

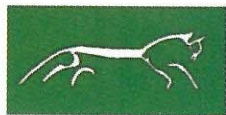
Permanent Aviation Fuel Facility Area 38 to Sha Chau

Pipeline Route and Berthing Facilities

Marine Archaeological Investigation

Task 3 Assessment of Archaeological Potential

Hong Kong SAR
Urmston Road APRIL 2004



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Permanent Aviation Fuel Facility

Area 38 to Sha Chau

Pipeline Route and Berthing Facilities:

Marine Archaeological Investigation;

TASK 3

Assessment of Archaeological Potential

Prepared for;

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By;

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Preface

This document reports on the examination of the geophysics survey undertaken along the proposed berth and pipeline route for the Permanent Aviation Fuel Facility for Chek Lap Kok airport. It also establishes the archaeological potential of the area to be impacted by the development in compliance with Task 3 of the guidelines established by the Antiquities and Monuments Office for Marine Archaeological Investigations under Environmental Permit 139/2002/A.

A draft report was submitted to the client in October 2002, and later produced as a final report in December 2002. This version of the report, April 2004, has been revised to include an exegesis of the measures to be taken to assess the archaeological potential of the identified anomalies. Other changes to the original October 2002 report include the changing of the report title as well superficial corrections.

Acknowledgements

Many thanks to Carmela Wong and Cynthia Kwok (EGS) for their efforts in interpreting my requests for interpreting the data.

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Abbreviations

EIAO	Environmental Impact Assessment Ordinance
MAI	Marine Archaeological Investigation
TM	Technical Memorandum

Summary

An examination of the results of the geophysical survey conducted by EGS of the proposed pipeline route and berth for the Permanent Aviation Fuel Facility for Chek Lap Kok revealed 26 surface and 10 sub-surface anomalies of potential archaeological interest. It has been recommended that the surface targets and selected sub-surface targets be examined using diver based investigation techniques and that the remaining sub-surface targets be subject to a watching brief at the time of the construction of the pipe trench.

Recommendations

The following are recommendations for the Visual Dive Survey and Watching Brief component, Task 4, of the MAI for the proposed permanent fuel aviation facility for Chek Lap Kok.

Recommendation 1

A diver based examination of the side scan sonar targets be undertaken. Photography and video to be used in the event that objects of archaeological importance be found.

Recommendation 2

A diver based examination of some of the sub-surface targets be undertaken using dive based excavation techniques.

Recommendation 3

During the dredging of the pipe trench a watching brief be implemented where the trench intersects SS1 and SS2. The watching brief will have the following components:

- Dredge operators to be made aware of the likely presence of a shipwreck near the coordinates given for SS1 and SS2 and are to report any unusual resistance or slowing down of the dredging in these areas.
- Dredging to cease in the nominated areas after a few metres of sediment has been removed, and divers, under the supervision of a maritime archaeologist, to examine the trench.
- The examination of the dredged material from these areas to be undertaken. This would be best done by having the spoil pumped directly onto a large screen situated on a barge on-site.

Recommendation 4

Recommendation 3 to be re-examined after the completion of the implementation of Recommendations 1 and 2, and in consultation with Leighton Contractors (Asia) Limited.

Recommendation 5

If in the course of the Diver Visual Survey and Watching Brief the identified targets of archaeological potential are identified as archaeologically important, as referred to Clause 2.1 of Annex 19 of the EIAO TM, then an immediate impact assessment is required. The impact assessment would follow the guidelines as set out in EIAO TM, Annex 19 Clauses 2.6 to 2.14.

1.0 Introduction

This report has been produced in compliance with EP 139/2002/A for the proposed construction of a permanent aviation fuel facility (PAFF) for the new Chek Lap Kok airport (Figure 1). The proposed development will link with the existing marine terminal at Sha Chau, which is connected by pipeline to the airport (EGS, July 2002:1)(Figure 1).

