

**APPENDIX 4B APPROVED METHOD STATEMENT ON MARINE
ECOLOGICAL IMPACT ASSESSMENT FOR OUTER TAP
MUN FCZ**



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Agriculture, Fisheries and
Conservation Department

Contract Ref.: AFCD/FIS/02/2019 Consultancy Services for Environmental Impact Assessment Study for Designation of New Fish Culture Zones

Method Statement on Marine Ecological
Survey for Outer Tap Mun Fish Culture
Zone

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Method Statement on Marine Ecological Survey for Outer Tap Mun Fish
Culture Zone



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Outer Tap Mun Baseline Coral Survey Results from the *Feasibility Study*

1. INTRODUCTION

1.1 Background

To pave the way for facilitating the sustainable development of the local mariculture sector, the Agriculture, Fisheries and Conservation Department (AFCD) proposed to lift the moratorium by designating new fish culture zones (FCZs) to create room for the mariculture sector to grow further, including allowing capture fishermen to switch to this sustainable mode of operation, and attracting new entrants. In 2014, the AFCD commissioned a consultancy study ⁽¹⁾ to explore suitable sites as new FCZs and Outer Tap Mun FCZ is one of the four Shortlisted Sites.

The designation of a FCZ of more than 5 hectares in size is classified as a designated project under Item M.1, Part I of Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO) (Cap. 499), and a statutory EIA is required before designation. In accordance with the EIAO, a Project Profile for application for an Environmental Impact Assessment (EIA) Study Brief has been prepared and submitted to Environmental Protection Department (EPD) on 15 October 2019. The EIA Study Brief (ESB-325/2019) (hereafter referred to as “the Study Brief”) was issued by EPD on 27 November 2019.

AFCD has commissioned ERM to undertake the “*Consultancy Services for Environmental Impact Assessment Study for Designation of New Fish Culture Zones*” (“the Study”). In accordance with *Clause 3.4.4* of the Study Brief, a marine ecological impact assessment shall be conducted to evaluate and assess potential impacts on marine ecology for the construction and operation of Outer Tap Mun FCZ (“the Project”).

1.2 Objectives and Scope of This Method Statement

Baseline information within the Assessment Area for the marine ecological impact assessment for the proposed FCZ at Outer Tap Mun i.e. the Mirs Bay Water Control Zone (WCZ) and the Tolo Harbour and Channel WCZ, in accordance with *Clause 3.4.4.2* of the EIA Study Brief (ESB-325/2019) is available from the following key sources:

- Consultancy Services for Identification of New Fish Culture Zones in Hong Kong – Feasibility Study (AFCD/FIS/01/14);
- Provision of Services on Desktop Review for Potential New Fish Culture Zones (AFCD/SQ/243/18/C);
- EIA Report for The Proposed Submarine Gas Pipeline From Cheng Tou Jiao Liquefied Natural Gas Receiving Terminal (EIA-089/2003);
- EIA Report for Hong Kong Offshore Wind Farm in Southeastern Waters (EIA-167/2009);
- Hong Kong Reef Check 2019;
- AFCD Final Report on Monitoring of Marine Mammals in Hong Kong Waters (2018-2019); and
- Available Published Scientific Literature

The *Feasibility Study* ⁽²⁾ included baseline coral survey at Outer Tap Mun undertaken in 2016 and presents the up-to-date and representative information regarding coral communities in the vicinity of the proposed FCZ site. The survey results of the *Feasibility Study* are included as **Annex B-A** and this shall be reviewed for the EIA study. The above data sources also provide up-to-date baseline information on important ecological habitats or habitats with conservation interest such as existing

(1) ERM (2018) Consultancy Ref. AFCD/FIS/01/14 Consultancy Services for Identification of New Fish Culture Zones in Hong Kong – Feasibility Study

(2) ERM (2018) Consultancy Ref. AFCD/FIS/01/14 *Op. Cit.*

marine parks and Sites of Special Scientific Interest, corals, mangroves, finless porpoise habitats etc. of the Assessment Area. Baseline survey of these habitats is not considered necessary.

There are identified data gaps with regards to the status of the subtidal habitat within the proposed FCZ site and along the coastline of the western Tap Mun in the vicinity of the Project, with no recent baseline information available. Therefore, baseline surveys at selected habitats within the Assessment Areas where potential impact could occur and up-to-date baseline information is not present are proposed to be conducted, in order to update the latest ecological conditions in these areas.

In accordance with the requirements in *Appendix C* of the Study Brief, marine ecological surveys shall be conducted for a duration of at least 6 months to fill in the identified data gaps as well as verify and update the desktop information on existing conditions of the Assessment Area ⁽³⁾⁽⁴⁾⁽⁵⁾ (**Figure B1.1**). The Assessment Area for Marine Ecological Impact Assessment shall be the same as the assessment area for Water Quality Impact Assessment covering the Mirs Bay Water Control Zone (WCZ) and the Tolo Harbour and Channel WCZ. Considering the sensitive receivers in the vicinity of the Project as well as the potential impacts of the Project, the Assessment Area will cover a distance of about 7 km from the Project Site.

