

## 9 Cultural Heritage

### 9.1 Introduction

9.1.1.1 This section presents the approach to and the findings of the Cultural Heritage impact assessment; the aim of which is to identify and examine the nature and extent of potential impacts of the project on marine archaeology.

9.1.1.2 For the purpose of the marine archaeology assessment, the “assessment area” occupies the proposed Windfarm site, and the proposed cable route alignment between the Windfarm and Tseung Kwan O.

### 9.2 Objectives

9.2.1.1 The objective of this Section is to address the requirements of the ESB. Accordingly, this Report presents the approach to and the findings of the marine archaeology impact assessment up to the point of establishing archaeological potential.

9.2.1.2 Clause 3.2 of Appendix C to the Brief also states that “*The results [of data examined during Task 1 and 2] would be presented as a written report and charts...*”. A separate report has been prepared and submitted to AMO to meet this particular objective, with the key findings reproduced in this Section.

### 9.3 Legislation, Standards & Guidelines

#### 9.3.1 Environmental Impact Assessment Ordinance (Cap. 499)

9.3.1.1 The cultural heritage impact assessment has been conducted in accordance with the requirements referred under Clause 3.4.6 and Appendix C of the ESB, and Annexes 19 and 10 of the Technical Memorandum of the EIA Ordinance (EIA-TM) that present guidelines for impact assessment and criteria for impact evaluation, respectively.

9.3.1.2 In addition, the Guidance Notes on Assessment of Impact on Sites of Cultural Heritage in Environmental Impact Assessment Studies under the EIAO apply. In particular, items 6.2(iii) and 6.3 of the Guidance Note are of relevance.

#### 9.3.2 Antiquities and Monuments Ordinance (Cap. 53)

9.3.2.1 The *Antiquities and Monuments Ordinance* was enacted in January 1976 to protect and preserve any “*site of cultural heritage*” within the HKSAR. This refers to the following:

- Historical buildings and structures, i.e. currently pre-1950 buildings and structures that possess definite heritage value;
- Archaeological sites and structures;
- Palaeontological sites, i.e., pre-Holocene geological beds of sedimentary rocks containing fossil remains and their impressions; and
- Other cultural features.

9.3.2.2 The Ordinance provides for two main areas of heritage protection:

9.3.2.3 The statutory declaration of sites of cultural heritage of exceptional qualities and significance in the Government Gazette as Monuments, Historical Buildings, Archaeological Sites, etc.

9.3.2.4 Relics, (defined under the Ordinance as fossils and objects/artefacts created, modified, etc. by human agency before AD 1800) discovered after 1976 are, by law, properties of the Hong Kong SAR Government. Search and excavation for relics should comply with the Ordinance. All discoveries of antiquities or supposed antiquities must also be reported.

### **9.3.3 Lord Wilson Heritage Trust Ordinance (Cap. 425)**

9.3.3.1 Other legislation that supplements the work of heritage preservation in the HKSAR includes the Lord Wilson Heritage Trust Ordinance that came into operation in 1992.

9.3.3.2 The Trust aims to preserve and conserve the human heritage of Hong Kong through a variety of means, including *inter alia* the:

- Identification, restoration and refurbishment of relics, antiquities and monuments and of other historical, archaeological and palaeontological objects, sites or structures in Hong Kong; and
- Provision of facilities at antiquities and monuments and at historical and archaeological sites or structures in order to assist public access to and appreciation of such sites or structures.

9.3.3.3 A key feature of the Trust is its commitment to conservation of the HKSAR's cultural heritage through the aural, visual and written recording of sites, through the publication of books, papers and periodicals, and through exhibitions.

## **9.4 Assessment Approach**

9.4.1.1 One of the general objectives under Clause 2.1(vii) of the ESB is, "to identify the negative impacts on any historical and archaeological resources and to propose measures to mitigate these impacts".

9.4.1.2 Clause 3.2(vi) of the ESB also states that among the key issues are, "the potential impacts on the marine archaeological deposit in the seabed of the project area and

the alignment of connection route likely to be affected by the dredging and construction works”.

- 9.4.1.3 Besides these general requirements, the specific requirements for conducting the Cultural Heritage Impact Assessment are introduced under Clause 3.4.6 of the ESB and in Appendix C to the Brief.

## 9.5 Baseline Conditions

### 9.5.1 Desktop Review

- 9.5.1.1 A review has been conducted to identify the potential for archaeological resources and, if identified, likely character, extent, quality and value. This includes:

- Historical land use and settlement data as well as archive records such as seabed survey data collected from previous geological research.
- Marine Department, Hydrographic Office - the Department holds a substantial archive of hydrographic data and charts; and
- Royal Naval Hydrographic Department in the UK.

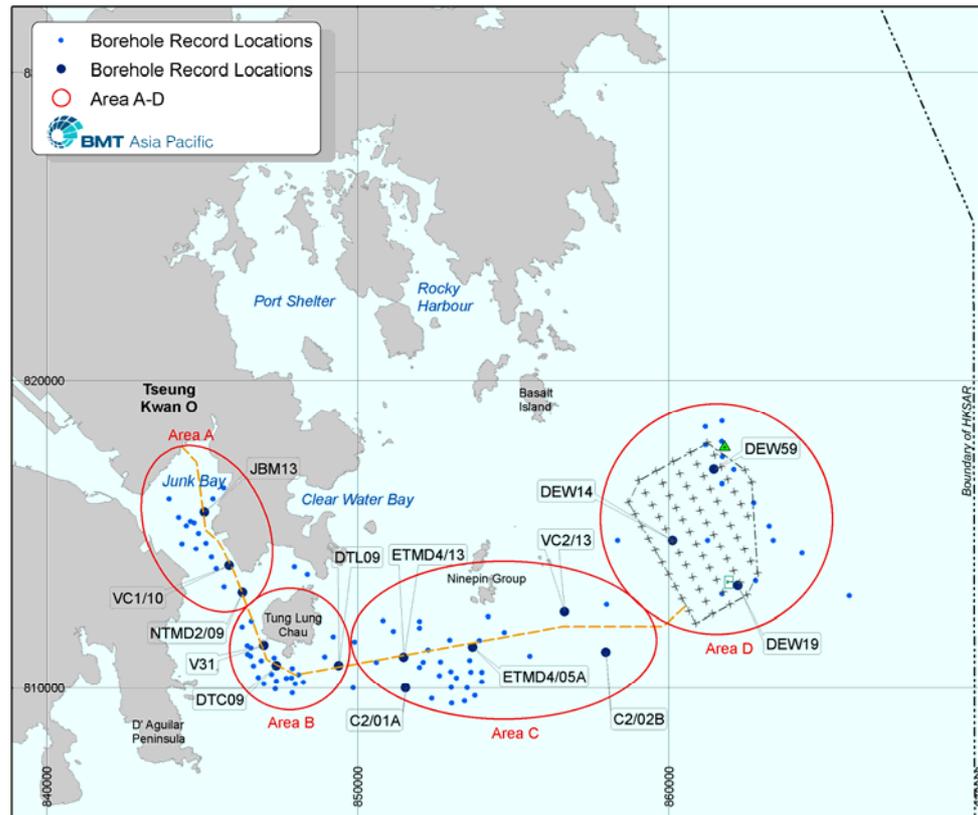
### 9.5.2 Review of Geology & Marine Sediment Records

- 9.5.2.1 Data and information on the geology and marine sediment in the assessment area is available from a variety of sources, including:

- Borehole records,
- Vibrocore records; and
- Geological publications.

