Appendix 6

Marine Archaeological Investigation

Agreement No. CE 1/2008 (WS) Improvement of Fresh Water Supply to Cheung Chau – Investigation

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Marine Archaeological Investigation Report

382831/B&V/008/Issue 2

Report Authorized For Issue By:	For and on Behalf of Black & Veatch Hong Kong Limited

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March 2009

AGREEMENT NO. CE 1/2008 (WS)

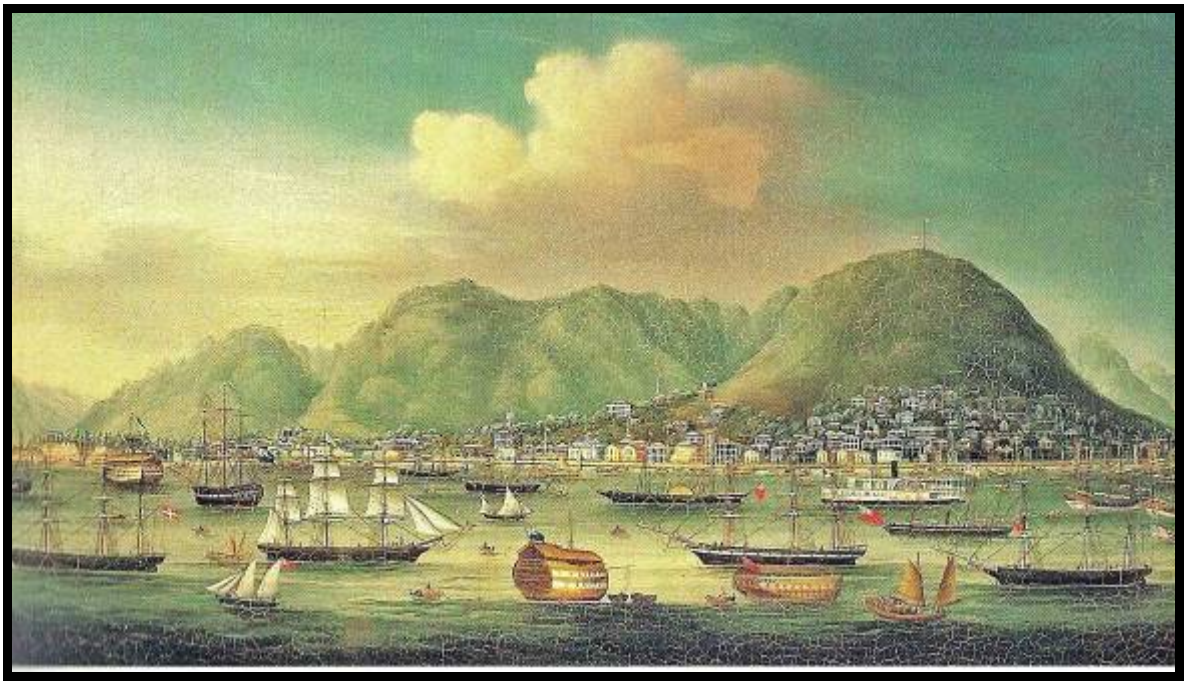
IMPROVEMENT OF FRESH WATER SUPPLY TO CHEUNG CHAU - INVESTIGATION

MARINE ARCHAEOLOGICAL INVESTIGATION (MAI)

PREPARED FOR BLACK & VEATCH

BY SDA MARINE LTD
SDA REPORT NUMBER: SDA00624

MARCH 2009



Painting of Cheung Chau by an unknown Chinese artist approximately 1868.
Source: *Precious Cargo - Scots and the China Trade*. Susan Leiper. National Museums of Scotland Publishing. 1997

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1. EXECUTIVE SUMMARY

SDA Marine Ltd was commissioned to complete a Marine Archaeological Investigation (MAI) for the seabed which will be impacted by construction of a new submarine water main between Lantau and Cheung Chau across the Adamasta Channel.

The methodology for the MAI follows the Guidelines for Marine Archaeological Investigation issued by the Antiquities and Monuments Office (AMO). The study comprised a Baseline Review and Geophysical Survey.

The Baseline Review established an abundance of historical references to pirate and maritime activity around Cheung Chau indicating high archaeological potential for shipwrecks in the vicinity of the new water main.

In December 2008, a comprehensive geophysical survey comprising side scan sonar, seismic profiler and multi beam bathymetry was carried out. The results did not identify any features on the seabed with archaeological potential. The data revealed that the seabed across the Adamasta Channel is extensively disturbed probably due to the construction of the numerous utilities which cross the channel. There is also evidence of dumped materials. During the geophysical survey, trawlers were seen working in the Adamasta Channel. Their action would further serve to damage or redistribute archaeological resources on the seabed.

As there are no archaeological remains within the study area, construction of the new water pipe will not have an impact on underwater cultural heritage.

There is no need for any further investigation or mitigation measures.

2. INTRODUCTION

2.1 Background

Cheung Chau is currently supplied with treated water from Silver Mine Bay Water Treatment Works on Lantau via two submarine water mains, 10" (about 250 mm) and 500 mm in diameter, across Adamasta Channel. Treated water is normally provided by the 500 mm diameter main, with the 10" main serving as emergency backup.

Laid in 1963, the existing 10" submarine water main providing emergency back up fresh water supply partially to Cheung Chau is approaching the end of its design life of 50 years. Repairs would be uneconomical and take a long time given the difficulty of the task and the condition of the main. To improve the reliability of water supply to Cheung Chau, it is necessary to strengthen the emergency back up by replacing the 10" submarine water main with a new 500 mm diameter submarine water main.

Black & Veatch (B&V) was commissioned by Water Supplies Department (WSD) to undertake the investigation study for the improvement of fresh water supply to Cheung Chau (hereinafter referred to as "the Project"). SDA Marine Ltd was commissioned by B&V to carry out a Marine Archaeological Investigation (MAI) of the seabed which will be impacted by the construction of the submarine water main. The aim of the investigation was to locate and assess underwater archaeological resources which may be damaged by the proposed water main.

2.2 Project Description

The Project is to construct and operate a new submarine water main across Adamasta Channel from Lantau to Cheung Chau to replace the existing submarine water main, which is serving as emergency back up, to improve the reliability of water supply to Cheung Chau. The Project will comprise the following:

(i) Laying of submarine water main of approximately 1400 m in length and 500 mm in diameter across Adamasta Channel;
(ii) Construction of landfall and associated works within Lantau South Country Park, Lantau Island; and
(iii) Construction of landfall and associated works near Tai Kwai Wan, Cheung Chau.

The submarine water main is the only aspect of the Project covered by the MAI.

The location of the Project is shown in ***Figure 1***.

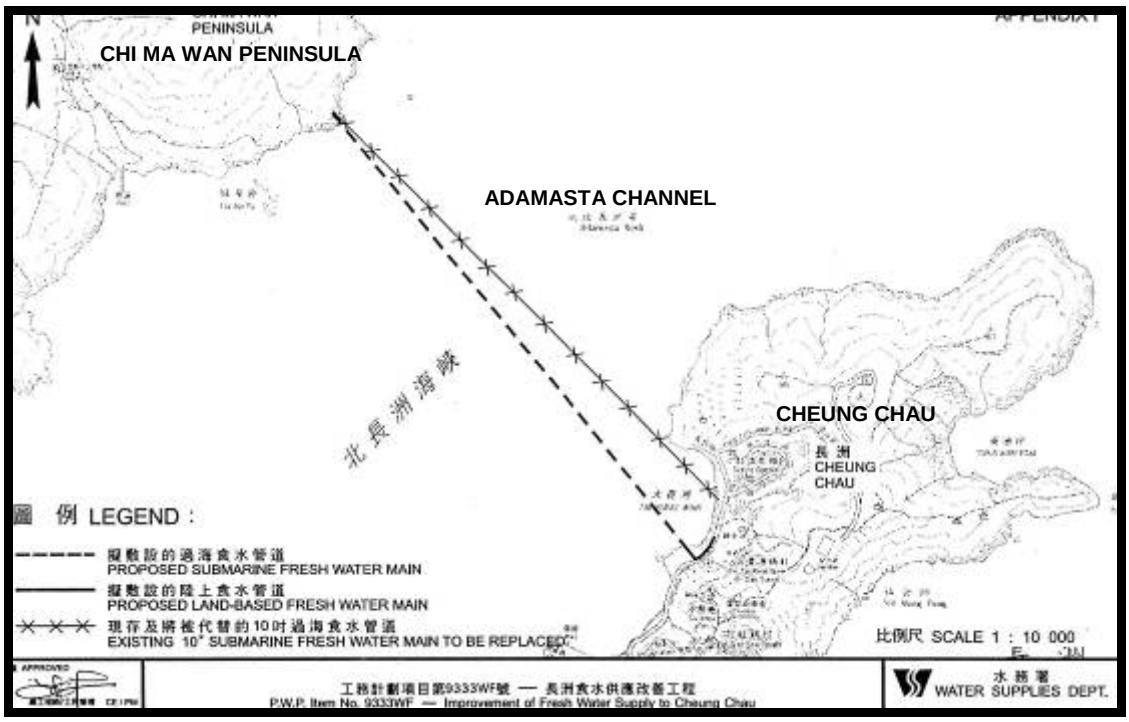


Figure 1: Proposed location of the new water main

2.3 Objectives of the Marine Archaeological Investigation

The objectives of the MAI are:

- Assess the archaeological potential of the study area from the results of a Baseline Review;
- Conduct a marine Geophysical Survey to obtain detailed data about the seabed and sub surface sediments;
- Through data interpretation identify and assess the location and significance of any underwater archaeological resources; and
- Assess the impact of the water main on the archaeological resources and recommend a mitigation strategy, if necessary.

3. LEGISLATIVE FRAMEWORK FOR MARINE ARCHAEOLOGICAL INVESTIGATIONS IN HONG KONG

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
- Guidelines for Marine Archaeological Investigation

3.1 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 January 1st 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 palaentological 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 support.

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 classified into two categories, as follows:

- ***Declared Monument*** – those that are gazetted in accordance with Cap. 53 by the Antiquities Authority and are to be protected and conserved at all costs;
- ***Recorded Archaeological Sites*** – those which are considered to be of significant value but which are not yet declared as monuments and should be either protected, or if found not possible to protect these sites mitigation measures should be proposed and implemented to preserved the archaeological resources.

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.

3.2 The Environmental Impact Assessment Ordinance

Since the introduction of the 1998 Environmental Impact Assessment (EIA) Ordinance (Cap. 499, S16), 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 EIA process and the Environmental Permit (EP) system. The EIA Ordinance 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 Memoranda (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.

3.3 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.

3.4 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.

4. METHODOLOGY

The MAI follows the methodology set out in Appendix C of the EIA study brief (ESB-187/2008), the relevant requirements in the EIAO-TM, Annexes 10 and 19 and Guidelines issued by the AMO.

In accordance with AMO Guidelines, the MAI consisted of a Baseline Review and Geophysical Survey.

4.1 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, architectural, anthropological, archaeological and other cultural studies; and
- Unpublished papers, records, archival and historical documents held in local libraries and other government departments.

4.2 Archive Search

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

4.3 Geophysical Survey

The geophysical survey was carried out by EGS (Asia) Ltd under the Geophysical Survey Term Contract Works Order No. GE/2007/04.21 issued by the CEDD.

The survey was carried out during the period of the 4th to 6th December 2008 and 8th December 2008.

The Study Area and survey corridor for the marine geophysical survey is shown in ***Figure 2***.

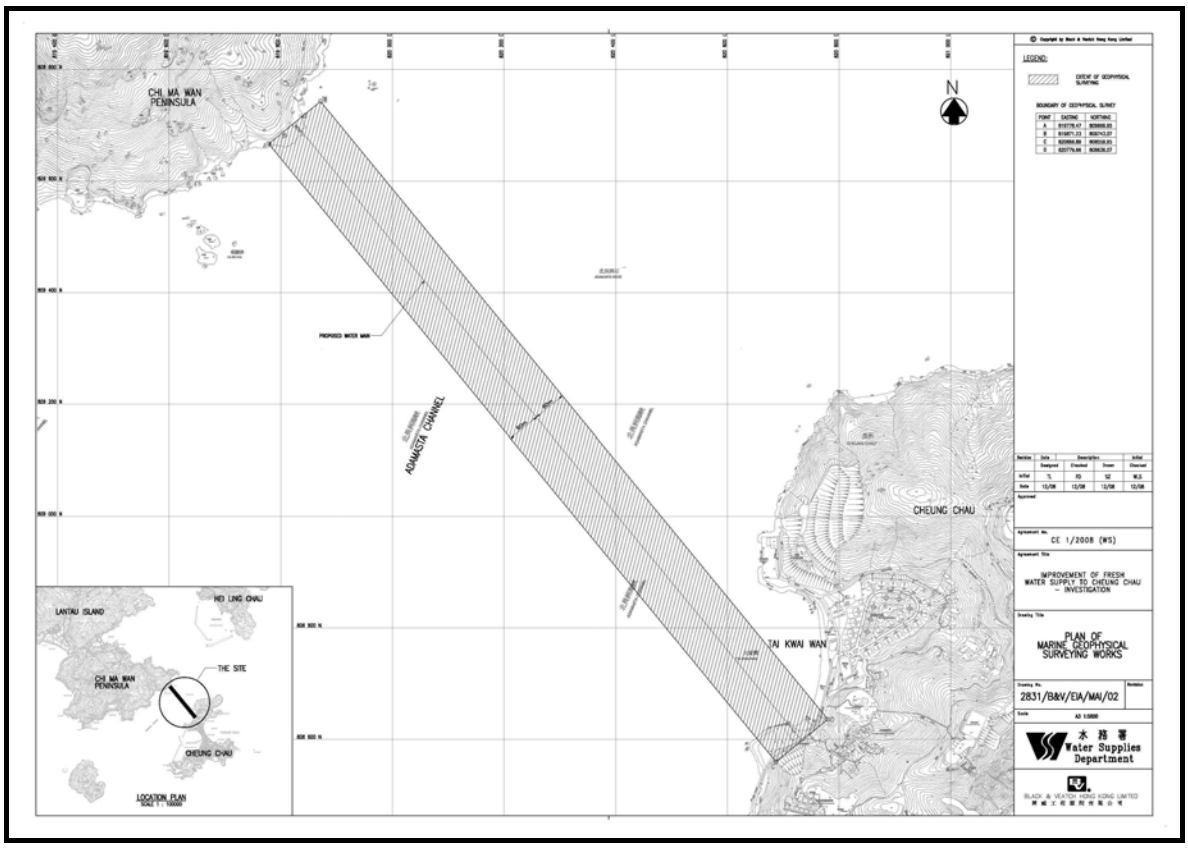


Figure 2: Study Area and Survey Corridor

4.3.1 Objectives of the Survey

The marine geophysical survey was carried out as part of the ground investigation for the replacement water pipe. The objectives of the survey were:

- To map sea bed levels in detail;
- To map the texture and features on the sea bed such as shipwrecks, rock outcrops and debris;
- To map the geological succession over the water mains corridor; 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 re-used for the archaeological assessment. The raw data were analysed in the offices of EGS.

4.3.2 Equipment

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

Equipment	Qty
C-Nav GcGPS	1
The EGS computerised navigation package v1.12 and PC	1
Knudsen 320M echo sounder	1
The Elac Seabeam 1180 multibeam system	1
Swath PC	1
272-TD system with digital tow fish	1
EGS boomer and hydrophone	1
EGS TVG console	1
Waverley recorder	1
TSS gyro compass	1
Valeport velocity profiler	1
TSS DMS 3-05 heave motion compensator (Swath)	1
TSS 320B heave motion compensator (SBES)	1
Seaspy magnetometer	1

4.3.3 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.

4.3.4 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

- GcGPS diagnostics enabling quality control

4.3.5 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 Yau Ma Tei typhoon shelter.

Carrying out the above quality assurance checking procedure ensured an accuracy of +/-1m or better.

4.3.6 Location of Tidal Measurements

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

4.3.7 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).

4.3.8 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.

Sub-Bottom and 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.

4.3.9 Swath (Multibeam) Bathymetry

Seabed level observations were made with a multibeam echo sounder (MBES) system with the transducers mounted over the starboard side of the survey vessel. The DGPS 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.

4.3.10 Calibration

For errors to be avoided, the MBES system requires careful calibrations. A significant (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. In addition, due to the fact that the speed of sound can vary significantly near the sea surface, a speed velocity probe is 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.

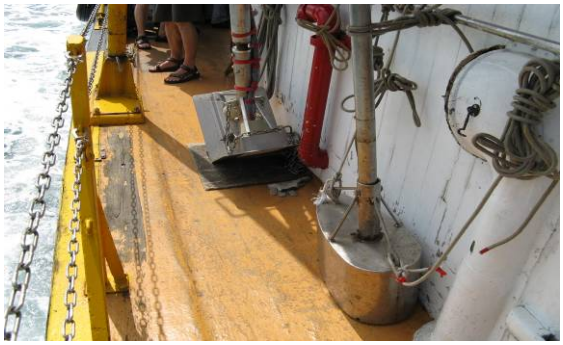
	
Illustrations of swath bathymetry systems	The Transducer of Elac Seabeam 1180 Swath System (upper) and single beam echo sounder (lower)

Figure 3: Swath Bathymetry System

4.3.11 Side Scan Sonar Survey

Prior to the commencement of survey the side scan sonar system was wet tested to confirm that the system was working correctly. 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: 8 seconds
- Source frequency: 100 kHz
- Pulse length: 25 µs
- Gain setting: Manually controlled
- Slant range: 75 m

All data was logged to the C-View SDMP where two channels (100 kHz 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 number, start fix and end fix of 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.

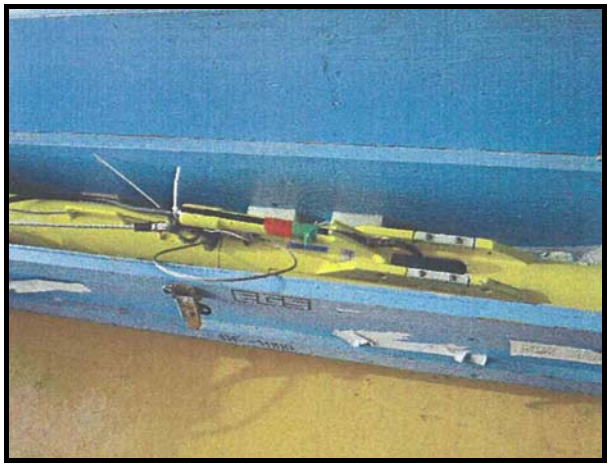


Figure 4: DF100 Side Scan Sonar fish

4.3.12 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 such that noise from the survey vessel was kept to a minimum.

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

- Vessel Speed: 1.5 – 1.8 m/sec
- Fix Interval: 8 seconds
- Out put power: +/- 500 volts
- Sweep: 80 ms (paper)
- Delay: 0 ms
- Gain setting: Manually controlled

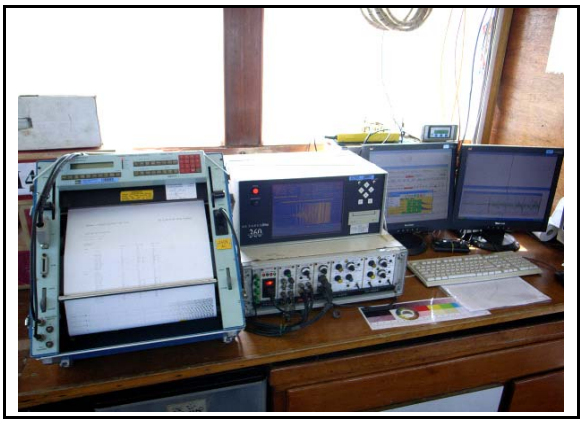


Figure 5: Onboard display for geophysical survey equipment

4.3.13 Magnetic Survey

As there is a high level of magnetic background noise over HKSAR during the daytime, the survey was carried out at night to avoid it.

The magnetometer transducer was towed astern of the survey vessel. A depth sensor was attached to the magnetometer sensor to maintain the sensor height above the seabed at 2 to 3m. the magnetometer tow fish was deployed at a distance of 15-22m at the stern of the survey vessel.

Figure 6: Magnetometer Fish

4.3.14 Site Safety

Safety was in accordance with the EGS Safety Manual, which is significantly based on industry requirements as set out in the 'Marine Geophysical Operations Safety Manual' (International Association of Geophysical Contractors, Ninth Edition, 2004).

4.3.15 Quality Assurance

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

4.3.16 Reduction of Observations and Interpretation

Swath (multibeam) Data

Tidal correction and simple filter are applied before the data sets are edited manually. Judgment is required at this stage, to identify small features which are real reflections from low-level noise; for guidance, two or more mutually consistent soundings which are higher or lower than the general sea bed level would be accepted, especially if the same anomalous soundings are present on separate survey traverses.

Gridded sounding selection is widely used for engineering purposes. The selection procedures for this project are as follows:

- The processed data were gridded on to a 1m spacing dataset and a 2.5m spacing dataset. During the gridding process, median sounding values were used.
- 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 then contoured using the 2.5m spacing dataset and coloured using 'C-View Bathy' processing and charting software, to provide the sounding plans.

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.

The interpretation of the side scan sonar records sought to identify the following 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.

4.3.17 Interpretation of the Geological Succession from Seismic Data

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

FORMATION	EVENT
Sea bed	N/A
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)	Accumulation of sediments during glacial/inter-glacial cycles during the Pleistocene

The seismic horizons were selected for interpretation in accordance with the list above and drawn on the digital data using C-View packages during preliminary interpretation.

All the geological horizons' levels were corrected to HKPD and plotted with the tide- and datum- reduced seabed presented in the alignment chart.

