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12 CULTURAL HERITAGE IMPACT

12.1 Introduction

12.1.1 Background

In accordance with the EIA Study Brief, a Marine Archaeological Investigation (MAI) was commissioned to cover the seabed which will be impacted by the construction of Hong Kong Boundary Crossing Facilities (HKBCF). The aim of the MAI is to assess the impact of the HKBCF on marine archaeological resources and recommend any mitigation measures, if necessary.

12.1.2 Key Objectives

The MAI comprises five tasks:

- Task 1: Baseline Review to assess the archaeological potential of the study area from a desk based review of existing literature;
- Task 2: Geophysical Survey data analysis to obtain detailed information about the seabed and sub-surface sediments;
- Task 3: Establish archaeological potential and assess the location and significance of any seabed features requiring further investigation and evaluation;
- Task 4: Diver inspection of seabed features;
- Task 5: Assess the impact of the construction of the HKBCF on archaeological resources, if present, and recommend a mitigation strategy, if necessary.

12.1.3 Study Scope

The MAI covers the footprint of the HKBCF and associated installations plus a buffer zone of 100m to allow for the impact of working vessels during construction. The HKBCF layout and MAI study area are shown in the **Figure 12.1**.

12.1.4 Legislation and Standards

The legislation, standards, guidelines and criteria relevant to the consideration of underwater cultural heritage impacts under this study include the following:-

- Antiquities and Monuments Ordinance;
- Environmental Impact Assessment Ordinance;
- Technical Memorandum on Environmental Impact Assessment Process; and
- Guidelines for Marine Archaeological Investigation.

12.1.4.1 Antiquities and Monuments Ordinance

Legislation relating to antiquities is set out in the Antiquities and Monuments Ordinance (Chapter 53 of the Laws of Hong Kong), which came into force on 1 January 1976. The Antiquities and Monuments Ordinance provides statutory protection against the threat of development on Declared Monuments, historical buildings and archaeological sites to enable their preservation for posterity.

The Ordinance contains the statutory procedures for the Declaration of Monuments. The legislation applies equally to sites on land and underwater. The purpose of the Ordinance is to prescribe controls for the discovery and protection of antiquities in Hong Kong. A summary of the key aspects of the legislation relevant to the current study is presented below.

- Human artefacts, relics and built structures may be gazetted and protected as monuments. The Antiquities Authority may, after consultation with the Antiquities Advisory Board (AAB) and with the Chief Executive's approval, declare any place, building, site or structure which the Antiquities Authority considers to be of public interest by reason of its historical, archaeological or palaeontological significance.
- The discovery of an Antiquity, as defined in the Ordinance must be reported to the Antiquities Authority (the Authority), or a designated person. The Ordinance also provides that, the ownership of every relic discovered in Hong Kong after the commencement of this Ordinance shall vest in the Government from the moment of discovery.
- No archaeological excavation may be carried out by any person, other than the Authority and the designated person, without a licence issued by the Authority. A licence will only be issued if the Authority is satisfied that the applicant has sufficient scientific training or experience to enable him to carry out the excavation and search satisfactorily, is able to conduct, or arrange for, a proper scientific study of any antiquities discovered as a result of the excavation and search and has sufficient staff and financial or other resources to enable him to carry out the excavation and search satisfactorily.
- Once declared a site of public interest, no person may undertake acts which are prohibited under the Ordinance, such as to demolish or carry on building or other works, unless a permit is obtained from the Antiquities Authority.

The Ordinance defines an antiquity as a relic (a moveable object made before 1800) and a place, building, site or structure erected, formed or built by human agency before the year 1800. Archaeological sites are administratively classified into two categories, namely:-

- Declared Monument – those that have been gazetted in accordance with Cap. 53 by the Antiquities Authority; and
- Recorded Archaeological Sites – those which have not been declared but recorded by the AMO under administrative protection.

It should also be noted that the discovery of an antiquity under any circumstances must be reported to the authority, i.e. the Secretary for Development or designated person. The authority may require that the antiquity or suspected antiquity is identified to the authority and that any person who has discovered an antiquity or suspected antiquity should take all reasonable measures to protect it.

12.1.4.2 The Environmental Impact Assessment Ordinance

Since the introduction of the 1998 Environmental Impact Assessment Ordinance (EIAO) (Cap. 499), the Antiquities and Monuments Office (AMO) have the power to request a MAI for developments affecting the seabed. Its purpose is to avoid, minimise and control the adverse impact on the environment of designated projects, through the application of the Environmental Impact Assessment (EIA) process and the Environmental Permit (EP) system. The EIAO stipulates that consideration must be given to issues associated with cultural heritage and archaeology as part of the EIA process. Annexes 10 and 19 of the EIA Technical Memorandum (EIAO-TM) outline the criteria for evaluating the impacts on sites of cultural heritage and guidelines for impact assessment, respectively.

The EIAO-TM identifies a general presumption in favour of the protection and conservation of all sites of cultural heritage and requires impacts upon sites of cultural heritage to be 'kept to a minimum'. There is no quantitative standard for determining the relative importance of sites of cultural heritage, but in general sites of unique, archaeological, historical or architectural value should be considered as highly significant.