- 9.5.2.2 The seabed in Eastern Waters is generally flat and homogenous, comprising quaternary sediments of the Chek Lap Kok Formation overlain by more recent and widespread sediment of the Hang Hau Formation. The Hang Hau Formation is generally characterised by soft to very soft and silty mud with shell fragments, and subsidiary clay and minor sand components (Strange *et al*, 1990b).

- 9.5.2.3 [Figure 9.1](#) represents borehole records in the Study Area, which for reporting purposes has been divided into Area A, B, C or D, while [Table 9.1](#) displays the sediment thickness at the locations referred for each of the four areas.

**Figure 9.1 Borehole Record Locations****Area A**

9.5.2.4 Area A covers an area between central Junk Bay and the northern section of the Tathong Channel. Geological records for the area indicate sediment thickness in this area to be at least 12 metres (VC1/10) and in some locations deeper than 35 metres (NTMD2/9).

9.5.2.5 The sediment character immediately west of Tit Cham Chau (JBM13) comprises sandy silt, becoming increasingly sandy further south where a medium to coarse sand layer is present (VC1/10).

**Area B**

9.5.2.6 Area B covers the sediments around Tung Lung Chau, where records indicate deep sediment. Immediately west of the island some 18 metres of sediment was retrieved (V31); whilst sediment thickness to the south of Tung Lung Chau is recorded at greater than 32 metres from each of two records along the proposed cable route (DTC9 and DTL9).

**Area C**

9.5.2.7 This area covers an array of records in offshore waters south of the Ninepin Island group. The sediment is generally very deep in this area, with two records (C2/1A and C2/2B) recording sediment depths of around 70 metres to the south of the proposed cable route. Record C2/1A retrieved medium sand material at the

bottom of the core, while C2/2B retrieved 'rock' at the end of the core.

- 9.5.2.8 Along the proposed cable route, two records (VC2/13 and ETMD4/13) report clay at the end of their cores at depths around 25 metres, while ETMD4/5A records slightly deeper conditions, with gravel reportedly encountered at a depth of around 27 metres.

### Area D

- 9.5.2.9 Area D covers the proposed Project area. Strange *et al* (1990b) describes the Hang Hau Formation thicken to be around 30 metres deep in the vicinity, while the area was classified as 'muddy' by the Hong Kong Geological Survey. Similarly, clayey sediment was recorded at depths > 30 metres at DEW19 south of the proposed Wind Farm, and records from DEW14 were generally consistent with this except that coarse sand was recorded at the end of the core. However, there are also exceptions, as indicated by record DEW59 which suggests a relatively shallow rock head at depths ~20 m below the seabed.

**Table 9.1 Description of Selected Boreholes**

Area ref.	Borehole / Vibrocore ID	Core depth, m (from seabed)	Sediment Depth, m	Character of core bottom material
A	JBM13	20.0	> 20.0	Medium sand
	VC1/10	12.0	>12.0	Clay
	NTMD2/9	35.0	>35.0	Silt
B	V31	18.0	>18.0	Silt
	DTC9	32.8	>32.8	Clay
	DTL9	33.3	>33.3	Clay
C	C2/1A	70.0	>70.0	Sand
	C2/2B	75.0	74.0	Sand underlain by CDG*
	ETMD4/5A	27.2	>27.2	Gravel
	ETMD4/13	25.0	>25.0	Clay
	VC2/13	25.0	>25.0	Clay
D	DEW14	33.7	>33.7	Coarse sand
	DEW19	31.2	>31.2	Clay
	DEW59	20.0	20.0	Sand on top of rock (at 20.0m)

**Note:** \*CDG = Completely Decomposed Granite

- 9.5.2.10 Based on the above, the marine sediment in Eastern Waters predominately comprises dark mud, with a high content of silt and clay. As such, the sediment is

largely anoxic and rich in organic material, and therefore would in general be suitable for the preservation of organic artefacts such as wood.

### 9.5.3 Review of Historical Archives

#### *General Eastern Waters*

- 9.5.3.1 HKSAR waters cover approximately 1,800km<sup>2</sup>, and approximately 230 islands. Owing to its location at the eastern mouth of Pearl River Delta, Hong Kong has performed a valuable role guarding the passage of boats to Guangdong province and around the south China coast. This significant maritime heritage continues to the present day as one of the World's busiest ports.
- 9.5.3.2 The number of historic ports and guard stations around the Hong Kong coastline attests to the historical prevalence of piracy. This combined with tropical storms / typhoons and the presence of numerous islands provided a constant threat to maritime activity.
- 9.5.3.3 Eastern Waters was referred to as an important shipping corridor from the time of the Song Dynasty (AD 960 -1279). During the Qing Dynasty (AD 1644 – 1911) vessels passing through the Tathong Channel reportedly stopped at a customs post near Fat Tong Chau, before proceeding west to the Pearl River Delta (1990a).
- 9.5.3.4 Of relevance to the Project, Junk Bay not only attracted merchant ships and boats for safe anchorage, it also captivated pirate leader's Cheng Li-cheung attention to set up a base for his force which was up to 600 ships in the early 17<sup>th</sup> Century (*ibid*).

#### *High Island Reservoir*

- 9.5.3.5 High Island Reservoir is one of only two known maritime archaeological sites in the HKSAR, with the other being identified in Penny's Bay, Lantau Island. The interest in the High Island Reservoir site followed the excavation of a wooden junk in 1973 during reservoir construction. Although the junk was not intact, it had been sufficiently well preserved by marine sediments for local experts to estimate that it would have been up to 20 – 25 metres long and 5 metres wide.
- 9.5.3.6 Following the discovery, a 4-day rescue excavation had been conducted. Various finds including pottery and porcelain, wooden planks and small metal objects had been discovered. The wide variety of pottery types present at the excavation prevented accurate dating of the wreck. The preservation of inorganic and organic materials was reportedly excellent.

