

## Permanent Aviation Fuel Facility (EP-262/2007/B)

Marine Archaeological Watching Brief Report

6<sup>th</sup> May 2008

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## Permanent Aviation Fuel Facility for Hong Kong International Airport

### Environmental Certification Sheet EP-262/2007/B

#### Reference Document/Plan

Document/ <del>Plan</del> to be Certified/ Verified:	Watching Brief Report
Date of Report:	6 <sup>th</sup> May 2008
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#### Reference EP Condition

Environmental Permit Condition:	Condition No.: 3.2
<i>Content: Measures to Mitigate Marine Archaeological Impact during Construction</i>	
3.2 A marine archaeologist shall be engaged during the carrying out of dredging works within 25m of the positions SS1 or SS2 as shown in Figure 3 of this Permit to provide recommendations on the dredging works to avoid any marine archaeological impact. All recommendations by the marine archaeologist shall be fully implemented.	

#### ET Certification

I hereby certify that the above referenced document/ <del>plan</del> complies with the above referenced condition of EP-262/2007/B	
Craig A Reid, Environmental Team Leader:	Date: 6 <sup>th</sup> May 2008

#### IEC Verification

I hereby verify that the above referenced document/ <del>plan</del> complies with the above referenced condition of EP-262/2007/B	
Dr Guiyi Li, Independent Environmental Checker:	Date: 8/5/2008

Notes: EP-262/2007/B has replaced the former EP-262/2007/A, EP-262/2007 and EP-139-2002/A for the PAFF project after the resubmission of revised EM&A Manual and revised EIA Report respectively.

## Permanent Aviation Fuel Facility (EP-262/2007/B) Marine Archaeological Watching Brief Report

6<sup>th</sup> May 2008

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For and on behalf of  
Environmental Resources Management

Approved by: Dr Robin Kennish

Signed: 

Position: Director

Date: 6<sup>th</sup> May 2008

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## *ENGLISH ABSTRACT*

Leighton Contractors (Asia) Limited, the construction contractor of the ECO Aviation Fuel Development Ltd, commissioned ERM-Hong Kong Limited to conduct a marine archaeological watching brief of two sub-surface anomalies with potential archaeological value during the construction stage of the Permanent Aviation Fuel Facility (PAFF) in Tuen Mun Area 38 in accordance with the Environmental Permit requirements (*Clause 3.2*) for PAFF.

The watching brief was conducted by a marine archaeologist, William Jeffery, from 21 to 28 February 2008 during the dredging of the surrounding seabed located within the route of the twin pipelines for the Permanent Aviation Fuel Facility (PAFF) tank farm at Tuen Mun Area 38 to Sha Chau.

The watching process consisted of monitoring the dredging of sediments to the recorded sub-surface depths of the anomalies, followed by a diver inspection of the uncovered seabed within the trench. Materials found in the location of the two anomalies consisted of urban waste, trash and recently quarried granite and feldspar rocks. No archaeological sites or relics were found and it is considered the anomalies have no cultural heritage significance.

## 中文摘要

易高航空燃料有限公司承建商禮頓亞洲有限公司委託香港環境資管理顧問有限公司按永久航空煤油之設備的環境許可証要求，在位於屯門第38區之永久航空煤油之設備的施工期間，在海床下具考古潛質的兩個異常跡象地點進行海洋考古監察

是次海洋考古監察由水下考古學家William Jeffery進行，並於2008年2月21至28日挖泥期間，在連接屯門第38區之永久航空煤油設備及沙洲的雙線管道附近之海床進行。

是次海洋考古監察包括在已記錄的兩個異常跡象地點監察挖出的海床泥土，之後在挖坑進行潛水監察。在此兩個異常跡象地點所發現的物質包括現代廢物，垃圾及近代開採的花崗岩和長石；並沒有發現考古遺址或古物。因此認為該兩個異常跡象並沒有文化遺產價值。

# 1 INTRODUCTION

## 1.1 PROJECT BACKGROUND

In order to ensure a secure means to supply aviation fuel during the operational lifeline of the Hong Kong International Airport (HKIA), a Permanent Aviation Fuel Facility (PAFF) is required to replace the existing temporary Aviation Fuel Receiving Facility adjacent to Sha Chau.

The Airport Authority Hong Kong (AAHK) is committed to provide the replacement facility and in accordance with the *Environmental Impact Assessment Ordinance* (Cap. 499) (EIAO), an Environmental Permit (EP) is required prior to construction work commencement.

As part of the EIAO requirement, an *Environmental Impact Assessment* (EIA) Study including a Marine Archaeological Investigation (MAI) was conducted. The revised EIA was submitted in 2007 and the environmental permit (EP-262/2007) was granted in May 2007. EP-262/2007 has been amended to EP-262/2007/A and issued by the EPD on 30 November 2007.

It should be noted that at the time of reporting, a further Variation to the Environmental Permit has been approved, primarily to allow for dredging works to continue during March 2008. As such, EP-262/2007/A has been amended to EP-262/2007/B and issued by the EPD on 27 February 2008.

In accordance with *Clause 3.2* of the EP, a marine archaeologist shall be engaged during the carrying out of dredging works within 25m of the positions SS1 or SS2 to provide recommendations on the dredging works to avoid any marine archaeological impact.