12.1.4.3 Technical Memorandum on Environmental Impact Assessment Process

The general criteria and guidelines for evaluating and assessing impacts to Sites of Cultural Heritage are listed in Annexes 10 and 19 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM). It is stated in Annex 10 that all adverse impacts to Sites of Cultural Heritage should be kept to an absolute minimum and that the general presumption of impact assessment should be in favour of the protection and conservation of all Sites of Cultural Heritage. Annex 19 provides the details of scope and methodology for undertaking Cultural Heritage Impact Assessment, including baseline study, impact assessment and mitigation measures. The full document is included in **Appendix 12A**.

12.1.4.4 Guidelines for Marine Archaeological Investigation

The AMO have issued Guidelines for Marine Archaeological Investigation (MAI) which detail the standard practice, procedures and methodology which must be undertaken in determining the marine archaeological potential, presence of archaeological artefacts and defining suitable mitigation measures. The full document is included in **Appendix 12B**.

12.2 Methodology

This MAI follows the methodology set out in Annexes 10 and 19 of the EIAO-TM. **(Appendix 12A)** and the Guidelines for MAI issued by the AMO **(Appendix 12B)**.

12.2.1 Baseline Review

A Baseline Review was undertaken to compile a comprehensive inventory of cultural heritage resources of the Study Area. The Review established the historical profile and potential for cultural heritage sites and included:-

- Marine charts records held in British Library and National Maritime Museum Library in London;
- Publications on local historical, anthropological, archaeological and other cultural studies; and
- Unpublished papers, records, archival and historical documents held in local libraries and other government departments.

12.2.2 Archive Search

All archives holding information on shipwrecks in Hong Kong were explored for relevant data.

12.2.3 Geophysical Survey

The survey was carried out by EGS under the Geophysical Survey Term Contract Works issued by Civil Engineering and Development Department. The surveys were carried out during November and December of 2008.

12.2.3.1 Survey Objectives

The marine geophysical survey was carried out as part of the ground investigation for the HKBCF project. The objectives of the survey were:-

- To map sea bed levels in detail;
- To map features on the sea bed such as shipwrecks, rock outcrops and debris;
- To map the geological succession in the study area; and
- To locate the position of the existing utilities.

Although the survey was designed to meet the requirements of the engineering site investigation the data was sufficiently detailed to be adopted for the archaeological assessment.

12.2.3.2 Equipment

The following equipment was mobilised onboard the commercially licensed survey vessel.

Table 12-1 Equipment for Licensed Survey Vessel

Equipment	Qty
C-Nav GcGPS	1
The EGS computerised navigation package v1.2 and PC	1
Knudsen echo sounder	1
The Reson 8125 multibeam system	1
Swath PC	1
Seismic profiler	1
Hydrophone	1
EGS TVG console	1
Waverley recorder	1
DF1000 side scan sonar system with digital tow fish	1
TSS Gyro compass	1
Valeport velocity profiler	1
TSS DMS 3-05 heave motion compensator	1
Seaspy magnetometer	1

A speedboat/sampan was mobilized to carry out echo sounding survey over the very shallow water area. The following equipment was used for the small boat survey.

Table 12-2 Equipment for Small Boat Survey

Equipment	Qty
C-Nav GcGPS	1
The EGS computerised navigation package v1.12 and PC	1
Knudsen echo sounder	1
TSS HS50 heave motion compensator (SBES)	1
KVH Azimuth 1000	1

Horizontal Location Control

The survey vessel was located with a globally corrected Global Positioning System (GcGPS) unit called C-Nav, for which no shore based differential correction transmitter is required. The system provides corrected positions to an accuracy of +/- 0.3m without the need for a shore-based transmitting system.

Computerized Navigation

The EGS computerized navigation system was added to the positioning system to control the steering of the boat along the traverses specified, and to log all horizontal and vertical control data.

This system provides the user with a dynamic analogue and digital screen display on which the following are continuously updated:-

- Skewed grid set parallel to the desired line direction;
- Boat position;
- Water depth;
- Date and Time; and

- GcGPS diagnostics enabling quality control.

Calibration, Accuracy and Quality Assurance

The positioning system was calibrated by checking the co-ordinates displayed by the navigation system at the previously co-ordinated point located at the Tuen Mun typhoon shelter. Carrying out the above quality assurance checking procedure ensured an accuracy of +/-1m or better.

Location of Tidal Measurements

Tidal levels were recorded at Tung Chung and tidal data collected were used to reduce all echo sounding data to Principal Datum, Hong Kong (PD).

Datums

This survey was carried out relative to Hong Kong Principal Datum. For reference, Chart Datum is 0.15m below Principal Datum (Reference: Hydrographic Office, Marine Department, Government of the HKSAR, 2005, Charts for Local Vessels).

Operating System on Board the Survey Vessels and in the Office

EGS has developed the C-View operating and interpretation software package. This system was installed on survey vessels and in the office. The system provided screen displays on up to three monitors for seismic profiling and side scan systems. Full operating systems coverage was provided, to enable the best survey records to be obtained. All raw data was logged digitally.

Side Scan Sonar Interpretation was carried out in the office; interpretation on the screen was then directed straight to Autocad without the need for further re-digitizing. Seismic data interpretation was carried out from the paper records.

12.2.4 Field Procedures

12.2.4.1 Survey Vessels

The swath (multibeam echo sounding), seismic, side scan sonar and magnetic surveys were carried out from a Class IV survey vessel, M V Wing Hung 2.