5. RESULTS

5.1 Baseline Review

5.1.1 Shipwreck Data

Practically nothing is known about the archaeological potential of the seabed deposits in Hong Kong. The only marine archaeological discovery is that of a late Sung/early Ming Dynasty boat uncovered during construction of the High Island Reservoir, near Sai Kung (Frost, 1974). Since then, no other historic shipwreck has been found. However, this is probably because there were no dedicated marine archaeological surveys until the introduction of the 1998 EIA Ordinance. Marine archaeology is therefore a new area of study in Hong Kong with very little baseline data to draw upon.

5.1.2 Archive Search

The UK Hydrographic Office (UKHO) holds a database of surveyed shipwrecks in Hong Kong, including those not shown on Admiralty Charts. The database contained no records of shipwrecks close to the study area.

The UKHO holds British navigation charts of the study area from 1864 (***Figure 7***) which interesting marks the Adamasta Channel as unsafe for ships. French Admiralty 1856 (***Figure 8***), and British Admiralty Chart 1899 (***Figure 9***). These charts are particularly useful as they may show wrecks which have been subsequently buried or broken up. However, none of these charts indicates a shipwreck within the study area although the 1899 chart shows a wreck south east of Cheung Chau Island.

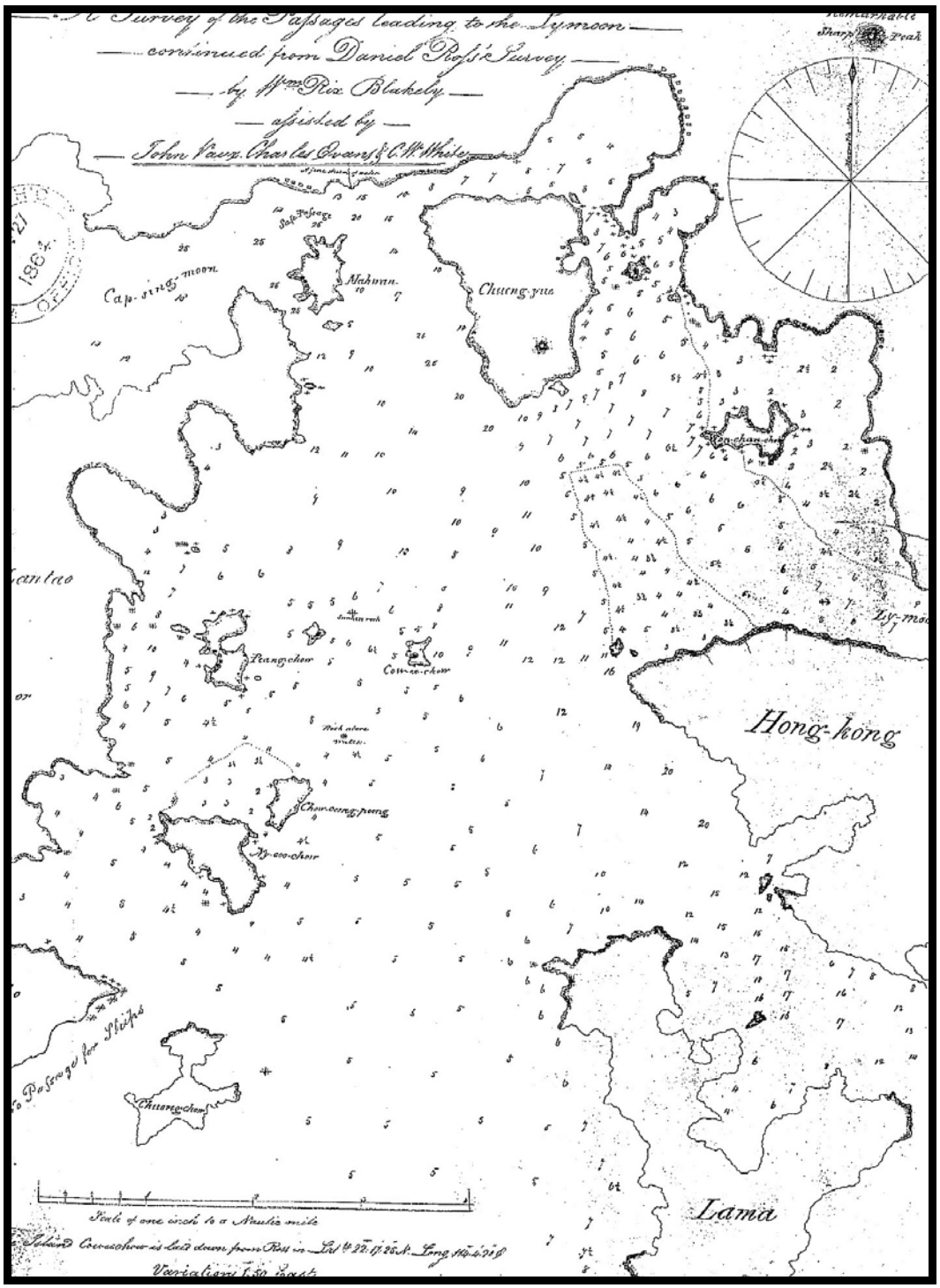


Figure 7: British Admiralty Chart 1864

There is an interesting note made by the creator of the chart, Lt Daniel Ross that when he went ashore on Cheung Chau to set up a triangulation station there were only two boat repairers resident as the island had just been devastated by pirates.

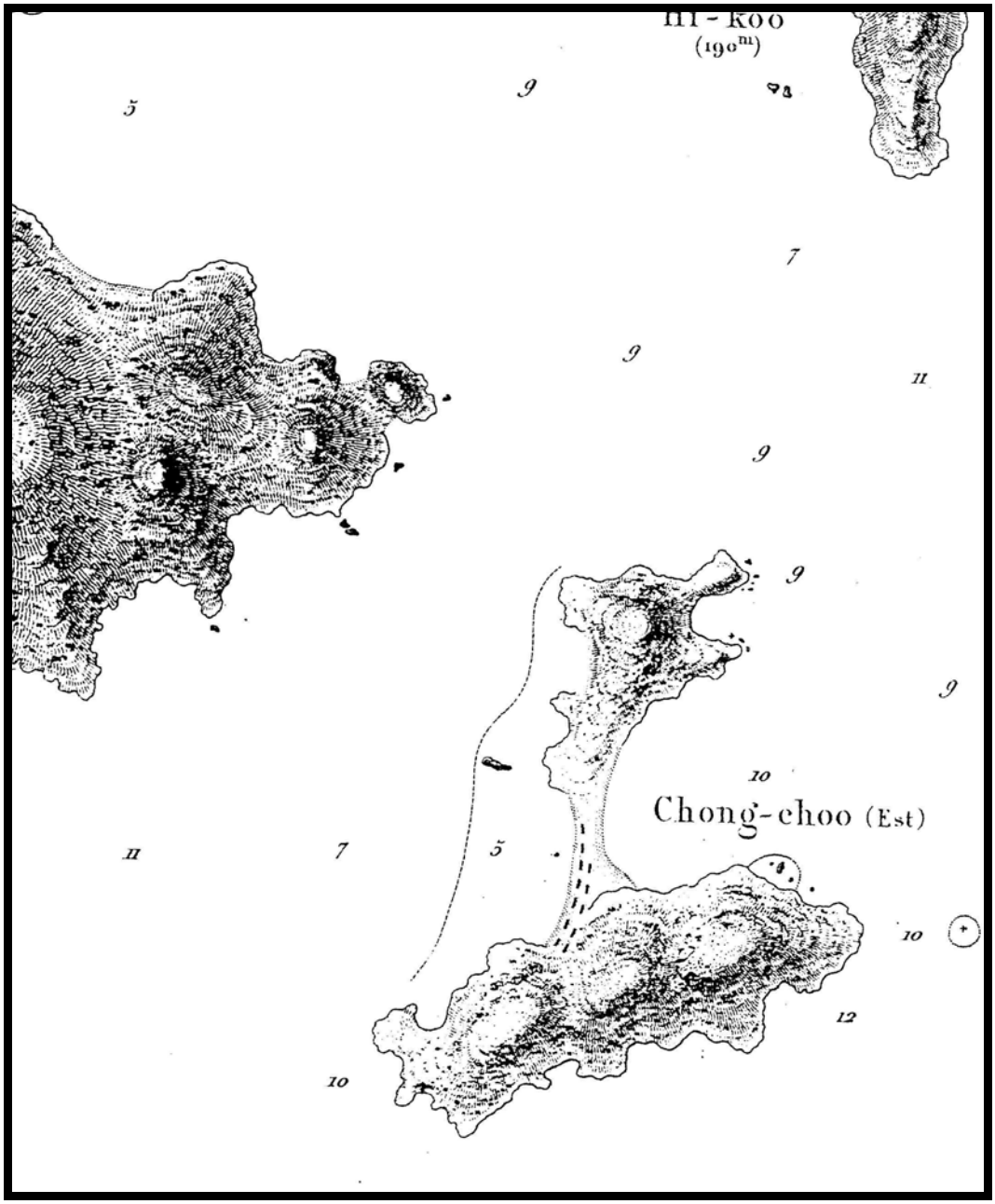


Figure 8: French Admiralty 1856

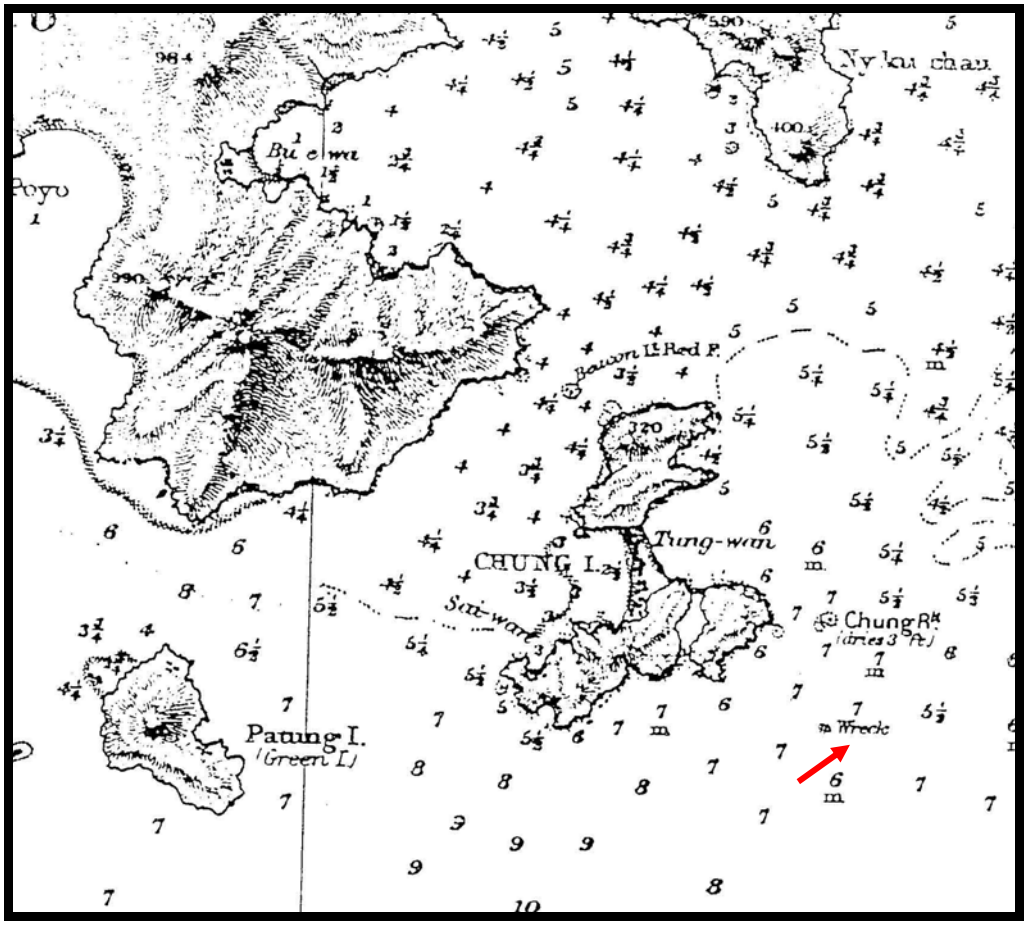


Figure 9: British Admiralty Chart 1899

5.1.3 Maritime Activity in the Vicinity of Cheung Chau

Cheung Chau is a small island situated just over five nautical miles west-south-west of Green Island at the western end of Hong Kong harbour. It is adjacent to the southern side of the much larger island of Lantau from which it is separated by the Adamasta Channel. The island is two and a quarter miles long at its greatest extent, and takes the form of a three-ended dumb-bell, with each arm radiating for roughly a mile from the low beach area where the town is built.

The island of Cheung Chau has proven archaeological potential and has been the focus of several detailed investigations. Finds from the middle Neolithic Period (4,000-2500 BC) through to the Song Dynasty (960-1297 AD) have been retrieved (Meacham, 1980: Wellings, 1986). To date all of the archaeological finds have been on land and there have been no underwater investigations.

The presence of sites on land suggests strongly that seafaring people would have used the natural harbours of the island for a considerable period. This is further supported by the presence of a Prehistoric rock carving on the east side of the island (discovered by the geologist Dr C.J. Peng in 1970: Bard, 1988). While there is no doubt as to the antiquity or

archaeological significance of the carving, its exact origin and age remain uncertain. Bard (1988) postulated that the carving was made two to three thousand years ago by early seafarers inhabiting the area and intended as a magical symbol for the appeasement of the powers of the sea or to invoke their protection.

The tombolo formation linking the northern and southern headlands of Cheung Chau Island creates an excellent west facing natural harbour, which together with Sai Wan village to the south west, has attracted fishermen as a port for hundreds of years (Hinton, 1977). Seen from a distance the island resembles a pair of dumb-bell weights, and has been known at various times and on some charts as Dumbbell Island. This name had fallen into disuse by the early 20th century (Sayer, 1975).

The Adamasta Channel between the Cheung Chau and the Chi Ma Wan peninsula has always been an important sea passage. The main route between Hong Kong and Macau passes through this channel, with the lesser used northern route passing Ma Wan and the northern Lantau coast. The Adamasta Channel remains the main marine route for the high speed ferries traveling between Hong Kong and Macau. By the mid-nineteenth century this route, which also linked Hong Kong with Canton and West River ports, became of increasing importance (Hayes, 1963). The Hong Kong Government Gazette from 1899 records that Cheung Chau was a very busy port used by junks and steamers en route to Macau.

The list of donors on the tablets in temples and old buildings underline Cheung Chau's business and kinship links over the Pearl River delta and beyond. An interesting head stone was found in position inside an old building on the Praya belonging to the Sei Yap Yik Sin Tong, which records its repair in the 23rd year of the Kuang-hsü (1897-9). The tablet has an interesting origin in that it arose from the washing up of a body carrying money onto one of Cheung Chau's beaches following a shipwreck (Hayes, 1963).

Cheung Chau has a long association with pirates (Lo, 1963). It is well known that it was the haunt of a large pirate band under the command of Cheung Po, also and more popularly known as Cheung Po-tsai. The island derives its name from him, meaning literally "*Cheung's Island*". Cheung was born into a fisherman's family in San Hui County, and was kidnapped by Cheng Yat's pirate band when he was fifteen years old. He eventually became a pirate himself and rose to be Chieftain of his particular band of brigands. After Cheng Yat's death, Cheung Po-Tsai became chief of one branch of the pirates. In 1808 he fought against the Ch'ing Government's Navy several times and was victorious on every occasion. His band repeatedly raided villages in the San Hui, Panyu and San On Counties. Cheung's forces and influence rapidly grew. At one time he had over 270 vessels, 7,000 swords, 1,200 guns and 16,000 men working under him (Murray, 1987). He had hideouts at Tung Chung (Lantau) and Chek Chue (modern Stanley on Hong Kong Island). He also built and endowed the Tin Hau Temples at Ma Wan, Cheung Chau and Stanley, all of which still stand and are dedicated to fishing and sea-faring activities. There is a cave on Cheung Chau Island which is associated with Cheung and a popular tourist destination.

Cheung's influence was so great that the Governor-General of Kwangtung and Kwangsi, Pa-ling, decided to defeat his gang decisively. First Cheung's supply lines were disrupted. Then the combined naval forces of Kwangtung massed at Chek Lap Kok, just outside Tung Chung on Lantau. Cheung requested help from his associate Kwok Po-tai who refused to send in reinforcements. Cheung managed to break out of the trap, and set out after Kwok. Kwok soon surrendered to the Manchus, and Cheung followed suit, after first being offered a post within the Ch'ing military establishment. However, some of their followers refused to surrender and continued to raid shipping and villages but government forces later suppressed them.

Following the surrenders of Kwok Po-tai and Cheung Po-tsai the Hong Kong region improved quickly. Some of their followers refused to surrender and continued to raid shipping and villages but government forces soon suppressed them. In 1850 the last two pirate bands under Shap Wu Tsai and Tsui Ah Po were suppressed by combined British and Manchu forces (Lui, 1990).

There are documentary records indicating that the prevalence of crime and piracy severely disrupted life in Cheung Chau during the Hsien Feng period (1851-62). In the early 1850's the island's leaders petitioned the local magistrate for assistance (Hayes, 1983). Consequently the district office sent down a proclamation for the establishment of a defence office and construction work began. This office seems to have assisted with the security of Cheung Chau and worked together with the Customs Station.

The Customs Station was opened by the Canton authorities as part of the "blockade" system set up in 1868-71 against the British colony of Hong Kong and later taken over by the Chinese Maritime Customs when they began to operate in the Hong Kong region in 1887. The Customs Station continued to function until the British took over Cheung Chau in April 1889 when it was moved elsewhere (Wright, 1950).

The Customs Station had the responsibility for searching all ships using the harbour and collecting taxes on imports. It also served to support the police in the battle against piracy and smuggling. There are records on the tablets from the Tin Hau temple and a hospital tablet which record the presence of an officer in charge of the military post. It seems likely that the military post of Cheung Chau in the second half of the 19th Century was responsible for law and order and for attacks against pirates and robbers in collaboration with the local customs officials. It also served as a guard post on the Chinese frontier around Hong Kong. The Customs Station eventually became a police station until pirates raided it in 1912 and three constables were killed (Wright, 1950).

L.C. Arlington, an employee of the Chinese Maritime Customs spent six years (1893-9) in charge of the Customs Station at Cheung Chau, wrote in his autobiography (Hayes, 1983):

> *"As well as numerous islands forming the Ladrones, [it] was the rendezvous of pirates, who kept all of us on the qui vive, foreigners and natives alike. Gangs of pirates would get together and attack the villages even in broad daylight, and after*

> *looting and killing, escape to either Macau or Hong Kong, where they disposed of their booty. The Customs Officers had many tussles and narrow escapes from these pests of the sea."*

He went on to say:

> *"During my time in Kowloon territory (1893-1901), piracies were so common that we regarded it as extraordinary if a day passed without one. Indeed, it was the daily routine for junk masters to report at the Customs Station that they had been pirated and all of their cargo looted."*
>
> Customs Duty was *"practically confined to chasing pirates and smugglers," and Arlington state that "at one time I had no less than sixty pirates chained to an old cannon to prevent them from escaping pending their transfer to Canton for trial"*.

The island was a popular resort of fishermen from the Pearl River Delta, who came to the market on Cheung Chau. During typhoons small craft made for the relative safety of the two bays on either side of the island. The main anchorage, of Chung Wan faces due west, with Sai Wan facing south-west. Neither are entirely safe anchorages, but this does not seem to have deterred fishermen from operating from the island. It was as protection against easterly winds that fishermen first came to shelter at Cheung Chau in large numbers (Davis, 1949).

Cheung Chau was described as a hsü, or market in an inscription on an incense burner dated 1785-86 in the Tin Hau Temple at Pak She. It is also listed as such in the Hsin-an Gazetteer of 1819 (Hayes, 1977). There were large communities of locally based Hoklos on both Peng Chau and Cheung Chau, some living in boats in the bays (Hayes, 1977). By the First World War a number of stone cottages had been built on the island as a summer leave centre for missionaries based in South China (Sayer, 1975).

The Cheung Chau Kaifong maintained a number of public boats, known as kai do. These were cargo vessels managed by locally prominent persons for a group of financially interested local parties who supported the venture. It was designed to assist the public by providing a safe, regular and reliable means of conveying cargo and passengers between Cheung Chau and Hong Kong.

A number of these kai do junks appear on lists of donors to the island Fong Pin Hospital in the 1870's. These vessels had names such as Kung Cheong (Public Prosperity), Yee Tai On (Righteous Peace), Kung Yik (Public Welfare) and On Shun (Peaceful Tranquility). They also made regular donations to the Tin Hau Temple for repairs in 1879 (Hayes, 1963).

The 1911 Census, taken a decade after the island had passed under British rule, gave a land population of 3,244, mostly Punti, and a seaborne population of 4,442 (Hayes, 1963). These figures may not be entirely accurate but they highlight the importance and scale of the maritime community using the island as a base. The nucleus of Cheung Chau society seems always to have been the community of fishermen and shopkeepers. Cheung Chau served as the market town for over a dozen villages on the central and south-west

coasts of Lantau, the largest of which was Shek Pik with a population of 363 in 1911, and for the inhabitants of the outer islands. There were over two hundred shops on Cheung Chau in the 1870's (Hayes, 1963). By 1948 Cheung Chau was one of the four major fishing ports in Hong Kong, along with Aberdeen, Shaukeiwan and Tai Po (Davis, 1949).