Subsequently, the information collected from desktop review and ecological surveys will be used to establish the general ecological profile and characterise the identified habitats within the Assessment Area. The proposed ecological surveys comprise:

- Coral survey; and
- Subtidal benthos survey, including amphioxus.

This *Method Statement* presents the methodology of the aforementioned marine ecological surveys. Reference has been made to the guidelines for evaluating and assessing marine ecological impact as outlined in Annexes 8 and 16 of the EIAO-TM, the relevant Guidance Notes (GN 7/2010, GN 10/2010 and GN 11/2010), and approved EIA reports on the EIA Register.

1.3 Structure of This Method Statement

Following this introductory section, the remainder of this *Method Statement* is presented as follows:

- Section 2 presents the methodologies for the marine ecological surveys, including coral survey and subtidal benthos survey.

(3) Chan, A.L.K, Choi, C.L.S., McCorry, D., Chan, K.K., Lee, M.W. and Ang, P. (2005) Field Guide to Hard Corals of Hong Kong. 1st edition (Eds. Chan, W.C. and Stokes, E.). Friends of the Country Parks and Cosmos Books Ltd, Hong Kong. 373 pp.

(4) Chen (2007) The Ecology and Biology of Amphioxus of Hong Kong. PhD, Thesis. The City University of Hong Kong.

(5) Google Earth (2020). Available at: <https://www.google.com/earth/> [accessed on 25-08-2020]

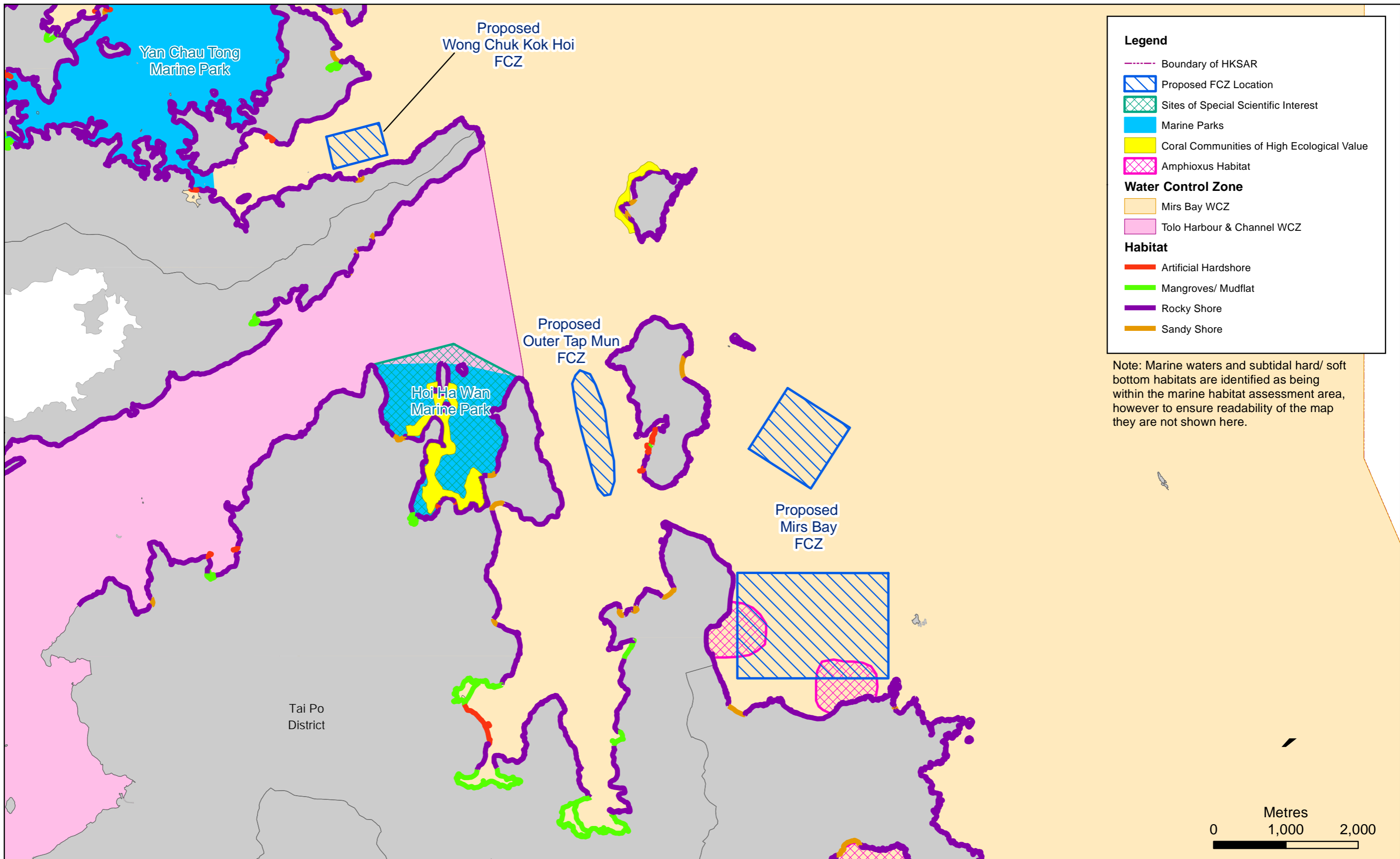


Figure B1.1

Assessment Area and Marine Habitat Identified for the Proposed Outer Tap Mun FCZ

2. MARINE ECOLOGICAL SURVEY

2.1 Coral Survey

Coral and benthic surveys, as described below, will be conducted to identify and characterize the existing ecological conditions of the seabed and shoreline within and in the vicinity of the proposed FCZ site. Coral survey locations are proposed in areas which have not been surveyed previously during the *Feasibility Study*, in order to fill in information gaps. The subtidal coral surveys, which will be conducted once in the wet/ dry season, will comprise of the following three components:

- Qualitative spot dive reconnaissance check;
- Semi-quantitative Rapid Ecological Assessment (REA) survey; and
- Drop Camera Survey

2.1.1 Qualitative Spot-dive Reconnaissance Check

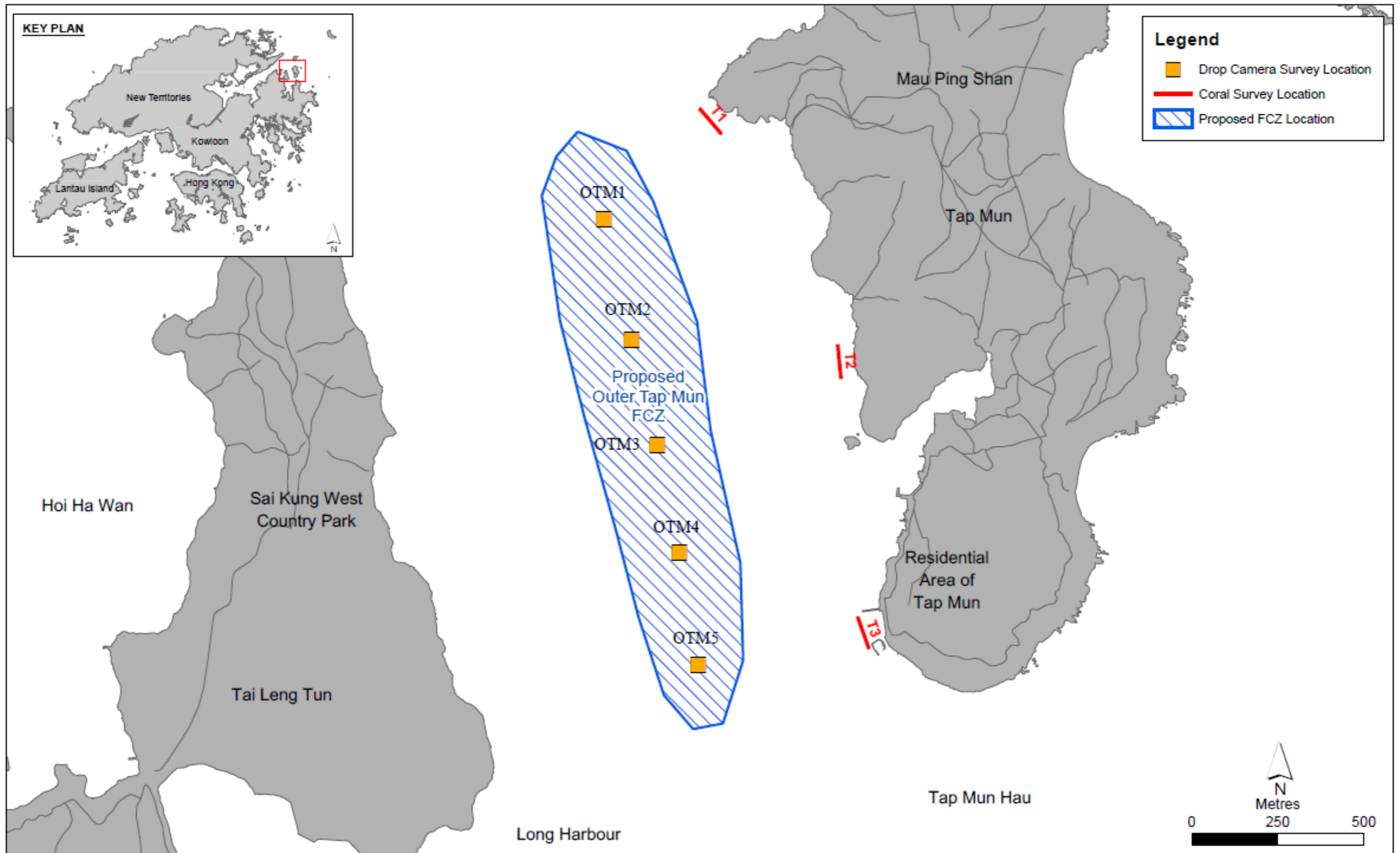
The qualitative spot dive reconnaissance check will investigate if coral communities (e.g. hard corals, soft corals, sea pen and black corals) are present at the areas along the natural shores in the vicinity of the proposed FCZ site (**Figure B2.1**).