12.2.4.2 Coverage

Main traverses for the swath, seismic and side scan sonar surveys were set at 40m intervals with cross lines at 200m intervals. Infill lines for swath data were defined on site to ensure full coverage.

The line spacing for echo sounding measurements by echo sounder were set at 10m intervals with cross lines at 50m intervals.

12.2.4.3 Swath (Multibeam) Bathymetry

Seabed level observations were made with a multibeam echo sounder system with the transducers mounted over the starboard side of the survey vessel. The GcGPS antenna was mounted directly above the transducers and as such the swath transducer acted as the datum for the survey vessel.

The swath system is a multibeam echo sounder. Instead of transmitting a single vertical pulse, which provides a record of water column thickness beneath the vessel track, the swath measures the same type of data over a 'fan' on both sides of the vessel.

12.2.5 Calibration

The Multibeam Echo Sounder (MBES) system requires careful calibrations. A potential source of error relates to the speed of sound in water; the MBES system requires the speed of sound be measured through the water column, and for these data to be entered into a file which is accessed by the MBES acquisition and processing software. On the west side of Hong Kong near the Pearl Estuary the speed of sound can vary significantly near the sea surface; therefore a speed velocity probe was installed at MBES transducer so that measurements are recorded at all times during the survey and the corresponding corrections can be made within the MBES system in real-time.

In addition, a patch test is required to calibrate system components, as follows:-

- Navigation Delay

  A survey line is set exactly over a well-defined feature, such as a rock outcrop, a significant slope or a man-made structure. The line is run twice in the same direction, once at the slowest possible speed and once at the highest speed.

- Pitch Offset

  A survey line is set exactly over a well-defined feature. The line is run in opposite directions at the same speed.

- Roll Offset

  A survey line is set over an area with a flat and featureless seabed. The line is run in opposite direction at the same speed.

- Yaw (Heading) Offset

  Two parallel lines are set to either side of a well-defined feature with the feature positioned in the middle of the two lines. The off-track distance between the feature and the lines are selected according to water depth and the fan width of the MBES system, so that the feature will be detected at the outer part of sounding "fan". The lines are run in the same direction at the same speed; once passing the feature to Port and once to Starboard.

By applying appropriate algorithms to match the apparent differences in the positions of the selected feature and the seabed topography measured in the individual calibration line, these calibration factors can be determined and are entered into the acquisition system to correct the seabed level measurements in real-time.

12.2.5.1 Side Scan Sonar Survey

Prior to the commencement of the survey, the side scan sonar system was wet tested to ensure the system was working correctly. The equipment used in the survey is shown in the **Image 1 of Appendix 12C**.

The side scan sonar tow fish was towed from the stern of the survey vessel, at a depth of around 5m beneath the sea surface, depending on the water depth.

The recording parameters for the side scan survey were as follows:-

- Vessel speed: 1.5 – 1.8 m/sec
- Fix interval: 10 seconds
- Source frequency: 100 kHz and 500 kHz
- Pulse length: 25 us
- Gain setting: Manually controlled
- Slant range: 75m

All data were logged on the C-view SDMP where four channels (100kHz port and starboard; 500kHz port and starboard) were simultaneously recorded with navigation, fix, vessel heading, cable out angle and length, fish heading, water depth.

Detailed log sheets were recorded with unique survey line numbers, start fix and end fix for each survey line, roll number, range, frequency and cable out value and angle. The corresponding C-View data file name was also recorded in these log sheets.

12.2.5.2 Seismic Reflection Survey

Prior to the commencement of survey the EGS boomer was wet tested to ensure the system was working correctly. The EGS boomer was towed from the stern of the survey vessel, at a distance of 20m such that noise from the survey vessel was kept to a minimum. The recording system used in the survey is shown in **Image 2 of Appendix 12C**.

The recording parameters for the seismic reflection survey were as follows:

- Vessel Speed: 1.5 – 1.8 m/sec
- Fix Interval: 10 seconds
- Out put power: +/- 500 volts
- Sweep: 80ms (paper)
- Delay: 0ms
- Gain setting: Manually controlled

12.2.6 Site Safety

Safety was generally in accordance with the 'Marine Geophysical Operations Safety Manual' (International Association of Geophysical Contractors, Ninth Edition, 2004).

12.2.7 Quality Assurance

Quality was assured by adopting the measures set out in the EGS ISO9001 Quality Handbook.

12.2.8 Reduction of Observations and Interpretation

12.2.8.1 Sounding and Swath (Multibeam) Data

For sounding readings, the influence of wave action was corrected in real time by the heave motion compensator. The smoothed sounding data was then reduced to levels below Principal Datum (PD) using the measured tide levels.

Tidal correction and filters were applied before the swath data sets were edited manually. Gridded sounding selection was used for engineering purposes. These gridded data were then plotted at a spacing of 6mm at the charting scale, to provide a sounding plan for the whole area surveyed This gridded plot was contoured using the 2m spacing dataset and coloured using processing and charting software to provide the sounding plans.

12.2.8.2 Side Scan Sonar Data

Processing and interpretation of side scan sonar data was carried out using the C-View interpretation software. All features were individually marked or grouped into regions using on- screen digitising. All offsets and laybacks were applied to the C-View system. The subsequently generated interpretation files were then imported to the Auto CAD environment on a line by line basis where the interpretation was reconciled and a detailed check was performed.