5.1.4 Maritime Activity in the Vicinity of Chi Ma Wan

The coast of south-western Lantau on the Chi Ma Wan Peninsula, encompasses the small villages of Tai Long, Ha Keng and Mong Tung Wan. The topography is mountainous and the coastline comes down sheer to the sea in most places, making it an unlikely location for anything but an emergency landfall at any time. It is interesting to note that the British Admiralty Chart from 1864 marks the Adamasta Channel as "*No passage safe for ships*", perhaps because of the inhospitable coast. The 1970's residential/resort development of Sea Ranch was founded at Yi Long Wan, due north of Shek Kwu Chau. The island is the site of a drug rehabilitation centre which was established in 1962. Prior to that the island was generally barren and uninhabited.

There is a European grave on the island, of one Elizabeth Ann McIntyre, who died at sea on the 21st of October 1845. Her husband was master of the ship "*Castle Huntly*". The "*Castle Huntly*" was a three-masted wooden caravel of just over thirteen hundred tons, built at the Port of Calcutta and owned jointly by Thomas Garland Murray of London and John Paterson of Castle Huntley. John Paterson was her first Master. Later the vessel passed through the hands of various owners and, in 1838, was re-registered at Bombay as the property of three Parsee merchants. Later, it appears, two of the owners sold out and she became the sole property of one Cursetzee Cawasjee. The closing entry says that the "*Castle Huntly*" was lost on Lincoln's Shoal some four hundred miles south of Hong Kong on 23rd October 1845, while on a voyage from China to Bombay. Lloyd's List confirms that the Master of the ship at the time of her loss was a Captain MacIntyre and adds that the Master, Officers, passengers and part of her crew were saved and landed at Hong Kong.

Documentary evidence indicates that the ship sailed regularly in this trade between Calcutta and the Canton River in 1835. It seems likely that the vessel met her end while still engaged in the opium traffic. The wife of the Master was buried at Hong Kong two days before the ship was lost, and it seems likely that the gravestone was brought to the island at a later date, as the granite used does not appear to be of Hong Kong origin (Moore, 1974).

5.2 Geophysical Survey Results

5.2.1 Drawings

The geophysical survey data are presented in summary charts and presented in ***Appendix A.***

Chart Figures 1.1 & 1.2: Seismic and Side Scan Sonar Track Plot
Chart Figures 2.1 & 2.2: Swath and Echo Sounding Track Plot
Chart Figures 3.1 & 3.2: Magnetic Survey Track Plot
Chart Figures 4.1 & 4.2: Contoured Sounding Plan
Chart Figures 5.1 & 5.2: Contoured Levels at the Base of Marine Deposits
Chart Figures 6.1 & 6.2: Contoured Levels on Top of Rock in any State of Decomposition
Chart Figures 7.1 & 7.2: Contoured Levels on Top of Presumed Moderately Decomposed Rock
Chart Figures 8.1 & 8.2: Contoured Isopachs of Marine Deposits
Chart Figures 9.1 & 9.2: Contoured Isopachs of Alluvium
Chart Figures 10.1 & 10.2: Contoured Isopachs of Rock in any State of Decomposition
Chart Figures 11.1 & 11.2: Seabed Features and Cable/Pipeline Alignments

5.2.2 Contoured Sounding Plan

The data from the echo sounder is used to compile the charts giving seabed depths across the study area. The most obvious features on the sounding plan (***Chart Figures 4.1 and 4.2***) are the rock outcrops located on the Lantau side. The main rock outcrop is more than 2m high. Apart from that the seabed is fairly featureless.

The seabed varies between 0 mPD and -8 mPD within the survey area.

5.2.3 Seismic Reflection Survey Results

The seismic reflection data is used to establish the seabed stratigraphy. It will also identify significant buried objects. In this instance the interpretation of the results indication that there is a layer of Marine Deposit across the whole area. The maximum thickness of the marine deposits over the survey area is 10 – 11 m approaching the centre of the channel. It gets thinner towards the rock outcrop area at the north and close to the shore areas. The details are shown on ***Chart Figures 5.1 and 5.2***.

From an archaeological perspective, the Marine Deposits called the Hang Hau Formation has the greatest archaeological potential. The formation consists of relatively homogenous very soft to soft, greenish grey silty clay and has a high moisture content. Therefore, the Hang Hau Formation sediments potentially provide an excellent substrate for the preservation of archaeological material. Additionally, the soft nature of the sediments would make it possible for archaeological material to be buried within the formation,

where it would have greater protection than if it were exposed on the seabed. However, the survey results did not reveal any significant buried features.

5.2.4 Alluvium

Chart Figures 6.1 and 6.2 show the level on top of rock in any state of decomposition, equivalent to the base of the Alluvium, where present. The surface is varying and reaches to around -32m below PD in the centre of the channel.

Isopachs of alluvium are presented in ***Chart Figures 9.1 and 9.2***. The survey results show that the alluvium over the survey area is mostly less than 10m thick.

5.2.5 Rock in any State of Decomposition

The topographic variation of the base of rock in any state of decomposition corresponds to the top of moderately decomposed rock. This horizon is presented in ***Chart Figures 7.1 and 7.2***.

Rock in any state of decomposition is missing in most of the survey area as shown in ***Chart Figures 10.1 and 10.2***.

The shallow geology within the HKSAR is well documented, charted and understood. Within the survey area the shallow geology comprises an upper unit of Holocene marine deposits known as the Hang Hau Formation, which in turn overlies older deposits of the Chek Lap Kok Formations. Below this unit lies rock in any state of decomposition (Grade IV/V rock) and presumed moderately decomposed rock (Grade III rock) observed generally >10m beneath the top of Grade IV/V rock.

Within the study area, the surficial sediments are assigned to the Quaternary Hung Hau Formation. The formation consists of relatively homogenous very soft to soft, greenish grey silty clay (Fyfe et al., 1997) and has a high moisture content. Therefore, the Hang Hau Formation sediments potentially provide an excellent substrate for the preservation of archaeological material. Additionally, the soft nature of the sediments would make it possible for archaeological material to be buried within the formation, where it would have greater protection than if it were exposed on the seabed. Across the whole of the study area there is between 10 – 11m of Hang Hau Formation. This would provide an excellent preservation environment for archaeological remains.

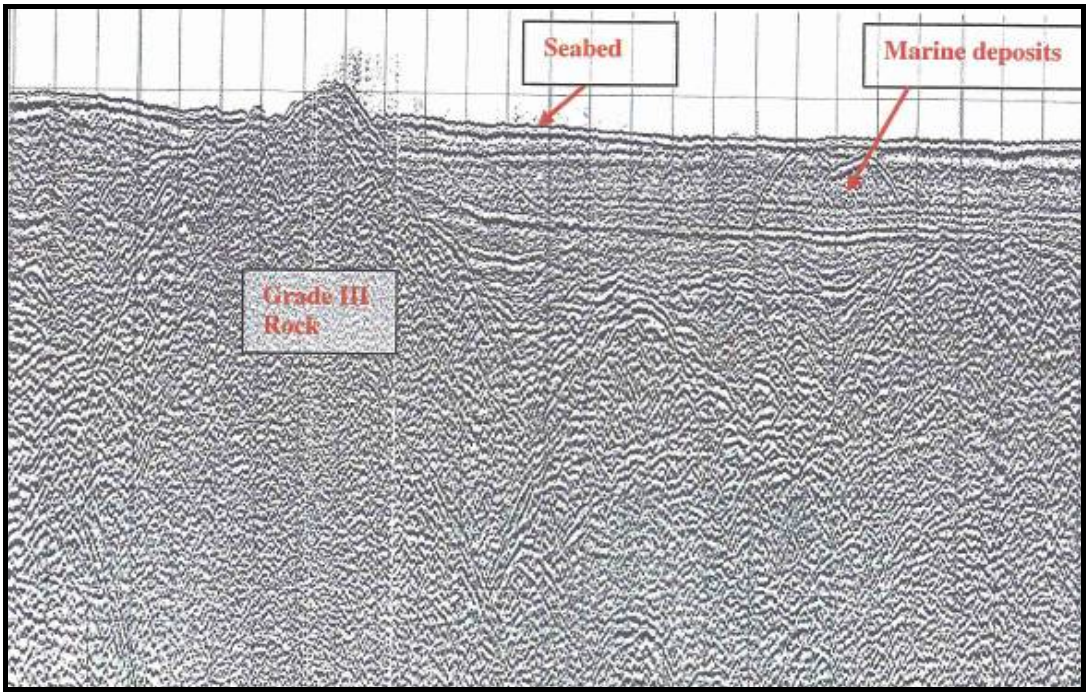


Figure 10: A copy of the seismic profiler data from the study area

5.2.6 Side Scan Sonar Results

The side scan sonar results provide the basis of detailed seabed features mapping across the study area. The data was excellent quality and enabled reliable classification of features as can be seen with the identification of concrete blocks over the existing water pipe. With the exception of the rock outcrop on the Lantau coast side the seabed comprises soft muddy sediments. Any objects with archaeological potential would stand out and be easily identified in this environment.

There is evidence of seabed disturbance along the routes of the existing three submarine cables. However, the seabed evidence is clearly the result of seabed excavation rather than the indicating archaeological resources. There is also clear evidence for extensive fishing trawling activity which would have had a negative impact on archaeological remains, if present.

As shown on the drawings the survey area is mainly covered with soft sediments (***Chart Figures 11.1 and 11.2***). While rock outcrops were observed at the north and close to the shore areas: boulders and concrete slabs related to the existing pipelines and cables were found scattered over the area. Side scan sonar data also showed that the seabed was extensively disturbed (***Figures 11 – 15***). ***Figure 15*** below is a copy of the side scan sonar data showing a large linear feature. It is in parallel with one of the existing submarine cables and an area of seabed disturbance connected with the cable installation. The size, location and conformity of the feature does not give it any archaeological potential.

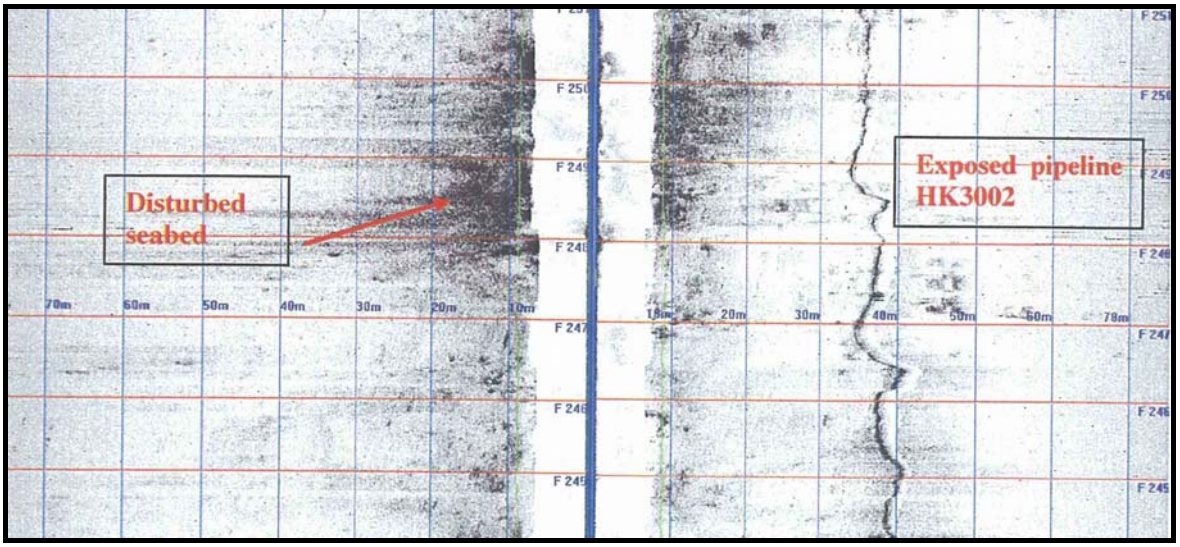


Figure 11: Side scan sonar data showing the disturbed seabed and exposed pipeline

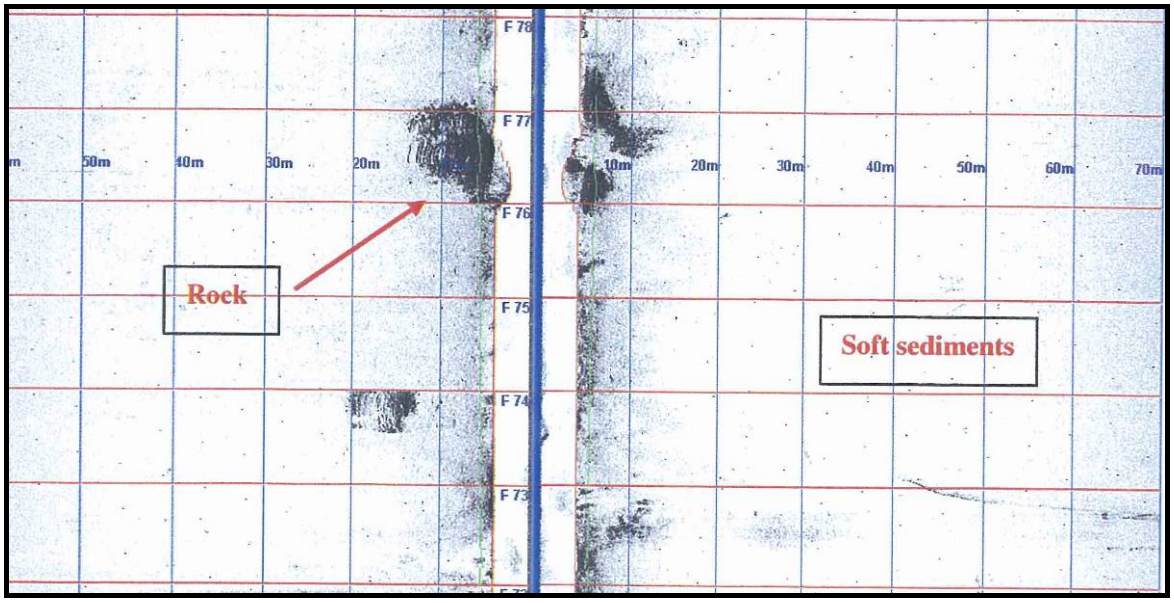


Figure 12: Side scan sonar data showing rock outcrops and soft sediments

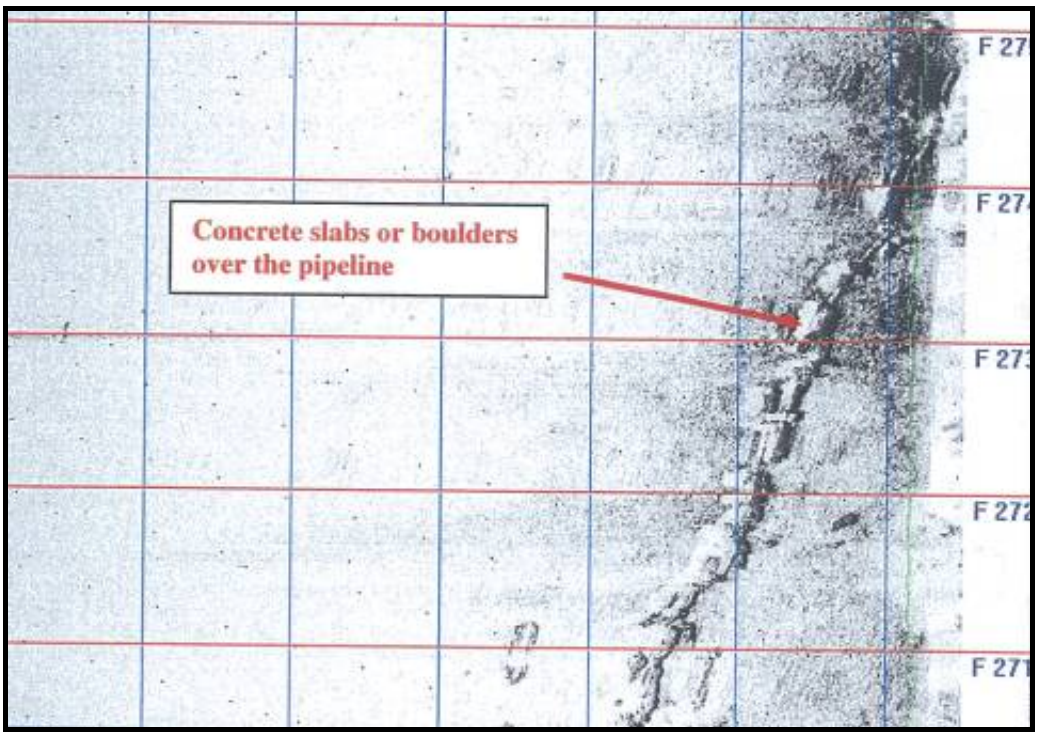


Figure 13: Side scan sonar data showing concrete slabs over the water main

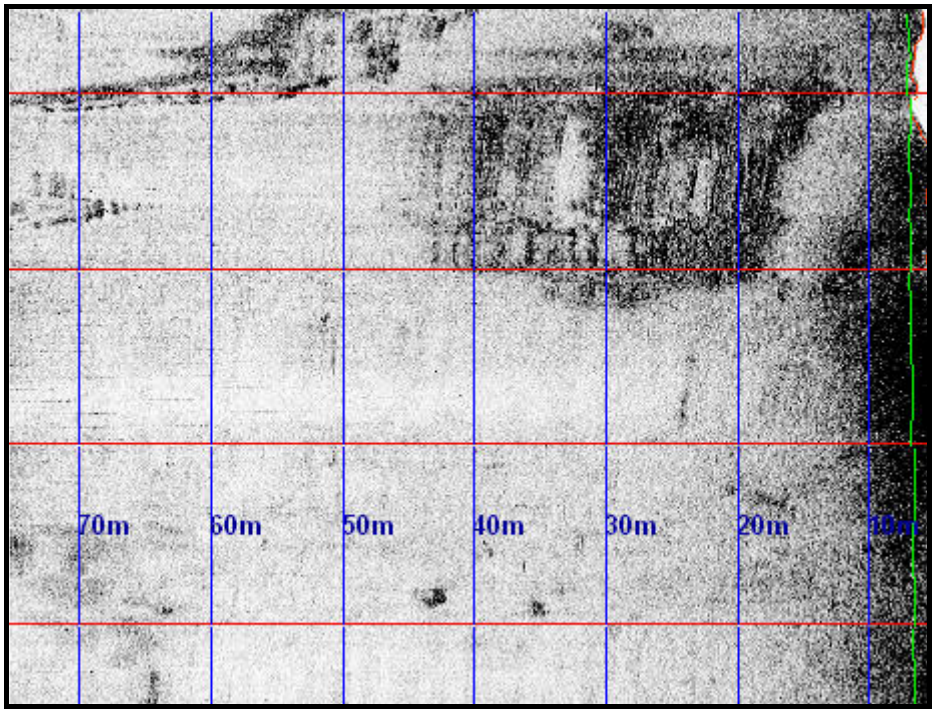


Figure 14: Side scan sonar data showing seabed debris.

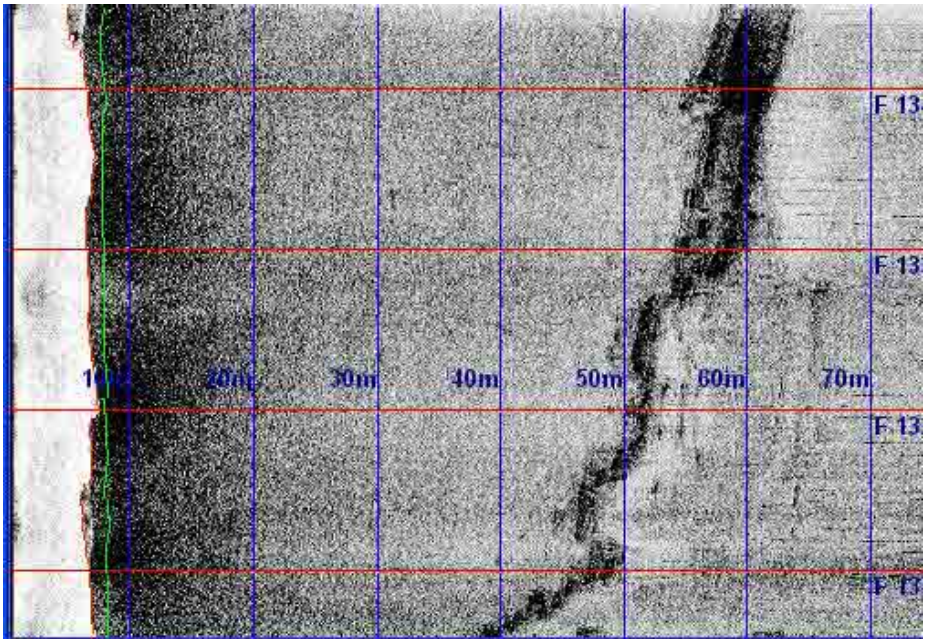


Figure 15: Side Scan Sonar data showing linear feature as shown on Chart Figure 11.1

5.2.7 Magnetic Data

The alignments of the existing pipelines and cables were successfully detected using the magnetometer.

5.2.8 Accuracy

The following estimates of accuracy apply:

- Sea bed levels +/- 0.15m
- Base of marine deposits +/- 1m
- Top of rock in any state of decomposition +/- 2m
- Top of presumed Grade III rock +/- 5m

6. CONCLUSION

6.1 Assessment Cultural Heritage Potential

The Baseline Review established an abundance of historical references to pirate and maritime activity around Cheung Chau indicating high archaeological potential for shipwrecks in the vicinity of the new water pipe. However, the geophysical survey data did not reveal any objects on the seabed with archaeological potential.

The seabed across the Adamasta Channel is extensively disturbed probably due to the construction of the numerous utilities which cross the channel. There is also evidence of dumped materials. During the geophysical survey, trawlers were seen working in the Adamasta Channel (***Figure 16***). Their action would further serve to damage or redistribute archaeological resources on the seabed.