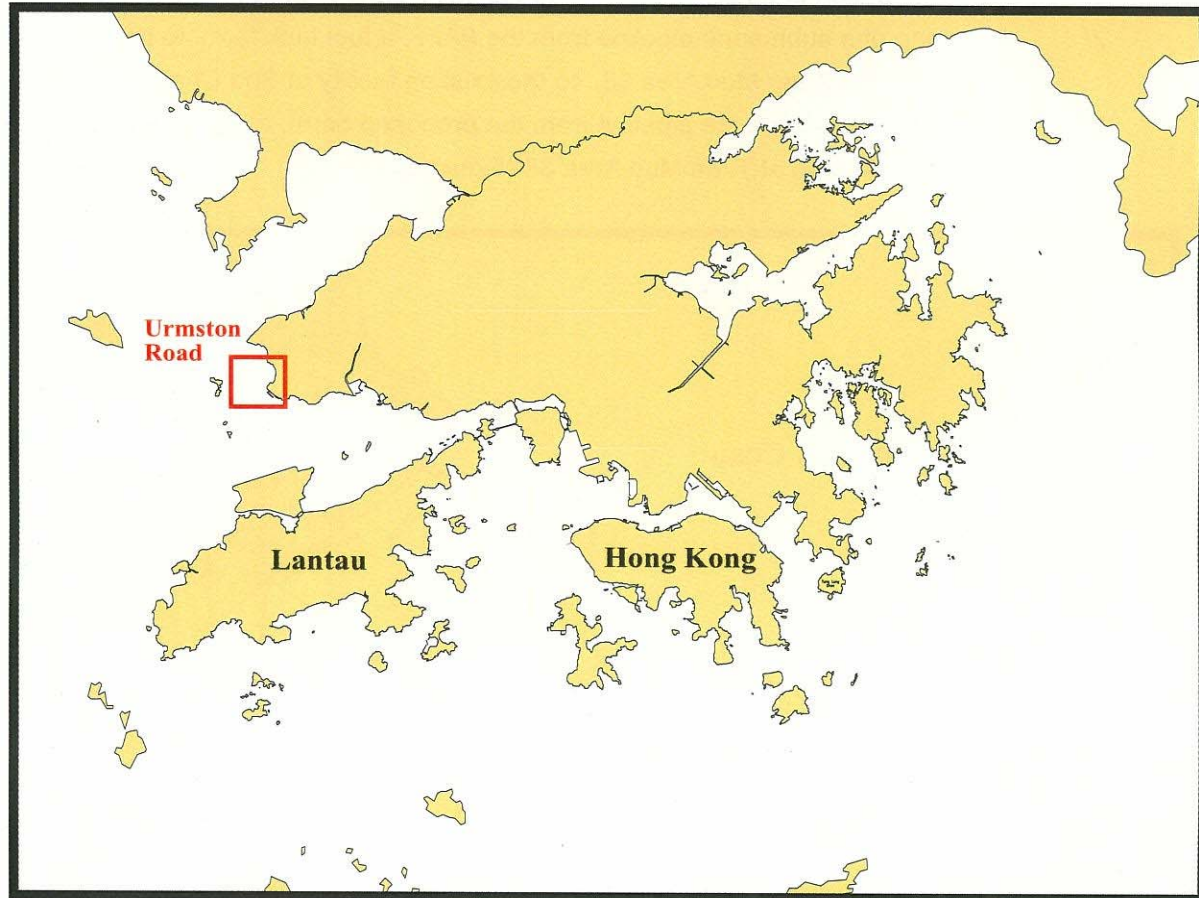


Figure 1: Area map

Environmental Permit 139/2002/A, 3.4, requires that a marine archaeological investigation (MAI) be conducted with "...submission of survey results and recommendations to avoid, minimize and mitigate any archaeological impact..". This MAI has been undertaken in compliance with the Guidelines for Marine Archaeological Investigation, which provide a four step process, detailing practice, procedures and methodology to be undertaken in determining the potential and presence of the submerged cultural resource as well as identifying mitigation measures (See Appendix A).

Task 1, a baseline review of the potential for the existence of the submerged cultural resources has been already conducted (Mouchel, April 2002). The geophysical survey, Task 2, was carried in June 2002 (EGS, July 2002). This report is fulfils the requirements for Task 3; the establishment of archaeological potential.

