

Agreement No. CE 2/2018(CE)

# Study for Pier Improvement at Lai Chi Wo and Tung Ping Chau – Investigation

## Executive Summary



Civil Engineering and Development  
Department

**Agreement No. CE2/2018(CE)**  
**Study for Pier Improvement at Lai**  
**Chi Wo and Tung Ping Chau -**  
**Investigation**

Executive Summary

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# 1 Introduction

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## 1.1 Background

1.1.1 On 1 June 2018, Civil Engineering and Development Department (CEDD) of the Government of the Hong Kong Special Administrative Region (HKSAR) commissioned Ove Arup and Partners Hong Kong Limited (Arup) under Agreement No. CE2/2018 (CE) to provide consultancy services for “Study for Pier Improvement at Lai Chi Wo and Tung Ping Chau – Investigation” (the Study).

## 1.2 The Study

1.2.1 Hong Kong is an international metropolis and comprises many natural scenic spots, rare geological features and hiking trails with rich biological diversity. The famous Hong Kong United Nations Educational, Scientific and Cultural Organization (UNESCO) Global Geopark, country parks, marine parks, old temples, eco-tourism sites and beautiful beaches in coastal areas are some examples for connection. Many attractions are located at remote rural areas without land access and rely on marine transport. In recent years, number of tourists attracted to these remote destinations has been constantly increasing.

1.2.2 Public piers play an important role in accessing these remote destinations. There are more than 100 public piers in Hong Kong. The majority of these piers were built and are maintained and managed by the HKSAR Government.

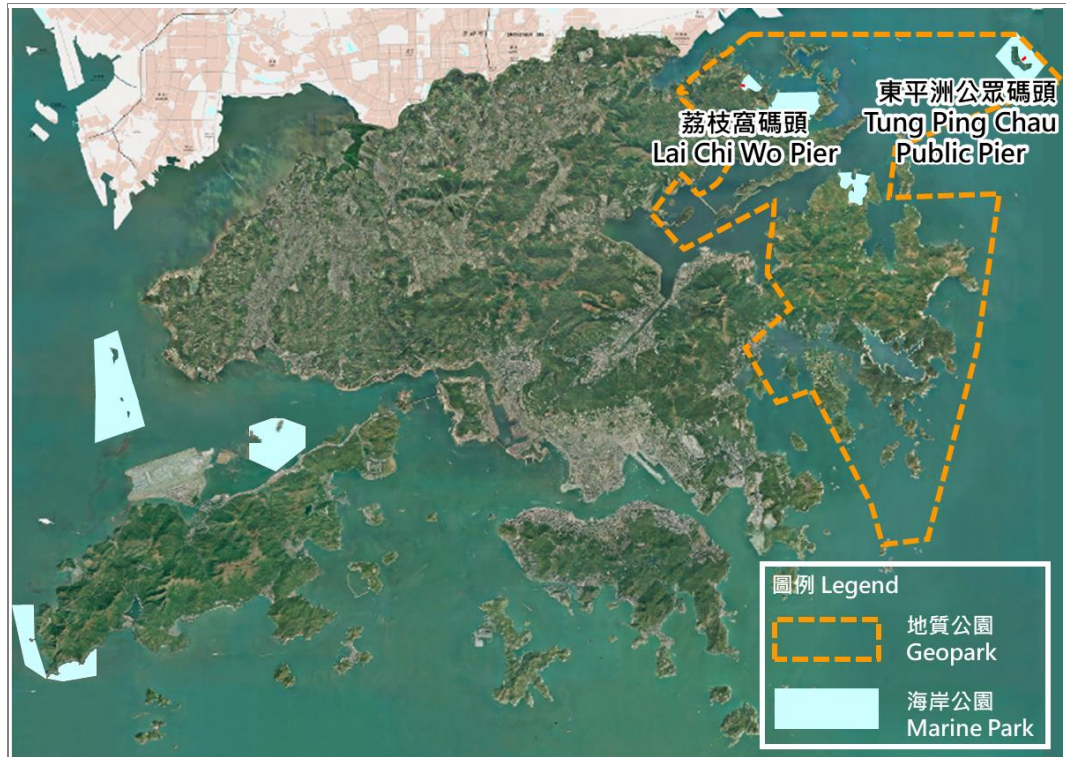
1.2.3 Although the Government departments carry out regular inspection and maintenance for the remote public piers to ensure their structural integrity, some public piers at remote rural areas are in places for many years and cannot cope with the current needs/usages, such as:

- (a) Small or primitive piers leading to safety concerns during berthing and unsatisfactory boarding condition especially for kids and elderly;
- (b) Inadequate water depth for berthing of vessels, in particular during low tide;
- (c) Limited berthing space or narrow accesses which cannot cater for fluctuating utilisation during festive times or weekends; and
- (d) Aged pier structures with a need for improvement works.

1.2.4 There is a need for pier improvement works for improving pier facilities and ensuring adequate structural integrity for safe pier usage by local villagers, mariculturists, visitors and tourists.

1.2.5 This Study focus on the pier improvement at two locations – Lai Chi Wo Pier and Tung Ping Chau Public Pier – they are located within the Yan Chau Tong Marine Park and Tung Ping Chau Marine Park respectively in the northeast region of Hong Kong (**Figure 1.1**).





**Figure 1.1 Location of Lai Chi Wo Pier and Tung Ping Chau Public Pier**

1.2.6 In accordance with Part I of Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO) Cap 499, any works within existing marine parks is a Designated Project (DP) and environmental impact assessment (EIA) has to be undertaken for the approval of the Director of Environmental Protection and the issuance of Environmental Permit (EP). In addition, the pier works within marine parks require approval of the Director of Agriculture, Fisheries and Conservation under the Marine Parks Ordinance (MPO) Cap 476.

## 1.3 Objectives of the Study

1.3.1 The overall objective of the Study is to conduct EIA and preliminary engineering studies, among other necessary investigations, before proceeding with the detailed design and construction of the Project.

1.3.2 The main objectives of the Study are to:

- (a) Produce preliminary engineering studies for individual piers taking into account public aspiration and other constraints and prepare preliminary engineering layouts;
- (b) Assess the environmental impacts for individual piers to ensure that the Projects will meet all statutory requirements of the EIAO including but not limited to obtaining approval of the EIA report produced in this Assignment;
- (c) Specify environmental monitoring and audit (EM&A) requirements to ensure the effective implementation of the recommended environmental protection and pollution control measures;

- (d) Evaluate the feasibility of adopting innovative design elements for the piers, including but not limited to floating platform, barrier-free facilities, prefabrication design, etc.
- (e) Collect and review opinions from stakeholders and the public on the project; and
- (f) Assist to gain support from stakeholders and the public through stakeholder consultation.

## 1.4 Scope and Structure of the Report

1.4.1 The Report is structured as follows:-

- (a) **Section 1** introduces the Study;
- (b) **Section 2** presents the findings of preliminary engineering studies and environmental impact assessments, and the preliminary layout of Lai Chi Wo Pier;
- (c) **Section 3** presents the findings of preliminary engineering studies and environmental impact assessments, and the preliminary layout of Tung Ping Chau Public Pier; and
- (d) **Section 4** summarises the Study and presents the way forwards.

## 1.5 Nomenclature and Abbreviation

1.5.1 **Table 1.1** lists out the abbreviated titles of government bureaux, departments, offices, statutory bodies and public organisations mentioned in this Report.

**Table 1.1 Abbreviations of Bureaux, Government Departments and Organisations**

Abbreviation	Full Title
CEDD	Civil Engineering and Development Department
HKSAR	Hong Kong Special Administrative Region
UNESCO	United Nations Educational, Scientific and Cultural Organization

1.5.2 **Table 1.2** lists out the meaning of abbreviation for expressions adopted in this Report.