Figure 16: Trawlers working in the Adamasta Channel

6.2 Assessment of Cultural Heritage Impact

As there are no underwater cultural resources within the study area there will be no negative impact from the construction of the new water main.

6.3 Mitigation of Adverse Environmental Impact

There is no need for any mitigation measures or further investigation.

6.4 Evaluation of Residual cultural Heritage Impact

There will be no residual cultural heritage impacts.

7. REFERENCES

Bard, S. 1988. *In Search of the Past: A Guide to the Antiquities of Hong Kong.* Hong Kong Urban Council.

Cheng, K.T. 1975. A History of Cheung Chau from Prehistoric times to the end of World War II. BA dissertation, Department of History, Hong Kong University.

Chiu, S.T., 1995. Major Achievements of Archaeological Rescue Projects Conducted in Hong Kong since 1990. *In: Archaeology in Southeast Asia*. The Museum and Art Gallery & the University of Hong Kong.

Davis, S.G. 1949. *Hong Kong in its Geographical Setting*. Collins London.

Davis, S.G. 1974. Rock carvings in Hong Kong and the New Territories. *Journal of the Hong Kong Archaeological Society*, **5**: 43-46.

Empson, H. 1992. Mapping Hong Kong. The Government Printer, Hong Kong.

Endacott, G.B. 1993. *A History of Hong Kong.* Oxford University Press.

Frost, R.J. 1974. Sha Tsui, High Island. *Journal of the Hong Kong Archaeological Society*, **5:** 23-30.

Fyfe, J.A., Shaw, R. 1997. *The Offshore Geology of Hong Kong.* Hong Kong Geological Survey Memoir. Geotechnical Engineering Office, Hong Kong.

Hayes, J.W. 1963. Cheung Chau 1850-1898. Information from Commemorative Tablets. *Journal of the Hong Kong Branch of the Royal Asiatic Society*. **3**: 88-106.

Hayes, J.W. 1977. *The Hong Kong Region 1850-1911. Institutions and Leadership in Town and Countryside*. Hamden.ArchonBooks.

Hayes, J.W. 1983. *The Rural Communities of Hong Kong. Studies and Themes. Hong Kong*. Oxford University Press.

Hayes, J. W. 1996. *Friends and Teachers. Hong Kong and its People 1953-1987*. Hong Kong University Press.

Hinton, W.J. 1977. Cheng Chow (*sic*) – Long Island. *Journal of the Hong Kong Branch of the Royal Asiatic Society*, **17**: 130-143.

Hong Kong Maritime Museum. 2006. *Piracy and the World of Zhang Baozai.*

Hydrographic Office. 2005. Marine Department, Government of the HKSAR. *Charts for Local Vessels*

Hong Kong Government Gazette, April 8, 1899.

Kwong, L.S.K. 1979. The Chinese Maritime Customs Remembered: an appeal for Oral History in Hong Kong. *Journal of the Hong Kong Branch of the Royal Asiatic Society.* **19***: 21-26.*

Leiper, S. 1997. *Precious Cargo - Scots and the China Trade*. National Museums of Scotland Publishing.

Lo, H.L. 1963. *Hong Kong and its External Communications Before 1942.* Institute of Chinese Culture, Hong Kong.

Lui, Y.C. (ed.) 1990. *Forts and Pirates - A History of Hong Kong. Hong Kong.* Hong Kong History Society.

Meacham, W. 1976. A "Missing Link" in Hong Kong Archaeology. *Journal of the Hong Kong Archaeological Society*, **7**: 110-117.

Meacham, W. 1980. *Archaeology in Hong Kong*. Heinmann Asia.

Meacham, W. 1980. Sai Wan. *Journal of the Hong Kong Archaeological Society*, **9**: 36-37.

Moore, Jean. 1974. The European Grave at Shek Kwu Chau. *Journal of the Hong Kong Branch of the Royal Asiatic Society*, Vol. **XIV**: 186-7.

Morse, H.B. 1926. *The East India Company Trading to China 1635-1834*. Oxford University Press.

Muckelroy, K. 1978. *Maritime Archaeology*. Cambridge University Press.

Murray, D.H. 1987. *Pirates of the South China Coast 1790-1810*. Stanford University Press.

Sayer, G.R. 1975. *Hong Kong 1862-1919*. Hong Kong University Press.

Sayer, G.R. 1980. *Hong Kong 1841-1862: Birth, Adolescence and Coming of Age*. Hong Kong University Press

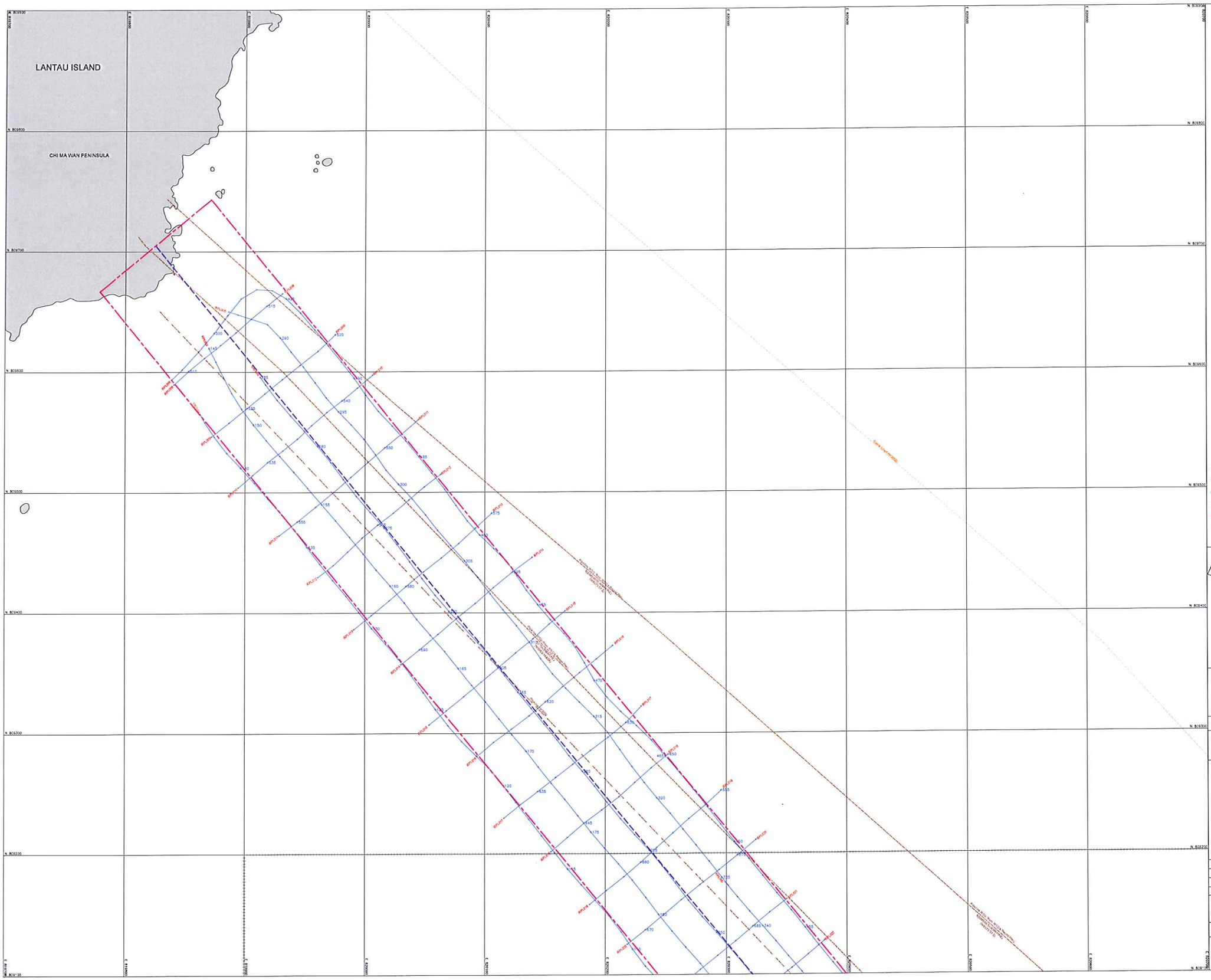
Strange, P.J. & Shaw, R. 1986. *Geology of Hong Kong Island and Kowloon*. Hong Kong Geological Survey Memoir, No**. 2**. Geotechnical Control Office. 1: 20 000 Sheet 11. Hong Kong Government Printer.

United States Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. 1991. *Requirements for Archaeological Resource Field Surveys*.

Wellings, P. 1986. Sai Wan, Cheung Chau. *Journal of the Hong Kong Archaeological Society*, Vol. **XI**: 129-133.

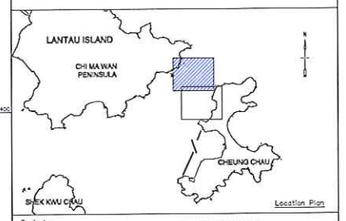
A Gazetteer of Place Names in Hong Kong, Kowloon and the New Territories. Hong Kong. Hong Kong Government Printer. 1960.

APPENDIX A
CHART FIGURES



Legend :

- Proposed Submarine Fresh Water Main
- Seismic and side scan track with fix positions and line numbers
- Chart overlap
- Survey boundary
- Existing cable/pipeline (Location Indicative Only)



Location Plan

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY
TO CHEUNG CHAU - INVESTIGATION,
PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU | FIGURE NUMBER : 1.1

Drawing Title :

SEISMIC AND SIDE SCAN SONAR TRACK PLOT

Notes :

1. Survey Date : 04–06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C-Nav GcGPS
5. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

Revision no.	Date	Drawn by	Checked by	Approved by	Remarks
0	19–12–2008	Clarence Siu	S K Wong	Margie Chan	Preliminary
1	14–01–2009	Clarence Siu	S K Wong	Margie Chan	Final

METRIC SCALE 1:1000

50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK213808

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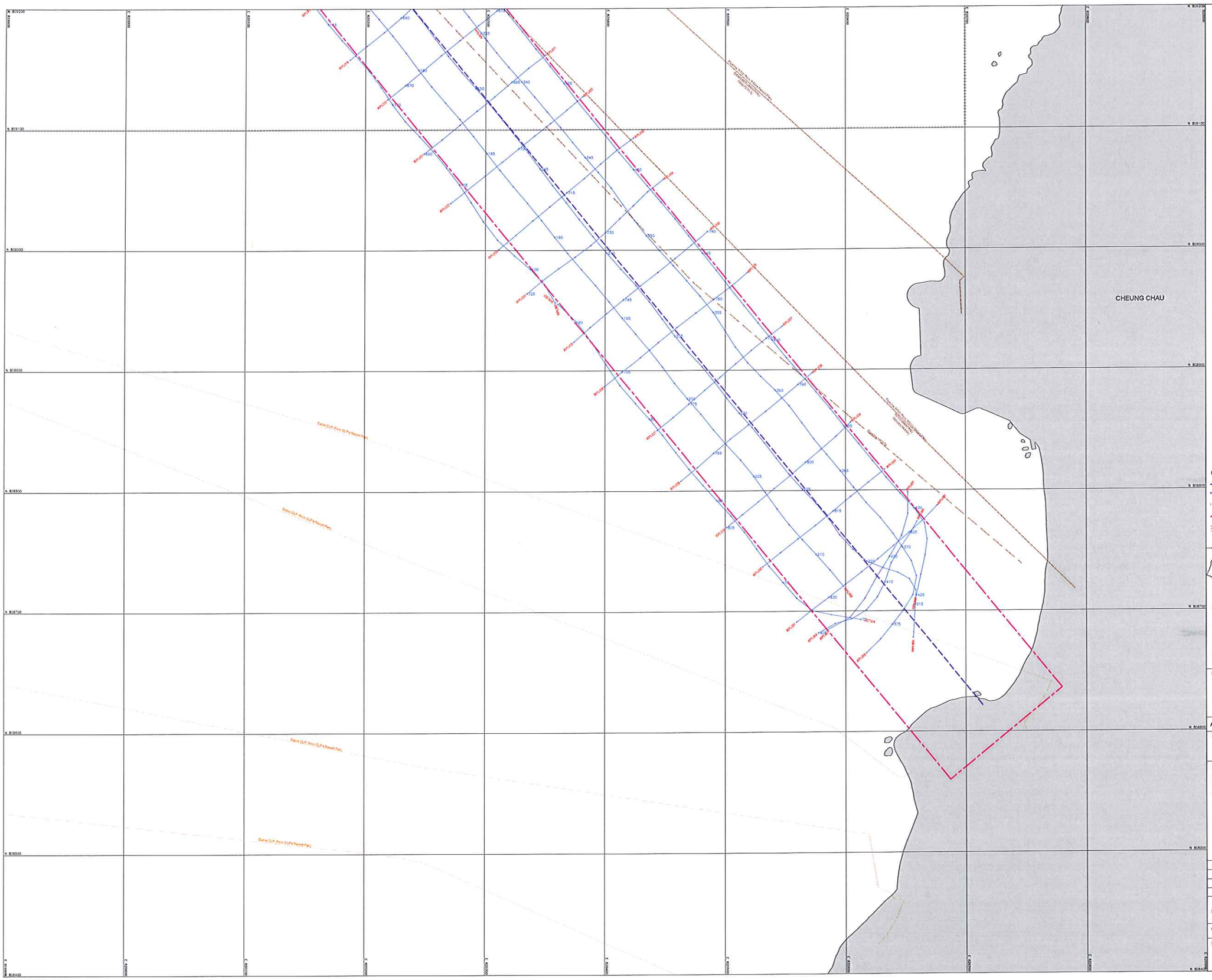
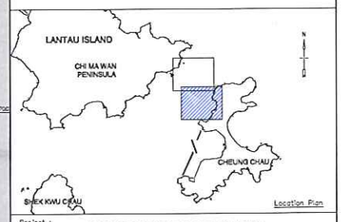


Legend :

- Proposed Submarine Fresh Water Main
- Seismic and side scan track with fix positions and line numbers
- Chart overlap
- Survey boundary
- Existing cable/pipeline (Location Indicative Only)



Location Plan

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY TO CHEUNG CHAU - INVESTIGATION, PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU | FIGURE NUMBER: 12

Drawing Title :

SEISMIC AND SIDE SCAN SONAR TRACK PLOT

Notes :
1. Survey Date : 04–06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C–Nav GeOPS
5. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

Revision no.	Date	Drawn by	Checked by	Approved by	Remarks
0	19–12–2008	Clarence Siu	S K Wong	Mangle Chen	Preliminary
1	14–01–2009	Clarence Siu	S K Wong	Mangle Chen	Final

METRIC SCALE 1:1000

50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK213808

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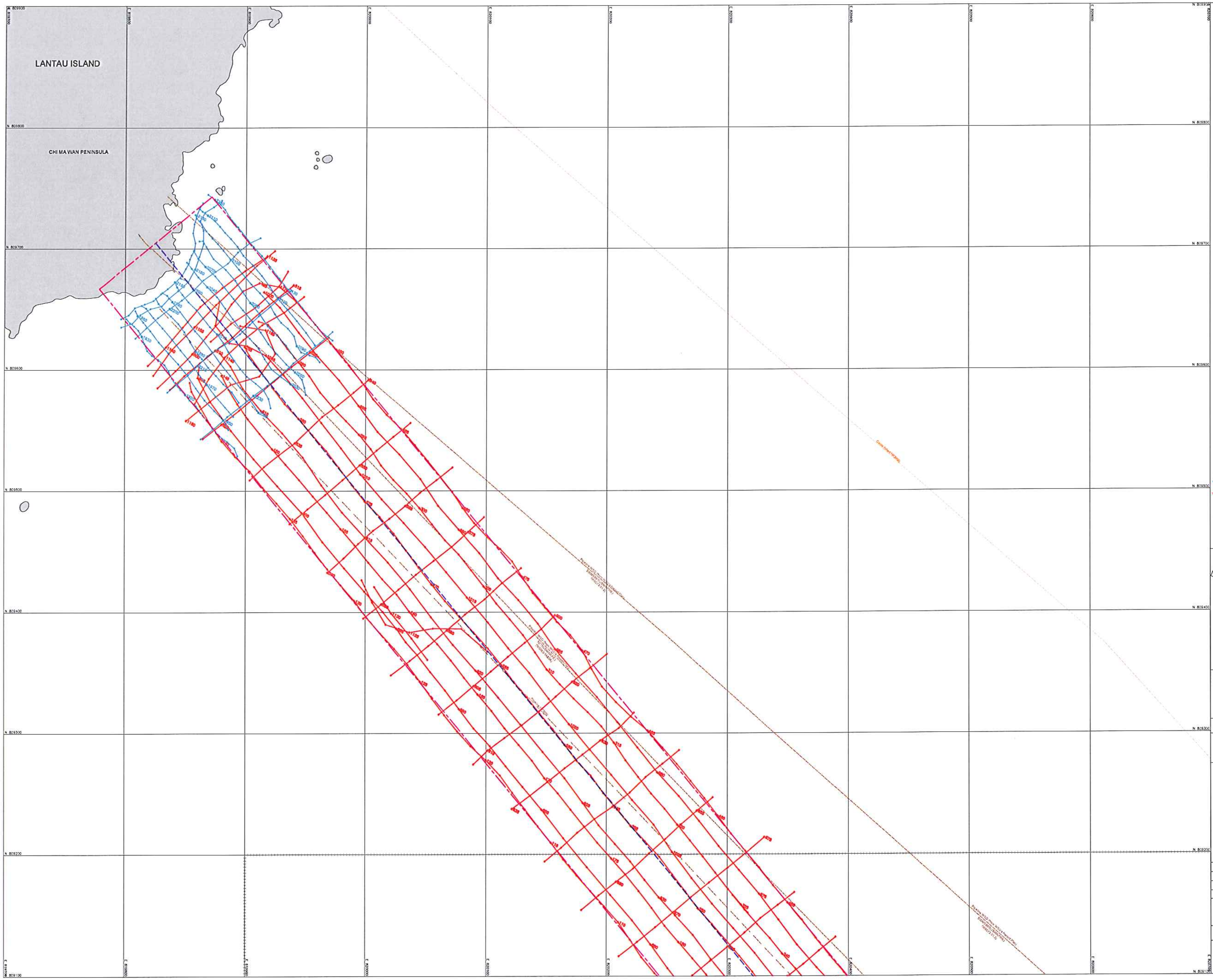
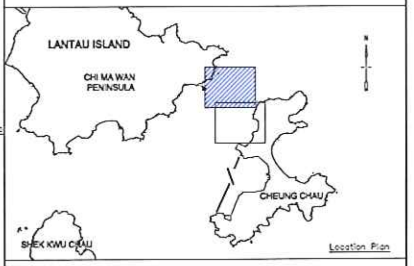


Legend :

— — — —	Proposed Submarine Fresh Water Main
—•—•—	Echo sounding track with fix positions
—•—•—	Swath track with fix positions
¦¦¦¦¦¦¦¦¦¦¦¦	Chart overlap
— - —	Survey boundary
═ ═ ═	Existing cable/pipeline (Location Indicative Only)



Location Plan

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY TO CHEUNG CHAU - INVESTIGATION, PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU

FIGURE NUMBER : 2.1

Drawing Title :

SWATH AND ECHO SOUNDING TRACK PLOT

Notes :
1. Survey Date : 04-06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C-Nav GcGPS
5. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

Revision no.	Date	Drawn by	Checked by	Approved by	Remarks
0	19-12-2008	Clarence Siu	S K Wong	Margie Chen	Preliminary
1	14-01-2009	Clarence Siu	S K Wong	Margie Chen	Final

METRIC SCALE 1:1000

50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor :

EGS (ASIA) LIMITED

JOB NO. : HK213808

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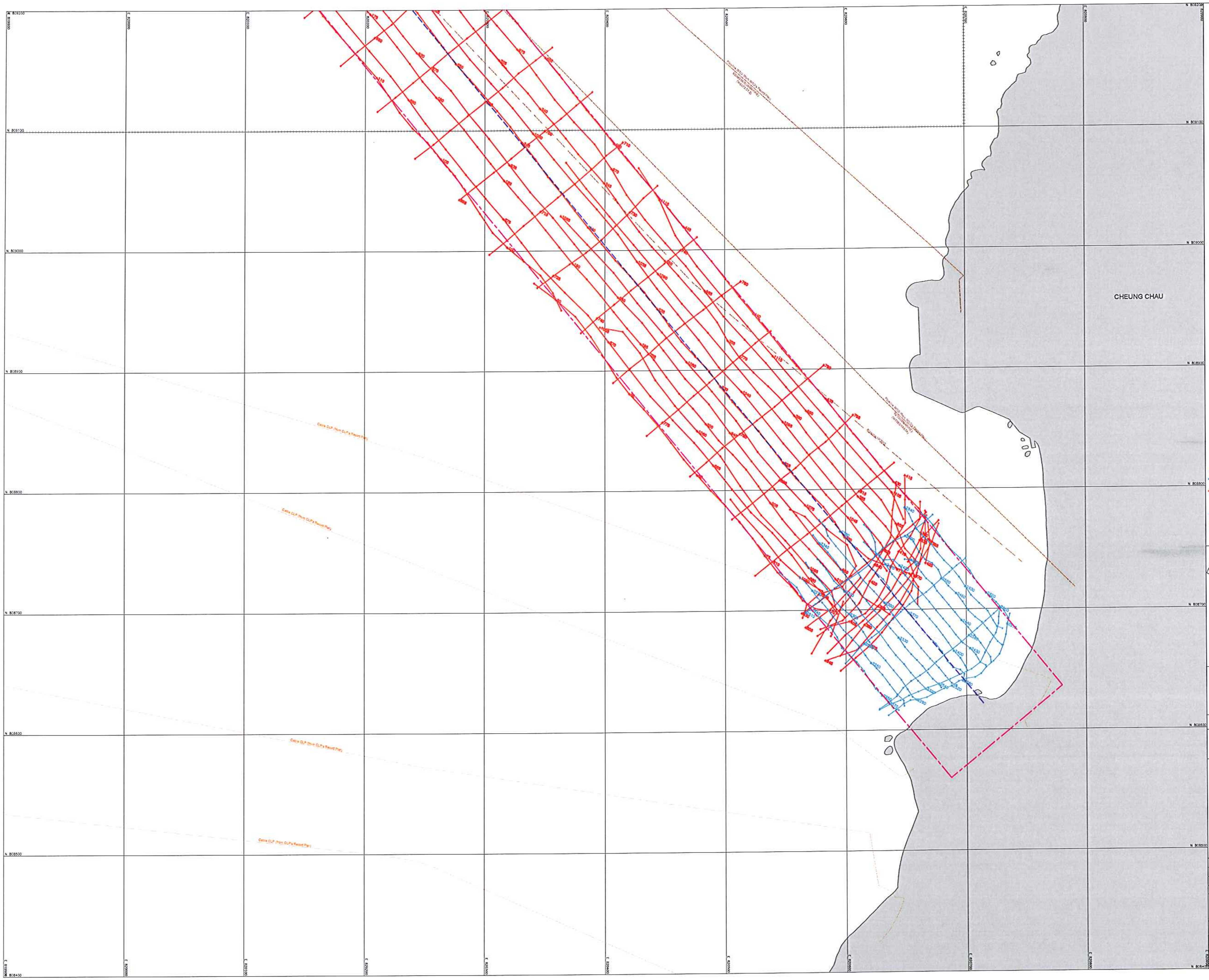
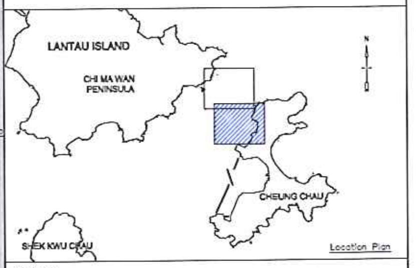