2.0 Development proposal

The proposed development, as it will impact the submerged cultural resource, involves three distinct components;

- 1/ the construction of an offshore berth to the south east of Shui Wing Steel
- 2/ the laying of a submarine pipeline from the PAFF, a fuel tank farm to be constructed at Tuen Mun Area 38, to the existing facility at Sha Chau
- 3/ the laying of a submarine pipeline from the proposed berth, to the proposed PAFF constructed at Tuen Mun Area 38 (Figure 2).

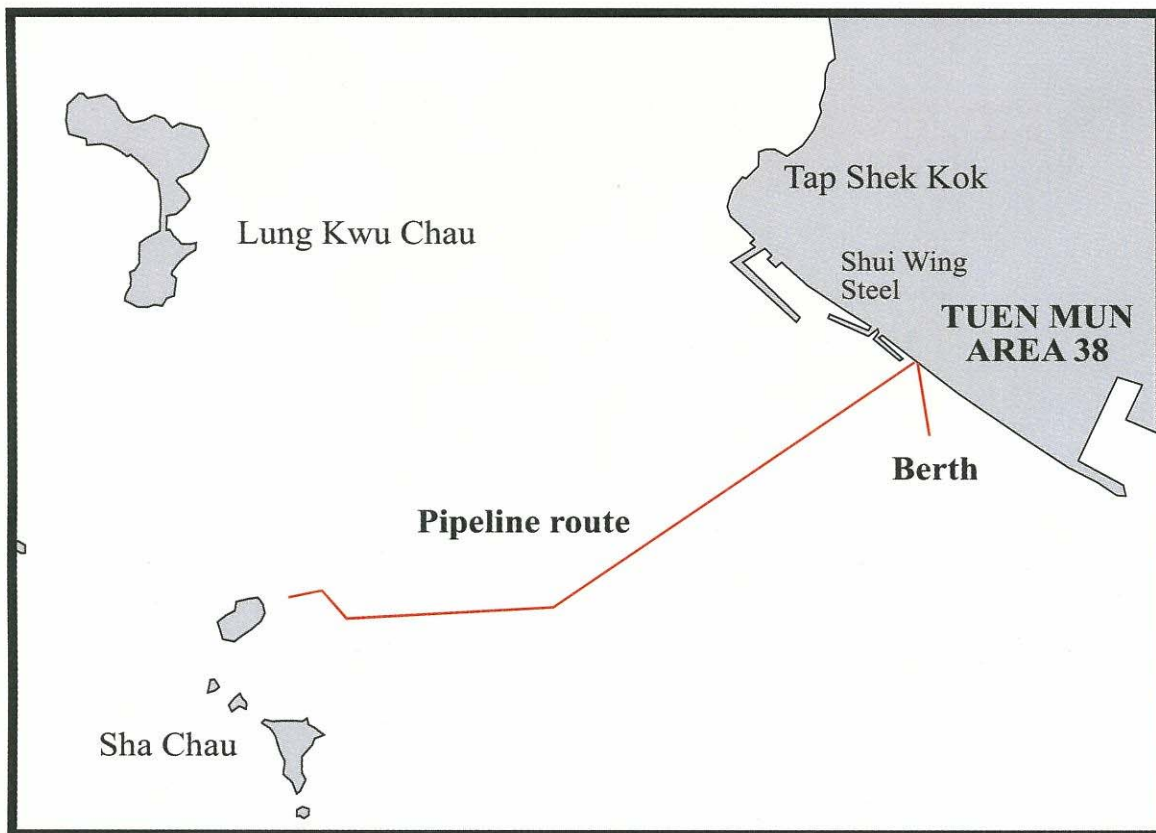


Figure 2: Proposed development

The berth will be positioned approximately 200 m from the existing reclamation (Mouchel, April 2002:9-12).

The twin pipeline from the PAFF to Sha Chau will be in a trench which will be approximately 3.0 to 3.5 m in depth and 3.5 m wide at its base, and up to 20 m wide at the surface of the seabed (Mouchel, April 2002:9-12). Where the pipeline crosses Urmston Road, the depth of the pipeline may increase to 7 m below the seabed. The trench for the pipeline from the proposed berth will be 11 m wide at the base and 16 m wide at the seabed surface (Mouchel, April 2002).