**Table 1.2 Abbreviations for Expressions adopted in this Report**

<b>Abbreviation</b>	<b>Full Meaning</b>
DP	Designated Project
EIA	Environmental Impact Assessment
EIAO	Environmental Impact Assessment Ordinance, Cap 499
EM&A	Environmental Monitoring & Assessment
EP	Environmental Permit issued under EIAO
LCA	Landscape Character Area
LCW	Lai Chi Wo
LR	Landscape Resource
MPO	Marine Parks Ordinance
PCCP	Plover Clove Country Park
PD	Principal Datum
SSSI	Site of Special Scientific Interest
TPC	Tung Ping Chau
WSR	Water Sensitive Receiver

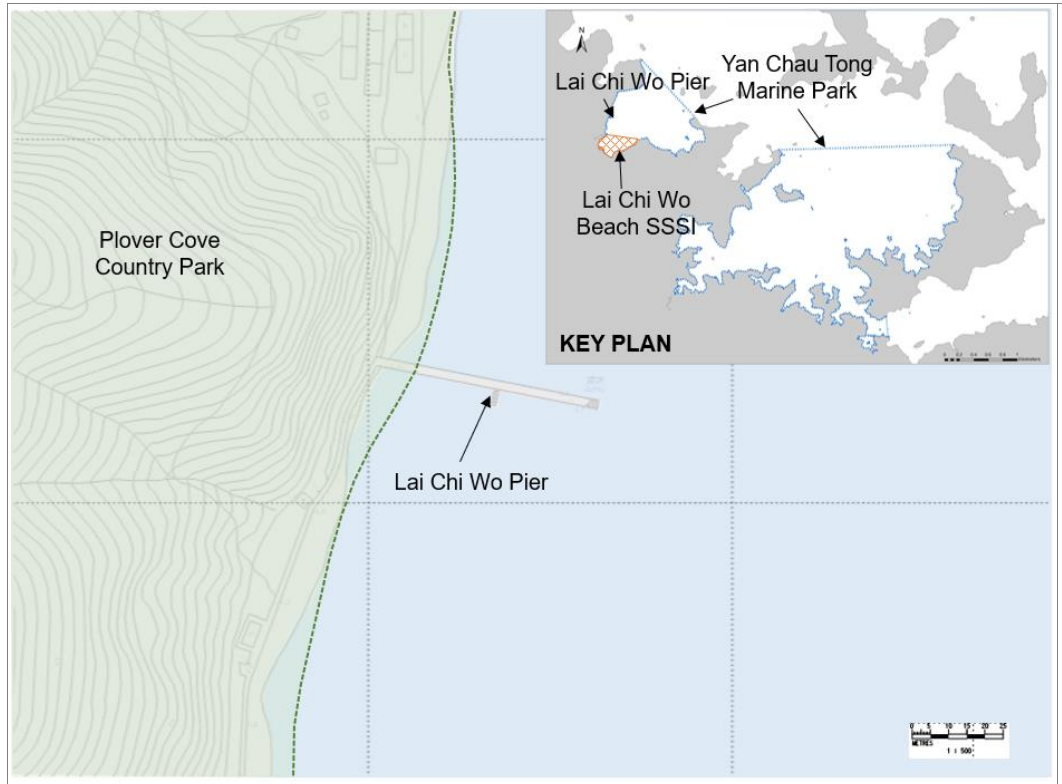


## 2 Lai Chi Wo Pier

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### 2.1 Existing Conditions

- 2.1.1 Lai Chi Wo (LCW) Pier is located within Yan Chau Tong Marine Park at the north-eastern coast of Plover Cove Country Park and close to the Lai Chi Wo Beach Site of Special Scientific Interest (SSSI) as shown in **Figure 2.1**. Yan Chau Tong is well-known for its rich fisheries resources. Lai Chi Wo was once a prosperous walled village where Hakka people settled about 400 years ago, and 500-600 residents were recorded in the most prosperous period. LCW Pier is also located partly within the Plover Cove Country Park and adjacent to Hong Kong UNESCO Global Geopark.
- 2.1.2 Lai Chi Wo Pier is a straight solid concrete finger pier of about 64m long and 2.5m wide, and orientates at a bearing angle of 103°. The pier top level is about 3m above the Principal Datum (mPD). There is a 4.2m long flight of steps at the sea end of the pier. There is also another 4.2m long and 1.2m wide flight of steps at 25-30m from the pier end and normal to the pier. A general view of the pier is shown in **Figure 2.2**.
- 2.1.3 The pier is the main access for the public and villagers to Lai Chi Wo village as the nearest land access is about 2-hour walk from Wu Kau Teng, or 2.5-hour walk from Luk Keng via Fung Hang. There is currently one licensed kaito service between Ma Liu Shui Ferry Pier and LCW Pier operating on Saturdays, Sundays and public holidays.
- 2.1.4 LCW Pier was constructed in the 1960s and is primitive and aging. It has a relatively narrow access and has only one primitive berth. LCW Pier has been suffering from aging problem and there are concerns on its structural integrity.



**Figure 2.1 Location Plan of Lai Chi Wo Pier**



**Figure 2.2 General View of Existing Lai Chi Wo Pier**



**Figure 2.3 Key Issues of Existing LCW Pier**

2.1.5 Due to its primitive nature, there is not sufficient water depth for safe berthing and manoeuvring of vessels at or near the pier head, in particular during low tide. Nevertheless, the pier could also be nearly flooded during high tides. The pier itself is narrow, and it might not be safe to wait or walk when the pier was over-crowded with pier users and cannot cope with the current growing needs. Improvement works are considered necessary to improve this existing facility standards of the pier. These concerns as shown in **Figure 2.3** are (1) deteriorating structural conditions; (2) insufficient water depth for berthing and manoeuvring; (3) low pier level; (4) undesirable berthing arrangement; and (5) non-fully restrained narrow pier.

## 2.2 Preliminary Pier Design

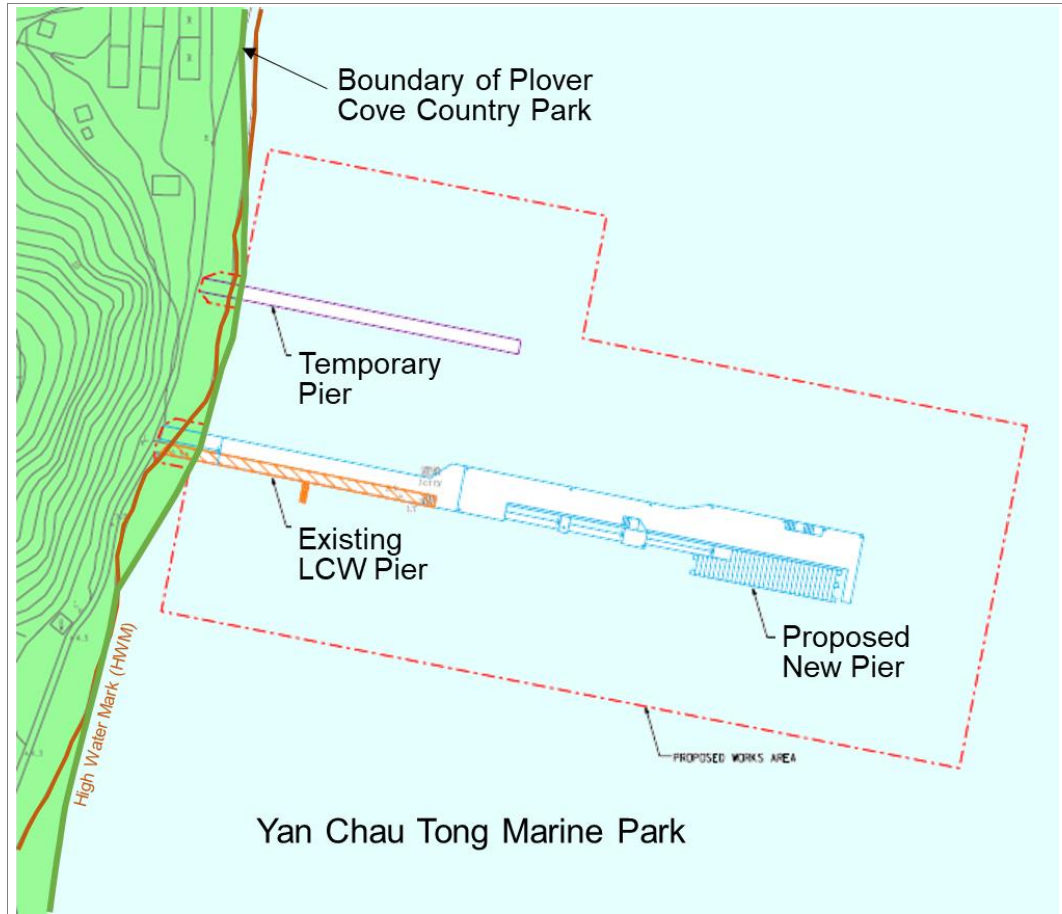
2.2.1 Design of new public pier and catwalk includes the following key considerations:

- (i) **Meeting public aspiration** to provide/enhance structurally adequate, robust and durable marine structures for the use as public pier and catwalk;
- (ii) **Environmentally friendly approach** to minimise the impact to the environment during the construction, operation and maintenance;
- (iii) **Smart city development** to improve people's quality of living as well as Hong Kong's sustainability, efficiency and safety; and

- (iv) **Prefabrication design** to optimise the use of prefabrication structural elements, facilitating on-site construction in a more efficient and cost-effective manner.

- 2.2.2 The proposed pier improvement works will include construction of new pier and catwalk, and integration with the existing LCW pier. The new pier and catwalk will be in the structural form of an open deck structure. Having considered (i) the presence of soft sediment below the seabed, and (ii) no dredging method, pile foundation is recommended to be adopted in terms of structural integrity, settlement performance and environmental conditions. Shallow foundation will be adopted in the nearshore area that ties in with the existing footpath and requires only minor to moderate filling above the existing ground.
- 2.2.3 The pier improvement works will provide two berths at locations with sufficient water depth to ensure safety for vessel berthing and manoeuvring. The new pier will be extended from the existing pier head towards south-east direction until the berths have sufficient water depths. The proposed LCW Pier will consist of barrier-free facilities such as floating pontoon and a gangway to facilitate the use by people-in-need, and PV panels if applicable. The floating pontoon will be located at the southern berth whilst the northern berth will use the conventional landing steps. The floating pontoon will be fixed in position by guide piles, which will constrain the movement of floating pontoon in any direction on plan and only vertical movement due to different water level would be allowed.
- 2.2.4 To provide a better wave conditions for vessel berthing at the floating pontoon, downstand wall will be considered as a part of pier improvement works to reduce the wave effect at the leeward side of the pier such that the floating pontoon will be positioned in stable and calm condition during normal weather and in an acceptable condition during extreme weather.
- 2.2.5 During construction of the proposed LCW Pier, concurrent undertaking of improvement works at the existing pier and berthing of public vessels is not spatially feasible, and it would not be safe. A temporary pier will be provided to maintain operation of the licensed kaito ferry service and to serve other public vessels.
- 2.2.6 The preliminary layouts of the proposed LCW Pier and temporary Pier are shown in **Figure 2.4**. An illustration of the proposed LCW Pier is shown in **Figure 2.5**.





**Figure 2.4 Preliminary Layout of Lai Chi Wo Pier**



**Figure 2.5 Isometric views of Lai Chi Wo Pier**

2.2.7 **Table 2.1** summarises the innovative ideas recommended to be considered and further developed in detailed design:

**Table 2.1 Summary of Innovative Ideas for Lai Chi Wo Pier**

Innovative Pier Element
1. Floating platform including anchor system and mooring/ berthing facilities



Innovative Pier Element	
2. Gangway	3. Solar power system
4. Gov-Wi-Fi	5. Flexible conduits
6. Benches / seats	7. Canopy
8. LED lighting	9. Smart information display system
10. Multi-functional lamp post	11. Surveillance system
12. Corrosion monitoring device	13. Eco-tiles or Eco-concrete

2.2.8 It is preliminarily considered that the new deck structure for Lai Chi Wo Pier and catwalk will be technically feasible to adopt prefabrication construction method. The prefabricated units will include precast pile caps, precast beams, precast fender blocks and precast slab panels.

2.2.9 The extent of pier improvement works and the provision of pier facilities will be further reviewed in detailed design stage. Pier improvement works will be designed with the view to avoid the need for dredging and disposal of soft marine sediment within Hong Kong waters.

## 2.3 Preliminary Engineering Assessment

2.3.1 The findings on preliminary engineering assessment for Lai Chi Wo Pier are summarised in this section.

### Geological / Geotechnical Conditions

2.3.2 The seabed is immediately underlain by a layer of marine deposits of about 4.9m to 8m thick. The marine deposits mainly comprise soft to very soft slightly sandy silty clay, and occasionally silty fine to coarse sand and sandy clayey silt. At least 2m thick of alluvium of slightly sandy clayey silt, silty clay and cobble were occasionally encountered beneath the marine deposits. Ground settlement is anticipated due to the presence of a layer of soft marine deposits, which could pose a risk on the shallow foundation option because of potentially extensive settlement and poor bearing capacity. Decomposed coarse ash crystal tuff were recorded immediately below the superficial deposits, and the engineering rockhead lies at about -21.49mPD to - 27.96mPD.

### Geo-environmental Conditions

2.3.3 All sediment samples would require Type I disposal (Open Sea Disposal (Dedicated Sites)) and Type 2 disposal (Confined Marine Disposal) for Category H and M samples respectively, in accordance with ETWB TC(W) Mo. 34/2002 – Management of Dredged/Excavated Sediment.

### Ground Settlement

2.3.4 Ground settlement is anticipated due to the presence of a layer of soft marine deposits, which could pose a risk on the shallow foundation option because of potentially extensive settlement and poor bearing capacity. Piled foundation is considered more appropriate where soft deposits are found whereas shallow foundation can be used if the seabed materials are granular and non-cohesive.

### Natural Terrain Hazard

- 2.3.5 No natural terrain hazard study is required as the covered portion of the new pier and temporary pier are located beyond the influence zone where landslide debris may reach.

### Man-made Features

- 2.3.6 No registered man-made features are present within the footprint or in the close proximity of the pier.

### Hydraulic and Metocean Conditions

- 2.3.7 Extreme wave heights at LCW Pier are summarised in **Table 2.2**.

**Table 2.2 Extreme Wave Heights (All Directions) at LCW Pier**

Loading Conditions	Wave Conditions	Water Level	Significant Wave Height, Hs (m)
Normal	Tropical Cyclone Signal No. 3	2-year return period sea level	0.5 - 0.6
Extreme	100-year return period wave conditions	10-year return period sea level	1.5 - 1.6
Extreme	10-year return period wave conditions	100-year return period sea level	1.1 - 1.2
Extreme	50-year return period wave conditions	50-year return period sea level	1.2 - 1.6
Extreme	100-year return period wave conditions	Mean lower low water level	0.6

- 2.3.8 To improve the wave conditions of the pier, downstand wall could be considered to enhance the berthing condition for the floating platform and could reduce wave height.
- 2.3.9 The proposed pier improvement works will not result in significant impact to current speed and pattern, and water circulation/flushing near the pier and the change to sedimentation rate would not be significant.