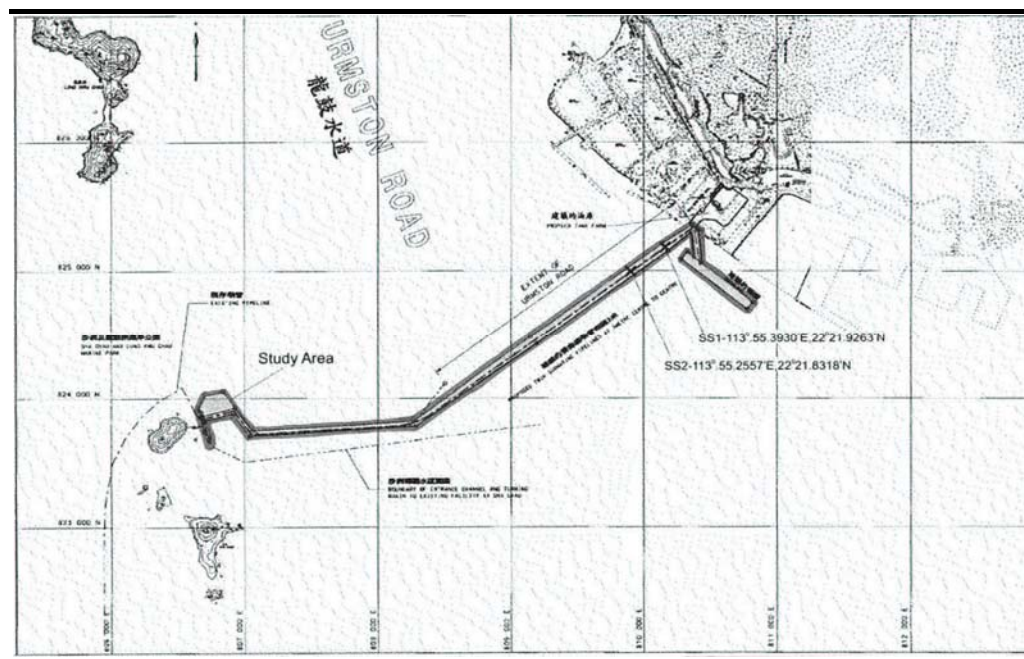
## 1.2 PREVIOUS MAI FOR PAFF

During the EIA stage for PAFF, a MAI was conducted and found the area of the proposed submarine pipeline route to have marine archaeological potential and containing 26 surface and 10 sub-surface anomalies of marine archaeological interest.

In November 2002, dive inspections were carried out on the 26 surface anomalies and it was concluded that they were not 'relics' as defined under the *Antiquities and Monuments Ordinance* being composed of various amounts of recently dumped urban waste, basalt and granite rock and of no cultural heritage significance. No inspections were implemented on the 10 sub-surface anomalies and it was assessed that only anomalies SS1 and SS2 represented potential archaeological material, the others being located in areas that have been dredged for navigation.

It was recommended in *Section 9.8* of the EIA report and *Section 9.2* of the EM&A that a marine archaeological watching brief be instigated during dredging within 25m either side SS1 and SS2 and a dive survey be undertaken in the nominated area SS1 after 3m of sediment removal and after 1m for SS2 to examine the trench for possible cultural remains (see *Figure 1.1*).

**Figure 1.1** Location of the PAFF Submarine Pipelines Route and Anomalies SS1 and SS2



This report presents the marine archaeological watching brief findings and recommendation made in case marine archaeological deposits are identified.

### 1.3 STRUCTURE OF THE REPORT

Following this introductory section, the remainder of this report comprises the following sections:

- Section 2* describes the legislations and guidelines associated with the works;
- Section 3* describes the objectives and methodology for the watching brief;
- Section 4* presents the watching brief findings;
- Section 5* presents the conclusions;
- Section 6* presents the recommendations; and
- Section 7* presents the bibliography.

## 2.1 ENVIRONMENTAL IMPACT ASSESSMENT ORDINANCE TECHNICAL MEMORANDUM ON THE EIA PROCESS

The EIAO - TM outlines the approaches required in investigating and assessing the impacts on marine archaeological sites. The following sections of the EIAO - TM are applicable:

*Annex 19: "There is no quantitative standard in deciding the relative importance of these sites, but in general, sites of unique archaeological, historical or architectural value will be considered as highly significant. A baseline study shall be conducted: (a) to compile a comprehensive inventory of places, buildings, sites and structures of architectural, archaeological and historical value within the proposed project area; and (b) to identify possible threats of, and their physical extent, destruction in whole or in part of sites of cultural heritage arising from the proposed project."*

The EIAO - TM also outlines the criteria for assessment of impact on sites of cultural heritage significance as follows:

*Annex 10: "The criteria for evaluating impact on sites of cultural heritage includes: (a) The general presumption in favour of the protection and conservation of all sites of cultural heritage because they provide an essential, finite and irreplaceable link between the past and the future and are points of reference and identity for culture and tradition; (b) Adverse impacts on sites of cultural heritage shall be kept to the absolute minimum."*

The EIAO - TM also outlines the approach in regard to the preservation in totality, and in part, to cultural resources:

*Annex 19: "Preservation in totality will be a beneficial impact and will enhance the cultural and socio-economical environment if suitable measures to integrate the sites of cultural heritage into the proposed project are carried out. If due to site constraints and other factors, only preservation in part is possible, this must be fully justified with alternative proposals or layout designs, which confirm the impracticability of total preservation."*

## 2.2 ANTIQUITIES AND MONUMENTS ORDINANCE, CAP. 53

The *Antiquities and Monuments Ordinance (Cap. 53) (AM Ordinance)* provides statutory protection against the threat of development on Declared Monuments, historical buildings and archaeological sites to enable their preservation for posterity. The *AM Ordinance* also establishes the statutory procedures to be followed in making such a declaration.