Part of the route of the pipeline, the last 2 km before reaching Sha Chau, will follow the navigation channel from Urmston Road, which was dredged six years previously (Gillon, pers. comm. 6/9/02).

The pipeline trench will be created using a trailer dredge, a process whereby water is jetted into the seabed and the resulting suspended sediments are sucked away (Gillon, pers. comm. 6/9/02).

It is anticipated that the berth will be constructed on a base of piles driven into the seabed.

3.0 The study area

The study area for this component of the MAI comprises of the area of the proposed berth and the route of the two pipelines. The boundary of the study area with regards to the pipeline route from the PAFF to Sha Chau is a corridor, 100 m, wide. The length of this corridor is approximately 4.5 km (Figure 3).

The corridor width of the study area, 100m, corresponds with the width of the side scanned path conducted by EGS. It was decided to keep this width for the study area to not only stay consistent with the area surveyed using remote sensing techniques, but also to provide a sufficient buffer should the route be slightly altered due to obstructions or other reasons. Furthermore, as it will be explained throughout this report, the presence of a shipwreck would be subtle and difficult to interpret from the geophysical data presented and that the remains of the wreck could be spread over a wide area. It is possible that tangible signs of a wreck may be discerned and identified some distance from the proposed pipeline route but considerable portions, unidentifiable unless visually/physically inspected, may lay across the axis of the proposed route, exposed and/or buried.

