considered negligible.	No important spawning nor nursery ground is identified in the affected area. No direct loss of important nursery and spawning grounds.	The affected area has a moderate level of fishing operation. In view of the small size of affected area, impact on fishing activity would be minimal.	No aquaculture activity is identified in the affected habitat. There would be no direct impact on aquaculture activity.	Minor	No fisheries specific mitigation measure is proposed.
Impingement and entrainment of fisheries resources	Long term impact during operational phase	The affected area would be localized in the vicinity of the proposed seawater intakes located at the artificial seawall of the Project	Adult fish is unlikely to be affected as they can actively swim away. The densities of ichthyoplankton and fish post-larvae at or near the artificial seawall (where the proposed seawater intake would be located) are expected to be limited.. Negligible loss of fisheries resources or production is therefore expected.	The level of ichthyoplankton and fish post-larvae resources is expected to be limited at and near the artificial seawall where the proposed seawater intake would be located. No nursery and spawning grounds would be affected.	The affected area would be localized. Impact on fishing activity would be minimal.	The affected area would be localized. Impact on aquaculture activity would be minimal.	Minor	No fisheries specific mitigation measure is proposed.
Changes of water quality and hydrodynamic regime	Long term impact during operational phase	The water quality changes would be localized in close vicinity of the Project site.	Loss of fisheries resources or production would be negligible.	Full water quality compliance is predicted at the recognized important spawning ground in North Lantau. No recognized nursery ground is located within the assessment area. There would be no unacceptable adverse impact on nursery and spawning grounds.	The water quality changes would be localized with negligible impact on fishing activity	Full water quality compliance is predicted at water areas related to oyster culture activities. There would be no unacceptable adverse impact on aquaculture activity.	Minor	No fisheries specific mitigation measure is proposed.
Maintenance dredging along the existing navigation channel	Transient impact on an as-needed basis following the existing practice	The affected area would be localized, same as the area affected by the existing maintenance dredging.	The affected area has a low level of fisheries production. The loss is considered negligible, same as that caused by the existing maintenance dredging.	No important spawning nor nursery ground is identified in the affected area. There would be no direct impact on nursery and spawning ground.	Due to the small size of affected area, impact on fishing activity would be minimal.	Maintenance dredging is an existing operation of the WENT Landfill project and a proposed operation under the WENTX project with no unacceptable adverse water quality impact. No change to these maintenance dredging works is proposed under this Project. Impact on aquaculture activity due to this Project would be negligible.	Negligible	No fisheries specific mitigation measure is proposed.

Potential Impact	Nature of Impact	Size of Affected area	Loss of Fisheries Resource / Production	Destruction and Disturbance of Nursery and Spawning Grounds	Impact on Fishing Activity	Impact on Aquaculture Activity	Overall Impact Significance	Mitigation Measures Required
Accidental leakage during delivery of waste or ash	No accidental leakage of waste and ash would occur with the design measures in place. No fisheries impact is identified	Not applicable	No loss of fisheries resource / production is identified.	No loss of important nursery and spawning grounds is identified.	No impact on fishing activity is identified.	No impact on aquaculture activity is identified.	No fisheries impact is identified.	No fisheries specific mitigation measure is required.

8.8 Mitigation Measures

In accordance with the guidelines in Annex 17 of the EIAO-TM, the general policy for alleviating fisheries impacts in order of priority are avoidance, minimization and compensation.

8.8.1.1 Avoidance

Non-dredged method will be adopted for the proposed marine construction works to prevent mud dredging and seabed disturbance. Potential impacts on fisheries resources due to the release of seabed sediments and any sediment-bound contaminants would be avoided.

As presented in **Section 5.7.2.3**, on-site wastewater treatment facilities and effluent reuse are proposed to prevent the discharge of process water and domestic sewage effluent from I·PARK2 into the marine environment. Treated or untreated process water may be contaminated with Municipal Solid Waste (MSW), leachate or ash and may contain various pollutants including SS, ammonia, organic contaminants and other toxic contaminants such as heavy metals. Domestic sewage may also contain organic, ammonia and *E. coli* loads. The proposed wastewater treatment and reuse scheme would avoid the exposure of fisheries resources to these contaminants and therefore the associated adverse fisheries impact would be prevented.