*"This Ordinance provides for the preservation of objects of historical, archaeological and palaeontological interest..."*

The Ordinance defines an antiquity as a relic (a movable object made before 1800) and a place, building, site or structure erected, formed or built by human agency before the year 1800. The Ordinance also states, amongst other things, that the discovery of an antiquity shall be reported to the Authority (Secretary for Home Affairs); that ownership of all relics discovered after 1976 shall be vested in the Government; that the Authority can declare a place, building, site or structure to be a monument, historical building or archaeological or palaeontological site or structure (and therefore introducing certain additional controls for these sites); and that licences and permits can be granted for excavation and for other work.

Over the years, surveys have been undertaken to identify archaeological sites in Hong Kong. The AMO has established boundaries for the identified sites and a set of administrative procedures for the protection of the known archaeological sites. However, the present record of archaeological sites is known to be incomplete as many areas have not yet been surveyed. There is a need therefore to ensure that the procedures and mechanisms which enable the preservation or formal notification of previously unknown archaeological resources that may be revealed or discovered during project assessment or construction are identified and implemented at an early stage of the planning of a project.

*Section 11 of the AM Ordinance* requires any person who discovers an antiquity, or supposed antiquity, to report the discovery to the Antiquities Authority.

## 2.3

### *MARINE ARCHAEOLOGICAL INVESTIGATION (MAI) GUIDELINES*

The MAI guidelines outline 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 baseline review, geophysical survey and establishing archaeological potential are considered the first three stages of a MAI and this was completed during the EIA stage for the PAFF in November 2002. Further stages of the MAI process include one or more of the following, a visual diver survey, a remote operated vehicle (ROV) survey and a watching brief.

Visual diver surveys were initiated in the PAFF in November 2002 and while the majority of the 26 surface and 10 sub-surface sites were concluded not to be of cultural heritage significance, the nature and significance of two sub-surface sites (SS1 and SS2) could not be determined. A watching brief was therefore recommended for these sites.

### 3.1 OBJECTIVES

The objective of this watching brief is to keep a watch for any archaeological material of cultural heritage significance when dredging was being implemented through the seabed to the level of SS1 (three metres) and SS2 (one metre) and within 25 metres horizontally of the anomalies (see *Table 3.1*). Following the dredging a dive inspection was required to further assess the seabed for archaeological material. If any archaeological material was found, an evaluation of impact was to be made in accordance with the *Antiquities and Monuments Ordinance (Cap 53)* and the *Environmental Impact Assessment Ordinance Technical Memorandum (EIAO-TM) Annexes 10 and 19*.

**Table 3.1 Detailed Information of SS1 and SS2**

Target	Approximate Depth	Depth below sea bed (m)	Length (m)	Height (m)	Latitude	Longitude
SS1	19	2.5	30	4	22°21.9263'N	113°55.3930'E
SS2	21	1	18	2.5	22°21.8318'N	113°55.2557'E

### 3.2 METHODOLOGY

Pursuant to the *Antiquities and Monuments Ordinance* an application for a *Licence to Excavate and Search for Antiquities* was submitted on 30 November 2007 and granted to the qualified marine archaeologist, William Jeffery, on 4 January 2008.

On 18 February 2008, a meeting was held with representatives of Leighton Contractors (Asia) Ltd. (Construction Contractor), UDL Dredging Ltd. (Dredging Works Contractor), BEKK Solutions Ltd. (Diving Survey Contractor), Ms Peggy Wong (ERM) and William Jeffery regarding the schedule of dredge watching and the dive surveys taken into account sea condition and tidal changes. The watching of the dredging was implemented on 21, 22, 23, 25 and 26 February 2008; and the dive inspections were initiated on 25 and 28 February 2008, all under the supervision or with the attendance of the marine archaeologist, William Jeffery.

#### 3.2.1 Dredging

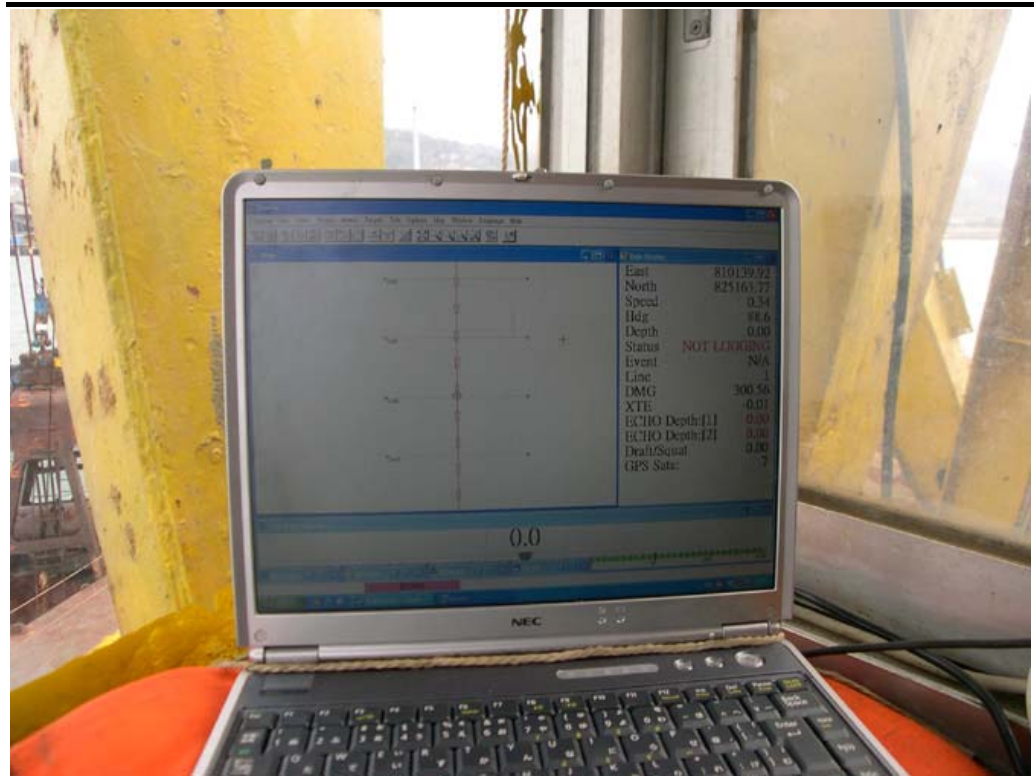
A bucket or grab dredge, capable of dredging a 20-metre wide trench was used to remove seabed sediments to the level of the sub-surface anomalies (see *Figure 3.1*). Located at the top of the crane used to raise and lower the bucket is a DGPS aerial which is directly above the dredge bucket; the readout is in the cabin with the dredge operator. This allows for accurate positioning of the trench (see *Figure 3.2*). The computer program displaying the DGPS