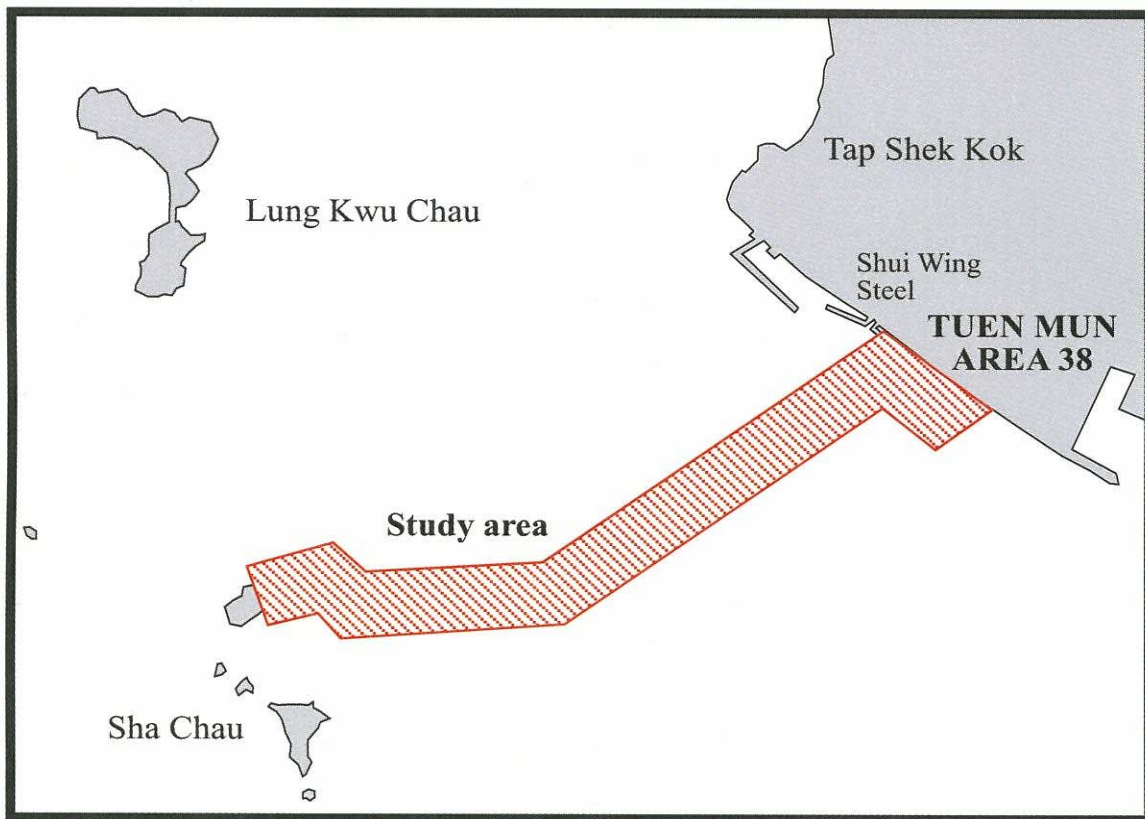


Figure 3: The study area

4.0 Legislative requirements

This section is derived from the Cultural Heritage Assessment (Task 1 baseline review) for this development, compiled by Mouchel (April 2002).

Environmental Impact Assessment Ordinance

Within the Environmental Impact Assessment Ordinance (EIAO) there is a stipulation which requires that consideration must be given to issues relating to cultural heritage and archaeology (Mouchel, April 2002:9-1). Furthermore Annexes 10 and 19 of the Technical Memorandum (See Appendix B) on EIA processes outlines the following :

- (i) the criteria for evaluating the impacts on sites of cultural heritage; and
- (ii) guidelines for impact assessment.

The Technical Memorandum (TM) identifies a general presumption in favour of the protection and conservation of all sites of cultural heritage and requires impacts on such sites to be kept at a minimum. There is no quantitative standard for assessing the significance of cultural heritage sites but it is generally accepted that sites of unique archaeological and historical value should be considered highly significant.

Antiquities and Monuments Ordinance

Legislation relating to antiquities is set out in Chapter 53 of the Laws of Hong Kong. The legislation applies equally to sites on land and underwater. Aspects of the legislation relevant to this study are :

- A/ Human artefacts, relics and built structures may be gazetted and protected as monuments.
- B/ 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, of which the Antiquities and Monuments Office (AMO) is the executive arm.
- C/ For archaeological sites, all relics dated prior to 1800 AD belong to the Hong Kong Government. Archaeological sites are classified into three categories:
 - 1/ *Designated* – those that have been declared as monuments and are to be protected and conserved at all costs;

- 2/ **Administrative Protection** – those which are considered to be of significant value but which are not declared as monuments and should be either protected, or if found not possible to protect these sites the salvaged, and;
 - 3/ **Monitored** – those which are of lesser significance or whose potential is not fully assessed which should not be disturbed with the exception of minor works if they are permitted and monitored by the AMO.
- D/ The legislation sets out the procedures for the issuing of Licences to Excavate and Search for Antiquities, the effect of which is to forbid all such activities being undertaken without such a licence.

Cultural Heritage

The Criteria for Cultural Heritage Impact Assessment (CCHIA), provided by the Home Affairs Bureau stress that preservation in totality must be taken as the first priority. Projects undertaken are not to cause excessive impact on archaeologically and historically significant sites unless there are adequate protection and mitigation measures, or a satisfactory rescue plan is proposed.

The AMO considers all pre – 1950s buildings and structures to be historical and deserving of protection. Post 1950s buildings and structures can also be afforded the same consideration for preservation, if of high architectural and historical significance. From this it can be possibly interpreted that shipwrecks may considered as 'structures'.

Archaeological sites are identified and recorded by the AMO either through systematic survey, casual finding or through the EIA process. Such sites are considered to be of cultural heritage value and their preservation in totality is to be the primary aim. According to the CHIA if this is not possible mitigation is to be achieved by the reduction of potential impacts and/or 'preservation' achieved by means of detailed cartographic and photographic survey or the preservation of an archaeological site 'by record', that is through excavation to extract the maximum data as the very last resort. The search for, and the excavation of all archaeological material requires a license from the Antiquities Authority.

5.0 Potential status for submerged cultural resource

5.1 Potential for existence of submerged cultural resources

The cultural heritage assessment identified a number of historic episodes and trends which have left archaeological remains within the study area (Mouchel, April 2002). These events can be broadly divided into two broad categories, that of Tuen Mun being a centre for trade and coastal defence and that of Urmston Road as being an open anchorage and a main trade route.