12.2.9 Diver Survey

The Underwater Inspection was carried out between 7th and 12th May 2009. The dive platform was a commercially licenced boat shown in **Figure 12.2**. SDA Marine Ltd directed a team of four divers supplied by Bekks solutions Ltd. All the divers hold HSE qualifications and diving was conducted with strict safety considerations. Each diver used surface supplied air and through water communications thereby enabling verbal contact with the dive supervisor at all times. A video recording of all time spent underwater was achieved by a helmet mounted video camera using the BP-DVIS Diver Video Inspection Unit as shown in **Figure 12.2**. The dive supervisor and marine archaeologist were able to monitor and direct the work of the diver at all times and view his activity on the surface television monitor.

A hand held GPS was used to relocate the position of the sonar contacts. Once on location, a 25-kg metal sinker was placed on the seabed at the fix point and a 5m, 15m and 20m radius sector seabed inspection completed by the diver. The principle of the search is that the diver extends the line to the set length and searches radially about the centre point. If any objects are present, the line will snag everything within the circumference of the search area. This approach ensured 100% seabed coverage despite restricted through water visibility. In addition, the diver used a hand held metal rod of 1.5m length to probe the seabed every 2m. **Figure 12.2** shows the diver with metal probe and search rope. The aim of the probe was to locate buried objects and establish the density of the seabed sediments. Continuous video footage of every dive was obtained.

12.3 Results

12.3.1 Baseline Review

The aim of the baseline review is to compile the most significant information to establish the archaeological potential of the seabed within the study area. It is not an exhaustive chronological history of the area. Only incidents and information relevant to the current study are included.

12.3.1.1 Archaeological Investigation on Chek Lap Kok

The first archaeologist to examine sites on the island was Walter Schofield, whose notebooks recorded that he visited Chek Lap Kok on at least four occasions in 1923, 1925, 1931 and 1933. Additional Neolithic stone and pottery artefacts were found during the 1950's by members of the University Archaeological Team, the predecessor of the Hong Kong Archaeological Society.

When the possibility of opening a new airport was first discussed in 1979, the Archaeological Society began a series of excavations on the sand bar site at Sham Wan Tsuen. This work yielded evidence of occupation during the late Tang (唐) and Song (宋) Dynasties and also during the Neolithic (Meacham, 1994).

After the final decision was made to proceed with the airport, the Hong Kong Archaeological Society was commissioned to organise a major archaeological rescue project with funds provided by the Royal Hong Kong Jockey Club. A sixteen month study of the history and archaeology of the island was completed including ten months of survey and excavation followed by analysis of the materials discovered and research on the history of the island.

During the project four major sites were excavated:-

- Fu Tei Wan (虎地灣): main deposit on a plateau with occupation during the Middle Neolithic Period dating to 4000-3300 BC;
- Ha Law Wan (蝦螺灣): discovery of a Yuan (元) Dynasty kiln complex probably associated with the smelting of iron ore;
- Kwo Lo Wan (過路灣): middle Neolithic deposit on hill slope and Bronze Age material with burials just behind the beach; and
- Sham Wan Tsuen (深灣村): a major Tang Dynasty lime kiln site was excavated. Late Neolithic and Han (漢) Dynasty materials were also recovered.

An unexpected result of the investigation was the discovery of remains of almost every phase of Hong Kong's known occupation, from the earliest phase of the Middle Neolithic, estimated at 4,000 BC. Equally unexpected was the complete absence of Ming (明) and early Qing (清) materials, ruins or graves. The detailed results of the excavation are presented in a detailed publication (Meacham, 1994).

Although construction of the airport resulted in the destruction of most of the archaeological sites the kiln complex at Ha Law Wan was preserved within the conservation area of the airport. The Tang Dynasty lime kiln at Fu Tei Wan was re-located to Tung Chung by the Gurkha Engineers where accessible to the public.

12.3.1.2 Historical Background of Chek Lap Kok

The island of Chek Lap Kok first appears in late Ming historical documents under the name 'Chek Lap Chau'. The name apparently derives from a fish formerly 'chek lap' (now known as 'lap yue') that was abundant in the waters around the island.

The first reference to the island in western sources is a brief mention in a British naval reconnaissance report by Lt. H.W. Parrish in 1794. He was part of a small survey expedition on a quest to identify suitable anchorages:

> '*intended to protect the large and valuable ships of the China Trade*'.

Bad weather restricted their movements but they made a brief reconnaissance of Chek Lap Kok the details of which are recorded in the log of the voyage:

> *"The Island of Shatlapko we found to extend towards the shore of Lantau; by which it appears, that the whole of this bay is sheltered from westerly winds.'*

The officer who sounded in the boat, reported his having seen boats pass through the Tung Chung channel and that the land in its neighbourhood on Lantau was '*low and cultivated*' (Cranmer-Byng & Shepherd 1964).

This is a very valuable contemporary description of Chek Lap Kok as it indicates that it was not a well known anchorage in 1794 and that there was evidence of coastal occupation on Lantau.

The first detailed evidence of human occupation on the island from written sources is the land use survey carried out in 1904-5 by British Army Indian surveyors, as part of the general registration of land ownership in the New Territories. This record reveals an elaborate and complicated web of ownership and land use.