coordinates also displays the position of the bucket when dredging the seabed and provides an offset value to the centreline of the trench. The cables that are used to lower and raise the dredge bucket are marked every metre to assist the operator in achieving the correct depth of penetration into the seabed of the bucket.

*Figure 3.1 The Bucket Dredge*

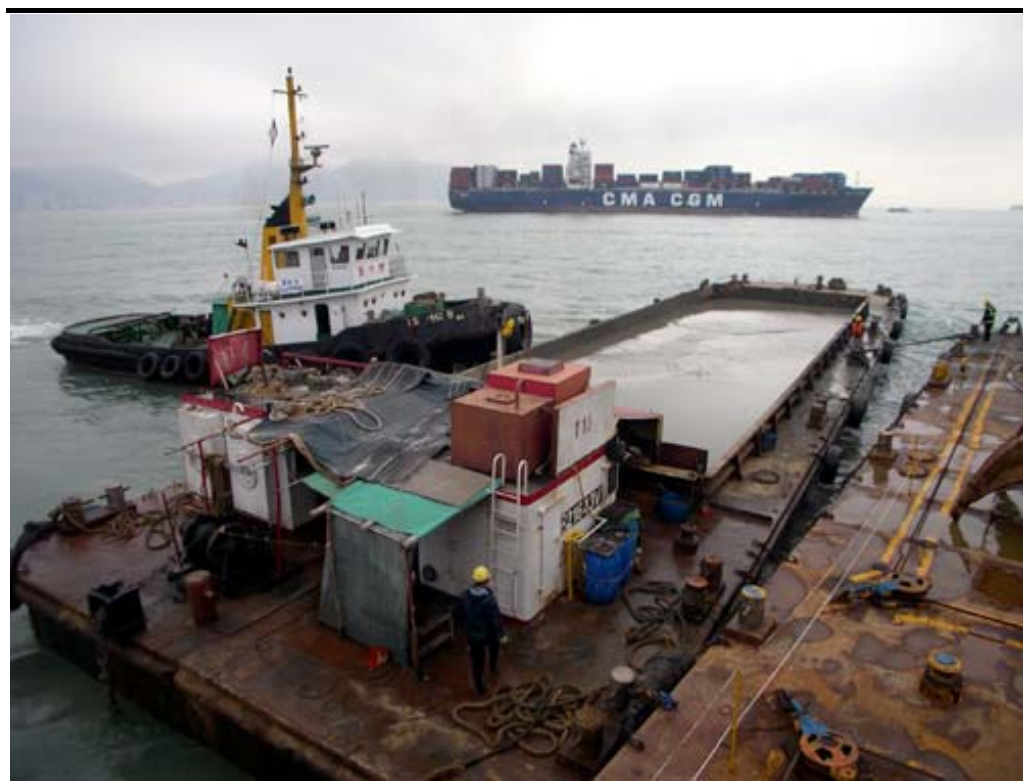


*Figure 3.2 The DGPS Readout as seen by the Dredge Operator*



The dredging barge is fixed in position by four large anchors. It is positioned at one end of the trench to be dug and winches onboard move it forward along the anchor wires at 2-3 metre increments. The dredged sediments (the bucket used in this case had a capacity of 6.5 m<sup>3</sup> and weighs 12 ton) are deposited in a split hopper barge positioned next to the dredging barge, of which the capacity is about 700m<sup>3</sup>. The split hopper barge is towed by a tug to the designated mud disposal areas for uncontaminated and contaminated mud (south of Cheung Chau/east of Ninepin and East Sha Chau respectively). (see Figure 3.3).

**Figure 3.3**     *The Split Hopper Barge and Tug Boat*



The seabed area to be impacted by the dredging in the vicinity of SS1 and SS2 varied in accordance with the planned depths of the East/West running pipelines. At SS1, the depth of the pipelines is to be about 3.6m. To achieve this depth with the most appropriate gradient on the trench walls, an area of about 13m to the north and 13m to the south of the anomaly needed to be dredged (see Figure 3.4).