At each survey location, a spot dive reconnaissance check will be conducted along a 100 m transect by coral specialists using SCUBA to identify the substrate type and associated sessile benthos, particularly the presence of hard and soft coral communities. The dive surveys will generally follow the bathymetry of the survey transect and will be separated into shallow water (< -5 mCD) and deep water (> -5 mCD) (to be adjusted based on the site condition and substrates). The characteristics of seabed and associated fauna along the survey transect will be recorded by photographs and videos to characterise the biological nature of the subtidal area along the survey transect. All organisms and coral colonies encountered will be identified to the lowest possible taxonomic level. This technique is regarded as standard practice for EIA marine baseline surveys in Hong Kong, with many previously approved EIA's utilising the same or similar methodology ^{(6) (7) (8) (9) (10) (11)}.

2.1.2 Semi-quantitative Rapid Ecological Assessment (REA) Survey

When corals are recorded during the qualitative spot-dive reconnaissance check, semi-quantitative survey, Rapid Ecological Assessment (REA), will then be undertaken with reference to the EIAO Guidance Notes (*GN 11/2010*) to provide information on the relative coverage of coral and other benthic groups, in addition to creating an inventory of sessile benthic taxa used to define the community types. This technique is regarded as standard practice for EIA marine baseline surveys in Hong Kong, with many previously approved EIA's utilising the same or similar methodology ^{(12) (13) (14)}

-
- (6) ERM (2016) Hong Kong Offshore LNG Terminal. EIA Study (AEIAR-218/2018). Prepared for CLP Power Hong Kong Limited.
- (7) ERM (2015) Additional Gas-fired Generation Units Project. EIA Study (AEIAR-197/2016). Prepared for Castle Peak Power Company Limited (CAPCO).
- (8) ERM (2010) Development of a 100MW Offshore Wind Farm in Hong Kong. EIA Study (AEIAR-152/2010). Prepared for Hong Kong Electric.
- (9) ERM (2003) The Proposed Submarine Gas Pipeline From Cheng Tou Jiao Liquefied Natural Gas Receiving Terminal, Shenzhen to Tai Po Gas Production Plant, Hong Kong. EIA Study (EIA-089/2003). Prepared for The Hong Kong and China Gas Company Limited.
- (10) AECOM (2016) Sha Tin Cavern Sewerage Treatment Works. EIA Study (AEIAR-202/2016). Prepared for the Drainage Services Department.
- (11) Black & Veatch Hong Kong Limited (2016) Outlying Islands Sewerage Stage 2 – South Lantau Sewerage Works. EIA Study (AEIAR-210/2017). Prepared for Drainage Services Department.
- (12) ERM (2016) (AEIAR-218/2018). *Op. Cit.*
- (13) ERM (2015) (AEIAR-197/2016). *Op. Cit.*



(15) (16) (17). The methodology outlined has been modified from the standardised REA survey technique established for the assessment of coral communities on the Great Barrier Reef (18) for the marine environment of Hong Kong (19).

Based upon the information gathered in the qualitative spot-dive reconnaissance check, such areas where coral appear to be the most abundant, or in close proximity to the proposed FCZ, the REA survey will then be performed along a 100 m transect. REA surveys are proposed to be conducted at shallow and deep water (-5 mCD and > -5 mCD zones dependant on the bathymetry of the site; to be adjusted based on the site condition and substrates) along the shoreline to search for hard coral, octocoral and black coral. After the transect line has been laid, video footage will be taken for the benthos along the transect and the assessment of the benthic cover (Tier I) and taxon abundance (Tier II) will be conducted in a swathe ~ 2 m wide, 1 m either side of each transect. The belt transect width is dependent on underwater visibility experienced, with regards to the marine environment in Hong Kong this generally consists of a swathe ~2 m wide, 1 m either side of the each transect. An explanation of the two assessment categories (Tiers) used in the survey is presented below.

Tier I - Categorisation of Benthic Cover

Upon the completion of each survey transect, ecological and substratum attributes (**Table B2.1**) will be assigned to standard ranked (ordinal) categories (**Table B2.2**).

Table B2.1 Tier I Benthic Attribute Categories

Ecological Attributes	Substratum Attributes
Hard coral	Bedrock
Dead coral	Continuous pavement
Octocoral (Soft corals and Gorgonians)	Rocks (<26 cm)
Black coral	Large boulders (>50 cm)
Dead standing coral	Small boulders (<50 cm)
Macroalgae	Rubble
Other Benthos (including sponges, zoanthids, ascidians and bryozoans)	Sand
	Mud/ Silt
	Other

(14) ERM (2010) (AEIAR-152/2010). *Op. Cit.*

(15) ERM (2003) (EIA-089/2003). *Op. Cit.*

(16) AECOM (2016) (AEIAR-202/2016). *Op. Cit.*

(17) Black & Veatch Hong Kong Limited (2016) (AEIAR-210/2017). *Op. Cit.*

(18) DeVantier LM, De'Ath G, Done TJ, Turak E (1998) Ecological assessment of a complex natural system: A case study from the Great Barrier Reef. *Ecological Applications* 8: 480-496.

(19) Fabricius KE, McCorry D (2006) Changes in octocoral communities and benthic cover along a water quality gradient in reefs of Hong Kong. *Marine Pollution Bulletin* 52: 22-33.