Legend :

- ▬ ▬ ▬ Proposed Submarine Fresh Water Main
- Echo sounding track with fix positions
- Swath track with fix positions
- ¦¦¦¦¦¦¦¦¦¦¦¦ Chart overlap
- ▬ ‑ ▬ Survey boundary
- Existing cable/pipeline (Location Indicative Only)



Location Plan

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY
TO CHEUNG CHAU - INVESTIGATION,
PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU

FIGURE NUMBER : 2.2

Drawing Title :

SWATH AND ECHO SOUNDING TRACK PLOT

Notes :

1. Survey Date : 04-06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C-Nav GcGPS
5. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

Revision no.	Date	Drawn by	Checked by	Approved by	Remarks
0	19-12-2008	Clarence Siu	S K Wong	Margie Chan	Preliminary
1	14-01-2009	Clarence Siu	S K Wong	Margie Chan	Final

METRIC SCALE 1:1000

50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor :

EGS (ASIA) LIMITED
8/F South, Somerset House, Taikoo Place, 979 King's Road, Quarry Bay, Hong Kong

EARTH SCIENCES & SURVEYING

JOB NO. : HK213808

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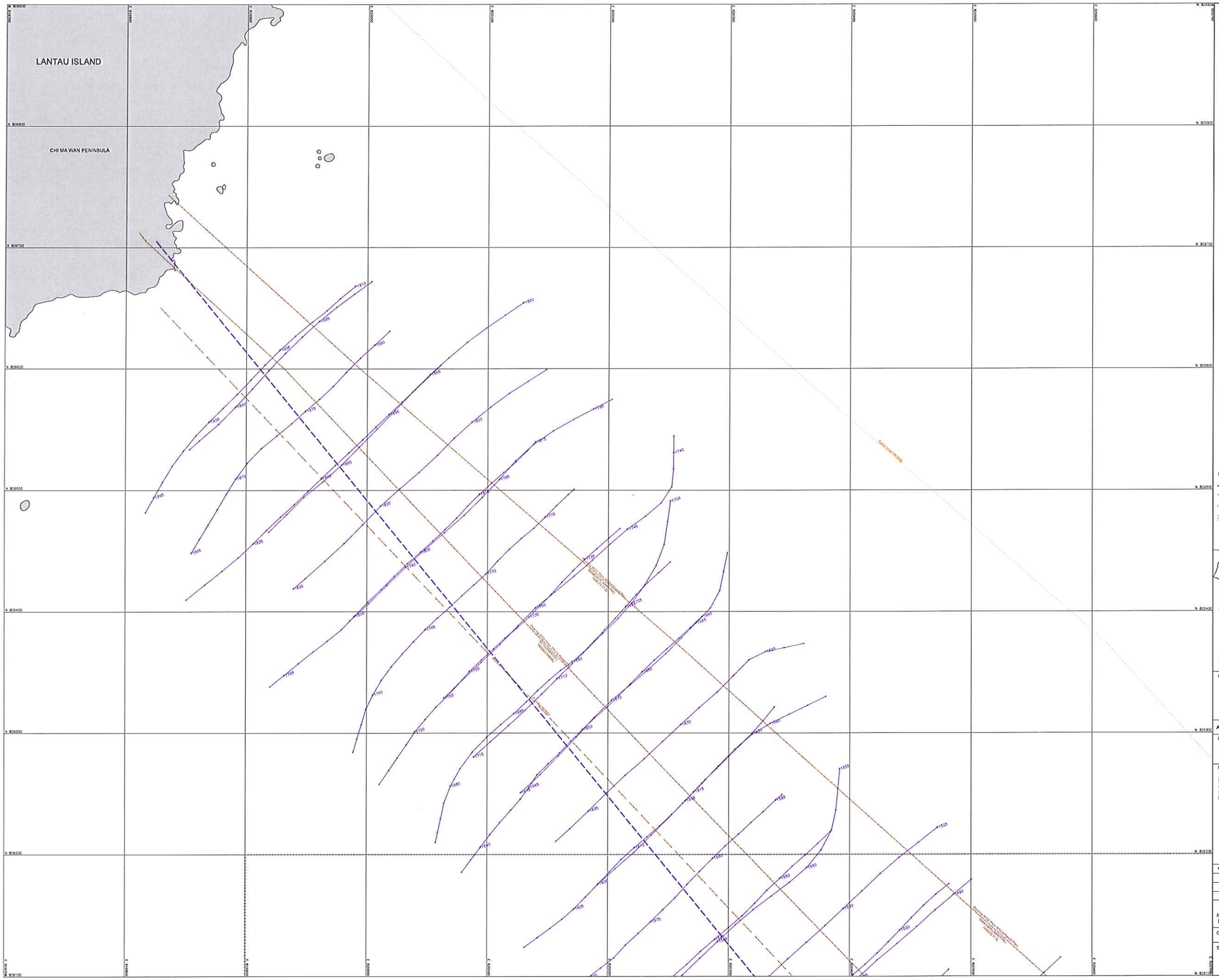
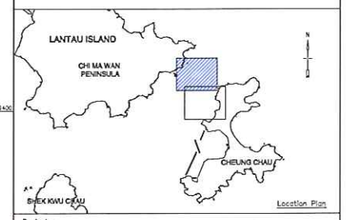


N

Legend :

- Proposed Submarine Fresh Water Main
- Magnetic track with fix positions
- Chart overlap
- Existing cable/pipeline (Location Indicative Only)



Location Plan

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY
TO CHEUNG CHAU - INVESTIGATION,
PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU | FIGURE NUMBER : 3.1

Drawing Title :

MAGNETIC TRACK PLOT

Notes :
1. Survey Date : 04-06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C-Nav DGPS
5. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

Revisions	Date	Drawn by	Checked by	Approved by	Remarks
0	19-12-2008	Clarence Siu	S K Wong	Mangle Chan	Preliminary
1	14-01-2009	Clarence Siu	S K Wong	Mangle Chan	Final

METRIC SCALE 1:1000

50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK213808

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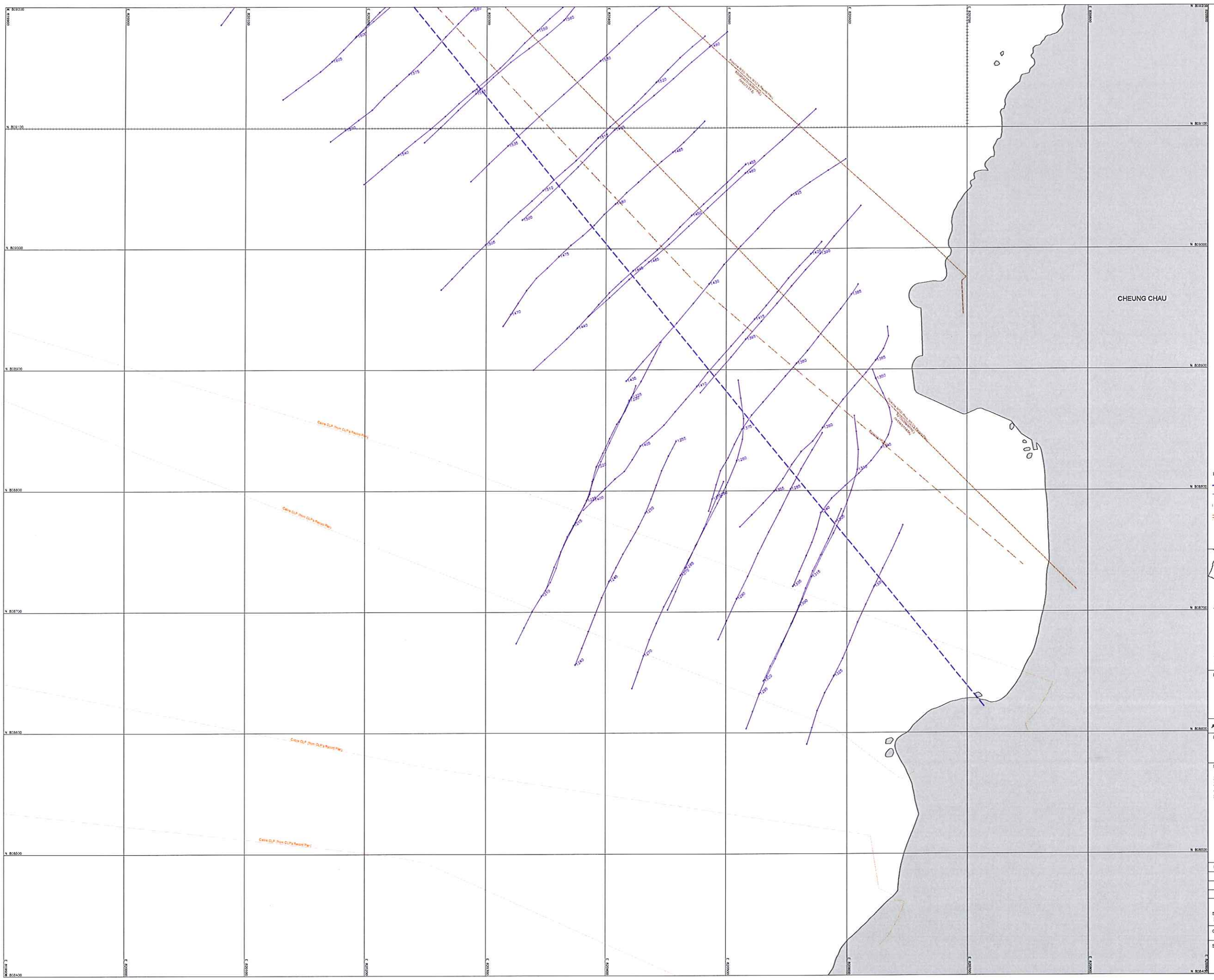

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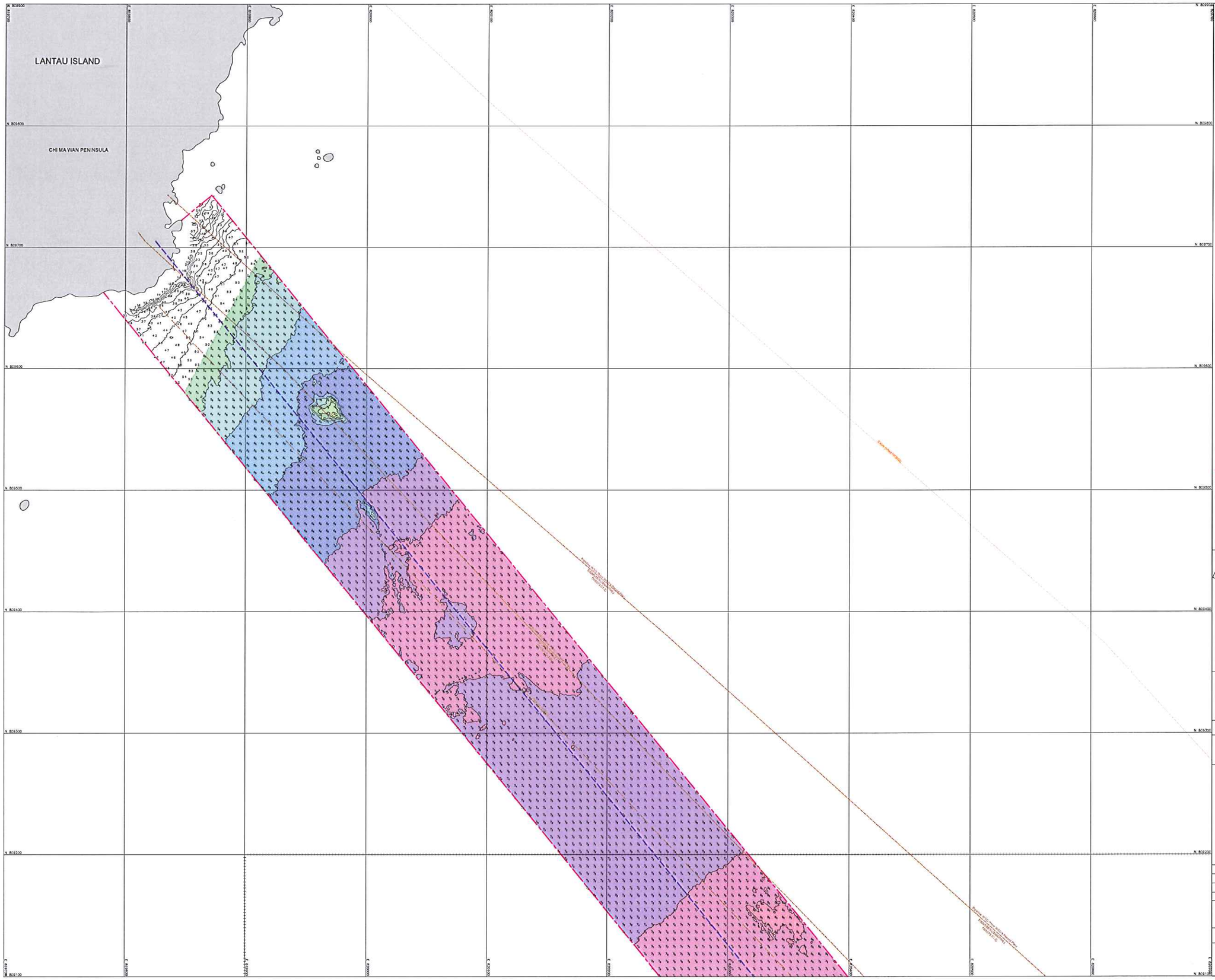

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY
TO CHEUNG CHAU - INVESTIGATION,
PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU | FIGURE NUMBER: 4.1

Drawing Title :

CONTOURED SOUNDING PLAN

Notes :
1. Survey Date : 04–06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C–Nav GcGPS
5. Equipment : Reson Seabat 8125 Swath System
   Knudsen Dual Frequency Echo Sounder
6. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

Revision no.	Date	Drawn by	Checked by	Approved by	Remarks
0	19–12–2008	Clarence Siu	S K Wong	Margie Chan	Preliminary
1	14–01–2009	Clarence Siu	S K Wong	Margie Chan	Final

METRIC SCALE 1:1000
50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor : EGS (ASIA) LIMITED
EARTH SCIENCES & SURVEYING
JOB NO. : HK213808

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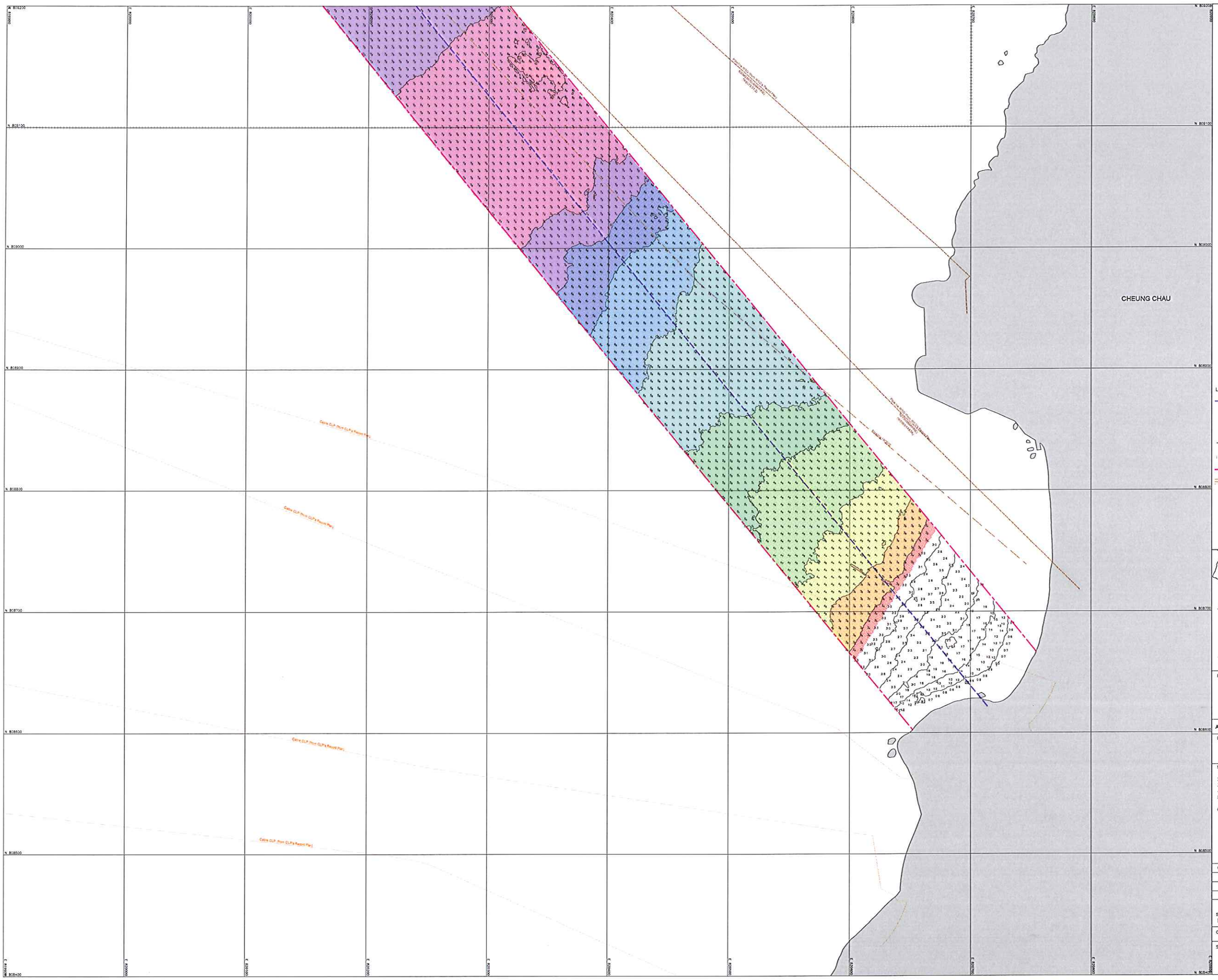
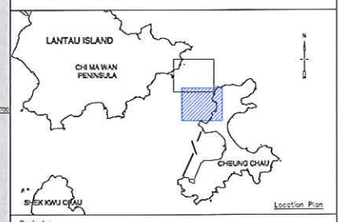


Legend :

- Proposed Submarine Fresh Water Main
- 23/21 Spot value in metres above/below HKPD measured by single beam echo sounder
- 34 Spot value in metres below HKPD measured by multibeam echo sounder
- Contour at 0.5 metre intervals
- Chart overlap
- Survey boundary
- Existing cable/pipeline (Location Indicative Only)

METRES (HKPD)

30 35 40 45 50 55 60 65 70 75 80 85



Location Plan

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY
TO CHEUNG CHAU - INVESTIGATION,
PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU | FIGURE NUMBER : 4.2

Drawing Title :

CONTOURED SOUNDING PLAN

Notes :

1. Survey Date : 04-06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C-Nav GeoPS
5. Equipment : Reson Seabat 8125 Swath System
   Knudsen Dual Frequency Echo Sounder
6. Coastline taken from 1:20000 Series HW200, Survey and Mapping Office, Lands Department

Revision no.	Date	Drawn by	Checked by	Approved by	Remarks
0	19-12-2008	Clarence Siu	S K Wong	Mangle Chan	Preliminary
1	14-01-2009	Clarence Siu	S K Wong	Mangle Chan	Final