It was found SS1 is located in an area of contaminated marine sediments starting at about one metre below the seabed: this first metre being uncontaminated sediments (see Figure 3.5). This one metre of sediments was removed by the dredging contractor on 19 February 2008 to allow for the MAI monitoring/watching of the one, 20-metre wide, two metre deep trench, 25 metres either side of SS1. This area was between 275 metres and 325 metres from the seawall at the Tuen Mun Area 38 and amounted to 2,000 m<sup>3</sup> of sediment (see Figure 3.5). It takes about 4 hours to fill the split hopper barge; the total dredging time was computed to be about 12 hours.

Figure 3.4 Cross Section of the Trench at SS1

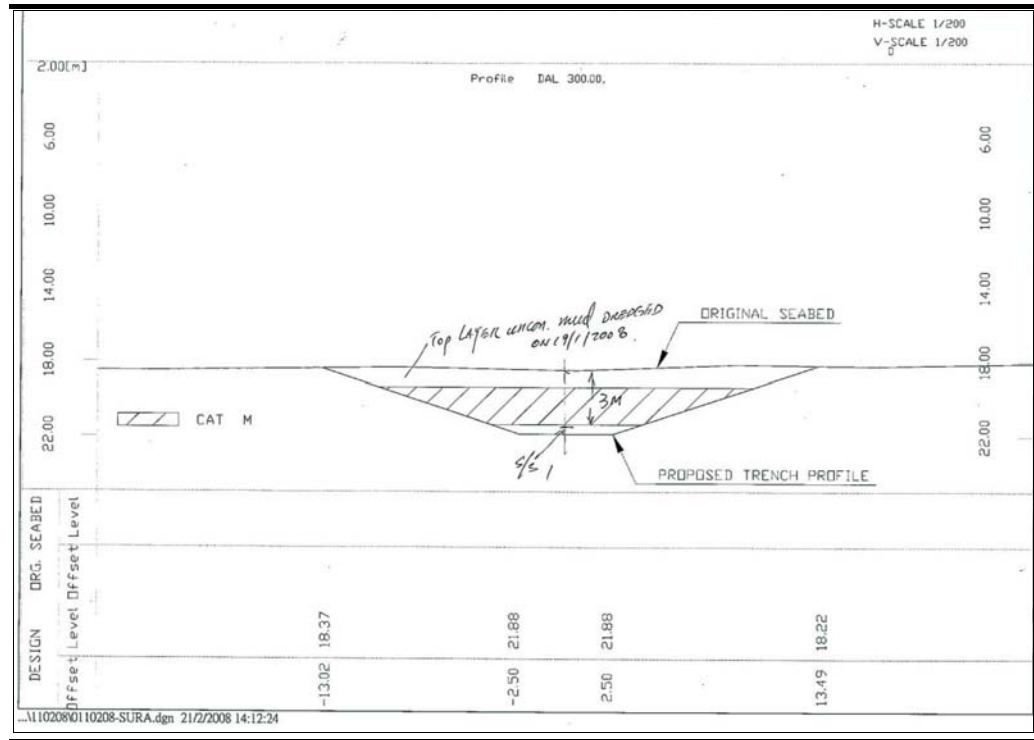
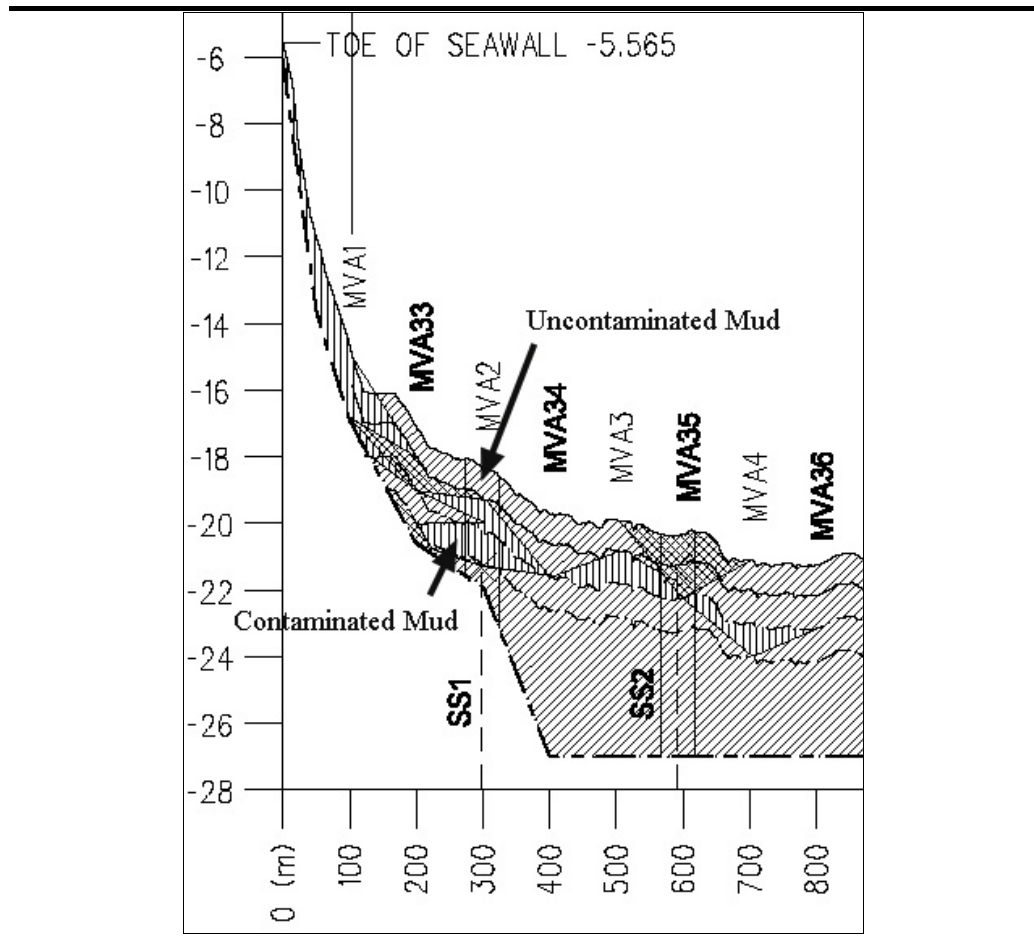
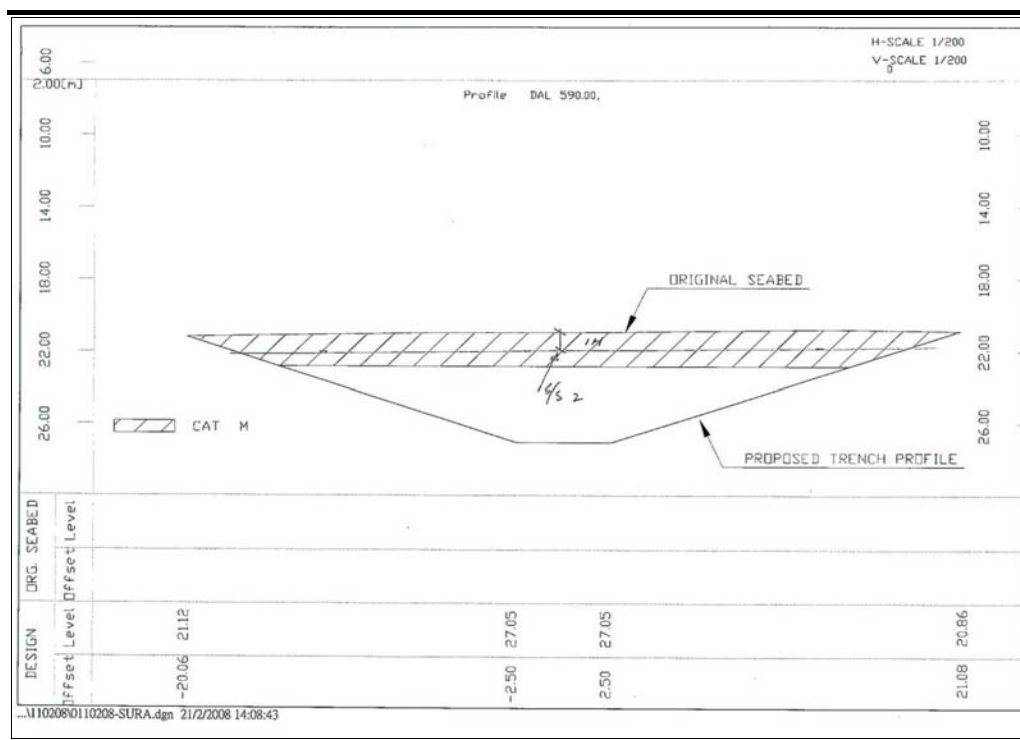