Table B2.2 Tier I Ordinal Ranks of Percentage Cover of Benthic Attributes

Rank	Percentage Cover (%)
0	None recorded
1	1-5
2	6-10
3	11-30
4	31-50
5	51-75
6	76-100

Tier II - Taxonomic Inventories to Define Types of Benthic Communities

An inventory of benthic taxa will be compiled for each transect. Taxa will be identified *in situ* to the following levels:

- Scleractinian (hard) corals to species, where possible;
- Soft corals, anemones and conspicuous macroalgae to genus level where possible;
- Other benthos (including sponges, zoanthids, ascidians and bryozoans) recorded to genus level, where possible, or phylum plus growth form.

Following the completion of the survey of each transect, each taxon in the inventory will be ranked in terms of abundance in the community (**Table B2.3**). These broad categories rank taxa in terms of relative abundance of individuals, rather than the contribution to benthic cover along each transect. The ranks are visual assessments of abundance, rather than quantitative counts of each taxon. Representative photos of organisms will be taken.

Table B2.3 Ordinal Ranks of Taxon Abundance

Rank	Abundance
0	Absent
1	Sparse
2	Uncommon
3	Common
4	Abundant
5	Dominant

The photographs and videos recorded for each REA transect will be reviewed in order to compile the REA data. Species lists, species richness and the relative coverage for ecological and substratum attributes will be presented.

2.1.3 Drop Camera Survey

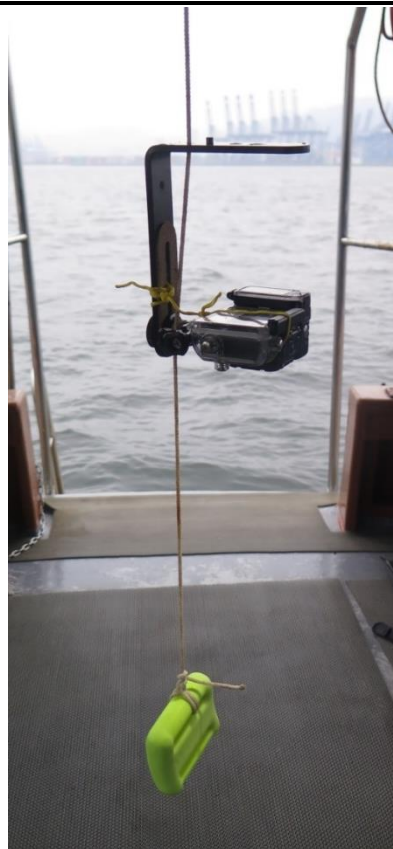
In order to characterise the substrate and benthic communities of the seabed within the proposed FCZ site, taking safety into consideration, the use of handheld drop cameras system will be utilised and deployed on vessel, mitigating the need of any person working underwater. This technique has been used for marine baseline surveys in Hong Kong and overseas, with previously approved EIA and projects utilising the same or similar methodology ⁽²⁰⁾ ⁽²¹⁾ ⁽²²⁾. The drop camera system will consist

(20) ERM (2010) (AEIAR-152/2010). *Op. Cit.*

of a high quality digital video camera (e.g. GoPro HERO3+ or equivalent) mounted on a tripod that could be lowered onto the seabed and towed above it to collect video footages and photographs (**Figure B2.2**). These techniques allowed greater survey coverage in a relatively short period of time compared to the SCUBA surveys, especially for areas which are exposed and offshore.

The survey locations are presented in **Figure B2.1**. During the survey, the drop camera system will be deployed from a support vessel at each survey location. Once the drop camera system reaches the bottom and maintain close to the seabed (~1m) or as far as practicable, the operator will allow the system to drift with the current, or alternatively move the system slowly and steadily over the substrate. Video footage and imagery of the seabed will be taken continuously throughout this deployment for at least two (2) minutes, with ~4m² of seabed recorded per second under wide angle camera setting (i.e. ~480m² for 2 minutes) if the camera is placed ~1m above seabed, to characterise the seabed substrate and benthic communities. Following retrieval, the footage and photographs will be examined ex-situ and verify the presence / absence of corals or other habitats / organism of interest (e.g. seagrass, soft mud with epifauna etc.).

Figure B2.2 Representative Photo of the Drop Camera System Set Up



- (21) ERM-Hong Kong and ERM-Malaysia (2009) Marine Survey for Coral Habitats: Photo Quadrat Assessment (PQA) of Mampak, For Confidential Client.
- (22) ERM-Hong Kong and ERM-Malaysia (2008) Coral Habitat Verification and Assessment Study for Block A-1 and Block A-3 Gas Development, Myanmar. For Confidential Client.

2.2 Subtidal Benthos Survey

Subtidal soft bottom surveys will be conducted as described below to characterize the existing ecological conditions of the seabed within the proposed FCZ site. Sampling locations, equipment involved, sampling procedure, laboratory analytical procedures, and QA/QC requirements for the proposed surveys are detailed below, with the methods similar to that of previously approved EIAs in Hong Kong ^{(23) (24) (25) (26) (27) (28)}.