Tuen Mun was in the 16th century known as a port. Its origins as such a settlement could have extended as far back as the Tang Dynasty, 618 to 907 AD. Tuen Mun was the final stage for many vessels, arriving from Persia, India, Arabia and later Europe, with the southwest monsoons, before moving up the Pearl River to Canton. The importance of Tuen Mun was such that a naval unit was based there by the Nan Han after the collapse of the Tang Dynasty.

Interest in Tuen Mun was not confined to the Chinese, for in the 16th century the port was occupied by the Portuguese for eight years. The Portuguese were routed from the area in 1521 when a small fleet of one warship and three unarmed sailing vessels were burnt and destroyed by the commander of the local Imperial forces.

Toward the end of the 16th century, mounting attacks by pirates devastated the coastal regions of China's provinces. Though eventually repelled, ports like Tuen Mun never recovered and went into decline.

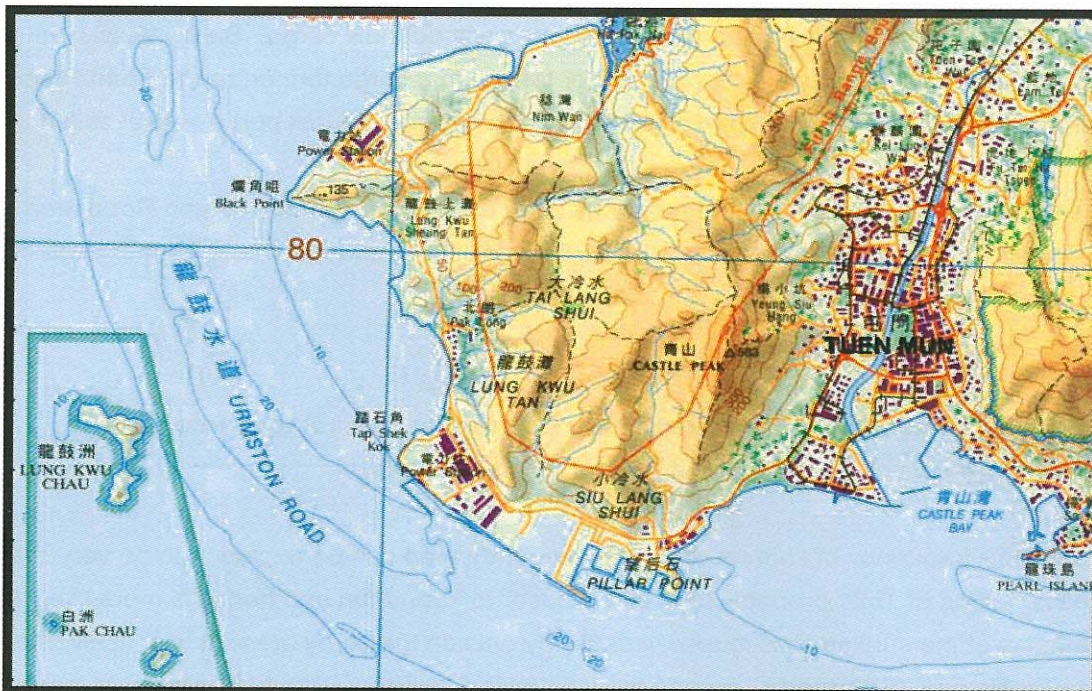


Figure 4: Area showing Tuen Mun and Urmston Road

The decline in Tuen Mun as a trade and gathering place for foreign vessels did not alter Urmston Road's advantages as a natural open anchorage. Vessels continued, though in diminished numbers, to anchor at Urmston Road throughout the 17th and 18th centuries. With the increase of western trade to China at the end of the 18th and early 19th centuries the area was a favourite anchorage for European and North American vessels. The anchorage however was not completely safe from the elements as it is recorded that one typhoon sunk, destroyed and/or dismantled eleven vessels. The anchorage declined in use with the establishment of Hong Kong, though it was used sometime after by opium smugglers.