Figure 3.5 Longitudinal Section Showing SS1 and SS2



At SS2, the planned depth of the pipelines is to be about 6 metres and providing for the most appropriate gradient of the trench walls, the area to be dredged is about 20 metres to the north and 20 metres to the south of SS2 (see Figure 3.6). Two, 20-metre wide trenches were therefore required to be dredged to the depth of the anomaly of one metre. This area was between 565 metres and 615 metres from the seawall at the Tuen Mun Area 38 and amounted to 2,000 m<sup>3</sup> of sediment (see Figure 3.5). It was computed that the dredging would take about 12 hours to dredge and dump these sediments.

Figure 3.6 Cross Section of the Trench at SS2



All personnel working on the dredging barge were made aware that a watch was being carried out for any archaeological material. In particular, the operators of the dredge bucket were made aware that they might encounter archaeological material and that they might have to stop the operation for an assessment of any recovered material.

In discussion with the Dredging Supervisor, it was concluded that the dredge operators would most likely not 'feel or hear' fragile material such as timber when grabbing the sediments with the bucket and only hard and dense material may be discerned. This meant that material had to be grabbed and brought up to be dumped in the split hopper barge for any archaeological assessment to be made. The process of dumping sediments in the barge also meant that heavy material would quickly sink to the bottom of the barge (about 4 metres deep), with a possibility that more positive buoyant material (timber) may initial remain on the top of the sediments (see Figure 3.7). Waterlogged timber from a shipwreck for instance would, however, most likely sink or be quickly covered with sediment.

*Figure 3.7 Dredge Bucket Dropping Sediment into the Barge*



The process of a watching brief for this project did not rely on the dredge operator on the observation of the timber in amongst sediment being grabbed on the seabed. Instead, every bucket grab of sediment were brought to the surface and watched by the marine archaeologist when dumped, and hence the barge was regularly inspected. If a closer inspection of material sitting on top of the sediment was required, it was possible to retrieve it from the barge. This watching was undertaken in accordance with the works programme of dredging operation, which was a 24-hour operation.

### **3.2.2 Dive Survey**

Following the watching of dredging operation, diver inspections of the exposed seabed were carried out. An appropriate area in the trench, centred on the anomaly was inspected by a commercial diver experienced with the local conditions, ie. nil visibility and strong currents.