METRIC SCALE 1:1000

50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK213808

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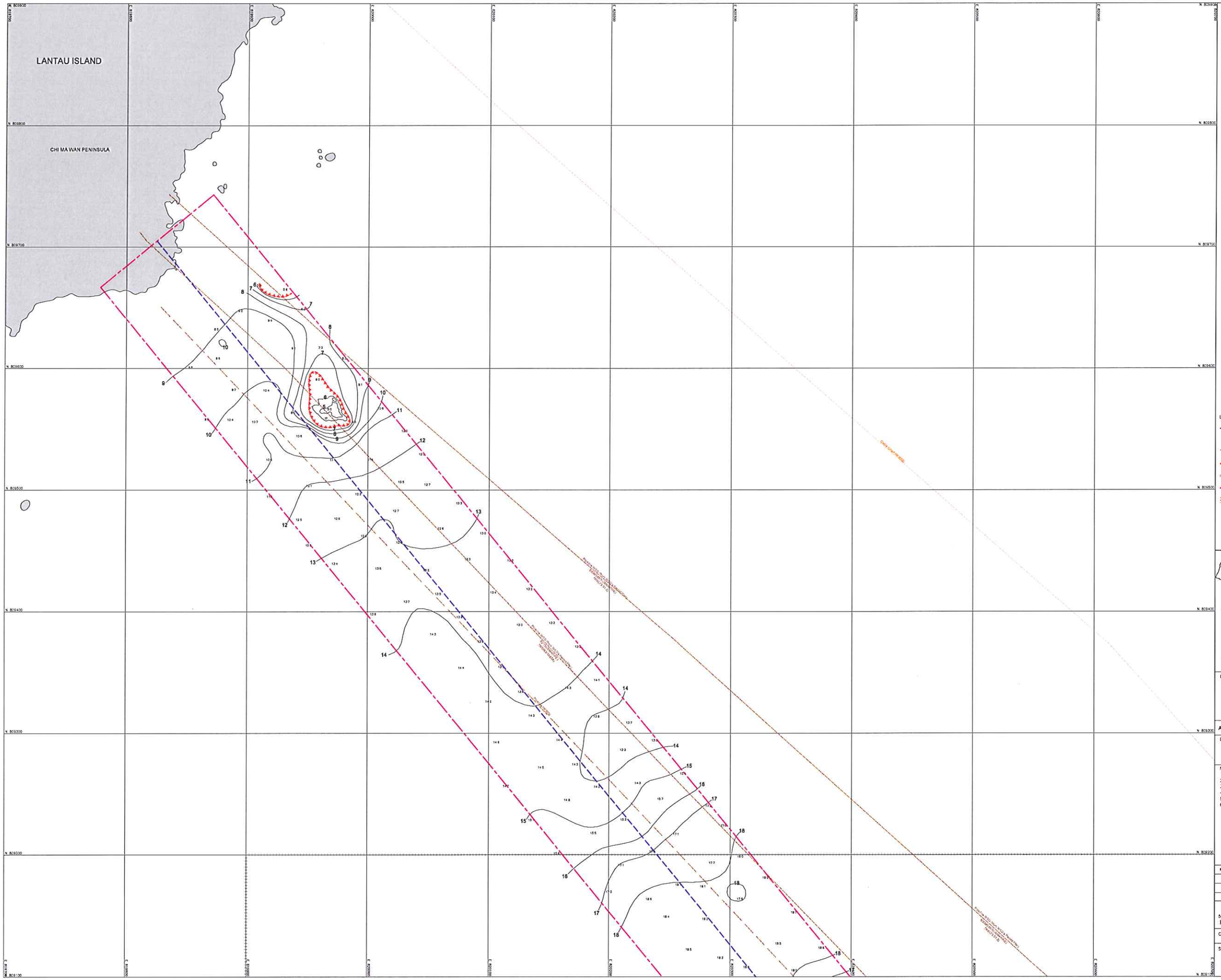

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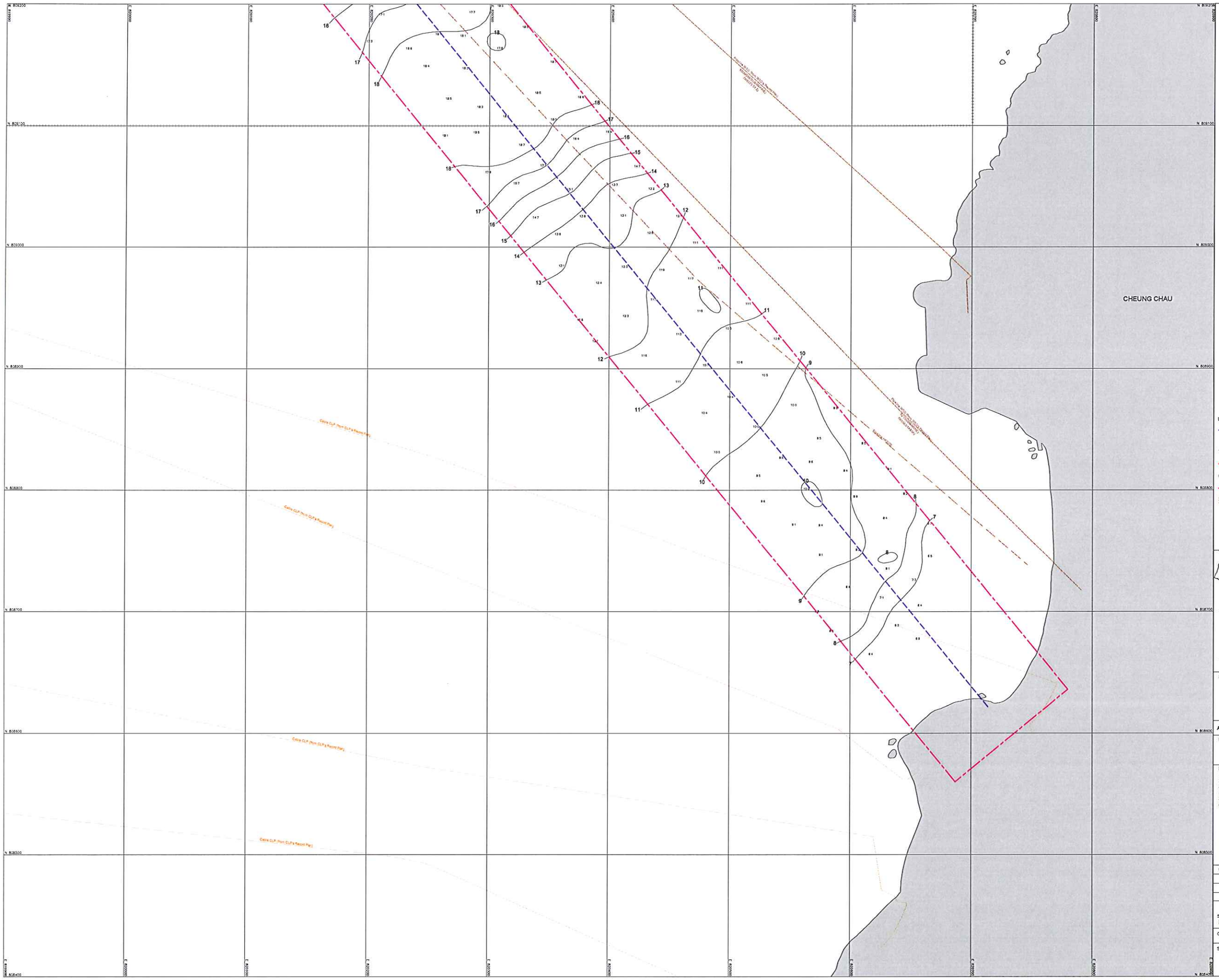
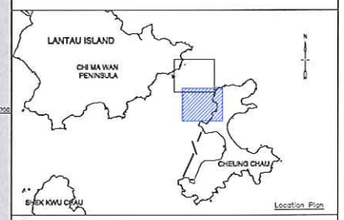


Legend :

- Proposed Submarine Fresh Water Main
- 21 Spot value in metres below HKPD
- Contour at 1 metre intervals
- Rock Outcrop
- Chart overlap
- Survey boundary
- Existing cable/pipeline (Location Indicative Only)



Location Plan

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY
TO CHEUNG CHAU - INVESTIGATION,
PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU | FIGURE NUMBER : 5.2

Drawing Title :

CONTOURED LEVELS AT
THE BASE OF MARINE DEPOSITS

Notes :
1. Survey Date : 04-06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C-Nav GeGPS
5. Equipment : EGS Boomer System
6. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

Revision no.	Date	Drawn by	Checked by	Approved by	Remarks
0	13-12-2008	Clarence Siu	S K Wong	Mangle Chan	Preliminary
1	14-01-2009	Clarence Siu	S K Wong	Mangle Chan	Final

METRIC SCALE 1:1000

50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK213808

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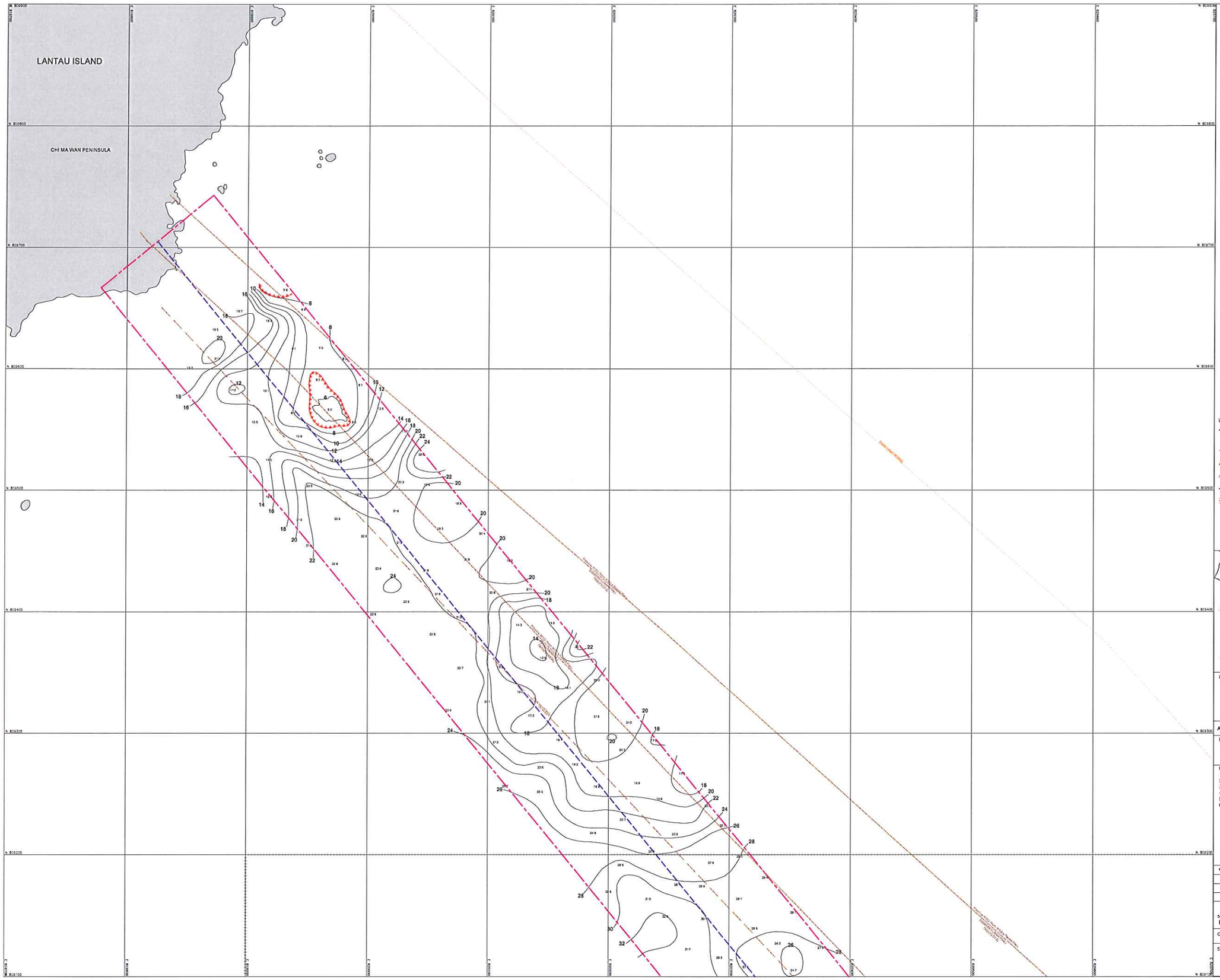

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY
TO CHEUNG CHAU - INVESTIGATION,
PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU | FIGURE NUMBER : 6.1

Drawing Title :

CONTOURED LEVELS ON TOP OF ROCK
IN ANY STATE OF DECOMPOSITION

Notes :
1. Survey Date : 04-06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C-Nav GdGPS
5. Equipment : EGS Boomer System
6. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

Revision	Date	Drawn by	Checked by	Approved by	Remarks
0	19-12-2008	Clarence Siu	S K Wong	Margie Chan	Preliminary
1	14-01-2009	Clarence Siu	S K Wong	Margie Chan	Final

METRIC SCALE 1:1000
50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor : EGS (ASIA) LIMITED
EARTH SCIENCES & ENGINEERING
JOB NO. : HK213808

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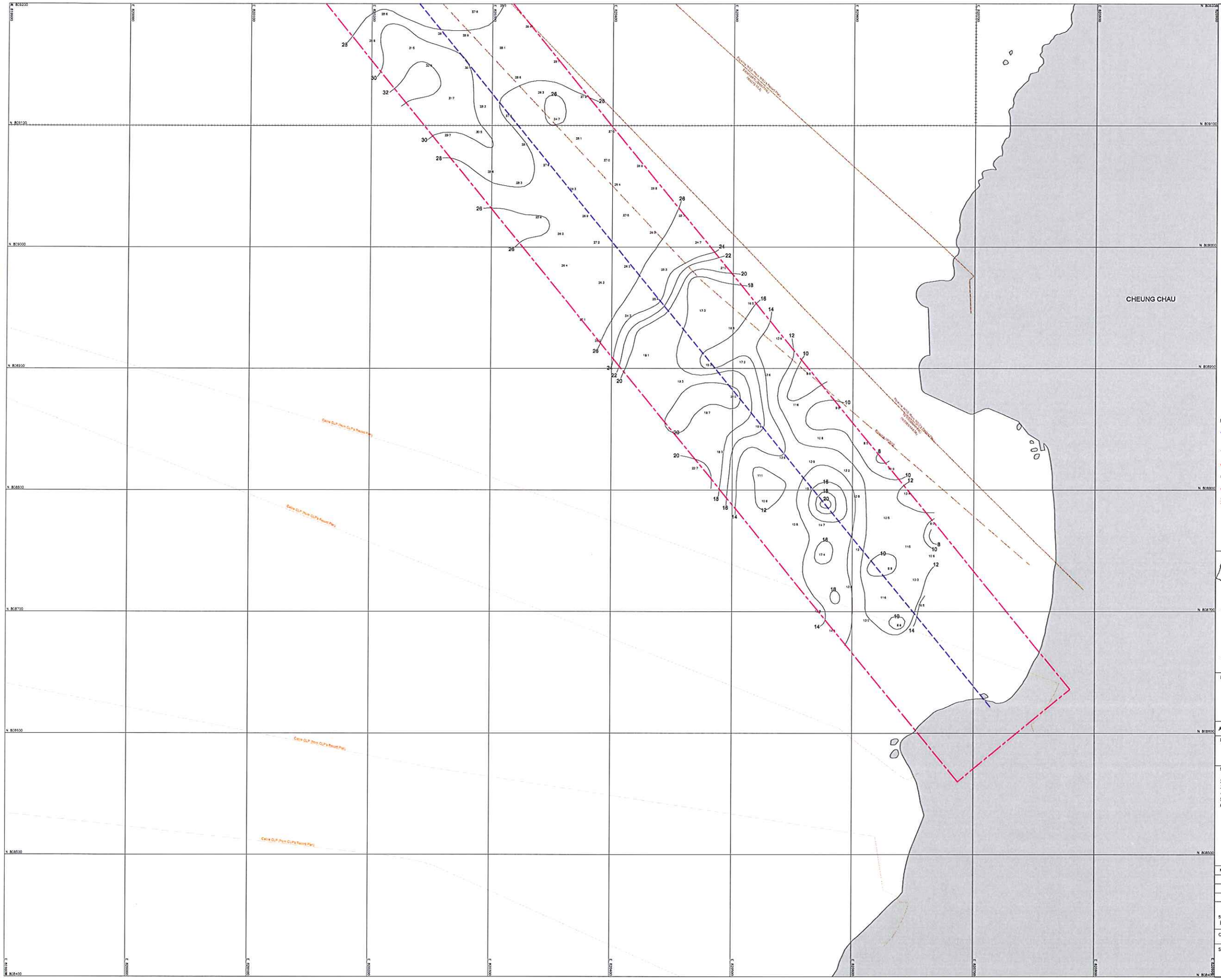
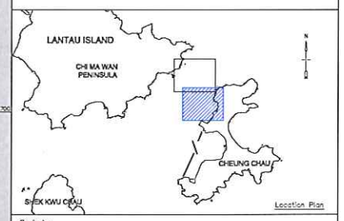


Legend :

- Proposed Submarine Fresh Water Main
- 31 Spot value in metres below HKPD
- Contour at 2 metre intervals
- Rock Outcrop
- Chart overlap
- Survey boundary
- Existing cable/pipeline (Location Indicative Only)



Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY
TO CHEUNG CHAU - INVESTIGATION,
PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU | FIGURE NUMBER : 6.2

Drawing Title :

CONTOURED LEVELS ON TOP OF ROCK
IN ANY STATE OF DECOMPOSITION

Notes :
1. Survey Date : 04-06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C-Nav GcGPS
5. Equipment : EGS Boomer System
6. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

Revision no.	Date	Drawn by	Checked by	Approved by	Remarks
0	19-12-2008	Clarence Siu	S K Wong	Mangle Chan	Preliminary
1	14-01-2009	Clarence Siu	S K Wong	Mangle Chan	Final

METRIC SCALE 1:1000
50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor : EGS (ASIA) LIMITED
EARTH SCIENCES & SURVEYING
JOB NO. : HK213808

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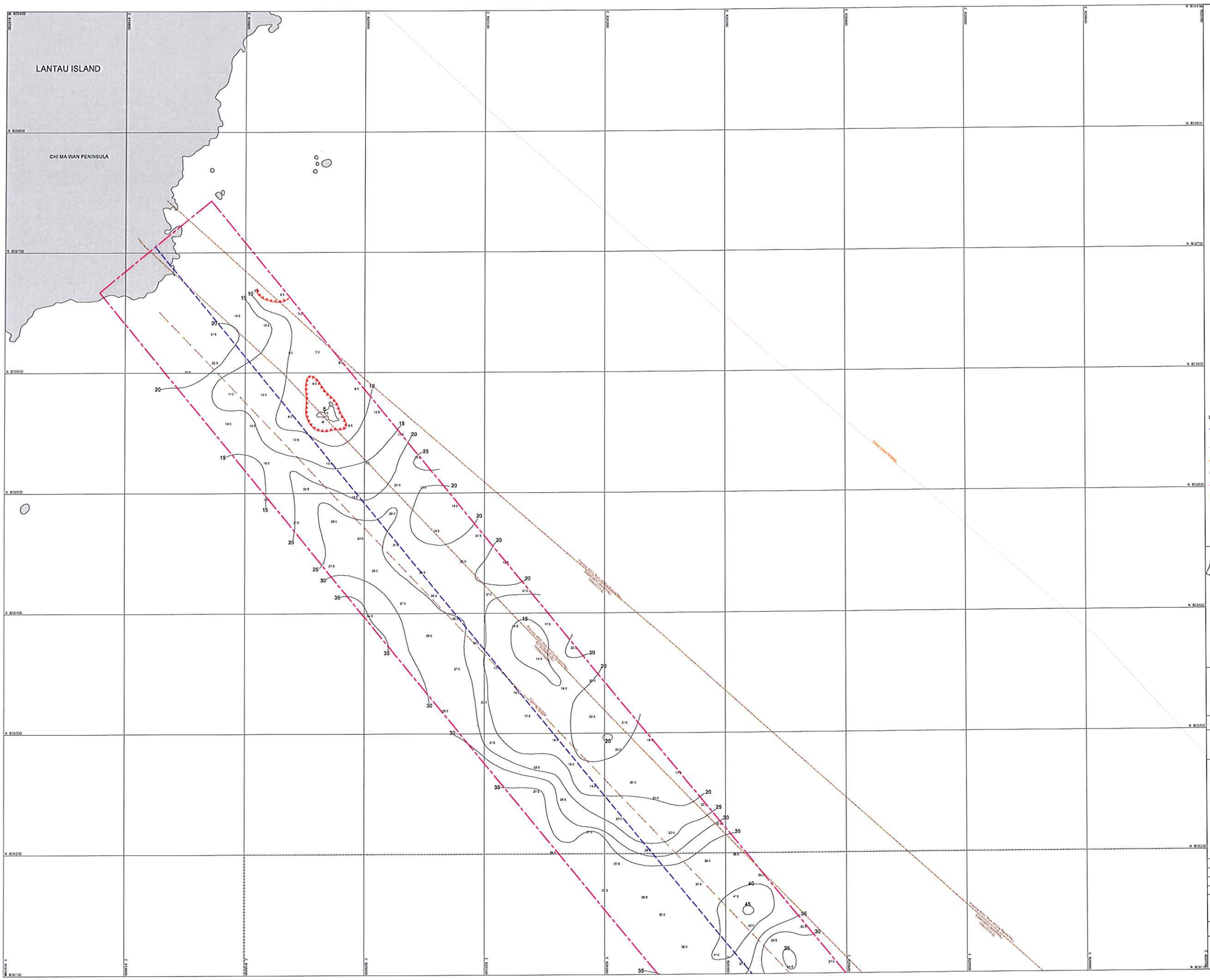
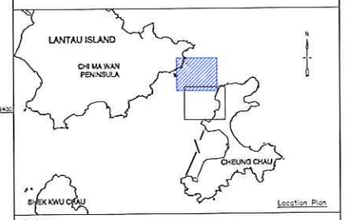