5.2 Potential for types of submerged cultural resource

From the historical summary presented above, the following site types can be expected to be found within the study area:

- 1/ Shipwrecks
- 2/ Ballast mounds
- 3/ Mooring anchors

The historical presence of shipwrecks in the wider area have accounted in the previous section, the naval action of 1521 and the typhoon in the 19th century. Other such typhoons and even pirate attacks may have created more such wrecks.

The use of Urmston Road as an anchorage may have resulted in the regular deposition of ballast mounds from vessels that arrived in the area without bulk cargo. Such vessels would have discharged such ballast in preparation for taking on a cargo further up the Pearl River. Ballast, most often than not, is hand sized rocks loaded on at the last port a vessel sailed from.

It could be expected that permanent moorings were established in the Urmston Road area for vessels that made regular journeys to China. Such moorings may be in the form of large iron or stone anchors.

5.3 Potential for the extent of the submerged cultural resource

The potential extent of the submerged cultural resource varies.

The extent or frequency of shipwrecks within the study area can be expected to be very low. The naval action of 1521 probably took place closer to Tuen Mun and hence is more likely that the remains of the sunken Portuguese vessels lay outside the study area. It is conceivable that some vessels may have tried to escape to Lintin Island, where a Portuguese outpost may have existed at the time, before they were sunk (Mouchel, April 2002:9-8). Those vessels on such a course may have passed, and/or were sunk within the study area.

Vessels sunk during combat, such as through pirate attacks, in the Urmston Road area, could possibly be situated within the study area but as the Urmston Road anchorage is many times larger than the study area, the expectation of the presence of such wrecks within the study area could be expected to be very low.

Shipwrecks caused through natural causes, such as typhoons, may be located within the study area, though it is a common principle that most vessels lost in adverse weather conditions, are wrecked when they hit something hard like a rock or coastline. It could therefore be expected that the relative frequency of wrecks would increase closer to shore. In the eastern end of the study area, the shoreline at the base of Castle Peak, land reclamation has already taken place, thereby potentially burying any shipwrecks. Sha Chau would have acted as a node for attracting shipwrecks throughout history and before.

Ballast mounds could be expected to be the most common site type within the study area, especially in the deeper waters of the study area. Ballast was usually discharged in deep waters where they would not form a navigation hazard.

Moorings could be expected to be found with less frequency within the study area, and more likely in the western and eastern ends where the water is relatively shallower.

5.4 Potential for the significance of the submerged cultural resource

To date, apart from a boat from the late Song/early Ming Dynasty (1368-1644) uncovered during the construction of the High Island Reservoir in 1970s, no shipwreck earlier than the 20th century has been identified (Arup, July 2001:12-24). It is not known whether ballast mounds or mooring anchors have located and recorded in previous MAI field surveys.

The rarity of such potential site types in Hong Kong gives them a temporary elevated level of significance. This assessment of significance conforms with EIO TM Annex 19 Clause 2.1 which states;

*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.***

6.0 Geophysical survey

6.1 The Geophysical data

Between 18th and 19th June 2002, EGS carried out a marine geophysical and hydrographical survey over the study area (EGS, July 2002). This survey comprised:

- Marine seismic profiling, side scan sonar, echo sounding along seven traverses set parallel to the route centreline and six traverses parallel to the long side of the berth area.
- Current speed and direction measured by Acoustic Doppler Profiler (ADCP) along the same traverses.

In July 2002 EGS produced a preliminary report, which presented the results. Those results relevant to this MAI are as follows:

Frontispiece Location of Proposed Route, Survey Area and Shore-Based Equipment

Proposed Route:

Figures AL1 to AL3 Alignment Charts 1:2000
(comprising digitised and interpreted echo sounding plans, side scan plans and seismic profiles)

Berth area:

Figure 1.1 Hydrophone Track Plot
Figure 1.2 Contoured Sounding Plan
Figure 1.5 Seabed features

Not produced in the report but available at the EGS Quarry Bay offices, were paper logs of the seismic and side scan sonar data.

6.2 Survey scope

The objectives of the survey, as instructed by Leighton Contractors (Asia) Limited to EGS, were as follows:

- 1/ To map the seabed.
- 2/ To map the major sub-bottom geological horizons within the survey area.
- 3/ To measure the flow of the current in the survey area.