The diver wore a full *Kirby Morgan* full-face mask which allowed for communications to the surface dive supervisor and the marine archaeologist (see *Figure 3.8*). A *Bowtech BP-CVIS II* compact video inspection system, incorporating a video camera and light mounted onto the diver's helmet, with a hard wire to a surface monitor for real-time display to the surface operator and marine archaeologist, was also utilised.

*Figure 3.8 Diver Being Prepared for Diving with the Full-face Mask and the Attached Camera and Lights*



A vertical line from the dredge barge to the anomaly was established (using the DGPS system on the dredge and verified as to the position by the marine archaeologist) which provided the diver with a commencement point for his survey. Measured lines were laid out from this point which the diver used as a guide in surveying the seabed. The diver felt for any objects on the surface as well as implementing two-three metre probing into the sediment.

The diver was supported on the surface with the following personnel, a Dive Supervisor, Safety Diver, Attendant and video operator. United States Navy Dive Tables were used and the non-decompression dive time for 27 metres (90 feet) being 30 minutes, was used as the bottom time for the diver. Two divers surveying different sections of the seabed were employed and this allowed for sufficient time to implement the required survey. The marine archaeologist attended all the diving and asked the divers to provide comments on what they found during and after their diving.

#### 4.1 DREDGING

##### 4.1.1 Anomaly SS1

Dredging commenced in the designated area around SS1 at 11:00hr on Thursday 21 February 2008 and was completed at 09:30hr on Friday 22 February 2008, a total time of 22.5 hours. While it was estimated that the dredging could be completed in 12 hours, there were a number of delays due to mechanical factors which contributed to it being carried out over this extended period.

The material dredged consisted of the clayey, silt and mud sediments consistent with the marine sediments of the Hang Hau Formations. As the dredge approached the location of SS1, some small granite rocks and a vehicle tyre were recovered (see *Figures 4.1 and 4.2*). At the exact location of SS1, some larger granite rocks (c. 500kgm) and fishing netting were observed as being recovered and dumped into the barge. Apart from a modern bottle, no other material was found.

*Figure 4.1 Vehicle Tyre in the Dredge*



*Figure 4.2 Granite Rocks and Mud, Scale 10cm Divisions*



#### **4.1.2 Anomaly SS2**

Dredging commenced in the designated area around SS2 at 11:00hr on Saturday 23 February 2008 and was implemented until 08:00hr on Sunday 24 February 2008 with still a 40 metre x 20 metre section of dredging to be carried out. Dredging recommenced on Monday 25 February 2008 at 13:30hr and was completed by 24:00hr on 25 February 2008, a total time of 31.5 hours. There were mechanical problems in addition to the strong current and poor weather that contributed to this extended period.

Again, the material dredged consisted of the clayey, silt and mud sediments consistent with the marine sediments of the Hang Hau Formations. As the dredge approached the location of SS2 (5-7 metres away), and at SS2, some very small amounts of refuse were recovered (plastic sheeting), in addition to a vehicle tyre, small pieces of wire cable, a few granite rocks and a fishing net (see *Figure 4.3*). No other material was found.

*Figure 4.3 A Fishing Net Hanging from the Bucket*



## 5.2 DIVE SURVEY

### 5.2.1 ANOMALY SS1

The diver inspection of the seabed (at 22 metres) around SS1 commenced at 11:15hr on 25 February 2008 and was completed by 12:15hr. A line was laid out 25 metres from the location of the anomaly in a westerly direction for the first dive, and in an easterly direction for the second dive. The diver moved along this line feeling for any objects and probing two metres into the seabed across the 5 metre width of the trench.

A three metre scattering of small granite rocks were encountered during the first dive. During the second dive, a random scatter of small granite rocks was encountered; one was recovered for photography (see *Figure 4.4*). No other material was found. The divers reported nil visibility although the underwater camera with the aid of a light allowed an occasional glimpse of the seabed to be seen from about 30 cm away. No objects in addition to what the diver reported were observed on the video.

## 5.2.2

### ANOMALY SS2

The diver inspection of the seabed (at 22.5 metres) around SS2 commenced at 12:07hr on 28 February 2008 and was completed by 13:17hr. A 25 metre line was laid out from the vertical line/anomaly in a westerly direction and the diver moved along it searching and probing over a 5-metre swath of the seabed. When the diver reached the end of the line, he moved north 15 metres and implemented another search and probing survey back to the start point. No objects of any kind were encountered.

During the second dive, a swath of seabed 25 metres east x 20 north/south of the anomaly was surveyed. A few shells and 2-3 small feldspar rocks were observed through the underwater video, one was recovered for photography (see *Figures 4.5*). While the divers reported nil visibility, the camera provided for a reasonable picture of the seabed from 30cm above and clearer to that observed in SS1. No objects in addition to what the diver reported were observed on the video.