Some fishermen made use of the coastal area for repairing their boats and for drying their fishing nets. On the north coast of the island there was a Tin Hau temple built in 1823. The temple was built of granite with money donated by some quarry companies.

After World War II, the quarrying activity declined and many people moved to the city for better employment. By the 1950s, only about two hundred people lived on the island.

12.3.1.3 Maritime Activity in the Vicinity of Tung Chung

During the 12th century there was a 50 year rebellion on Lantau as the Government sought to control fishing and salt working activities. It is recorded in the 1819 gazetteer of Xin'an (新安) that there was an attempt in 1197 to stop private salt trading in Lantau. The islanders successfully repulsed a government invasion force by mining their harbours with stakes and engaging them in a sea battle. They captured merchant ships and killed more than three hundred people. Tung Chung is very likely to have been one of the harbours involved in the battle (Murray, 1987).

Tung Chung is also associated with one of the most famous pirate battles in the history of Hong Kong. Extensive documentary evidence records a nine day battle in the Bay of Tung Chung which took place between 20 to 29 November 1809. Exactly what happened is a matter of some dispute as the accounts from sources such as Official Qing historians and Portuguese records have very different biases. For example, the official account talks of 1,400 pirates being killed and many pirate ships sunk or damaged. The Portuguese account is similarly inflated with claims of having destroyed a third of the pirate fleet by fire ships. There is one remarkable eye witness account by Richard Glasspoole, an officer from the British East Indiaman *the Marquis of Ely* which was stationed about twelve miles off Macau at the time. Glasspoole says that the combined Chinese and Portuguese fleet inflicted no significant damage at all on the pirates.

Glasspoole had been captured on 7 September 1809 while returning to his ship from a trip to Macau to fetch a pilot. Beset by heavy weather, he escaped one set of pirates only to fall into the hands of Cheung Po Tsai (張保仔). Eventually, some two days after the battle, he and his shipmate's ransom were paid. It consisted of goods to the value of about $4,000 including two bales of superfine cloth, two chests of opium, two casks of gunpowder, a telescope and the rest in dollars.

Glasspoole's account was written shortly after the battle for his local masters, the Select Committee of Supercargoes of the East India Company in Macau, and published in London in 1815. He describes the Qing government fleet as comprising ninety three war junks, six Portuguese ships, a brig and a schooner.

There is another contemporary description of the battle which was translated in 1831 and published in London (Neumann, 1831). It includes the following description of the fighting:

" *… In consequence of this determination all commanders and officers of the different vessels were ordered to meet on the seventeenth at Chek Lap Kok, to blockade the pirates in Ta Yu Shan, and to cut off all supplies of provisions that might be sent to them. To annoy them yet more, the officers were ordered to prepare the materials for the fire-vessels. These fire-vessels were filled with gunpowder, nitrate and other combustibles; after being filled, they were set on fire by a match from the stern, and were instantly all in a blaze. The Major of Heang Shan, Pang Noo, asked permission to bring soldiers with him, in order that they might go ashore and make an attack under the sound of martial music, during the time the mariners made their preparation.*

On the twentieth it began to blow very fresh from the north, and the commander ordered twenty fire-vessels to be sent off, when they took driven by the wind, an easterly direction; but the pirates' entrenchments being protected by a mountain, the wind ceased, and they could not move father on in that direction; they turned about and set on fire two men of war. The pirates knew our design and were well prepared for it; they had bars with very long pincers, by which they took hold of the fire-vessels and kept them off, they that they could not come near. Our commander, however, would not leave the place; and being very eager to fight, he ordered that an attack should be made, and it is presumed that about three hundred pirates were killed. Pao (i.e.Cheung Po Tsai) now began to be afraid, and asked the Spirit of the Three Po, or old Mothers to give a prognostic. The Puh, or lot for fighting was disastrous; the Puh, or lot to remain in the easterly entrenchment, was to be happy. The Puh, or lot for knowing if he might force the blockade or not on leaving his station tomorrow, was also happy.

There arose with the daylight on the twenty-second a light southerly breeze; all the squadrons began to move, and the pirates prepared themselves to joyfully leave their station. About noon, there was a strong southerly wind, and a very rough sea on. As soon as it became dark the pirates made sail, with a good deal of noise, and broke through the blockade, favoured by the southerly wind. About a hundred vessels were upset, when the pirates left Ta Yu Shan. But our commander being unaware that the pirates would leave their entrenchments was not prepared to withstand them. The foreign vessels fired their guns and surrounded about ten leaky vessels, but could not hurt the pirates themselves; the pirates left the leaky vessels behind and ran away"

Whatever the truth of the details of the battle, there is no question that at the end of the nine day battle the pirates were not defeated. However Cheung Po Tsai eventually surrendered in 1810 to the Viceroy Bailing of the Qing navy. At the time of surrender he had over 270 junks, 16,000 men, 5,000 women, 7,000 swords and 1,200 guns (Cortesão, 1944.). These figures clearly indicate the scale of the pirate activities in the region.

A remarkable 18m long Qing scroll painted on silk depicts the actions of the Viceroy Bailing (c.1748-1816) from his assumption to office in 1809 to the successful solution to the piracy problem in the summer of 1810. It is divided into twenty 'episodes' and includes the pirate battle at Tung Chung. The scroll is currently displayed in the Hong Kong Maritime Museum at Stanley and a section of it is presented in **Image 3 of Appendix 12C**.