Legend :

- Proposed Submarine Fresh Water Main
- 21 Spot value in metres below HKPD
- Contour at 5 metre intervals
- Rock Outcrop
- Chart overlap
- Survey boundary
- Existing cable/pipeline (Location Indicative Only)



Location Plan

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY
TO CHEUNG CHAU - INVESTIGATION,
PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU | FIGURE NUMBER : 7.1

Drawing Title :

CONTOURED LEVELS ON TOP OF
PRESUMED MODERATELY DECOMPOSED ROCK

Notes :

1. Survey Date : 04-06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C-Nav GeoGPS
5. Equipment : EGS Boomer System
6. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

Revision no.	Date	Drawn by	Checked by	Approved by	Remarks
0	19-12-2008	Clarence Siu	S K Wong	Mangle Chan	Preliminary
1	14-01-2009	Clarence Siu	S K Wong	Mangle Chan	Final

METRIC SCALE 1:1000

50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK213808

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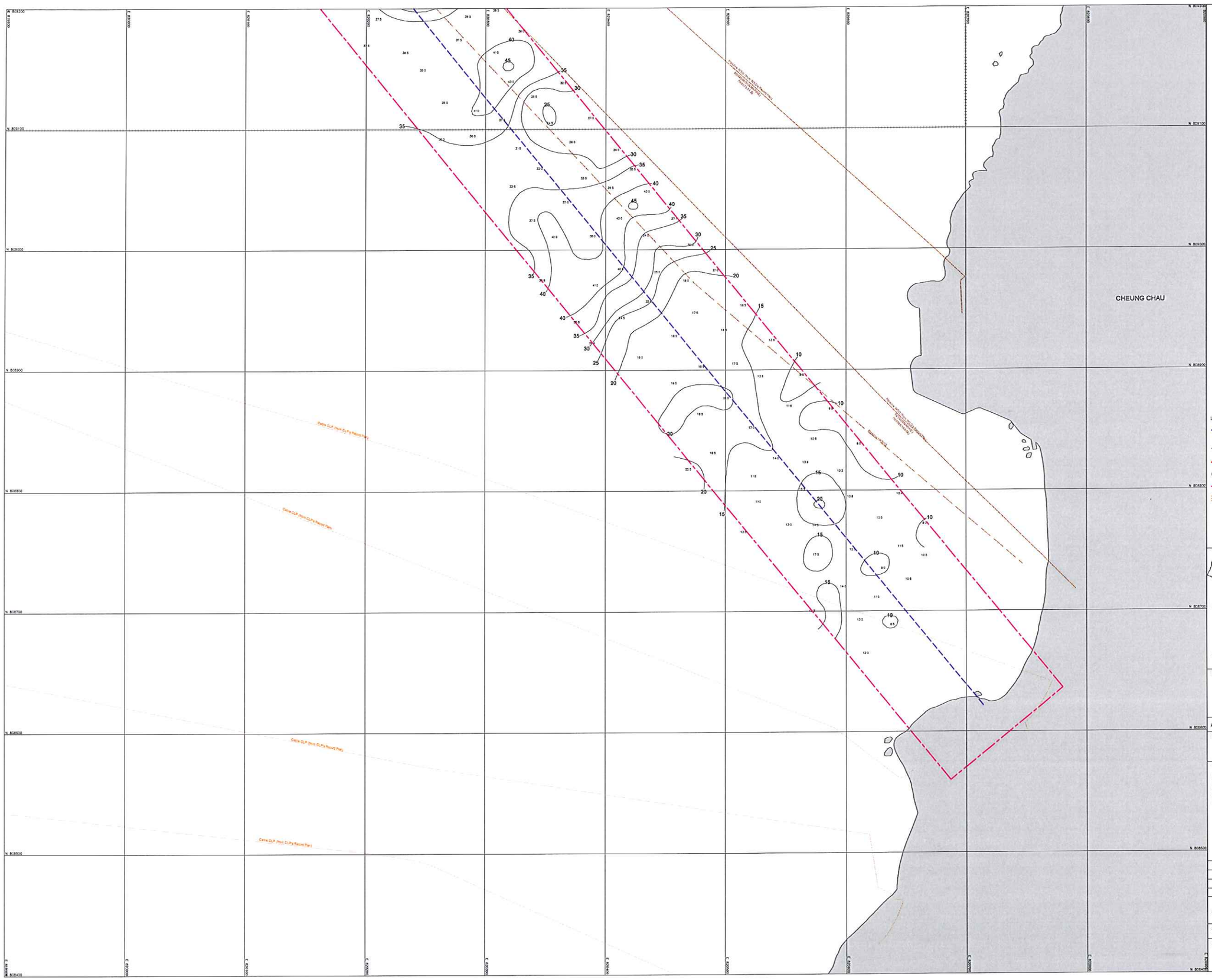

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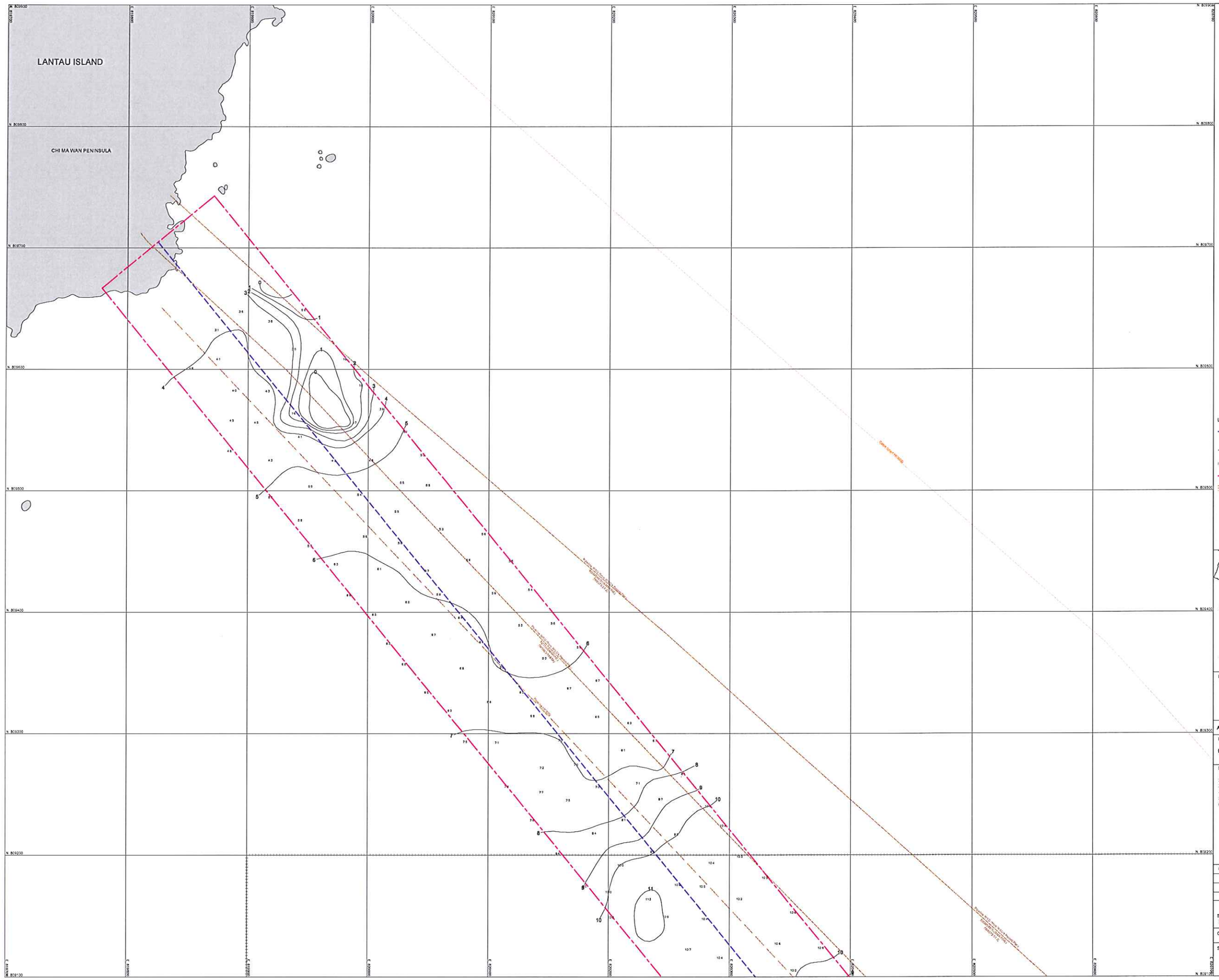
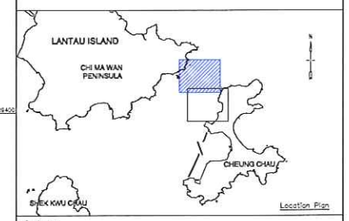


Legend :

- Proposed Submarine Fresh Water Main
- Spot value in metres below HKPD
- Contour at 1 metre intervals
- Chart overlap
- Survey boundary
- Existing cable/pipeline (Location Indicative Only)



Location Plan

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY
TO CHEUNG CHAU - INVESTIGATION,
PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU | FIGURE NUMBER : 8.1

Drawing Title :

CONTOURED ISOPACHS OF MARINE DEPOSITS

Notes :
1. Survey Date : 04-06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C-Nav GcGPS
5. Equipment : EGS Boomer System
6. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

Revision no.	Date	Drawn by	Checked by	Approved by	Remarks
0	19-12-2008	Clarence Siu	S K Wong	Mang's Chen	Preliminary
1	14-01-2009	Clarence Siu	S K Wong	Mang's Chen	Final

METRIC SCALE 1:1000

50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK213808

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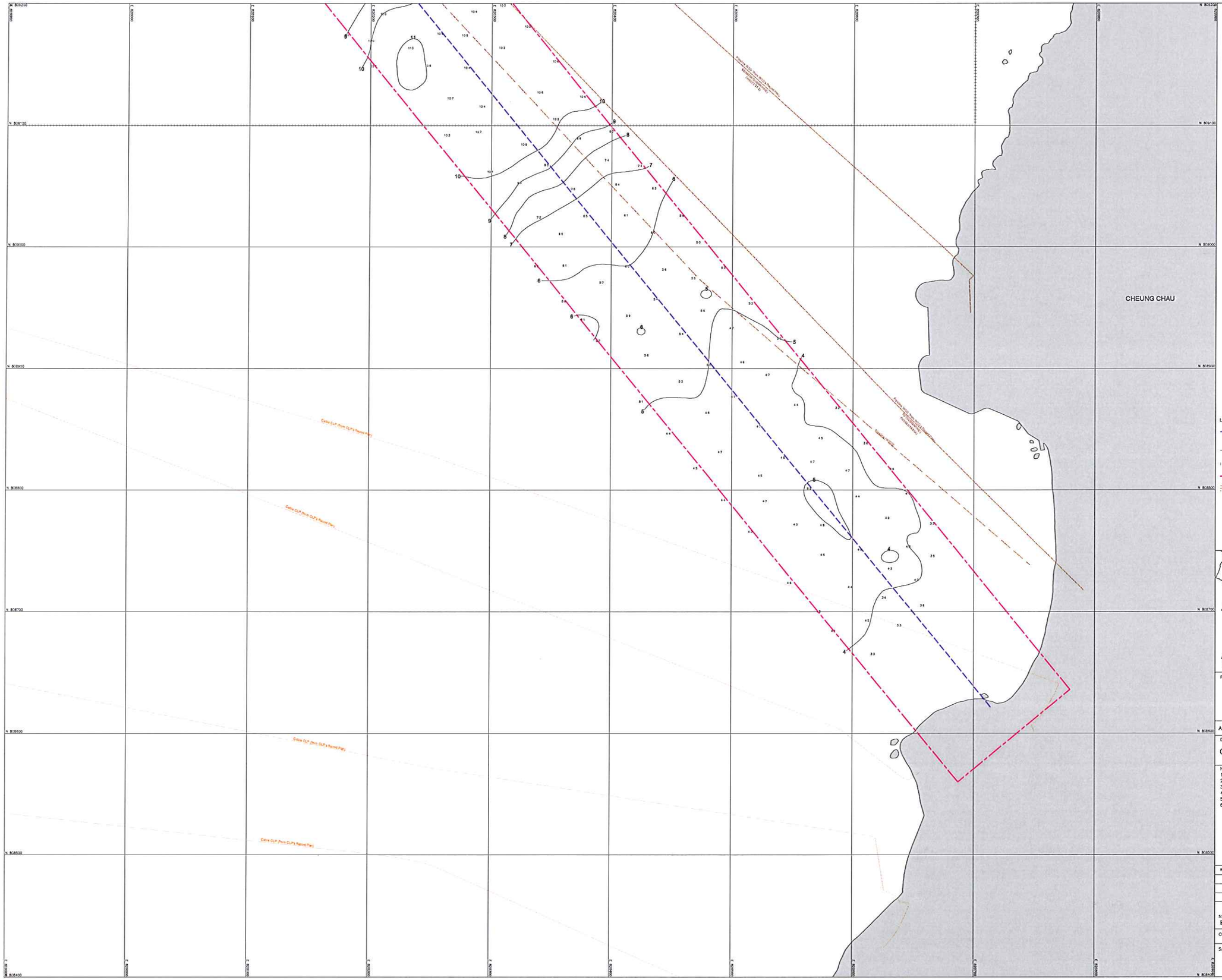
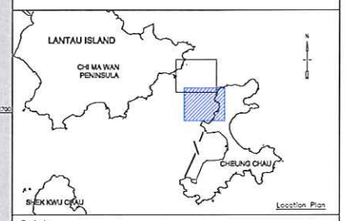


Legend :

- Proposed Submarine Fresh Water Main
- 31 Spot value in metres below HKPD
- Contour at 1 metre intervals
- Chart overlap
- Survey boundary
- Existing cable/pipeline (Location Indicative Only)



Location Plan

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY
TO CHEUNG CHAU - INVESTIGATION,
PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU | FIGURE NUMBER : 8.2

Drawing Title :

CONTOURED ISOPACHS OF MARINE DEPOSITS

Notes :
1. Survey Date : 04-06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C-Nav GcGPS
5. Equipment : EGS Boomer System
6. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	18-12-2008	Clarence Siu	S K Wong	Mangle Chan	Preliminary
1	14-01-2009	Clarence Siu	S K Wong	Mangle Chan	Final

METRIC SCALE 1:1000

50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK213808

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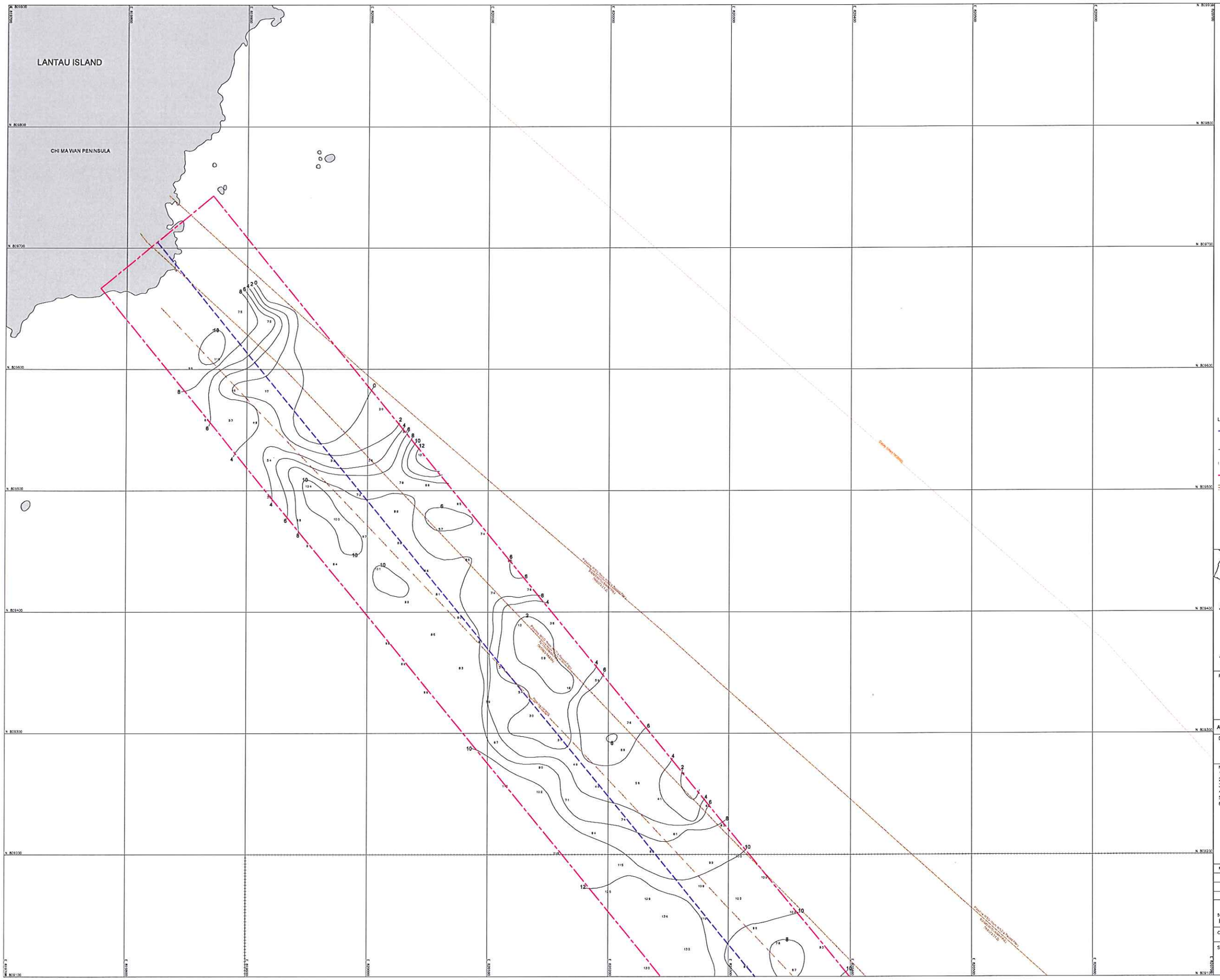
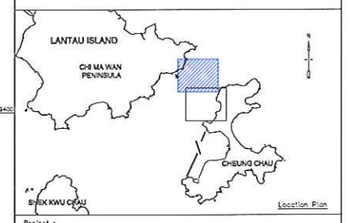


Legend :

- Proposed Submarine Fresh Water Main
- Spot value in metres below HKPD
- Contour at 2 metre intervals
- Chart overlap
- Survey boundary
- Existing cable/pipeline (Location Indicative Only)



Location Plan

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY
TO CHEUNG CHAU - INVESTIGATION,
PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU | FIGURE NUMBER : 9.1

Drawing Title :

CONTOURED ISOPACHS OF ALLUVIUM

Notes :
1. Survey Date : 04-06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C-Nav GcGPS
5. Equipment : EGS Boomer System
6. Coastline taken from 1:20000 Series HK20C, Survey and Mapping Office, Lands Department

Revision no.	Date	Drawn by	Checked by	Approved by	Remarks
0	19-12-2008	Clarence Siu	S K Wong	Margie Chen	Preliminary
1	14-01-2009	Clarence Siu	S K Wong	Margie Chen	Final

METRIC SCALE 1:1000

50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor : EGS (ASIA) LIMITED
EARTH SCIENCES & SURVEYING
6/F, SOUTH SEAS CENTRE, TOWER 75, 75 MODY ROAD, TSIM SHA TSUI, KOWLOON, HONG KONG
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JOB NO. : HK213508

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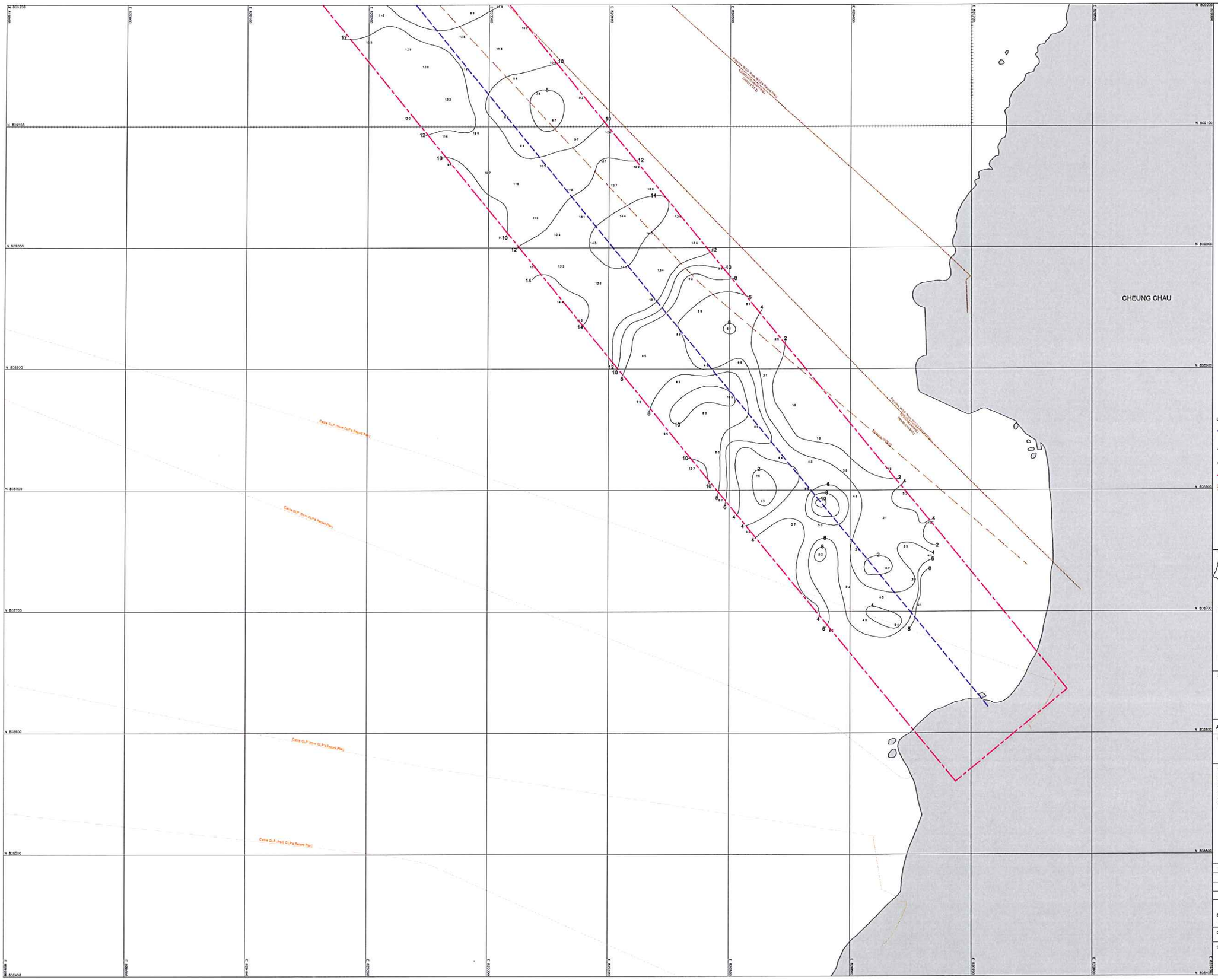