**Figure 4.4** *Small Granite Rock from SS1*

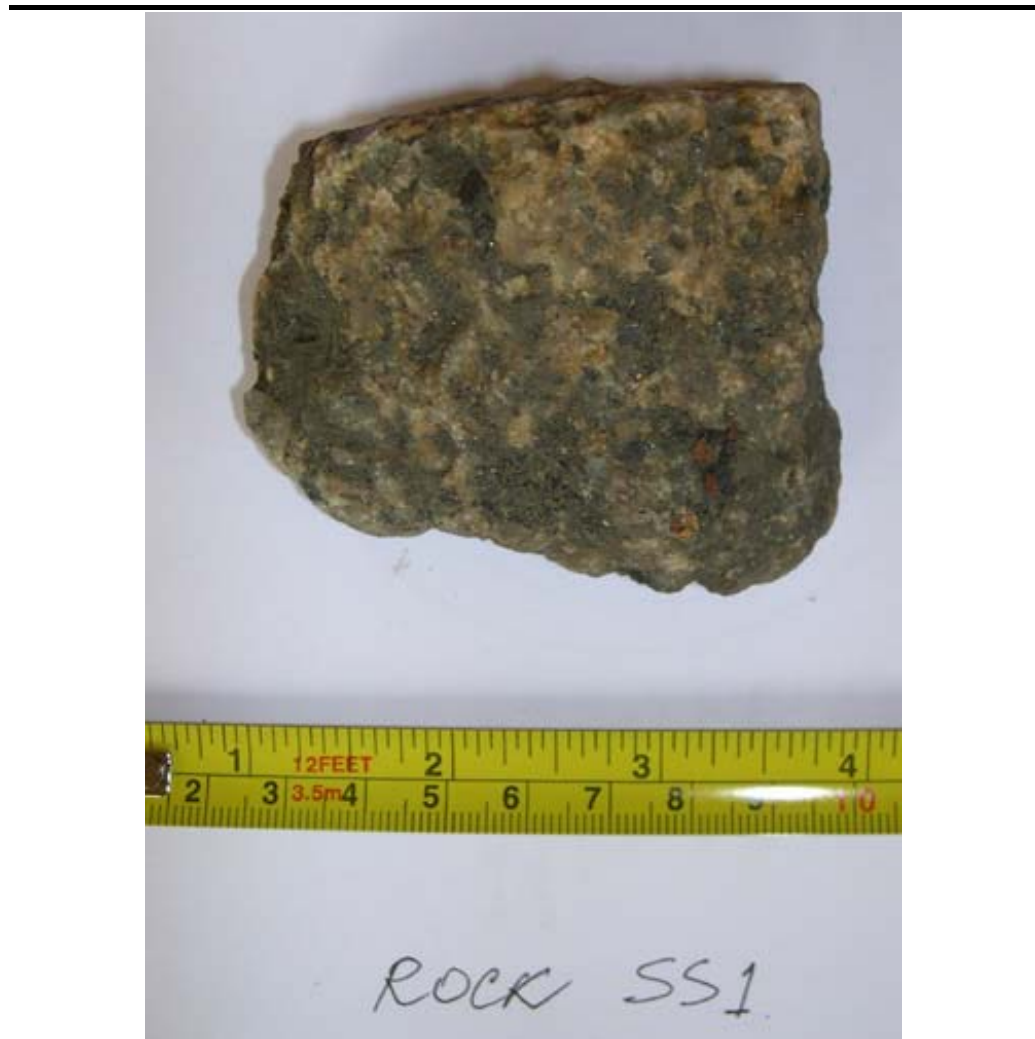


Figure 4.5 Diver Holding Feldspar Rock at SS2 and a Small Feldspar Rock from SS2



### 5.1 ASSESSMENT OF CULTURAL HERITAGE SIGNIFICANCE

The material observed during the dredging and dive surveys in the vicinity of the SS1 and SS2 anomalies has no cultural heritage significance. No archaeological material was observed during the dredging in either area. What was observed included a small number of rocks, fishing nets and vehicle tyres. The diver surveys, conducted at the depths that exposed the anomalies, failed to locate any material other than a small number of granite and feldspar rocks. These same rocks can be found as land fill in the yard with the PAFF tanks (see *Figure 5.1*)

**Figure 5.1** *Rocks Similar to that Found at SS1 and SS2 in the Current Landfill adjacent to the PAFF Fuel Tanks*



It is concluded that the anomalies are associated with the contemporary use of Urmston Road as a busy seaway and the activities of the adjacent factories, power station, PAFF and reclamation material collection area.

## 6 RECOMMENDATIONS

### 6.1 MITIGATION MEASURES

No mitigation measures need to be put in place by the PAFF project in regard to the anomalies SS1 and SS2 are of no cultural heritage significance.

### 6.2 IMPLICATIONS FOR THE MAI PROCESS

This Watching Brief was implemented in accordance with the current Marine Archaeology Impact process, which calls for:

1. Baseline Review
2. Geophysical Survey
3. Establishing Archaeological Potential
4. Remote Operated Vehicle (ROV)/Visual Diver Survey/Watching Brief

Tasks 1 and 2 are analysed and synthesised to establish the archaeological potential (Task 3) of an area and sites. If an area or sites have archaeological potential then Task 4 can be recommended and where, as in this case, a diver survey is not conclusive in regard to assessing the archaeological potential of two anomalies, then a Watching Brief during dredging can be implemented. Dredging is a destructive process to archaeological sites such as shipwrecks which can contain timber and a whole range of fragile organic and non organic material. It is also destroys the provenance of artefacts which is fundamental in analysing archaeological material. The MAI process and particular the Watching Brief is an attempt at an equitable and practical solution in mitigating the impact of construction activities on archaeological material while providing for a project's continuance.

Coroneos, C., 2004, *Permanent Aviation Fuel Facility Area 38 to Sha Chau, Pipeline Route and Berthing Facilities. Marine Archaeological Investigation, Task 3 Assessment of Archaeological Potential*. Archaeo-Environments Ltd.

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Chile	Puerto Rico
China	Russia
France	Singapore
Germany	South Africa
Hong Kong	Spain
Hungary	Sweden
India	Taiwan
Indonesia	Thailand
Ireland	UK
Italy	US
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Korea	

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