During the dredging of the seabed between Chek Lap Kok and Tung Chung for the new airport in 1993, part of a cannon and a cannon ball were discovered and reported to the Provisional Airport Authority **(Image 4 of Appendix 12C)**. An inscription on the cannon reveals that it was manufactured around 1808 in China (Meacham, 1994). There is no way of knowing its exact origin but it is the only evidence that has been found for the above battle.

With the surrender of the pirates in 1810, the inhabitants of Lantau and Chek Lap Kok were able to live in peace and continue their intensive farming and quarrying. The large amount of granite produced on the island favoured the development of granite quarrying. The products were used to build roads and houses in the developing city of Hong Kong.

The modern period saw the northern part of Lantau remain relatively undeveloped. The advent of steam power meant that fewer trading vessels needed to take refuge in the safe anchorage provided by Tung Chung. Additional the ever increasing draft of modern vessels meant that the shallow waters of the approach to Tung Chung and the bay itself precluded the settlement from becoming a port of call and commercial centre, The incorporation of Lantau into the New Territories in 1898 resulted in the departure of the garrison and seven or eight war junks as well as their supply vessels.

12.3.1.4 The Tung Chung Walled City

The disruption and danger posed by the pirates led to the building of the Tung Chung walled city, also called the Tung Chung Fort. It was built on a piece of land between Sheung Ling Pei(上嶺皮） and Ha Ling Pei (下嶺皮) villages in the Tung Chung Valley. It was built in 1832 by Ho Chun Lung a captain from the Chin Shan Battalion of the Heung Shan Brigade (Bard, 1988).

The walled city backs up against the Tai Tung mountain. Its four rubble filled walls enclose an area of 225 feet by 265 feet and the more formidable front wall runs to about 15 feet thick. Along the main wall can be seen six old muzzle loading cannons each fixed to a cement base. There are two on the western side and four on the eastern side. They bear inscriptions but only four out of the six are still legible. They detail the casting of each cannon: for example the inscription on the second one from the east states that it was cast in the 8th moon of the 14th year of the Jiaqing (嘉慶) reign (1809), serial number Qing 80, weighing 1,000 catties and was cast by the master of the Man Shing Furnace.

At this time the pirate Cheung Po Tsai had a very strong influence on Lantau Island. The governor-general of Kwangtung and Kwangsi, Pa-Ling (兩廣總督百齡), was responsible for suppressing Cheung and his colleagues. He organised the casting of cannons and had them mounted throughout the coastal regions so that the area become more strongly fortified against Cheung's attacks. All the cannons that he cast bore serial numbers.

Two further cannons are dated to 1841 and were probably used for defence against the British and the opium traders **(Image 5 of Appenedix 12C)**. On the eastern side of the main gate one of the cannons was cast in the 1st moon of the 10th year of the Jiaqing reign (1805) and weighs 1,200 catties. It is highly likely that this cannon was also used for the defence of the region against piracy. The cannon lying next to the one above has been severely weathered and its inscription is illegible. It is clear from the differing casting dates that the cannons were cast elsewhere and transported. Although they have been cast over a period of 4 decades they all shared the same purpose of defending the region against pirates and foreign invaders. The walled city (also known as Tung Chung Fort) has been declared a monument and has been extensively repaired and it now opens as a visitor attraction.

12.3.1.5 Tung Chung Battery (東涌小炮台)

Further evidence for the severity of the pirate threat is demonstrated by the presence of Tung Chung Battery **(Image 6 of Appendix 12C)**. Tung Chung is in a valley surrounded by hills on three sides and faces the sea to the north. The valley is well drained by streams and provides fertile land for farming. As the entrance to Tung Chung a low lying hill known as the Shek She Shan (the rocky lion mountain) is situated. The Tung Chung Battery is found on the mountain's north slope.

The Tung Chung Battery was built in 1817 in order to strengthen defences on the northern coast of Lantau Island and to guard the Tuen Mun waterway. It had two cannon places, seven guard houses and an ammunition store. To its south at the entrance to Tung Chung was the Tung Chung Hau Shuen (with eight guard houses) built in the same year. The fort and the guard houses together had a garrison of thirty soldiers under the command of a *patsung* sent from the Tai Pang Battalion (Lui Yuen-chung, 1990). There is little documented evidence about the Tung Chung Battery after 1877 and its existence seemingly was forgotten. Recently, rubble walls were found on a knoll near the Tung Chung ferry pier. They are completely ruined but likely to form one of the two cannon places of the Tung Chung Battery. The remains of the Tung Chung Battery are protected under the Antiquities and Monuments Ordinance as a declared monument.

12.3.1.6 Summary of Archaeological Potential

The density of archaeological remains on the former island of Chek Lap Kok indicates that the waters around the HKBCF study area have been used by humans for more than 6,000 years. It is likely that human occupation took place on the exposed continental shelf around Hong Kong during the period between 10,000 and 6,000 yBP at the coast and within estuaries and that the occupation sites shifted relatively rapidly towards higher ground with the rapid rate of inundation. Since 6,000 yBP sea levels have stabilised (Fyfe, et al, 1997).