2.2.1 Benthic Grab Survey

Benthic sediment samples will be collected within the proposed FCZ site for biological analyses (i.e. taxonomic identification and abundance of subtidal benthos) with particular attention on the presence of amphioxus or any notable marine benthos. Seabed sediment samples will be collected from five (5) sampling locations representative of the subtidal soft-bottom habitats (**Figure B2.3**). Amphioxus habitat has not been identified at or in vicinity of the proposed FCZ site from the literature, and as reported in the literature, amphioxus are mostly found in shallow, subtidal sand flats ⁽²⁹⁾.

Consequently the muddy soft bottom of the proposed FCZ site may not be suitable habitats for amphioxus and the sampling locations are proposed within the FCZ site to confirm this. At each location, one grab sample will be collected from the seabed. The number of sampling locations is considered sufficient given the scale of the Project and the relatively homogenous nature of sediments at the proposed FCZ site. Sampling will be conducted twice, once in the wet season and once in the dry season.

The benthic grab surveys will be conducted utilizing a modified Van Veen grab sampler (960 cm² sampling area; 11,000 cm³ capacity) with a supporting frame attached to a swiveling hydraulic winch cable. Sediments for biological analysis will be sieved on board the survey vessel. The sediments will be washed into a sieve stack (comprising 1 mm² and 500 µm² meshes) and gently rinsed with seawater to remove all fine material. Following rinsing, any material remaining on the two screens will be combined and carefully rinsed using a minimal volume of seawater into pre-labelled thick triple-bagged ziplock plastic bags. A 5% solution of borax-buffered formalin containing Rose Bengal in seawater will then be added to the bag to ensure tissue preservation. Samples will be sealed in plastic containers for transfer to the taxonomy laboratory for sorting and identification.

2.2.2 Parameters Measured

The parameters to be measured for subtidal benthos analysis are:

- Total number of species (diversity)
- Abundance of each species recorded (biomass)

In addition to the above parameters, other relevant data will also be measured and recorded, inclusive but not limited to; time, weather conditions, sea conditions, special phenomena (if any), and other activities undertaken around the sampling location that may influence the sampling results.

(23) ERM (2016) (AEIAR-218/2018). *Op. Cit.*

(24) ERM (2015) (AEIAR-197/2016). *Op. Cit.*

(25) ERM (2010) (AEIAR-152/2010). *Op. Cit.*

(26) ERM (2003) (EIA-089/2003). *Op. Cit.*

(27) Cinotech Consultants LTD (2013). (AEIAR-206/2017). *Op. Cit.*

(28) Black & Veatch Hong Kong Limited (2016). (AEIAR-210/2017). *Op. Cit.*

(29) Chen Y, Cheung SG, Shin PKS (2013). A baseline study of benthic community associated with Amphioxus Sand in subtropical Hong Kong. *Marine Pollution Bulletin*. 72, 274–280.