#### *Tung Lung Fort*

- 9.5.3.7 Tung Lung Fort is located at the northeast of Tung Lung Island. The Fort was constructed by order of Yang Lin, then Viceroy of Guangdong and Guangxi from 1719 – 1724 during the Qing dynasty in order to defend the area against foreign colonialists and piracy. Tung Lung Fort is a Declared Monument in Hong Kong.

#### *Fat Tau Chau Old Chinese Custom Station*

9.5.3.8 Fat Tau Chau Old Chinese Customs Station, located on northern Junk Island, was discovered in 1962. This Custom Station and two other two stations located elsewhere in Hong Kong were constructed in 1868 to collect 'likin' on opium trade. The Custom Station ceased operation in 1899 when the New Territories was leased to Great Britain. Fat Tau Chau Old Chinese Custom Station is a Declared Monument in Hong Kong.

#### **Rock Carving Sites**

9.5.3.9 Two rock-carving sites are found along Tathong Channel south of Junk Bay. One is located on Tung Lung Island, and the other is on the coast of Big Wave Bay. They are both Declared Monuments in Hong Kong.

9.5.3.10 Tung Lung Island Rock Carving is the largest *in situ* rock carving found in Hong Kong, measuring 1.8m by 2.4m. The exact age of this carving is unknown but was mentioned in the 1819 Xinan Gazetteer stating that "*the impression depicts the image of a dragon*".

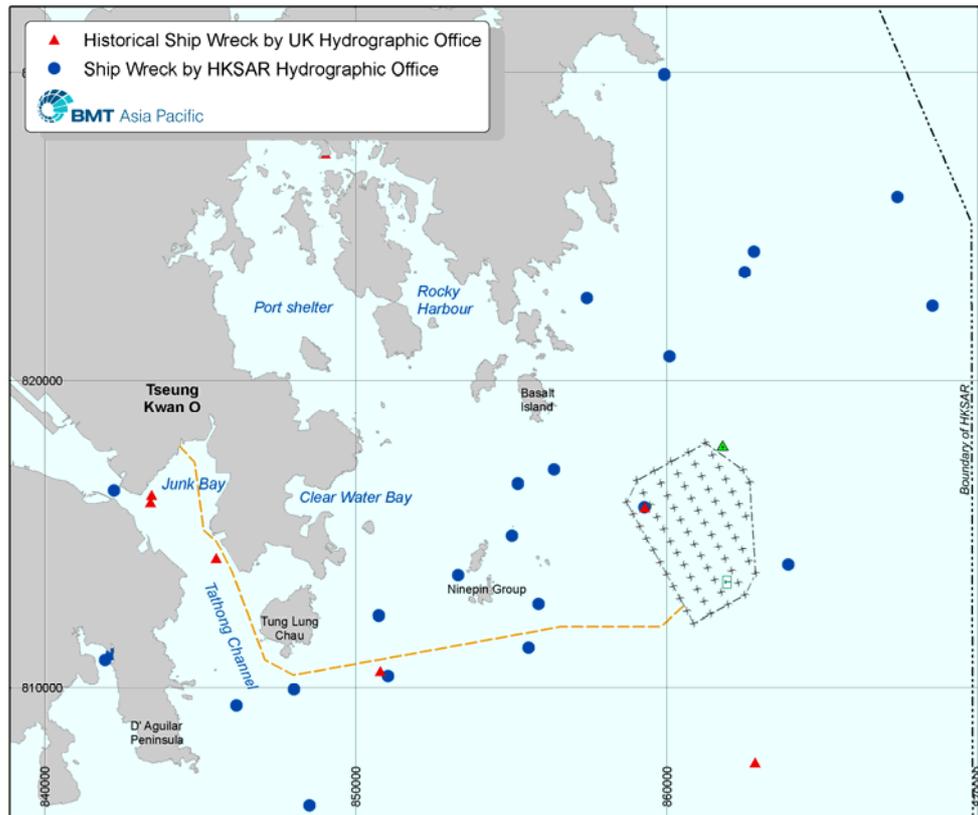
9.5.3.11 Big Wave Bay Rock Carving is believed to have been created by early inhabitants that depended on the sea for their livelihood. The exact age of this monument is still not clear.

#### **9.5.4 Review of Marine Charts**

9.5.4.1 In the historical context of vibrant maritime activity throughout Hong Kong, a review of marine charts has been conducted. [Figure 9.2](#) displays the locations of charted wrecks in the assessment area.

9.5.4.2 Most displayed wrecks (14 in total) are from the 2006 version of the HKSAR Marine Department's *Electronic Navigational Chart* (ENC). These 14 wrecks have been charted based on a combination of historical information, recent shipwreck reports and seabed surveys mostly conducted between 2000 and 2005 by the Hydrographic Office of the Marine Department. As such, the wrecks displayed are only those charted on the seabed (i.e., not entirely buried) and there are no publicly available records of these wrecks for inspection.

9.5.4.3 Only one of the 14 wrecks from the ENC lies within the Wind Farm boundary, while other wrecks were identified early on as constraints to be avoided when planning the alignment of the transmission cable route.

**Figure 9.2** Locations of Shipwrecks in the Assessment Area

**Source:** HKSAR Hydrographic Office and United Kingdom Hydrographic Office.

9.5.4.4

Figure 9.2 also presents a further four records not on the latest ENC, and hence not considered by the HKSAR Hydrographic Office to be of marine navigation concern as well as of wreck potential. These are the records of the UK Hydrographic Office that held information on Hong Kong waters up to the 1997 hand-over. The four objects include two rows of small boats and scattered wreckage at the west of Junk Bay; an unidentified object some 1 metre above an otherwise flat seabed off (what was previously) Fat Tong Chau, and a potential wreck to the southeast of Tung Lung Island.

9.5.4.5

A fifth object from the UK records coincided with the position of a shipwreck inside the Wind Farm footprint from the Marine Department ENC. The UK records describe this as a shipwreck resting some 9 metres above the seabed.