However, it is highly unlikely that there will be prehistoric archaeological remains on the seabed at this location. Across the study area the Marine Deposit is a minimum of 18m thick. The Marine Deposit has been locally classified as the Hang Hau Formation and dated from 7,960 yBP to 2,170 yBP (Fyfe, J.A., Shaw, R. 1997). It is composed of soft olive-grey clayey to sandy silt with shell debris scattered throughout. Any evidence for human occupation during the pre-Holocene would be beneath this layer at the interface with the alluvium. Archaeological remains would therefore be buried beneath a substantial thickness of soft marine mud. Tung Chung has documented maritime history of sea battles and pirate infestation. The fort and battery built to defend against the pirates are still in-situ at Tung Chung and can be visited. The pirate sea battle in particular would give the seabed in the study area high archaeological potential. However, the archaeological potential is significantly reduced due to Chek Lap Kok airport and the seabed disturbance which occurred during its construction. The geophysical survey data has indicated extensive seabed disturbance.

12.3.2 Archives Search

The UK Hydrographic Office (UKHO) holds a database of surveyed shipwrecks in Hong Kong, including those not shown on Admiralty Charts. These charts are particularly useful as they may show wrecks which have been subsequently buried or broken up. They also show the original shore lines prior to any reclamation.

The UKHO holds charts of the study area including the French Admiralty for 1856 **(Image 7 of Appendix 12C)** and the British Admiralty Chart 1899 **Image 8 Appendix 12C)**.

The database contained no records of shipwrecks within the study area.

12.3.3 Geophysical Survey

The interpretation of the side scan sonar records in this area had sought to quantify the following elements and features on the seabed:-

- Indicators for the presence of intact or broken up shipwrecks;
- Isolated objects which could have archaeological potential;
- Areas of disturbed seabed attributed to anchoring or trawling;
- Large area of debris, dumped materials or concrete slabs;
- Seafloor with pipeline/cable related scars;
- Higher reflectivity areas attributed to gravel or sandy materials and rocks;
- Lower reflectivity areas attributed to relatively clean or undisturbed marine sediments; and
- Any other significant sonar contacts.

12.3.3.1 Seismic Data

General

Although there are masked zones over the north boundary and south portion of the survey area, the quality of the seismic records was good and acceptable.

Interpretation of the Geological Succession

The interpretation of the seismic records sought to quantify the following elements of the offshore geological succession:-

Table 12-3 Interpretation of Seismic Records

FORMATION	EVENT
Marine Deposits of Holocene age (Hang Hau Formation)	The base of these deposits occurred during the last ice age
Alluvium (Chek Lap Kok Formation; mainly coarse sediments with gravels)	Up to four ice ages occurred during the Pleistocene
The top of rock in some state of decomposition	N/A
Grade III rock	N/A

The main components of the seabed stratigraphy are presented in **Image 9 of Appendix 12C**.

Marine Deposits are generally soft or very soft clays or silts, and as such are readily identifiable on seismic records as a clear conformable horizon sometimes with an unconformity represented by a desiccated layer or by local re-working of deposits by ancient river systems.

Interpretation was carried out as follows:-

The seismic horizons were selected for interpretation in accordance with the list above, and drawn on copies of the seismic records during preliminary interpretation. All traverse crossing points were then calculated, and marked on the seismic records. The records were then physically correlated at all of these points and the horizons digitized, plotted and contoured.

12.3.3.2 Organic Masking / Presentation /Plot Drawings

Organic Masking

Seismic data interpretation has revealed a significant masked areas east of Chek Lap Kok within the survey boundary. This is probably caused by the presence of organic materials on the seabed (e.g. discharge from the airport) and anaerobic bacteria feeding on decaying organic material at depth. The gas bubbles so generated absorb the seismic energy, thereby preventing reflections from deeper horizons.

Presentation

The results have been presented in summary plots. The geophysical survey covered the study areas for both the HKBCF and the Tuen Mun-Chek Lap Kok Link. Only the data relevant to the HKBCF is included in this report which explains why the plots do not include all the plots drawings in the sequence.

Plot Drawings (See **Appendix 12D**)

- Plots 1.3, 1.4, 1.5 Echo Sounding and Swath Bathymetry Track Plots
- Plots 2.3, 2.4, 2.5 Seismic and Side Scan Sonar Track Plots
- Plots 4.3, 4.4, 4.5 Colour Contoured Swath Bathymetry Plans
- Plots 5.3, 5.4, 5.5 Contoured Levels at the Base of Marine Deposits

- Plots 6.3, 6.4, 6.5 Contoured Levels on Top of Rock in Any State of Decomposition
- Plots 7.3, 7.4, 7.5 Contoured Levels on Top of Presumed Moderately Decomposed Rock
- Plots 8.3, 8.4, 8.5 Isopachs of Marine Deposits
- Plots 9.3, 9.4, 9.5 Isopachs of Alluvium
- Plots 10.3, 10.4, 10.5 Isopachs of Rock in Any State of Decomposition
- Plots 11.3, 11.4, 11.5 Sea Bed Features and Cable Alignments

The plots show the exact area of seabed covered by each piece of equipment.

Table 12-4 Interpretation of Track Records

POSITION/TRACK TYPE	DEFINITION
Echo sounding and swath bathymetry track	This is the track of the echo sounder and swath header, used to define sea bed levels
Seismic and side scan track	Seismic and side scan surveys have been conducted simultaneously, hence tracks of seismic data are presented here for presentation purposes

Colour Contoured Bathymetry Plan (**Plots 4.3, 4.4, 4.5 of Appendix 12D**)

Seabed level readings are presented in the drawings at 15m grids (6mm in chart scale). Bathymetric data collected by swath system are shown in colour contoured format, while seabed levels from echo sounder are shown in non-colour lines.