## 2.4 Environmental Impact Assessment

### General

- 2.4.1 The Project comprises demolition, construction and operation works within Yan Chau Tong Marine Park and Plover Clove Country Park (PCCP). Works within PCCP requires approval from Lands Department and prior written consent of the Country and Marine Parks Authority. The Project is a Designated Project (DP) by virtue of Item Q.1, Part I of Schedule 2 of the EIAO.

- 2.4.2 In accordance with the requirements of Section 5(1) of the EIAO, a Project Profile (No. PP-561/2017) for the Project was submitted to the Director of Environmental Protection (DEP) for application for an EIA Study Brief on 27 December 2017. Pursuant to Section 5(7)(a) of the EIAO, the DEP issued a Study Brief (No.: ESB-305/2017 dated 9 February 2018) for the EIA study. The EIA Report, EIA Executive Summary and EM&A Manual (EIA-264/2020) were made available for public inspection between 8 October 2020 and 6 November 2020 inclusive.
- 2.4.3 The EIA approval was granted on 29 December 2020 with conditions on submission of a Pier Design Plan to specify the use of locally manufactured/recycled eco-materials, such as eco-tiles and eco-concrete in the design and construction of the pier with a view to enhancing ecological functions of the pier and minimizing the carbon footprint of the Project.
- 2.4.4 The findings of the EIA for LCW Pier are summarised below.

### **Water Quality**

- 2.4.5 During the construction phase, given the small scale of the pier and the adoption of piled foundation with sufficient column-to-column spacing, hydrodynamic impact from the new structures of the improved pier and the temporary pier is not anticipated.
- 2.4.6 Potential water quality impact would arise from the construction activities, in particular the marine-based site investigation and foundation works. Nevertheless, no dredging operation is involved, and there will neither be direct discharge on-site, within the Yan Chau Tong Marine Park nor other water sensitive receivers (WSRs). Therefore, with the implementation of recommended mitigation measures such as the use of silt curtain to confine the suspended solids, adverse water quality impact is not anticipated. In addition, with good site control practices, emergency spillage plan and provision of portable toilets, adverse impacts from surface runoff from construction site operation, accidental spillage of chemicals and sewage from workforce are not anticipated.
- 2.4.7 During the operational phase, as there is no planned increase in the existing Kaito services nor alteration of their routing, no adverse water quality impact is anticipated from the Project. Given the small scale of the pier and the adoption of concrete pile foundation with sufficient column-to-column spacing, hydrodynamic impact from the new pier is not anticipated.

### **Ecology**

- 2.4.8 Ecological surveys covering a 12-month duration were conducted and survey results were documented in the EIA report. Though the seabed surrounding the existing pier was muddy and with the presence of corals, only low coverage of very tiny common hard coral was recorded at the existing pier head. No faunal species of conservation importance was identified in intertidal surveys.
- 2.4.9 The proposed LCW Pier will be constructed on top of the existing LCW Pier and the pier desk structure will be supported by piles. The footprint of proposed LCW Pier to be constructed would occupy a total area of 0.156 ha but the actual seabed loss will be much smaller (about 0.0058 ha) as only the piled foundation will directly encroach the marine habitats. As the area of actual seabed loss for construction of the future piles and the concrete landing is small, and the coverage

of common hard corals (i.e. <1%) on the existing pier head is low, the potential direct impacts are considered minor. It is also anticipated that the future piles could provide new and additional hard substrates for coral colonization.

- 2.4.10 The proposed LCW Pier is within Yan Chau Tong Marine Park and close to Lai Chi Wo Beach Site of Special Scientific Interest (SSSI). Seagrass bed and mangrove are the two important habitats within the marine park and SSSI. However, no seagrass bed and mangrove will directly be affected or indirectly impacted by water quality given the scale of the works and construction method.
- 2.4.11 The coral communities in Hong Kong Reef Check site “Lai Chi Wo” is located over 500m from the LCW Pier. Impacts to the coral communities are not likely both directly and indirectly during the construction phase.
- 2.4.12 For terrestrial ecology, two short walkways connecting the proposed LCW Pier and the temporary pier to the existing footpath inside Plover Cove Country Park will partly fall within the country park, however, the scale of works will be very small and will not cause any tree loss, significant impact to the country park is not anticipated. In addition, as the Project mainly consists of marine-based works, potential impacts to terrestrial recognized sites of conservation importance including Lai Chi Wo Special Area, Conservation Area, Fung Shui Woodland and the Ecologically Important Stream are not expected. The potential direct impact to terrestrial ecology during the construction phase is ranked as insignificant.
- 2.4.13 Except the mitigation measures for water quality, no specific ecological mitigation measures for marine ecology are required during the construction phase. As a precautionary measure, a pre-construction dive survey should be conducted to verify the conditions of the small coral colonies on the existing LCW Pier before any construction works, and site inspection should be conducted to make sure no trees within the Plover Cove Country Park will be affected.
- 2.4.14 During operational phase, as there will be only a limited number of piles and a small above-seabed downstand wall in the marine habitats, change in hydrodynamic regime or water quality is not anticipated. It is not anticipated the frequency of vessels or visitor numbers would increase due to the Project and no significant impact is expected for the water sensitive receivers in the vicinity. Disturbance to terrestrial habitats or fauna due to the lighting at the pier head is also not likely. Hence, no significant operational phase impacts to marine ecology, recognized sites or species of conservation importance are anticipated from the Project. Residual impacts are also acceptable.

### **Fisheries**

- 2.4.15 As only piles foundation will be constructed at the pier, and prefabricated structures will be built on-top, together with the approaches for avoidance and minimisation of impacts, potential fisheries impacts on fisheries resources due to construction of the pier are considered minor. Silt curtain will be installed to further minimize the increased suspended solids during construction phase. Potential negative impacts from the deployment of silt curtain such as further reduction of fisheries resources are very limited. Since no unacceptable adverse impacts on fisheries resources and fishing operations are anticipated, fisheries-specific mitigation measures are not required during the construction phase.

- 2.4.16 The footprint of the LCW Pier would occupy a total area of about 0.156ha and cause a permanent loss of fishing ground. The loss is considered to be of insignificant proportion compared with the 1,651 km<sup>2</sup> (approximately 165,100 ha) of Hong Kong's total marine waters which is mostly available for fishing. Hence, the permanent loss of fishing ground is considered insignificant. Since no unacceptable adverse impacts on fisheries resources and fishing operations are anticipated, fisheries-specific mitigation measures are not required during the operational phase.

### Other Environmental Aspects

- 2.4.17 Other environmental aspects, including air quality, noise, waste management, land contamination, landscape and visual, cultural heritage and antiquities, have been duly assessed in the EIA according to the Study Brief (ESB-305/2017) for both construction and operational phases. Given the small scale of pier improvement works of LCW Pier, adverse environmental impacts are not anticipated. Nevertheless, good site practices and control measures with reference to relevant technical memoranda, standards and guidelines have been recommended in the EIA (AEIAR-225/2020) to ensure the compliance with the relevant legislation, standards and guidelines. The key findings and control measures are summarised in **Table 2.3**.