## 9.5.5

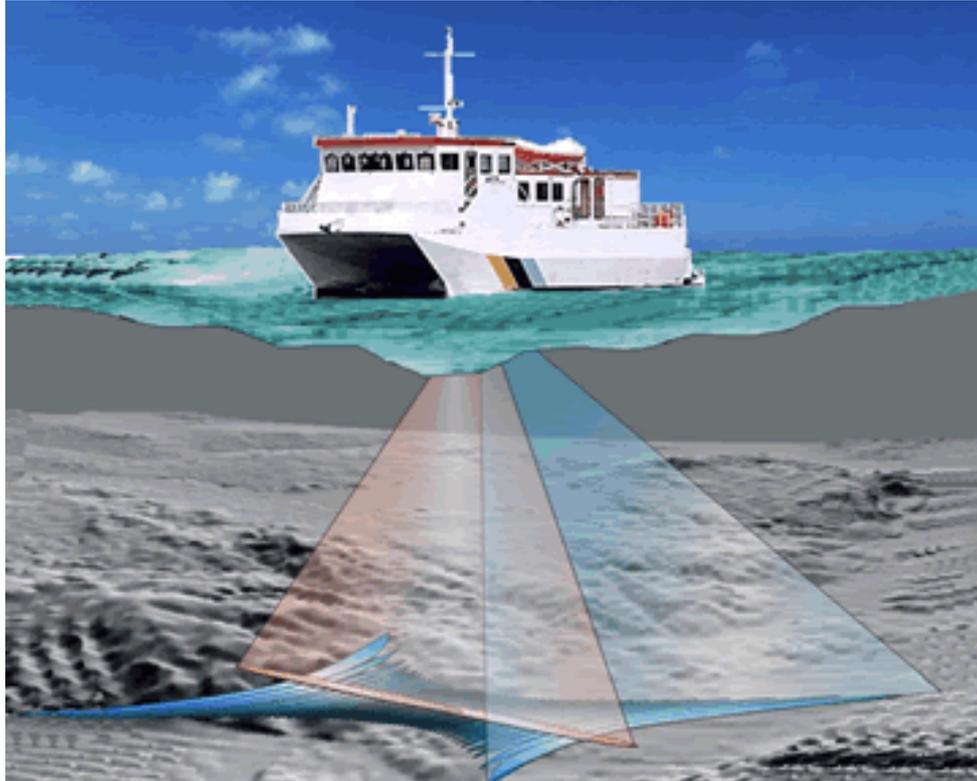
### Geophysical Survey

9.5.5.1

In accordance with marine archaeological investigation (MAI) guidelines, a marine geophysical survey was conducted in August 2006 with the aims of:

- Providing exact definition of objects of greatest archaeological potential;
- Assessing the depth and nature of the seabed sediments to define which areas consist of suitable material to bury and preserve archaeological material; and



**Figure 9.4 Marine Geophysical Survey Arrangement**

**Source:** Marine Department, HKSAR Government (2006)

9.5.5.5 Side-scan sonar has two primary functions as a tool for marine archaeological survey:

- Detection of shipwreck on or just below the seabed; and
- Detection of smaller features, including sand-waves / sandbars that may indicate buried material with archaeological potential.

9.5.5.6 The geophysical data acquisition was conducted by specialist contractor working to survey specifications prepared by a qualified geophysicist. The project geophysicist also supervised data collection, and was jointly responsible for geophysical data interpretation to discriminate objects with archaeological potential and areas of seabed where conditions for archaeological preservation would be favourable.

#### ***Data Acquisition & Quality***

9.5.5.7 The survey commenced on August 8, 2006. Thereafter, survey continuity was interrupted by difficult weather conditions on three occasions due to the close passage of tropical depressions. A small extension to the survey area was requested on August 24, and the survey was completed on August 31, 2006.

9.5.5.8 Data quality was monitored continuously. Some minor 'streaking' of records was observed as a result of swell induced movement on the tow fish and due to seabed turbulence from crossing vessels introducing unavoidable back-scatter 'noise' in

the water column in a few places. Overall, the data quality was observed to be satisfactory throughout the survey.

### **Data Evaluation**

- 9.5.5.9 The side scan sonar data were initially screened by the geophysical contractor before further analysis and verification by the project geophysicist to focus upon those features of potential archaeological relevance. A marine archaeologist was subsequently engaged to conduct an independent review of the marine archaeological potential based on the geophysical survey data.

## **9.6 Assessment Methodology**

### **9.6.1 Establishing Archaeological Potential**

- 9.6.1.1 Analysis of the data and information obtained through the desktop review and the geophysical survey is able to provide an indication of the likely character and extent of known and potential archaeological resources within the Study Area.
- 9.6.1.2 Side scan sonar records have been examined for individual items that meet the following criteria:
- Seabed materials imply quiescent conditions and the potential for burying items without disturbance. Those conditions would be met by low energy sediments such as clayey mud, silts and fine sands that would appear on the images as pale, low reflection (back-scatter) environments.
  - Individual items appear to be partly or largely buried and generally without sharp geometric or angular definition, implying that they have been in place for a moderately long period and are not recent debris.
- 9.6.1.3 Insufficient information on the detailed design is available at this time, and as such it has been agreed with AMO that additional geophysical surveys shall be conducted after completion of the EIA Study but in advance of any marine works. Additional geophysical survey requirements to meet the dual objectives of advancing the engineering design and satisfying AMO's expectations on marine archaeology are thus included in [sub-section 9.12](#).
- 9.6.1.4 The definition for object value for the Project has been adopted from the Cultural Heritage Impact Assessment for the Duddon Sands Offshore Windfarm project:
- **Very high:** A recorded archaeological item with unique archaeological value / a target of very high potential to contribute to knowledge and understanding and/or outreach;
  - **High:** A recorded archaeological item with above average archaeological value / a target of high potential to contribute to knowledge and understanding and / or outreach;

- **Moderate:** A recorded archaeological item with average archaeological value / a target of moderate potential to contribute to knowledge and understanding and / or outreach;
- **Low:** A recorded archaeological item with below average archaeological value / a target of low potential to contribute to knowledge and understanding and / or outreach; and
- **Negligible:** An item with no archaeological value / a target with no potential to contribute to knowledge and understanding and / or outreach.

**9.6.2 Assessment & Evaluation of Potential Impacts**

9.6.2.1 The potential impact magnitude is a function of the scale, nature and location (i.e., disturbance magnitude) of the proposed marine works against the known or potential value of the archaeological target.

9.6.2.2 With reference to the Duddon Sands wind farm study, evaluation of the disturbance magnitude was determined as follows:

- **Very high:** Complete destruction of an object;
- **High:** Fundamental change of an object;
- **Moderate:** Appreciable change of an object;
- **Low:** small change of an object; and
- **Negligible:** No real change.