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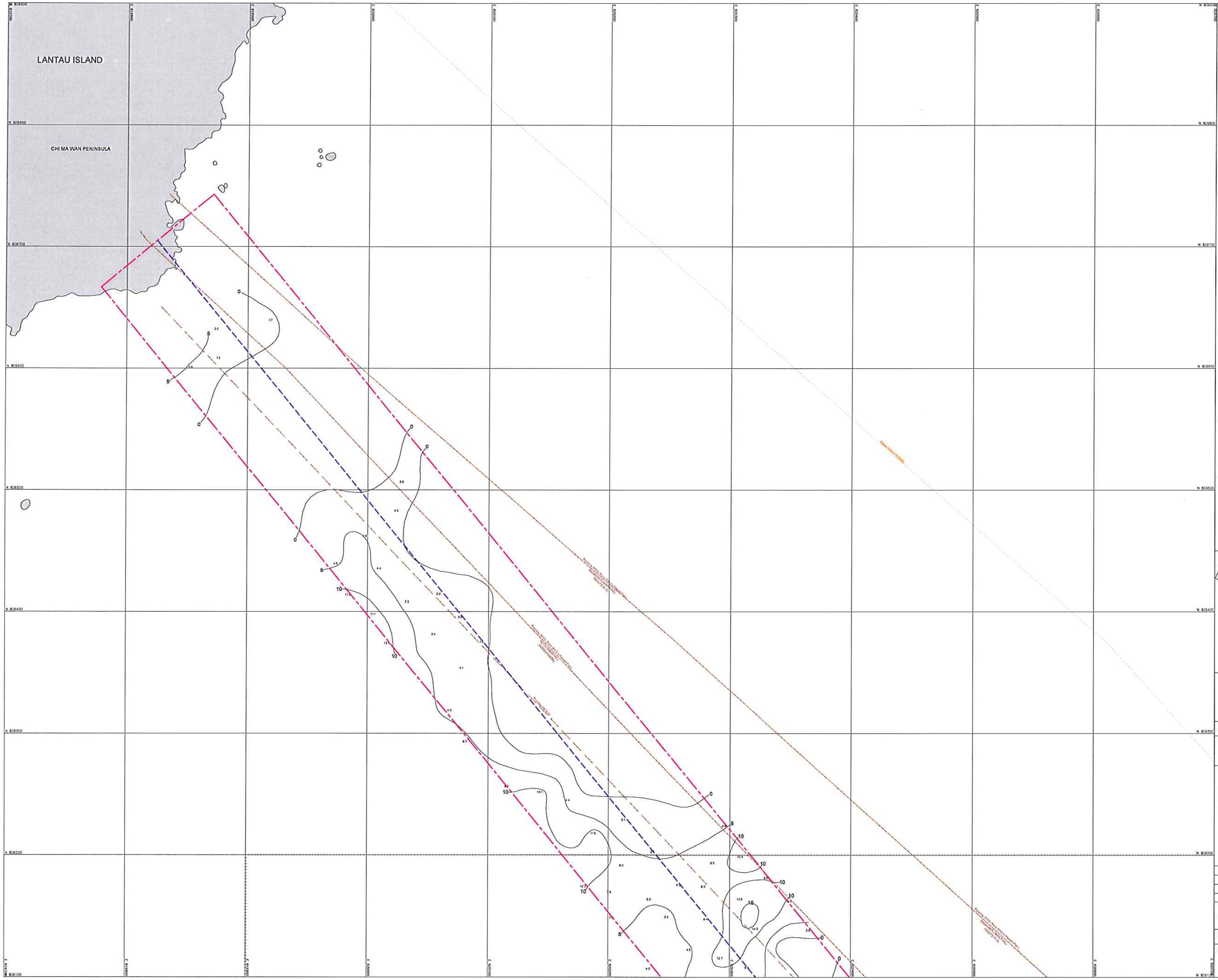
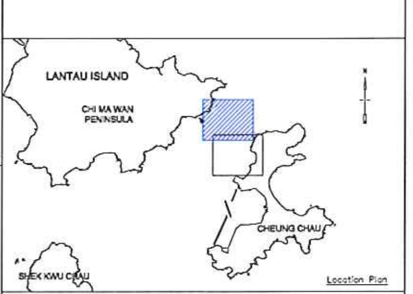


Legend :

- Proposed Submarine Fresh Water Main
- 21 Spot value in metres below HKPD
- Contour at 5 metre intervals
- Chart overlap
- Survey boundary
- Existing cable/pipeline (Location Indicative Only)



Location Plan

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY
TO CHEUNG CHAU - INVESTIGATION,
PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU

FIGURE NUMBER : 10.1

Drawing Title :

CONTOURED ISOPACHS OF ROCK IN ANY STATE OF DECOMPOSITION

Notes :

1. Survey Date : 04-06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C-Nav GcGPS
5. Equipment : EGS Boomer System
6. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

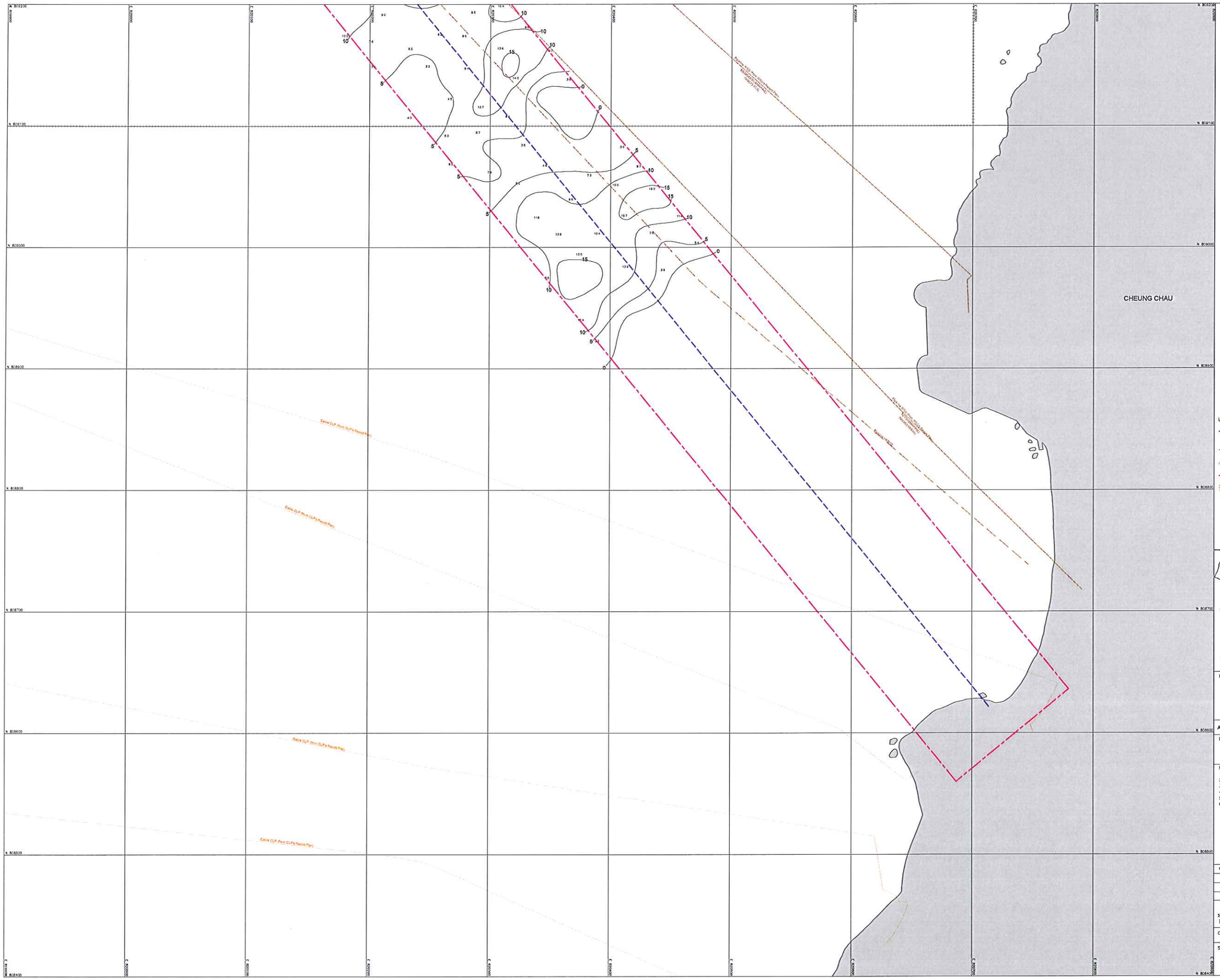
Revision no.	Date	Drawn by	Checked by	Approved by	Remarks
0	19-12-2008	Clarence Siu	S K Wong	Margie Chen	Preliminary
1	14-01-2009	Clarence Siu	S K Wong	Margie Chen	Final

METRIC SCALE 1:1000
50 40 30 20 10 0 50 100

Client : **Civil Engineering and Development Department**

Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK213808



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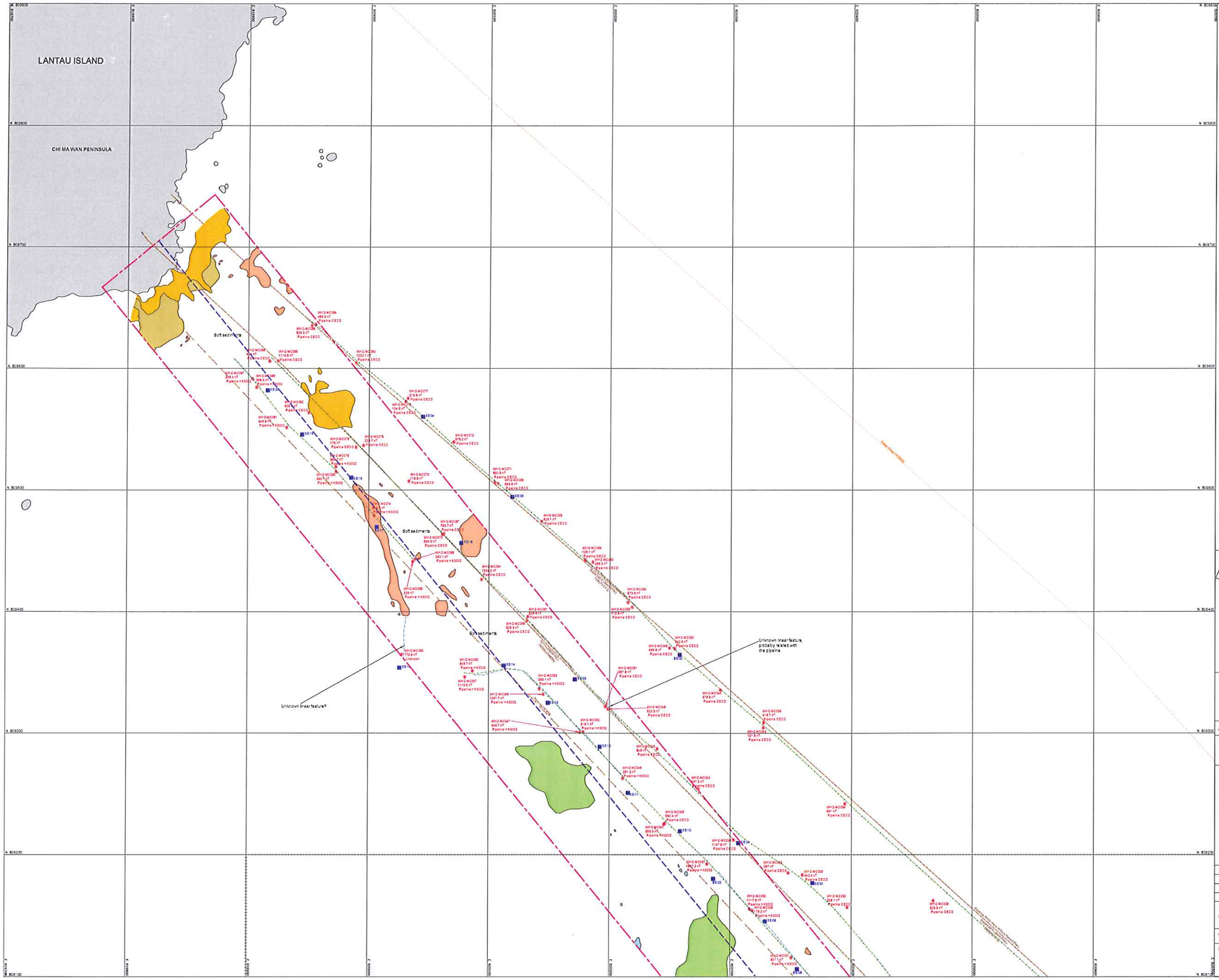
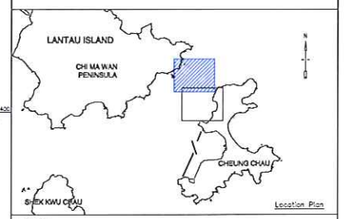


Legend :

- Proposed Submarine Fresh Water Main
- Cable/pipeline position, as determined by magnetometer, with reference number and anomaly size
- Cable/pipeline position, as determined by seismic profiler
- Coarse sediments
- ROCK
- Disturbed seabed
- Scattered boulders/Concrete slab
- Debris
- Sand ripples
- Interpreted cable/pipeline position, by magnetometer, seismic profiler and side scan sonar
- Cable/pipeline-related scars, observed from side scan sonar
- Existing cable/pipeline (Location Indicative Only)
- Chart overlap
- Survey boundary



Location Plan

Project :

WORKS ORDER NO. GE/2007/04 21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY TO CHEUNG CHAU - INVESTIGATION, PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU | FIGURE NUMBER : 11.1

Drawing Title :

SEABED FEATURES AND CABLE/PIPELINE ALIGNMENTS

Notes :

1. Survey Date : 04~06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C-Nav GeGPS
5. Equipment : DF-1000 Side Scan Sonar System
   Seasay Magnetometer
6. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

Revision no.	Date	Drawn by	Checked by	Approved by	Remarks
0	19-12-2008	Clarence Siu	Milton Chung	Margie Chen	Preliminary
1	14-01-2009	Clarence Siu	Milton Chung	Margie Chen	Final

METRIC SCALE 1:1000

50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK213808

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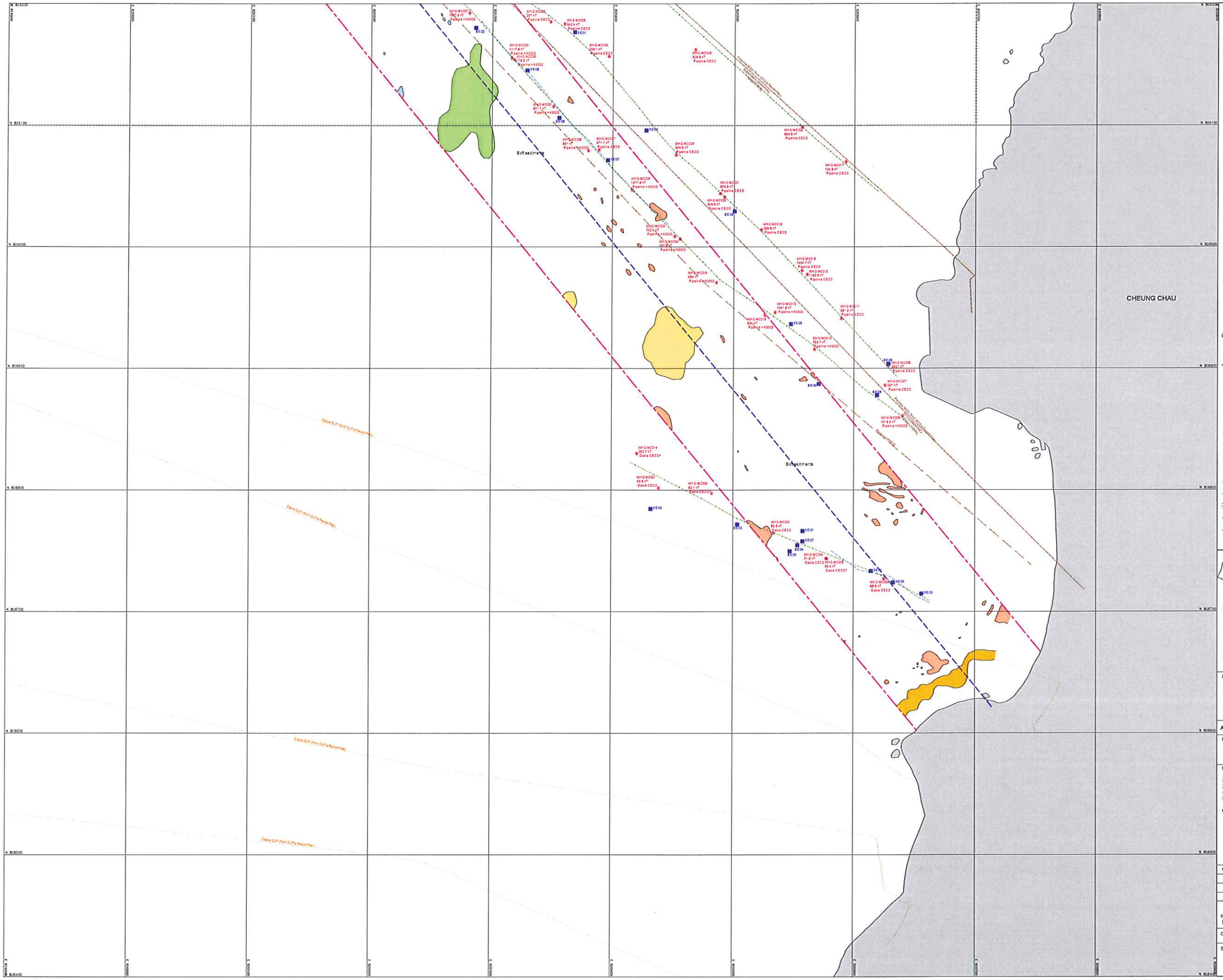
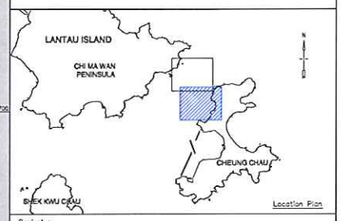


Legend :

- Proposed Submarine Fresh Water Main
- Cable/pipeline position, as determined by magnetometer, with reference number and anomaly size
- Cable/pipeline position, as determined by seismic profiler
- Coarse sediments
- ROCK
- Disturbed seabed
- Scattered boulders/Concrete slab
- Debris
- Sand ripples
- Interpreted cable/pipeline position, by magnetometer, seismic profiler and side scan sonar
- Cable/pipeline-related scars, observed from side scan sonar
- Existing cable/pipeline (Location Indicative Only)
- Chart overlap
- Survey boundary



Location Plan

Project :

WORKS ORDER NO. GE/2007/04.21
AGREEMENT NO. CE 1/2008 (WS)
IMPROVEMENT OF FRESH WATER SUPPLY
TO CHEUNG CHAU - INVESTIGATION,
PROPOSED GEOPHYSICAL SURVEYS

AREA : LANTAU ISLAND TO CHEUNG CHAU | FIGURE NUMBER : 11.2

Drawing Title :

SEABED FEATURES
AND
CABLE/PIPELINE ALIGNMENTS

Notes :

1. Survey Date : 04–06,08/12/2008
2. Grid System : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Positioning : C–Nav GcGPS
5. Equipment : DF-1000 Side Scan Sonar System
   Seaspy Magnetometer
6. Coastline taken from 1:20000 Series HM20C, Survey and Mapping Office, Lands Department

Revision no.	Date	Drawn by	Checked by	Approved by	Remarks
0	19–12–2008	Clarence Siu	Milton Chang	Margie Chan	Preliminary
1	14–01–2009	Clarence Siu	Milton Chang	Margie Chan	Final

METRIC SCALE 1:1000

50 40 30 20 10 0 50 100

Client : Civil Engineering and Development Department

Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK213808

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