**Table 2.3 Key Findings and Control Measures of Other Environmental Aspects for Pier Improvement at LCW**

Aspect	Construction Phase		Operational Phase	
	Key Findings	Control Measures	Key Findings	Control Measures
Air Quality	<ul style="list-style-type: none"> <li>No adverse impact</li> </ul>	<ul style="list-style-type: none"> <li>Prefabrication construction method</li> <li>Good site practices for dust control</li> </ul>	<ul style="list-style-type: none"> <li>The project does not intend to increase licensed Kaito frequency</li> <li>Vessels berthed at the pier will be located farther away from the air sensitive receivers</li> </ul>	N/A



Aspect	Construction Phase		Operational Phase	
	Key Findings	Control Measures	Key Findings	Control Measures
Noise	<ul style="list-style-type: none"> <li>No adverse impact</li> </ul>	<ul style="list-style-type: none"> <li>Prefabrication construction method</li> <li>Good site practices for construction noise control</li> </ul>	<ul style="list-style-type: none"> <li>The project does not intend to increase licensed Kaito frequency</li> <li>Vessels berthed at the pier will be located farther away from the noise sensitive receiver</li> </ul>	N/A
Waste Management	<ul style="list-style-type: none"> <li>Generation of small quantities of construction and demolition waste, chemical waste and general refuse</li> </ul>	<ul style="list-style-type: none"> <li>Prefabrication construction method</li> <li>Good site practices for waste handling</li> </ul>	<ul style="list-style-type: none"> <li>The project does not intend to increase licensed Kaito frequency and number of visitors</li> <li>No increase in the amount of general refuse</li> </ul>	N/A
Land Contamination	<ul style="list-style-type: none"> <li>No land contamination identified in site survey</li> </ul>	N/A	N/A	N/A
Landscape and Visual	<ul style="list-style-type: none"> <li>Acceptable landscape and visual impact with mitigation measures</li> <li>No tree felling and direct impact on trees</li> </ul>	<ul style="list-style-type: none"> <li>Minimise construction area</li> <li>Site hoarding</li> <li>Lighting control</li> </ul>	<ul style="list-style-type: none"> <li>Acceptable landscape and visual impact with mitigation measures</li> </ul>	<ul style="list-style-type: none"> <li>Sensitive design and deposition of pier structures</li> </ul>

Aspect	Construction Phase		Operational Phase	
	Key Findings	Control Measures	Key Findings	Control Measures
Cultural Heritage	<ul style="list-style-type: none"> <li>No adverse impact</li> </ul>	<ul style="list-style-type: none"> <li>As a precautionary measure, Antiquities and Monuments Office (AMO) should be informed in case of discovery of antiquities or supposed antiquities in the course of marine works</li> </ul>	<ul style="list-style-type: none"> <li>No adverse impact</li> </ul>	N/A

### Environmental Monitoring and Audit

- 2.4.18 An Environmental Monitoring and Audit (EM&A) programme has been formulated. The EM&A programme will provide management actions to check the effectiveness of the recommended mitigation measures/good site practices and compliance with relevant statutory criteria, thereby ensuring the environmental acceptability of the construction and operation of the Project.
- 2.4.19 Notwithstanding the above, corresponding Environmental Permit (No. EP-586/2021) was granted on 19 February 2021, all general and specific conditions as stipulated in the EP shall be strictly followed. The EP is uploaded onto the website for Environmental Impact Assessment Ordinance of EPD.

## 2.5 Stakeholder Consultation

- 2.5.1 A comprehensive stakeholder consultation strategy has been formulated for the Study to solicit support and opinions from the key stakeholders. Stakeholder consultation was conducted in two stages, namely (i) Initial Stakeholder Consultation and (ii) Stakeholder Consultation, to enable better and early consultation of the stakeholders and to facilitate consensus building throughout the Study process.
- 2.5.2 The stakeholders generally supported the conceptual pier design and the proposed new pier facilities including floating pontoon platform, cover for waiting area and powering of pier facilities by renewable energy.
- 2.5.3 The key stakeholders' views / opinions are summarised as follows:
- Retention / Removal of the existing solid pier structure;
  - Provision of a landing for berthing small vessels;

- (c) Provision of waiting area;
- (d) Safety of using pontoons to get on and off vessels;
- (e) Berthing of small vessels at the proposed floating pontoon;
- (f) Number of berths at the pier;
- (g) Provision of ramps of suitable gradient that facilitates the use by people-in-need;
- (h) Location of the new pier; and
- (i) Use of renewable energy for the pier;

## **2.6 Implementation**

- 2.6.1 The proposed improvement works will not involve any resumption of private land.
- 2.6.2 As the pier improvement works involve the provision of a new floating platform and the piled deck structure which will be over and upon the foreshore and sea-bed, the proposed pier improvement works at Lai Chi Wo will require gazettal under the Foreshore and Sea-bed (Reclamations) Ordinance.
- 2.6.3 It is estimated that the construction stage will take about 32 months to complete pier improvement works.

## **2.7 Summary**

- 2.7.1 Based on the preliminary engineering assessment and environmental impact assessment, the proposed pier improvement works at Lai Chi Wo Pier are technically feasible and environmentally acceptable.
- 2.7.2 Environmental Monitoring and Audit will be carried out during construction to ensure all recommended mitigation measures are properly and effectively implemented and to ensure compliance with the intended aims of the measures.

## 3 Tung Ping Chau Public Pier

### 3.1 Existing Condition

- 3.1.1 Tung Ping Chau (TPC) Public Pier is located at the Tung Ping Chau Marine Park as shown in **Figure 3.1**. Tung Ping Chau Marine Park is well known for the protection of coral communities, algal bed and unique geological features. The land area of Tung Ping Chau is partly within the boundary of Plover Cove (Extension) Country Park, Ping Chau Site of Special Scientific Interest (SSSI), and Hong Kong UNESCO Global Geopark.
- 3.1.2 The existing Tung Ping Chau Pier is about 98m long, comprising a about 14m long solid pier head, a about 35m long catwalk and a about 49m long causeway. The solid pier head is around 5.5m wide and consists of a 1.1m wide flights of step on either side of pier head. The pier head level is about +4.9mPD. The solid pier is founded on a dredged pocket backfilled with rubble. A general view of the pier is shown in **Figure 3.2**.
- 3.1.3 The whole island is surrounded by sea, and the Tung Ping Chau Public Pier is the only access for the public and villages to Tung Ping Chau. There is currently one licensed kaito service between Ma Liu Shui and Tung Ping Chau operating on Saturdays, Sundays and public holidays.



**Figure 3.1 Location Plan of Tung Ping Chau Public Pier**

- 3.1.4 TPC Public Pier was constructed in the 1960s. In 2008, upgrading works were completed for the whole pier to widen both the causeway and catwalk. The causeway top was modified by constructing a wider longitudinal reinforced concrete slab dowelled to the rubble. The catwalk was completely reconstructed with the pedestals supporting the original catwalk abandoned and cut to below seabed level. The catwalk is supported by steel beams and the steel beams span

between the solid pier and the causeway, with an intermediate support by a cross-head connected to two reinforced concrete piles. The solid pier is covered by a 9.3m long and 4.43m wide pitched roof structure.



**Figure 3.2** General View of Existing Tung Ping Chau Public Pier



Narrow and steep flights of landing steps

Undesirable berthing arrangement

**Figure 3.3** Key Issues of Existing TPC Public Pier

3.1.5 Due to the constrained conditions of the existing TPC Public Pier, there are safety concerns of vessels and patrons/public using the pier. Improvement works are considered necessary to improve this existing facility standards of the pier. These concerns as shown in **Figure 3.3** are (1) narrow and steep flights of landing steps; and (2) Undesirable berthing arrangement.