The proposed seawater intake and outfall systems of the Project are isolated systems and free from any process water, MSW, leachate, ash and domestic sewage. Discharges from these seawater intake and outfall systems are predicted to cause only localized and minor fisheries impact.

8.8.1.2 Minimization

Mitigation measures recommended in the water quality impact assessment for minimizing the potential water quality impact will also serve to protect fisheries resources and ensure no unacceptable adverse impact on fisheries. The recommended water quality mitigation measures are presented in **Section 5.8**. In view of the negligible / minor and localized fisheries impact arising from the construction and operation activities of the proposed Project, no fisheries-specific mitigation measure is proposed.

8.8.1.3 Compensation

The loss of fishing ground and fisheries habitat and indirect water quality changes from the Project construction and operation have been assessed to be negligible or minor. It is anticipated that no unacceptable adverse fisheries impact would be resulted. No fisheries compensation measure is proposed.

8.9 Evaluation of Cumulative Impacts

The potential concurrent projects within the assessment area are identified in **Section 2** and their potential fisheries impacts are summarized in **Table 8-6** below.

Table 8-6 Potential Concurrent Projects

Concurrent Project	Potential Fisheries Impact	Construction Programme		Reference
		Start	Complete	
West New Territories Landfill Extensions (WENTX)	Fisheries impact was not considered in the reference documents. No fisheries impact is expected from the WENTX project	2023	2037	Approved EIA for WENTX; Supporting Document for Variation of EP
Nim Wan Road (South)	Project information is not available. No fisheries impact is expected from the land-based road works	Under Review	Under Review	N/A
Upgrading of Nim Wan Road (North) and Deep Bay Road	Project information is not available. No fisheries impact is expected from the land-based road works	Not Available	Not Available	N/A
Lung Kwu Tan Reclamation and the Re-planning of Tuen Mun West Area	Permanent and temporary fisheries impacts during construction and operational phases are expected	2027	2030–31	PWSC Paper No. (2023-24)25; EIA Study Brief No. ESB-367/2024
Decommissioning of West Ash Lagoon in Tsang Tsui	Fisheries impact was not considered in the reference document. No fisheries impact is expected from this decommissioning project.	2026	2026	Project Profile (DIR-305/2024)

Lung Kwu Tan Reclamation and the Re-planning of Tuen Mun West Area is the only identified concurrent project that may cause cumulative fisheries impacts. The potential cumulative impacts may include loss of fisheries habitat / fishing ground, increase in marine traffic, underwater sound and changes of hydrodynamics and water quality during construction and operation phases.

The impact of temporary and permanent loss of fishing ground and fisheries habitat is ranked minor. The fisheries impacts due to increase of marine traffic and underwater sound during construction phase are ranked negligible. The key concern on cumulative fisheries impacts would be the changes of hydrodynamics and water quality. The cumulative hydrodynamics and water quality impact assessment for this Project has incorporated the major concurrent project "Lung Kwu Tan Reclamation and the Re-planning of Tuen Mun West Area" using the available reclamation layout in the EIA Study Brief No ESB-367/2024. Details of the

hydrodynamic and water quality modelling methodology and impact assessment are presented in **Section 5**. As presented in **Sections 8.7.1.2** and **8.7.2.3** above, the changes of hydrodynamics and water quality due to this Project are predicted to be localized and the associated fisheries impact would be minor. The concurrent project is located over 2 km away from I·PARK2. No unacceptable adverse cumulative hydrodynamics and water quality impact on fisheries would be caused by this Project.

8.10 Residual Fisheries Impacts

The loss of fishing ground due to the seawall modification / construction and operation of the new berthing facility, the impingement and entrainment of fisheries resources due to the operation of the proposed seawater intake systems as well as the indirect water quality changes due to the Project construction and operation have been assessed to be negligible or minor. No adverse residual fisheries impact is expected from the Project. With implementation of the recommended water quality mitigation measures during construction and operation phases, the disturbance to fisheries habitats and resources through the deterioration of water quality will be further minimized. No unacceptable adverse residual impact on fisheries is expected from the Project.

8.11 Environmental Monitoring and Audit (EM&A) Requirements

8.11.1 Construction Phase

No adverse residual fisheries impact is expected from the Project. No monitoring program specific for fisheries is required. However, water quality monitoring and audit would be required to ensure the effectiveness of the mitigation measures. A summary of the water quality monitoring programme is presented in **Section 5.11**. Details of the EM&A programme are presented in the standalone EM&A Manual.