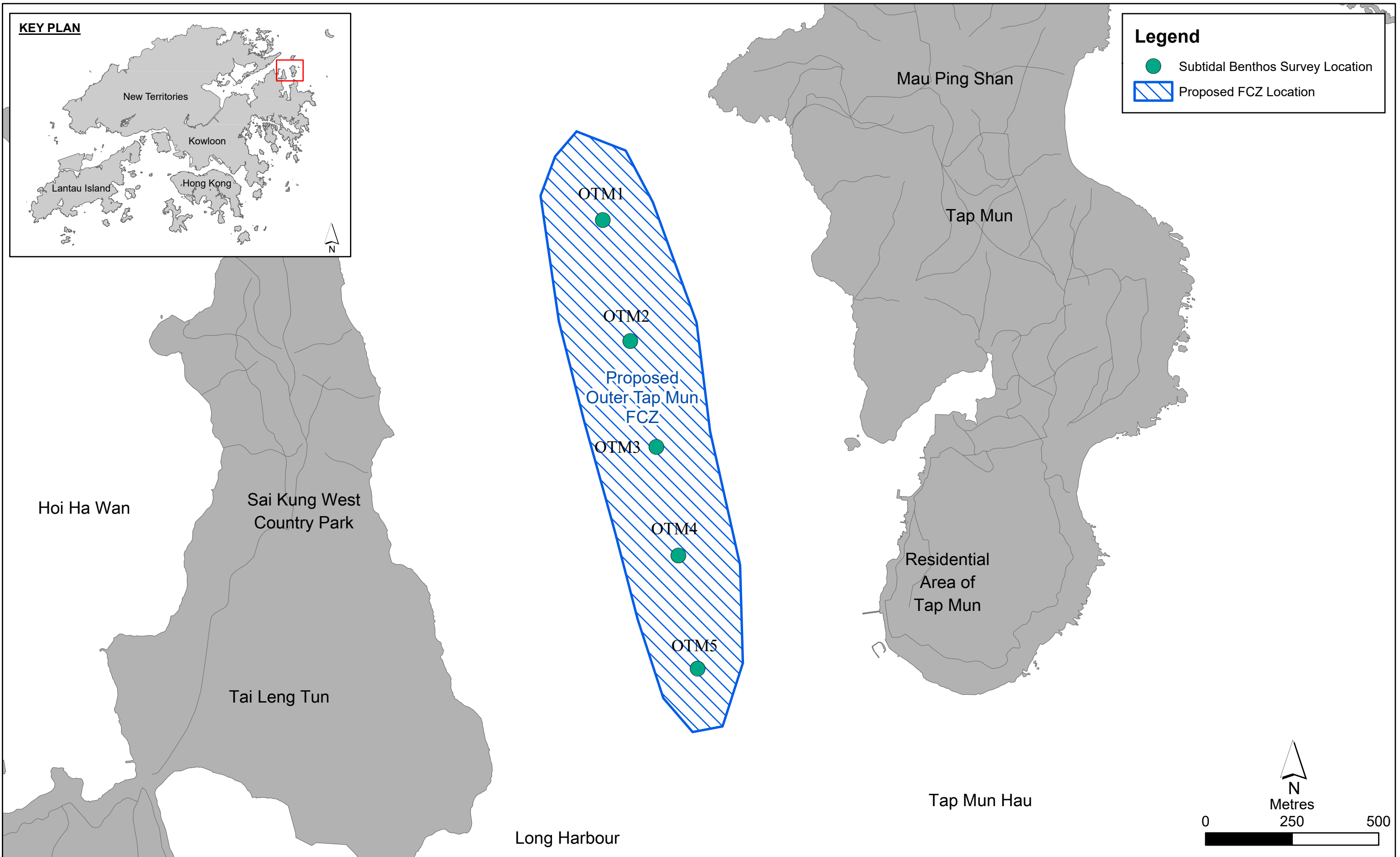


Figure B2.3

Proposed Subtidal Benthos Survey Locations at Outer Tap Mun

2.2.3 Laboratory Analyses

The benthic laboratory will perform sample re-screening after the samples have been held in formalin for a minimum 24 hours to ensure adequate fixation of the organisms. Individual samples from the 500 μm^2 and 1 mm^2 mesh sieves will be gently rinsed with fresh water into a 250 μm^2 sieve to remove the formalin from the sediments. Sieves will be partially filled while rinsing a specific sample to maximize washing efficiency and prevent loss of material. All material retained on the sieve will be placed in a labeled plastic jar, covered with 70% ethanol, and lightly agitated to ensure complete mixing of the alcohol with sediments. Original labels will be retained with the re-screened sample material.

Standard and accepted techniques will be used for sorting organisms from the sediments. Small fractions of a sample will be placed in a petri dish under a 10-power magnification dissecting microscope and scanned systematically with all animals and fragments removed using forceps. Each petri dish will be sorted at least twice to ensure removal of all animals. Organisms representing major taxonomic groups, such as Polychaeta, Arthropoda, Mollusca and miscellaneous taxa will be sorted into separate, labeled vials containing 70% ethanol.

Taxonomic identifications will be performed by qualified and experienced specialist using stereo dissecting and high-power compound microscopes. These are generally to the species level except for unidentified taxa, which will be identified to genera as far as practical. The careful sampling procedure employed minimizes fragmentation of organisms. If breakage of soft-bodied organisms occurred, only anterior portions of fragments will be counted, although all fragments will be retained and weighed for biomass determinations (wet weight).

2.2.4 Quality Assurance & Control (QA/QC) Procedures

The sediment samples will be evaluated for acceptance based upon the degree of disturbance, penetration depth, and amount of leakage from the grab. In the following cases, a sediment sample would be rejected and another sample collected:

- The sediment sampler doors open in recovery, causing possible surface washout.
- Half sample obtained where the sediment sampler had not struck a flat area of seabed, or improper deployment of benthic grab, or half sample of sediment.
- Disruption of the sample by heavy shaking or contamination (these can occur when a sample is badly handled or if the sediment sampler strikes the side of the vessel during operations).
- The sample represents less than 30% of the sediment sampler's total capacity (i.e. less than 15 cm penetration).
- Grab deployment location deviates from the designated position ⁽³⁰⁾.

Before sieving each sample on site, the grab, frame and sample containers will be washed with seawater to avoid cross contamination of samples.

Sample integrity for subtidal benthos analyses should be maintained for the duration of the survey, demobilization through to delivery to the appropriate laboratory. All samples should be accompanied with a Chain of Custody form to document sample management and delivery.

2.3 Proposed Survey Schedule

The proposed survey schedule for marine ecological surveys to be conducted for the Project, as outlined in *Sections 2.1 to 2.2*, is presented in **Table B2.4**.

(30) Concerns about positional errors must be weighed against the aims of the survey. Horizontal accuracies to within a few metres are acceptable distance.