## 3.2 Preliminary Pier Design

3.2.1 Design of new public pier and catwalk includes the following key considerations:

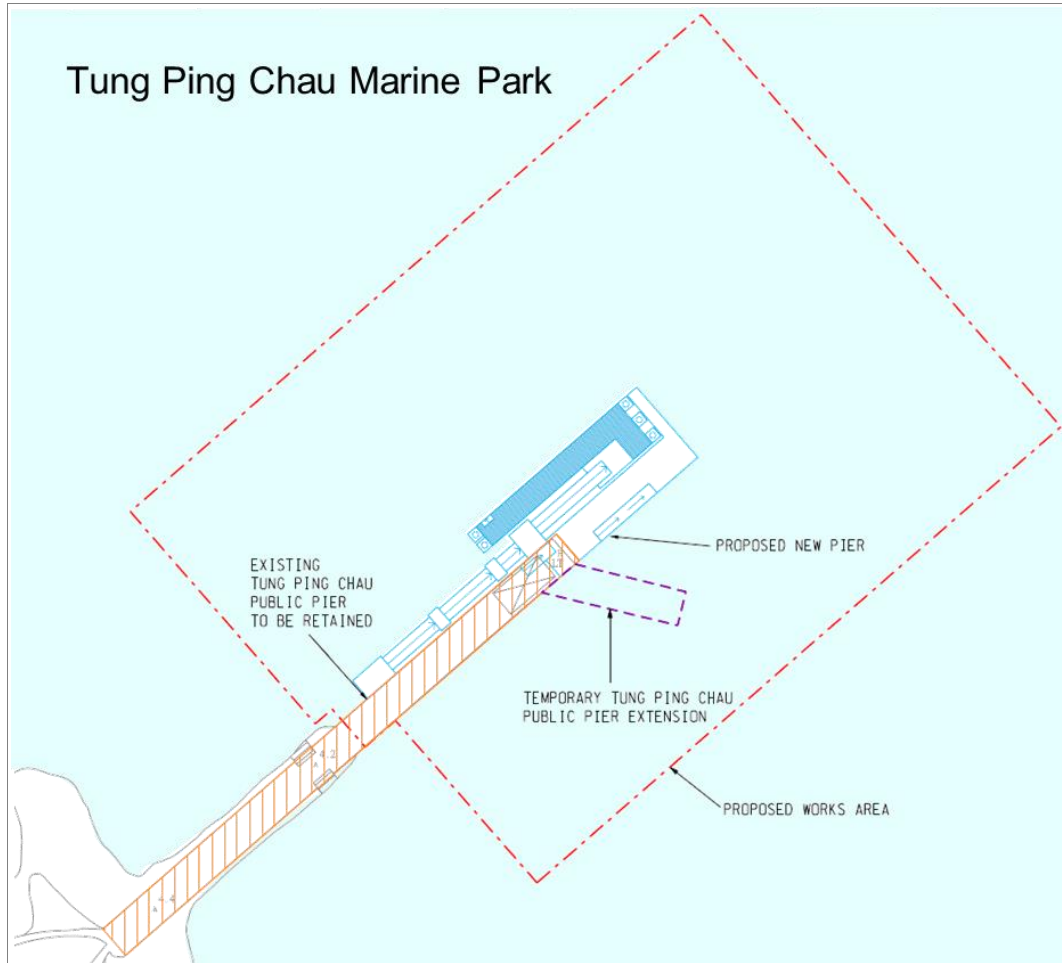
- (i) **Meeting public aspiration** to provide/enhance structurally adequate, robust and durable marine structures for the use as public pier and catwalk;
- (ii) **Environmentally friendly approach** to minimise the impact to the environment during the construction, operation and maintenance;
- (iii) **Smart city development** to improve people's quality of living as well as Hong Kong's sustainability, efficiency and safety; and



- (iv) **Prefabrication design** to optimise the use of prefabrication structural elements, facilitating on-site construction in a more efficient and cost-effective manner.
- 3.2.2 The proposed pier improvement works will include construction of new pier, and alteration and modification of the existing pier and catwalk. The new pier and catwalk will be in the structural form of an open piled deck structure in order to minimise any impact on environment and hydrodynamics.
- 3.2.3 The pier improvement works will provide two berths at locations with sufficient water depth to ensure safety for vessel berthing and manoeuvring. The piled deck structure will extend the existing pier head by 26m towards the sea. Its width ranges from 5.5m to 6m, and increases to a gross width of 15m (including the floating pontoon) at the pier head. The proposed TPC Public Pier will consist of barrier-free facilities such as floating pontoon and a gangway to facilitate the use by people-in-need, and PV panels if applicable. The floating pontoon will be located at the northwest berth whilst the south-eastern berth will use the conventional landing step. The floating pontoon will be fixed in position by guide piles, which will constrain the movement of floating pontoon in any direction on plan and only vertical movement due to different water level would be allowed.
- 3.2.4 To provide a better wave conditions for vessel berthing at the floating pontoon, downstand wall will be considered as a part of pier improvement works to reduce the wave effect at the leeward side of the pier such that the floating pontoon will be positioned in stable and calm condition during normal and extreme weathers.
- 3.2.5 During construction of the proposed TPC Public Pier, concurrent undertaking of improvement works at the existing pier and berthing of vessels is not spatially feasible, and it would not be safe. A temporary pier will be provided to maintain operation of the licensed kaito ferry service and to serve other public vessels.
- 3.2.6 The preliminary layouts of the proposed TPC Public Pier and temporary Pier are shown in **Figure 3.4**. An illustration of the proposed TPC Public Pier is shown in **Figure 3.5**.
- 3.2.7 **Table 3.1** summarises the innovative ideas recommended to be considered and further developed in detailed design:

**Table 3.1 Summary of Innovative Ideas for Tung Ping Chau Public Pier**

Innovative Pier Element	
1. Floating platform including anchor system and mooring/ berthing facilities	
2. Gangway	3. Solar power system
4. Flexible conduits	5. Benches / seats
6. Canopy	7. LED lighting
8. Surveillance system	9. Corrosion monitoring device
10. Eco-tiles or Eco-concrete	



**Figure 3.4 Preliminary Layout of Tung Ping Chau Public Pier**



**Figure 3.5 Isometric views of Tung Ping Chau Public Pier**

3.2.8

It is preliminarily considered that the new deck structure for Tung Ping Chau Public Pier and catwalk will be technically feasible to adopt prefabrication construction

method. The prefabricated units will include precast pile caps, precast beams, precast fender blocks and precast slab panels.

- 3.2.9 The extent of pier improvement works and the provision of pier facilities will be further reviewed in detailed design stage. Pier improvement works will be designed with the view to avoiding the need for dredging and disposal of soft marine sediment within Hong Kong waters.

### 3.3 Preliminary Engineering Assessment

- 3.3.1 The findings on preliminary engineering assessment for Tung Ping Chau Public Pier are summarised in this section.

#### **Geological / Geotechnical Conditions**

- 3.3.2 The seabed is predominantly underlain by a layer of marine sand, following by a thin layer of gravel and cobble. No clay layer was encountered in the existing boreholes and it is anticipated that the rockhead profile will not be varied dramatically in the vicinity of the existing pier. The project-specific geophysical survey reveals the presence of silty clay in the area northeast around 90m from the existing pier head, which is outside the footprint of the proposed TPC Public Pier.
- 3.3.3 Piled foundation option considered to be a feasible option. As the piled foundation could be socketed into the bedrock and provide sufficient pile capacities to resist the additional loading from the proposed pier improvement work, the ground settlement of the subsea material would be small.

#### **Geo-environmental Conditions**

- 3.3.4 No sediment is anticipated within the footprint of the proposed TPC Public Pier.

#### **Ground Settlement**

- 3.3.5 Immediate ground settlement is anticipated due to the presence of a layer of marine sand, which could not be removed within the sensitive marine park. Piled foundation is considered more appropriate.