9.6.2.3 Accordingly, **Table 9.2** presents the criteria for gauging impact significance.

**Table 9.2 Matrix of Impact Significance**

		Value of Target				
		Very high	High	Moderate	Low	Negligible
Disturbance Magnitude of the Works *	Very high	Very significant	Very significant	Significant	Moderate	Minor
	High	Very significant	Significant	Significant	Moderate	Minor
	Moderate	Significant	Significant	Moderate	Moderate	Minor
	Low	Moderate	Moderate	Moderate	Minor	Not significant
	Negligible	Minor	Minor	Minor	Not significant	Not significant

Note: \* Disturbance magnitude is a function of works nature and scale, and proximity to a given target.

### 9.6.3

#### Visual Diver Survey

9.6.3.1

The requirement to conduct visual diver survey will be triggered by the following criteria, they are:

- Unavoidable and significant adverse impact posed upon an identified surficial target; and
- The importance of this identified surficial target cannot be determined using geophysical surveys.

9.6.3.2

A number of techniques are available for marine archaeological dive survey, including towed survey adopting either a towline or an underwater vehicle, a swim-line survey conducted by a team of divers, or elaboration of this method for corridor and grid survey. A circular survey is tentatively recommended for this study due to its applicability in underwater conditions with poor visibility. Once the targets have been identified and their marine archaeological potential has been verified by a diving marine archaeologist, a sampling strategy can be devised as appropriate.

9.6.3.3

As referred above, the detailed Wind Farm layout will not be finalised until after completion of the EIA study due to rapidly changing turbine technologies that affect foundation type, and so the visual diver survey shall be undertaken during the detailed design stage of the Project. This is consistent with the approach adopted for the *EIA Study for Further Development of Tseung Kwan O Feasibility Study* that was approved without conditions.

### 9.6.4

#### Mitigation

9.6.4.1

Mitigation measures to avoid, reduce or ameliorate potential impacts on targets of archaeological potential will be determined on a site-by-site basis, but priority shall be given to avoidance.

## 9.7

### Evaluation of Baseline Marine Archaeological Potential

#### 9.7.1

##### Seabed Conditions

###### *Wind Farm Area*

9.7.1.1

Marine geophysical survey within the area has determined that seabed throughout the site is uniform and largely undisturbed. Despite the presence of trawling activity in the area, the paucity of trawl marks suggests that the sea floor surface may be periodically dynamic and that impressed features may be covered or dissipated relatively rapidly.

9.7.1.2

The texture of the seabed is consistent with fine silty sand, and as such the conditions for burial and subsequent preservation of archaeological artefacts would appear to be favourable.

###### *Cable Route*

9.7.1.3 The seabed of much of the cable route corridor comprises coarser material, including potential rock outcrops and potentially dumped material, and is considered less likely to provide conditions suitable for the preservation and burial of artefacts. Hence, large parts of the proposed cable route corridor are expected to have minimal or no archaeological potential.

9.7.1.4 Similarly, those areas north of Fat Tong Chau where fine sediments were evident are also subject to drag and trawl marks. Hence, any superficial buried artefacts in this area would likely have been disrupted.

## 9.7.2 Marine Archaeological Potential

### *Overview*

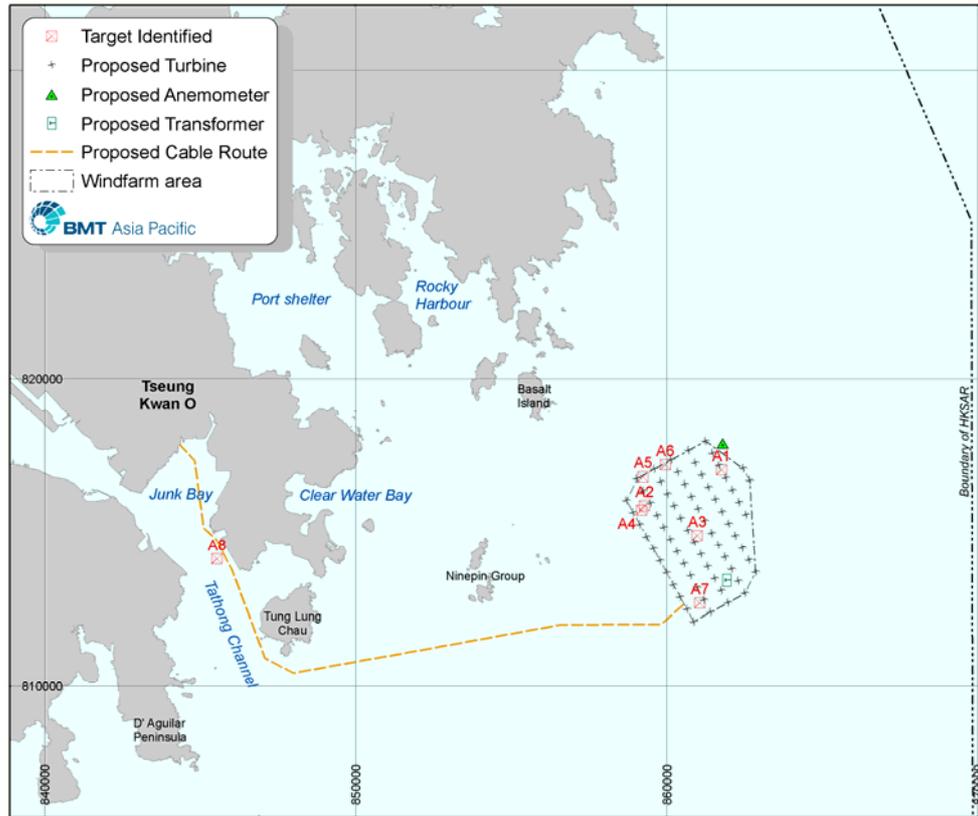
9.7.2.1 The desktop review and marine geophysical survey have been directed primarily toward recognition of local seabed disturbances that could be associated with partly or largely buried wrecks and cargoes. Such features may be better preserved and recognisable within the finer sediments, but are less likely to be preserved in areas of coarser materials or outcropping rock. Hence the sea floor conditions recorded by side-scan sonar survey would appear to largely confine any marine archaeological potential to the Wind Farm site itself.

9.7.2.2 Side-scan sonar records have been examined by project geophysicist and by a marine archaeologist for individual items that meet the relevant criteria set out in [Section 9.6.1](#).

9.7.2.3 Following the analysis of the collected geophysical survey data by the experts, eight targets with marine archaeological potential were identified: seven within the Wind Farm area and one along the cable route in the Tathong Channel.

9.7.2.4 [Figure 9.5](#) displays the locations of the targets. Detailed images of each of the eight targets and the adjacent seabed are presented in the [Appendix 9A](#).