8.11.2 Operational Phase

The fisheries impact arising from the Project operation is predicted to be localized and minor. A water quality monitoring and audit programme is proposed during the operational phase to verify the water quality predictions. Monitoring locations will include key water and fisheries sensitive receivers. Monitoring parameters will cover DO, temperature, salinity and TRC, etc. Details of the EM&A programmes are presented in the standalone EM&A Manual. Discharge licenses should be obtained under the WPCO for the brine discharge from the proposed desalination plant and the spent effluent discharge from the proposed seawater cooling system. Regular monitoring of effluent quality in terms of key water quality parameters such

as temperature may be specified in as a condition of the WPCO discharge license, and any necessary effluent monitoring programme should be implemented in accordance with the WPCO license requirements. No fisheries-specific monitoring programme is considered necessary for the operational phase.

8.12 Conclusions

8.12.1 Fisheries Sensitive Receivers

A literature review of fisheries baseline information in the assessment area has been undertaken. Results from the review indicate that level of fisheries production of the Project area is low, whereas the level of fisheries operation of the Project area is moderate. Sensitive receivers identified in the assessment area include area of oyster culture activities granted or to be granted in Deep Bay (which overlaps with the traditional oyster production area and the mariculture subzone), important spawning ground for commercial fisheries resources in North Lantau and artificial reefs in Sha Chau and Lung Kwu Chau Marine Park.

8.12.2 Construction Phase

Loss of fisheries habitat and fishing ground is predicted along the artificial shore of Middle Ash Lagoon and West Ash Lagoon due to the seawall modification / construction of the new berthing facility for I·PARK2. The affected area would be small of 4.4 ha including a permanent habitat loss of 1.8 ha and a temporary construction works area of 2.6 ha. The level of fisheries production of the affected habitat would also be low. The loss of fishing area caused by the Project construction is considered minor.

Marine construction works have been designed to reduce potential impacts on the water quality which will, in turn, reduce impacts on fisheries resources. Disturbance of fisheries habitat and resources due to deterioration of water quality in terms of SS elevations and DO depletion from the proposed marine construction works are predicted to be minor. The predicted SS elevations and DO depletion are short term and localised to immediate vicinity of the works area. Full SS and DO compliances are predicted at all identified fisheries sensitive receivers.

Increase in construction marine vessels due to the Project construction would be limited. Underwater sound generated from marine construction activities would be negligible as compared to the background level induced by the existing marine traffic at or near the Project site. The associated impact on fishing activity due to increase in marine vessels and marine construction activities would be negligible.

8.12.3 Operational Phase

There would be a permanent loss of seabed fisheries habitat and fishing ground along the artificial shore of Middle Ash Lagoon and West Ash Lagoon due to the proposed seawall modification and new berthing facility for I·PARK2. The affected area would be very small of about 1.8 ha. The fisheries production level of the affected habitat would also be low. The loss of fishing area caused by this Project operation is considered minor.

No important nursery nor spawning ground is located at and near the Project area. The ichthyoplankton and fish larvae resources at or near the artificial seawall of TTAL (where the proposed seawater intakes are located) would be limited. Fisheries impact due to impingement and entrainment of fish and crustacean larvae or eggs in the proposed seawater intake systems of the Project would be minor.

The water quality effects due to the discharges from the proposed desalination plant and seawater cooling system would be localised in close vicinity of the outfalls. Full water quality compliances are predicted at all identified fisheries sensitive receivers during the Project operation. The minor changes of coastline configurations due to the seawall modification / proposed berthing facility of I·PARK2 is predicted to cause minor impact on the hydrodynamic regime in the assessment and thus no adverse fisheries impact would arise.

Under the existing situation, most of the MSW is delivered to the WENT Landfill via marine route. During the operational phase, MSW will be delivered to I·PARK2 using the same marine route. No new navigation channel for marine vessel is proposed under this Project. Maintenance dredging along the marine route is an existing operation. Any future maintenance dredging during the I·PARK2 operation would be similar to that carried out under the existing baseline scenario. No additional fisheries impact would arise from the maintenance dredging work of I·PARK2.

The waste / ash will be placed in containers that are sealed to prevent spillage of the contents during transportation. The containers shall be in good condition and free from damage or any other defects. Marine delivery of waste or ash would not cause any fisheries impact

8.13 References

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