#### **Natural Terrain Hazard**

- 3.3.6 No natural terrain catchment would potentially pose an impact to the pier.

#### **Man-made Features**

- 3.3.7 No registered man-made features are present within the footprint or in the close proximity of the pier.

#### **Hydraulic and Metocean Conditions**

- 3.3.8 Extreme wave heights at the TPC Public Pier are summarised in **Table 3.2**.

**Table 3.2 Extreme Wave Heights (All Directions) at TPC Public Pier**

Loading Conditions	Wave Conditions	Water Level	Significant Wave Height, Hs (m)
Normal	Tropical Cyclone Signal No. 3	2-year return period sea level	0.7
Extreme	100-year return period wave conditions	10-year return period sea level	1.8 – 2.1
Extreme	10-year return period wave conditions	100-year return period sea level	1.2 – 1.4
Extreme	50-year return period wave conditions	50-year return period sea level	1.9
Extreme	100-year return period wave conditions	Mean lower low water level	1.7

- 3.3.9 To provide a better wave conditions for vessel berthing at the floating pontoon, downstand wall could be considered as a part of pier improvement works to reduce the wave effect at the leeward side of the pier such that the floating pontoon will be positioned in stable and calm condition during normal and extreme weathers.
- 3.3.10 The proposed pier improvement works will not result in significant impact to current speed and pattern, and water circulation/flushing near the pier and the change to sedimentation rate would not be significant.

## 3.4 Environmental Impact Assessment

### General

- 3.4.1 The Project comprises demolition, construction and operation works within Tung Ping Chau Marine Park. The Project is a Designated Project (DP) by virtue of Item Q.1, Part I of Schedule 2 of the EIAO.
- 3.4.2 In accordance with the requirements of Section 5(1) of the EIAO, a Project Profile (No. PP-562/2017) for the Project was submitted to the Director of Environmental Protection (DEP) for application for an EIA Study Brief on 27 December 2017. Pursuant to Section 5(7)(a) of the EIAO, the DEP issued a Study Brief (No.: ESB-306/2017 dated 9 February 2018) for the EIA study. The EIA Report, EIA Executive Summary and EM&A Manual (EIA-265/2020) were made available for public inspection between 8 October 2020 and 6 November 2020 inclusive.
- 3.4.3 The EIA approval was granted on 29 December 2020 with conditions on submission of a Pier Design Plan to specify the use of locally manufactured/recycled eco-materials, such as eco-tiles and eco-concrete in the design and construction of the pier with a view to enhancing ecological functions of the pier and minimizing the carbon footprint of the Project.
- 3.4.4 The findings of the EIA for TPC Public Pier are summarised below.

### **Water Quality**

- 3.4.5 During the construction phase, given the small scale of the pier and the adoption of piled foundation with sufficient column-to-column spacing, hydrodynamic impact from the new structures of the improved pier and the temporary pier is not anticipated.
- 3.4.6 Potential water quality impact would arise from the construction activities, in particular the marine-based site investigation and foundation works. Nevertheless, no dredging operation is involved, and there will neither be direct discharge on-site, within the Tung Ping Chau Marine Park nor other WSRs. Therefore, with the implementation of recommended mitigation measures such as the use of double casing system, Y-shape funnel and closed grab to be implemented during marine-based site investigation and construction works, adverse water quality impact is not anticipated. In addition, with good site control practices, emergency spillage plan and provision of portable toilets, adverse impacts from surface runoff from construction site operation, accidental spillage of chemicals and sewage from workforce are not anticipated.
- 3.4.7 During the operational phase, as there is no planned increase in the existing licensed Kaito services nor alteration of their routing, no adverse water quality impact is anticipated from the Project. Given the small scale of the pier and the adoption of concrete pile foundation with sufficient column-to-column spacing, hydrodynamic impact from the new pier is not anticipated.

### **Ecology**

- 3.4.8 Ecological surveys covering a 14-month duration were conducted and survey results were documented in the EIA report. Coral surveys in tiers by different techniques, including detailed coral mapping survey in which 531 coral colonies from 43 species were recorded, were performed. Except 6 colonies classified as rare species, all other coral colonies were common or uncommon species.
- 3.4.9 The plan view area of the proposed TPC Public Pier extension is about 0.056 ha, but the actual marine habitats loss will be only about 0.002 ha of seabed and 0.004 ha of marine waters as only the piled foundation will directly encroach the seabed. The potential impacts due to the loss of small areas for the future piles and the concrete landing during the construction phase are considered minor. It is also anticipated that the future piles to support the pier structures could provide new and additional hard substrates for coral colonization.
- 3.4.10 Boundaries and layouts of the proposed works area, the proposed pier extension and temporary pier were formulated to avoid areas with higher coral coverage. The design of the proposed pier extension has been adjusted to minimize direct impacts (i.e. direct encroachment) and indirect impact (i.e. reduction of sunlight) to hard corals. Most of the structures being constructed will be above water surface, allowing sunlight to reach the seabed, and corals to be directly encroached are limited to those on the vertical seawalls of the outer most part of the existing pier head.
- 3.4.11 A total of 90 coral colonies were recorded within the plan view area of the proposed pier extension together with the temporary pier. All corals within the footprint of the TPC Public Pier are suggested to be translocated to a recipient site within Tung

Ping Chau Marine Park. A detailed coral translocation plan should be prepared during the detailed design stage of the Project to recommend a final recipient site.

- 3.4.12 While presence of amphioxus in the Project Site is not likely due to the substrates with boulder and gravel embedded in sediments within the Project Site, significant impacts to amphioxus in other locations are not expected due to the scale of the works. Similarly, impacts to other marine organisms of conservation importance such as Green Turtle or seahorse are not expected either.
- 3.4.13 As the proposed works area only involve marine habitats, terrestrial habitats including the recognized sites of conservation importance such as Plover Cove (Extension) Country Park, Geo Park and the Ping Chau SSSI will not be encroached. Direct impacts on the natural resources in these recognized sites of conservation importance are avoided.
- 3.4.14 Various monitoring and audit will be conducted for the construction works and the corals. Water quality monitoring will be conducted at the nearby waters prior to the commencement of the construction as well as during the construction phase to ensure that the water quality complies with the established environmental standards. Besides the monitoring of the translocated corals on the success of translocation exercise, corals monitoring will be conducted to corals within the proposed work area and the nearest reef check site during construction stage and post-construction stage. General site inspection within Plover Cove (Extension) Country Park will also be conducted to ensure no ecological disturbance on the country park.
- 3.4.15 During the operational phase, the permanent loss of marine habitat (about 0.004 ha water column and 0.002 ha of subtidal seabed) is considered minor. As there will be only a limited number of piles and a small above-seabed downstand wall will be constructed in the marine habitats, change in hydrodynamics regime or water quality is not expected. It is not anticipated the frequency of vessels or visitor numbers would increase due to the Project and no significant impact is expected for the water sensitive receivers in the vicinity. Disturbance to terrestrial habitats or fauna due to the lighting at the pier head is not likely. Hence, no significant operational phase impacts to marine ecology, recognized sites or species of conservation importance, are anticipated from the Project. Residual impacts are also acceptable.

### **Fisheries**

- 3.4.16 As only piles foundation will be constructed at the pier, and pre-cast structures will be built on-top, together with the approaches for avoidance and minimisation of impacts, potential fisheries impacts on fisheries resources due to construction of the pier are considered minor. Since unacceptable adverse impacts on fisheries resources and fishing operations are not anticipated, fisheries-specific mitigation measures are not required during the construction phase.
- 3.4.17 Permanent fishing ground loss occurs during operational phase due to the footprint of proposed TPC Public Pier. About 0.056 ha fishing ground loss is considered to be of insignificant proportion as compared with the 1,651 km<sup>2</sup> (approximately 165,100 ha) of Hong Kong's total marine waters which is mostly available for fishing. Since no unacceptable adverse impacts on fisheries resources and fishing operations are anticipated, fisheries-specific mitigation measures are not required.