**Figure 9.5 Location of Targets with Marine Archaeological Potential**



**Wind Farm Area**

9.7.2.5

Table 9.3 summarises the location and attributes of the seven discrete targets in the Wind Farm area. Five of the targets (A1 - A5) each have a sharp outline as a result of no or limited burial, while a further two targets that are relatively poorly defined were also identified as being of potential interest.

9.7.2.6

Appendix 9A presents further details of the definition of each of the targets.

**Table 9.3 Targets with Archaeological Potential in the Wind Farm Area**

Target	East	North	Type	Size (m)
A1	861767	817021	Potential wreck	4 x 16
A2	859299	815872	Potential wreck	6 x 46
A3	860994	814898	Unknown (potential anchor)	1 x 4
A4	859200	815735	Unknown (potential wreck related)	5 X 9
A5	859250	816803	Potential wreck	11 x 36
A6	859969	817189	Unknown (potential wreck related)	4 x 7
A7	861076	812689	Unknown (potential wreck related)	7 x 10

**9.7.3****Target A1**

- 9.7.3.1 This target is located approximately 1 km south of the proposed wind monitoring mast. The definition of Target A1 is weak and can only be recognised because of the uniform seabed conditions.
- 9.7.3.2 The target appears to be linear and largely buried or only slightly prominent, and its observed dimensions are approximately 16 metres by 4 metres. While the identity cannot be confirmed from side-scan data interpretation alone, the possibility of a wreck cannot be discounted.

**9.7.4****Target A2**

- 9.7.4.1 This target is located near the western apex of the wind farm site. The marine geophysical survey results indicate that the target is approximately 46 metres long and 6 metres wide, and as its location coincides with a record of a shipwreck (Figure 9.2 refers), it may well be the side of a ship hull. If the target is the same wreck, its sharp definition would suggest it is of fairly recent origin and not of any particular heritage value.
- 9.7.4.2 The geophysical survey also suggests that the target is only slightly prominent on the seabed and may include an associated depression, although this finding is notably different than the account of the UK Hydrographic Office which suggested a far more prominent target, some 9 metres above the seabed.
- 9.7.4.3 As such, an initial dive survey was conducted at the area by BMT in September 2006, primarily to explore its ecological potential, that is, if the target is a shipwreck then there may be potential for it to physically support coral growth. Ultimately no wreck was observed, thus suggesting it is not elevated to 9 metres above the seabed, but is hidden within highly fluidised marine mud that was encountered during the dive.
- 9.7.4.4 The likely hypothesis remains that this wreck is of modern origin, but in the absence of evidence at this time the target has been retained for further investigation.

**9.7.5****Target A3**

- 9.7.5.1 The figure of Target A3 in the Annex displays it as being located in the centre of the Wind Farm. It is of small size, being approximately 4m by 1m, and lies adjacent to or at the end of a drag mark.
- 9.7.5.2 If directly associated with the drag mark then it is likely of modern origin, and is quite possibly an anchor. For this reason, this target has been assigned a low level of potential marine archaeological value, but has been retained subject to further investigation.

**9.7.6****Target A4**

- 9.7.6.1 As the seabed is largely flat and homogenous, this provides a valuable backdrop to

support the identification of contrasting anomalies. From a review of the side-scan sonar data, it was possible to identify only a few such anomalies, and by taking a precautionary approach Target A4 was identified. This target is relatively small but notably angular, with dimensions of approximately 5 x 9m, and may potentially be related in some way to a wreck but has been redistributed by trawling activity.

### 9.7.7

#### Target A5

9.7.7.1

This target is located approximately 38 m south of the northwest boundary of the Wind Farm site. The marine geophysical survey results indicate that the target is approximately 36 metres long and 11 metres wide. Its size and its definition suggest it a shipwreck, although with no historical records to confirm this it may be of contemporary origin. Target A5 has been retained as a precaution.

### 9.7.8

#### Target A6

9.7.8.1

Similar to Target A4, it was possible to identify an anomaly with dimensions of approximately 4 x 7m that may also potentially be related in some way to a wreck element that has been redistributed by trawling activity. Target A6 is poorly defined, and has been retained as a precaution.

### 9.7.9

#### Target A7

9.7.9.1

Similar to Target A4 and A6, one further anomaly, this time with dimensions of approximately 7 x 10m was identified from data analysis. Target A7 may also be wreck-related, that has potentially been redistributed by trawling activity, and has therefore also been retained as a precaution.

#### *Cable Route*

9.7.9.2

The seabed condition along most of the cable route corridor does not meet the required criteria for the burial and preservation of artefacts. However, Target A8 has been selected for its unusual appearance and possible partial burial. [Table 9.4](#) summarises the Target.

**Table 9.4 Targets with Archaeological Potential along the Cable Route**

Target	East	North	Type	Size (m)
A8	845551	814126	Unknown	1m (with 6m separation)

9.7.9.3

Target A8 is located in an area of sand to the south of Fat Tong Chau where extensive trawl / drag marks were visible (Appendix 9A refers). Target A8 consists of two prongs each rising approximately 1 metre above the sea floor and separated by a distance of approximately 6 metres.

9.7.9.4

The proximity and similarity of the prongs suggests that they may be part of a single partly buried target. While the identity and hence significance of Target A8 is unknown, it is noted that it is located some 90m northwest of a possible wreck as displayed on the Hong Kong marine charts generated by the UK Hydrographic

Office (Figure 9.2 refers). While the possibility of there being a wreck was subsequently discounted by the HKSAR Hydrographic Office, some potential remains that Target A8 represents wreck-related deposits redistributed by trawling activity.

### 9.7.10 Evaluation of Importance of Identified Targets

9.7.10.1 On account of the absence of supporting documents that could indicate the history of these targets, it is not possible to signify their archaeological importance with any certainty. Amongst all targets, Targets A2, A3 and A5 are believed to be of modern origins due to their characteristic features captured by the side scan sonar whilst the rest of the objects remain unknown. As such, Targets A2, A3 and A5 are classified as of low value.

9.7.10.2 Considering the maritime history of Eastern Waters and that the potential of archaeological significance cannot be dismissed, it has been determined that the eight exposed or partly exposed targets on the seabed pose marine archaeological potential. Additionally, the potential remains for the presence of entirely buried and/or masked targets with marine archaeological potential within the assessment area.

9.7.10.3 Taking a precautionary approach, all targets except Targets A2, A3 and A5 with archaeological potential are therefore considered to be of high / very high value.