The seabed varies between –2m PD and –11m PD within the survey area.

12.3.3.3 Marine Deposits (Plots 5.3, 5.4, 5.5 of Appendix 12D)

The drawings illustrate the general topographic levels at the base of the Marine Deposits.

Within the footprint of the HKBCF there is a layer of Marine Deposit. Close to the coast near CLK its minimum thickness is 18m increasing to 28m in the northern section of the study area.

12.3.3.4 Alluvium (Plots 6.3, 6.4, 6.5 of Appendix 12D)

Plots 6.3 to 6.5 show the level on the top of rock in any state of decomposition, equivalent to the base of Alluvium where present. The surface is varying and reaches to about -60m below PD.

Isopachs of Alluvium are presented on Images 9.3 to 9.5. The survey results show that alluvium over the survey area is mostly more than 6m thick.

12.3.3.5 Rock in Any State of Decomposition and Grade III Rocks (Plots 7.3, 7.4, 7.5 and 10.3, 10.4, 10.5 of Appendix 12D)

The topographic variation of the base of rock in any state of decomposition corresponds to the top of moderately decomposed rock.

12.3.3.6 Sea bed Features (Plots 11.3, 11.4, 11.5 of Appendix 12D)

As shown on the drawings, sandy clays and silts are common features on the seabed, with numerous trawl marks, anchor scars, and scattered modern debris.

Image 10 of Appendix 12C is a copy of the side scan sonar data showing evidence of seabed disturbance caused by anchors.

12.3.3.7 Cable Alignments (Plots 11.3, 11.4, 11.5 of Appendix 12D)

Four submarine cables run through the study area. These are important for the MAI as they represent areas of previous disturbance.

Image 11 of Appendix 12C is a copy of side scan sonar data showing the seabed disturbance caused by cable installation.

12.3.3.8 Areas of Archaeological Potential

Three sonar contacts with archaeological potential were identified from the side scan sonar survey data. On the seabed features **Plots 11.3 and 11.5 of Appendix 12D** the sonar contacts have been classified as debris by EGS. Within a busy shipping area with evidence of recent seabed disturbance, the survey classification of *debris* is logical and appropriate for the Site Investigation report. However, from an archaeological perspective these targets could be contemporary debris from modern vessels or artefacts of historical significance.

Seismic profiler data showing the sonar contacts is not available as all three are located in areas where data was adversely affected by sediment masking.

Careful examination of the side scan sonar records does not provide evidence for intact shipwrecks. It is more likely that each of the targets is an isolated object or a shipwreck which has been broken up by previous disturbance, such as trawling.

Figure 12.1 presents the location of each sonar contact in relation to the HKBCF layout. The details of each contact are presented in the table below and the side scan sonar data showing each one is presented as **Images 12, 13 & 14 of Appendix 12C**.

Table 12-5 Sonar Contacts with Archaeological Potential

SONAR CONTACTS WITH ARCHAEOLOGICAL POTENTIAL			
Contact Number	Easting Northing	Dimensions (m)	Distance from BCF
SC006	812594.0E 819664.9N	1.7 x 1.3 x nmh*	10.8
SC010	813205.2E 820466.6N	1.4 x 0.8 x 0.4	114.2
SC011	812981.7E 820406.6N	1.4 x 2.0 x 0.3	19.6

*Note: nmh = no measurable height

12.4 Impact Assessment

Figures 12.3 show the proposed layout of the HKBCF and the areas where dredging and reclamation will take place. It is assumed that during Phase I construction, dredging will be carried out at Portions A, B, D. The rescue berth and the proposed dredged seawall would destruct the archaeological resources, if present. Phase 2 construction comprising fully dredged seawall and dredging of the underground APM would also impact on archaeological resources, if present.

There would be less impact in the area of the non-dredged seawall but this area would be indirectly impacted by the activities of the barges required for the dredging and reclamation. In the non-dredged areas where there will be reclamation, the seabed would be impacted by the installation of the band drains.

Figure 12.4 is a cross section through the seabed at the proposed BCF presenting the depths of reclamation and dredging.

12.4.1 Diver Survey

The diver survey successfully located and indentified all three of the sonar contacts. Each of them was easily identified as modern debris:

- SC006 Metal pole

- SC010 Concrete block with marine growth
- SC011 Canvas strap and building debris

Figure 12.5 are still photographs taken from the video footage of each object . The quality of the images is poor due to the high sedimentation.

The hand held probe used by the divers did not locate any buried objects. The seabed at this location is extremely disturbed due to the impact of the airport construction. The diver inspection at this area also confirmed that the seabed is regularly trawled. This activity would serve to either destroy or redistribute archaeological resources. The seabed in this area is characterised by an almost total absence of marine life which is further evidence for the trawling activities.

12.5 Recommendation

The diver survey located and identified each of the sonar contacts as modern debris and confirmed the extent of previous seabed disturbance. It is therefore concluded that there is no underwater cultural heritage within the study area.

There is no need for any further investigation or mitigation measures

12.6 References

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