### Other Environmental Aspects

3.4.18 Other environmental aspects, including air quality, noise, waste management, land contamination, landscape and visual, cultural heritage and antiquities, have been duly assessed in the EIA according to the study brief (ESB-306/2017) for both construction and operational phases. Given the small scale of pier improvement works of TPC Public Pier, adverse environmental impacts are not anticipated. Nevertheless, good site practices and control measures with reference to relevant technical memoranda, standards and guidelines have been recommended in the EIA (AEIAR-226/2020) to ensure the compliance with the relevant legislation, standards and guidelines. The key findings and control measures have been summarised in **Table 3.3**.

**Table 3.3 Key Findings and Control Measures of Other Environmental Aspects for Pier Improvement at TPC**

Aspect	Construction Phase		Operational Phase	
	Key Findings	Control Measures	Key Findings	Control Measures
Air Quality	<ul style="list-style-type: none"> <li>No adverse impact</li> </ul>	<ul style="list-style-type: none"> <li>Prefabrication construction method</li> <li>Good site practices for dust control</li> </ul>	<ul style="list-style-type: none"> <li>The project does not intend to increase licensed Kaito frequency</li> <li>Vessels berthed at the pier will be located farther away from the air sensitive receivers</li> </ul>	N/A
Noise	<ul style="list-style-type: none"> <li>No adverse impact</li> </ul>	<ul style="list-style-type: none"> <li>Prefabrication construction method</li> <li>Good site practices for construction noise control</li> </ul>	<ul style="list-style-type: none"> <li>The project does not intend to increase licensed Kaito frequency</li> <li>Vessels berthed at the pier will be located farther away from the noise sensitive receiver</li> </ul>	N/A



Aspect	Construction Phase		Operational Phase	
	Key Findings	Control Measures	Key Findings	Control Measures
Waste Management	<ul style="list-style-type: none"> <li>• Generation of small quantities of construction and demolition waste, chemical waste and general refuse</li> </ul>	<ul style="list-style-type: none"> <li>• Prefabrication construction method</li> <li>• Good site practices for waste handling</li> </ul>	<ul style="list-style-type: none"> <li>• The project does not intend to increase licensed Kaito frequency and number of visitors</li> <li>• No increase in the amount of general refuse</li> </ul>	N/A
Land Contamination	<ul style="list-style-type: none"> <li>• No land contamination identified in site survey</li> </ul>	N/A	N/A	N/A
Landscape and Visual	<ul style="list-style-type: none"> <li>• Acceptable landscape and visual impact with mitigation measures</li> <li>• No tree felling and direct impact on trees</li> </ul>	<ul style="list-style-type: none"> <li>• Minimise construction area</li> <li>• Site hoarding</li> <li>• Lighting control</li> </ul>	<ul style="list-style-type: none"> <li>• Acceptable landscape and visual impact with mitigation measures</li> </ul>	<ul style="list-style-type: none"> <li>• Sensitive design and deposition of pier structures</li> </ul>
Cultural Heritage	<ul style="list-style-type: none"> <li>• No adverse impact</li> </ul>	<ul style="list-style-type: none"> <li>• As a precautionary measure, Antiquities and Monuments Office (AMO) should be informed in case of discovery of antiquities or supposed antiquities in the course of marine works</li> </ul>	<ul style="list-style-type: none"> <li>• No adverse impact</li> </ul>	N/A

### Environmental Monitoring and Audit

3.4.19 An EM&A programme has been formulated. The EM&A programme will provide management actions to check the effectiveness of the recommended mitigation measures/good site practices and compliance with relevant statutory criteria, thereby ensuring the environmental acceptability of the construction and operation of the Project.

- 3.4.20 Notwithstanding the above, corresponding Environmental Permit (No. EP-587/2021) was granted on 19 February 2021, all general and specific conditions as stipulated in the EP shall be strictly followed. The EP is uploaded onto the website for Environmental Impact Assessment Ordinance of EPD.

## 3.5 Stakeholder Consultation

- 3.5.1 A comprehensive stakeholder consultation strategy has been formulated for the Study to solicit support and opinions from the key stakeholders. Stakeholder consultation was planned and conducted in two stages, namely (i) Initial Stakeholder Consultation and (ii) Stakeholder Consultation, to enable better and early consultation of the stakeholders and to facilitate consensus building throughout the Study process.
- 3.5.2 The stakeholders generally supported the conceptual pier design and the proposed new pier facilities including floating pontoon platform, cover for waiting area and powering of pier facilities by renewable energy.
- 3.5.3 The key stakeholders' views / opinions are summarised as follows:
- (a) Provision of a covered waiting area with benches;
  - (b) Provision of an uncovered area at pier head for unloading goods;
  - (c) Provision of solar panels for power supply of the pier;
  - (d) Provision of ramps of suitable gradient that facilitates the use by people-in-need;
  - (e) Safety of using pontoon to get on and off vessels;
  - (f) Berthing of small vessels at the proposed floating pontoon;
  - (g) Minimising the footprint area of new pier structure to reduce impact on coral communities;
  - (h) Enhancing aesthetics of new pier structure;
  - (i) Plan of coral translocation; and
  - (j) Work arrangement when green turtles are sighted and the associated mitigation measures.

## 3.6 Preliminary Pier Design

- 3.6.1 The proposed improvement works will not involve any resumption of private land.
- 3.6.2 As the pier improvement works involve the provision of a new floating platform and the piled deck structure which will be over and upon the foreshore and sea-bed, the proposed pier improvement works at Tung Ping Chau will require gazettal under the FS(R)O.
- 3.6.3 It is estimated that the construction stage will take about 40 months (i.e. 14 months for pre-construction preparation work and 26 months for construction works) to complete pier improvement works.

## 3.7 Summary

- 3.7.1 Based on the preliminary engineering assessment and environmental impact assessment, the proposed pier improvement works at Tung Ping Chau Public Pier are technically feasible and environmentally acceptable.
- 3.7.2 Environmental Monitoring and Audit will be carried out during construction to ensure all recommended mitigation measures are properly and effectively implemented and to ensure compliance with the intended aims of the measures.

## 4 Conclusion and Way Forward

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- 4.1.1 Based on the preliminary engineering assessment and environmental impact assessment, the proposed pier improvement works at Lai Chi Wo Pier and Tung Ping Chau Public Pier are considered technically feasible and environmentally acceptable.
- 4.1.2 As both piers are within marine parks, they constitute as Designated Projects under Schedule 2 of the EIAO. Environmental impact assessments were completed for each pier and have been approved by the Director of Environmental Protection with conditions.
- 4.1.3 Environmental Monitoring and Audit will be carried out during construction to ensure all mitigation measures recommended are properly and effectively implemented and to ensure compliance with the intended aims of the measures.
- 4.1.4 The stakeholders generally supported the proposed pier layout and arrangement of new pier facilities including floating platform, cover for waiting area and powering of pier facilities by renewable energy.
- 4.1.5 As the construction of new pier structures and provision of new floating platform will be carried out over and upon the foreshore and seabed, the proposed pier improvement works will require gazettal under the Foreshore and Sea-bed (Reclamations) Ordinance Cap 127.
- 4.1.6 The findings and recommendations of this Executive Summary should be referenced in the detailed design and construction stages when taking forward the proposed pier improvement works.