## 9.8 Construction Phase Impact Assessment

9.8.1.1 As referred in sub-section 9.6.2, different project construction activities may affect targets to a varying extent depending on their scale, nature and location. The following sources that may pose potential impacts to these targets include:

- Foundation construction for turbines and offshore transformer station.
- Transmission and array cable laying works.
- Vessel anchoring / stabilisation.

9.8.1.2 Potential impacts associated with the construction activities are primarily direct impacts.

9.8.1.3 The impact potential decreases with increasing distance between targets of archaeological potential and sources of impacts. Figure 9.5 presents the overlay of the location of the eight targets and the tentative project layout.

9.8.1.4 Table 9.5 presents the approximate distance separation of each target to the closest permanent works area.

**Table 9.5 Distance Separation of Targets from Works Areas**

Target	Size (m)	Approx. Distance from Works (m)	Nature and Scale of Works
A1	4 x 16	0 / 160	Array cable jetting / Turbine foundation
A2	6 x 46	190	
A3	1 x 4	230	
A4	5 X 9	280	
A5	11 x 36	210	Turbine foundation
A6	4 x 7	230	
A7	7 x 10	160	
A8	2@ 1m ea. (with 6m separation)	130	Transmission cable jetting

## 9.8.1.5

Disturbance magnitude is taken a function of works nature and scale, and proximity of works to a given target. With reference to Table 9.5 the closest targets to works locations are:

- Target A1 – positioned directly on the array cable route on the preferred North-South array cable alignment, or 160m from the nearest turbine.
- Target A8 - approximately 130m from the transmission cable route.

## 9.8.1.6

For Target A1, a potential wreck with dimension 4m x 16m, direct impact from array cable jetting is anticipated. The Jetting operation involves fluidising sediments whilst cables are being laid and buried into the desired sediment depth using a remotely operated vehicle (ROV). The anticipated direct impact is potential damage to this target from high-pressured water jetting. Thus, the impact is considered to be potentially very significant and mitigation is proposed in [sub-section 9.10](#).

## 9.8.1.7

Target A8 is located within an active trawling zone about 130m from the transmission cable jetting. Based on the distance separation as indicated by the current layout arrangement, no significant direct or indirect impacts are anticipated.

## 9.9 Operation Phase Impact Assessment

9.9.1.1 The key potential impact associated with Project operation is anchor damage upon exposed artefacts or targets of potential archaeological interest. Accordingly, a buffer zone shall be implemented to ensure adequate separation between permanent structures and targets of archaeological potential. Section 9.10 refers.

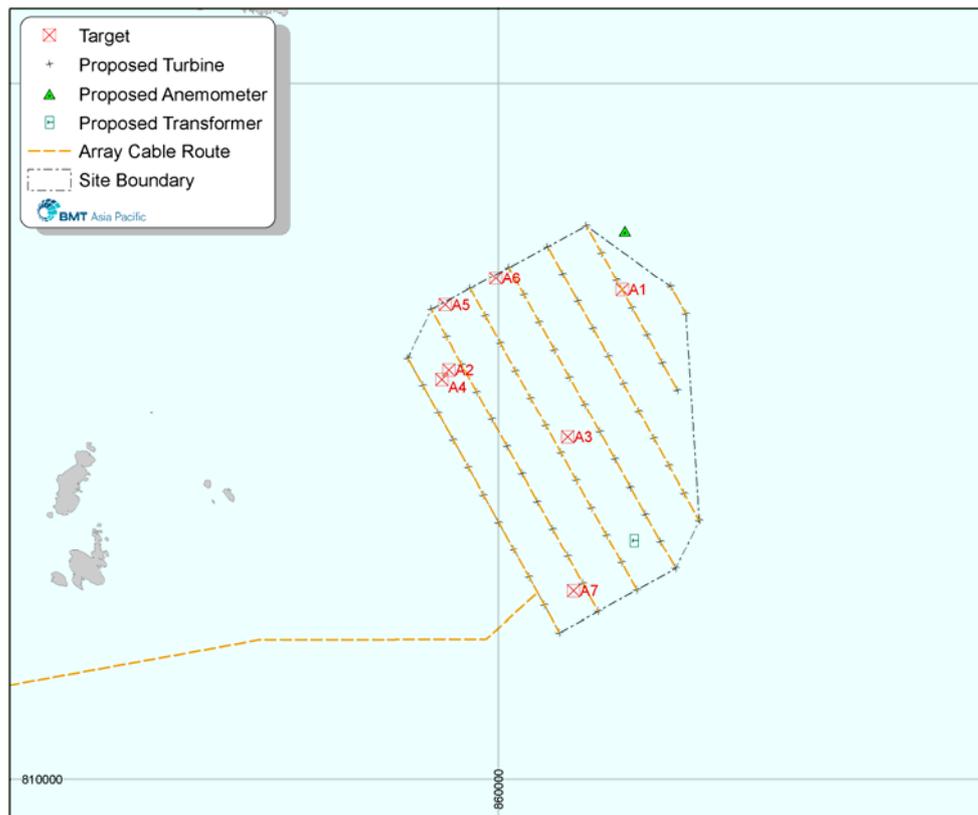
9.9.1.2 The ultimate value of targets will be subject to the findings of the additional penetrative survey but at the EIA stage, all targets are conservatively assumed to be of high / very high marine archaeological value. With reference to Table 9.2, the disturbance magnitude of works is considered as negligible, and therefore only minor impacts are anticipated during Project operation.