Method Statement on Marine Ecological Survey for Outer Tap Mun Fish
 Culture Zone

Table B2.4 Tentative Survey Schedule for Marine Ecological Surveys

Survey	Method	Wet Season		Dry Season			
		Sep 20	Oct 20	Nov 20	Dec 20	Jan 21	Feb 21
Coral Survey	Qualitative Spot-dive Reconnaissance Check			✓			
	REA			✓			
	Drop Camera Survey				✓		
Subtidal Benthos Survey	Benthic Grab Survey	✓	✓			✓	✓

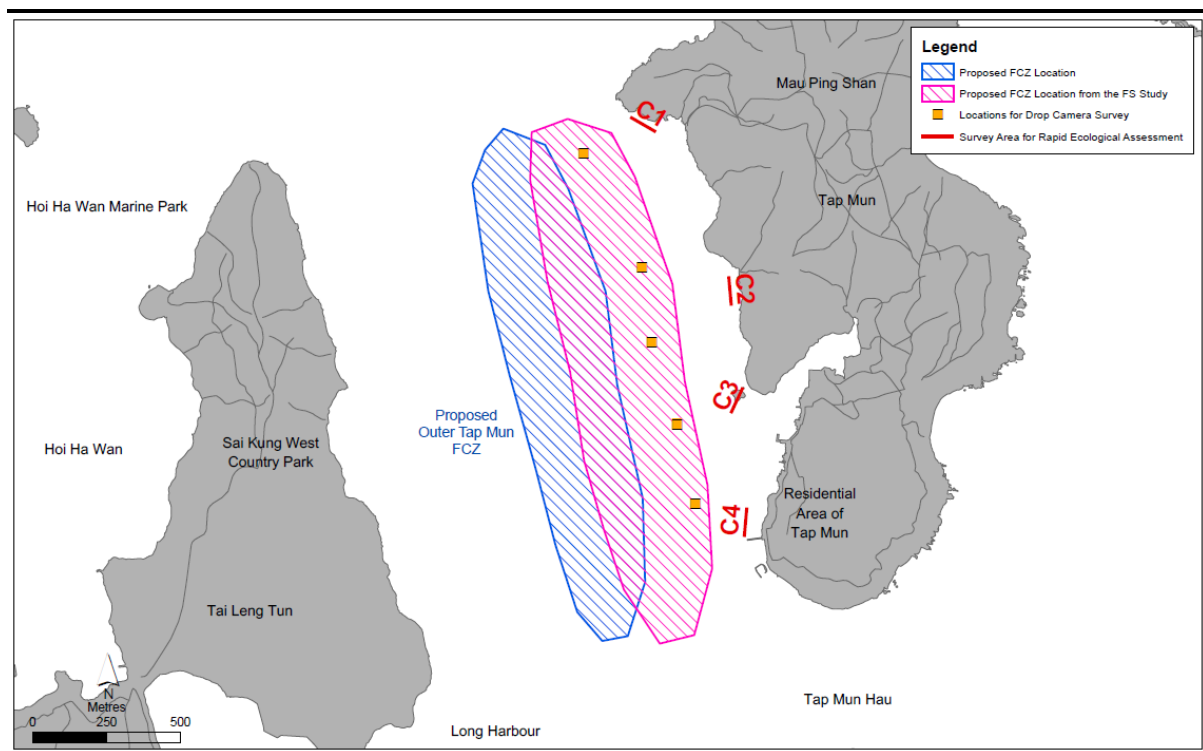
Annex B-A

Outer Tap Mun Baseline Coral Survey Results from the *Feasibility Study*

1. MARINE ECOLOGICAL SURVEY

The *Feasibility Study* under AFCD/FIS/01/14 conducted REA dive and drop camera surveys (**Figure B-A1.1**). At Outer Tap Mun, a total of 29 hard coral species and one black coral species were recorded at four (4) survey transects. The survey transects revealed low coral coverage (<5%) at all transects except for one (1) transect in the shallow water region that recorded 76 - 100% hard coral coverage. The coral assemblages recorded in that shallow water transect were dominated by *Platygyra acuta* and *Pavona decussata*. It should be noted that there was observed partial mortality on some *Platygyra acuta* colonies. The remaining three (3) survey transects recorded common coral species for northeastern and eastern waters in Hong Kong except a few uncommon coral species; *Cyphastrea chalcidicum*, *Dipsastraea helianthoides*, *Favites flexuosa* and *Goniopora djiboutiensis*⁽¹⁾. Patches of black corals *Antipaths curvata* were also found in the deep waters. Representative photos of the seabed and coral conditions during the surveys are presented in **Figure B-A1.2**. Results of drop camera survey also showed that the seabed of this site (~16 mCD) was dominated by silty mud without any hard substrate or benthic organism (**Figure B-A1.3**).

Figure B-A1.1 Locations for Baseline Coral Survey at Outer Tap Mun



(1) AFCD (2005) Field Guide to Hard Corals of Hong Kong.

Figure B-A1.2 Representative Photos of the Seabed and Coral Conditions at the Survey Transects for Outer Tap Mun



a) Macro-algae and small coral colonies in shallow water at C1, C3 and C4.



b) Sandy substrata in deep water at all transects.



c) Hard coral, *Cyphastrea serailia*, in soft substrata in deep water.



d) Hard coral bed consisting of, *Pavona decussate* and *Platygyra acuta*, in shallow water at C2.



e) Hard coral, *Platygyra acuta*, in shallow water at C2.



f) Partial mortality of Hard coral, *Platygyra acuta*, in shallow water at C2.

Figure B-A1.3 Representative Photos of the Seabed from the Drop Camera Survey for Outer Tap Mun