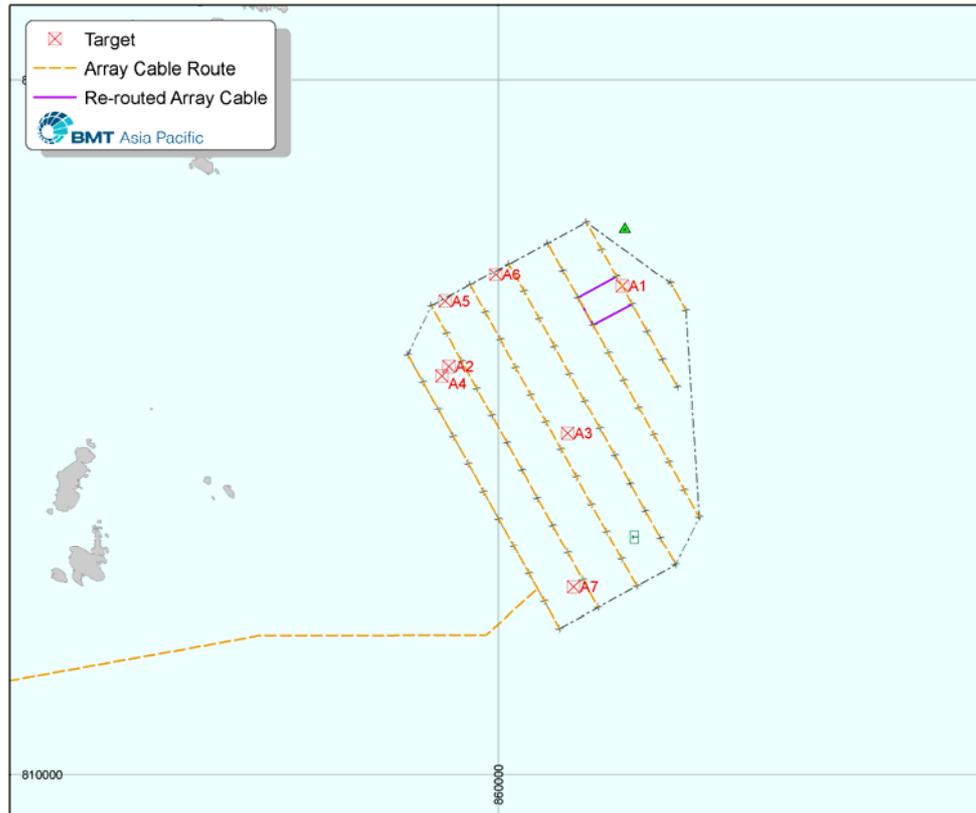
## 9.10 Impact Mitigation and Best Practice Measures

### 9.10.1 Mitigation of Potential Impacts on Target A1

9.10.1.1 Based on the current tentative array cable alignment (Figure 9.6 refers), Target A1 may be exposed to an adverse impact during jetting. Accordingly, it is proposed to re-route the array cable alignment to eliminate the potential impact. Figure 9.7 displays the amended array cable alignment in the vicinity of Target A1.

**Figure 9.6 Tentative Turbine Locations and Array Cable Alignment**



**Figure 9.7 Re-routed Array Cable near Target A1**

9.10.1.2 Since additional penetrative investigation will be conducted during the detailed design studies stage, in case other buried / masked objects are identified where construction is scheduled, avoidance shall be adopted as the primary mitigation approach as far as practicable.

9.10.1.3 Provided that the recommended mitigation measures are fully implemented, the distance between all targets and works areas shall exceed the 150m buffer zones and thus potential impact potential is considered to be minor.

### 9.10.2 Best Practice Impact Avoidance Measures for all Targets

9.10.2.1 With the exception of Target A1 located on the proposed array cable route, the construction and operational phase impact assessments have indicated that no adverse impacts are anticipated, i.e., impact significance varies from 'minor' to 'insignificant'.

9.10.2.2 As the development intention is to maintain the disturbance magnitude at the minimum level practicable, a 150m-diameter buffer zone shall be implemented around each identified target as a best practice measure to ensure potential impacts can be avoided. Within these buffer zones there shall be no permanent works or temporary anchoring of construction or maintenance vessels.

9.10.2.3 The buffer separation shall be implemented with the use of on-board GIS systems for marine vessel manoeuvring.

## 9.11 Residual Impacts

- 9.11.1.1 With implementation of the referred mitigation measures, no adverse residual impacts are anticipated during Project construction or operation.

## 9.12 Environmental Monitoring & Audit

- 9.12.1.1 It is the full intention that the Project gives priority to impact avoidance through the sensitive location of turbines and cables, rather than impact mitigation. To ensure the Project development does not result in any unforeseen impacts on objects of marine archaeological potential, further marine geophysical comprising seismic and magnetic surveys shall be conducted across the Study Area as the detailed engineering design advances, and before any marine construction works commence.
- 9.12.1.2 Such further marine geophysical surveys shall be conducted to an appropriate specification prepared by a qualified geophysicist and to the satisfaction of a qualified marine archaeologist. Upon completion of the surveys, a Report shall be prepared by the qualified marine archaeologist for submission to AMO to include inter alia, the findings of the further marine geophysical survey and a discussion on the need for dive surveys.
- 9.12.1.3 Should any additional targets of archaeological significance be identified during these surveys, potential adverse impacts shall be mitigated via a strategy of avoidance.
- 9.12.1.4 It is also proposed the 150m buffer separation be implemented with the use of on-board GPS systems for marine vessel positioning. The contractor shall be required to maintain such records during construction for those works in the vicinity of the targets.
- 9.12.1.5 In addition to the mitigation measures stated in the EIA documents, the further marine geophysical survey report shall recommend appropriate mitigation measures to address adverse impact, if any. All the mitigation measures should be implemented and monitored before the commencement of construction works.

## 9.13 Conclusion & Recommendations

- 9.13.1.1 A marine archaeological impact assessment has been conducted in accordance with Clause 3.4.6 of the EIA Study Brief and Appendix C to the Brief.
- 9.13.1.2 Following desktop study and marine geophysical survey, a total of eight partially buried targets with marine archaeological potential have been identified. An experienced geophysicist and a marine archaeologist were engaged to interpret the survey findings.
- 9.13.1.3 The location and dimensions of Target A2 is consistent with a wreck as found on marine charts developed by the hydrographic offices of the Hong Kong SAR and

the United Kingdom. None of the remaining seven targets exactly coincided with those detailed on the HKSAR marine charts.

- 9.13.1.4 It was concluded that Target A2 and also Target A3 and Target A5 are likely to be of modern origin, and hence of low marine archaeological potential. The nature and archaeological potential of Targets A1, A4, A6, A7 and A8 are unknown at this time and as a precautionary measure at this planning stage it has been concluded they are of high marine archaeological potential.
- 9.13.1.5 It has been identified that Target A1 may potentially be impacted by array cable installation, and mitigation measures have been proposed accordingly. A buffer separation zone to avoid direct impacts on all targets during construction and operation has also been proposed as a best practice.
- 9.13.1.6 Further marine geophysical investigations adopting seismic and magnetic surveys shall be conducted in parallel with the detailed marine engineering design prior to any site works. This further survey shall provide further information as to the nature and the marine archaeological potential of all eight identified targets, and shall also generate information on the nature and marine archaeological potential of any entirely buried and / or masked targets that side scan sonar alone is unable to detect.
- 9.13.1.7 Upon completion of the surveys, a Report shall be prepared by the qualified marine archaeologist for submission to AMO to include inter alia, the findings of the further marine geophysical survey and a discussion on the need for dive surveys.
- 9.13.1.8 Overall, the planning approach has been a precautionary one of impact avoidance by sensitively locating turbines and marine cables, rather than impact minimisation. With this approach, no adverse impacts on cultural heritage / marine archaeology are anticipated.

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