(EGS, July 2002:1)

The carrying out of instruction 2/ has implications on the ability of the sub-bottom data collected to be of use to identify potential cultural deposits under the seabed. The sub-bottom profiling was not carried out with the intention to locate shipwrecks but to record seabed stratigraphy down to solid rock. The seismic records were therefore interpreted to quantify only the following elements of geological succession:

(Seabed)

Base of marine deposits

Top of *in situ* weathered rock (in any state of decomposition)

Top of Grade III rock (Moderately decomposed)

Put simply the frequency required to penetrate the seabed to the depths in order to reach solid rock would be of a such a range that the subtle signs of a wreck in the upper strata of the seabed may not have been picked up with sufficient resolution for them to be identified.

6.3 Equipment

The following equipment was used for this survey:

- The EGS seismic boomer (conventional boomer) (EGS hydrophone, EG&G seismic power pack, Waverley thermal recorder, EGS signal processor, 360 Octopus processor, C-view Online Mapping System).
- Klein 2000 side scan sonar
- Klein 2000 side scan sonar console
- C-view Online Mapping System
- Deso 25 dual frequency echo sounder
- 300khz 'Workhorse' ADCP
- Sercel DGPS NDS200 HF transmitter
- Sercel NR203 10-channel DGPS receiver
- The EGS computerised navigation system
- Class III commercial licensed vessel

(EGS, July 2002:2)

6.4 Horizontal spatial control

The survey vessel was located by a Differential Global Positioning system (DGPS) unit, for which only a single differential signal transmitter is required (EGS, July 2002:3). Position information collected was received in WGS 84 and was converted to Hong Kong Metric Grid (1980) for presentation in the charts provided in the EGS July 2002 report.

6.5 Vertical spatial control

EGS operates a permanent recording tide gauge on a dolphin at the Castle Peak Power Station (EGS, July 2002:3). The tide data recorded was used to reduce all observations to Principal Datum (PD), Hong Kong (EGS, July 2002:4).

6.6 Survey coverage

The survey covered the study area set for this MAI. The main traverses were 20 m apart, with cross lines for interpretation at 60 m intervals (EGS, July 2002:4). A chart depicting the track plots in the proposed berth area were provided in Figure 1.1 of the EGS July 2002.

6.7 Marine seismic profiling

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

Vessel speed -	1.5 – 2.5 m/sec
Fix interval -	10 seconds
Sweep speed -	80 ms (seismic recorder)
Power source -	Boomer set at 100 joules
Filter settings -	600 Hz – 2400 Hz
Assumed velocity -	1600 m/sec in superficial sediments

(EGS, July 2002:5)

6.8 Side scan sonar

A Klein 2000 side scan sonar was used to generate side scan records on board. The difference between the fish transducer and the seabed was derived from the difference between the echo sounder output (water column thickness) and the depth sensor in the transducer (EGS, July 2002:5). In-coming side scan data was displayed on the Klein 2000 console screen and recorded on paper at the same time.

6.9 Echo sounder

Sea bed levels were measured with an Atlas Deso 25 dual frequency echo sounder (EGS, July 2002:5). The echo sounder was calibrated at the beginning and the end of every survey day by the 'bar check' method. A circular 'bar' was lowered below the echo sounder transducer at shallow depths to calibrate for the depth of the transducer below the water surface and at all other depths at 1m intervals starting from the greatest water depth, to calibrate for the speed of sound in seawater.

6.10 Data quality

Soundings

The influence of wave action was removed manually from the sounding data and the smoothed sounding data was digitised and reduced to levels below PD using the measured tide data.

Seismic data

Generally the quality of the data was good with the exception of poor results collected close to the sea wall near Area 38 (EGS, July 2002:6). Furthermore the presence of dumped material on the seabed, which was present throughout the survey area, acted as a random reflector and reflect the acoustic signal in all directions; only weak signals were picked up.

6.11 Accuracy

The following are the estimates of accuracy:

Sounding	+/- 0.15 m	
Top of base of soft sediments	+/- 1 m	
Top of rock in any state of decomposition	+/- 2 m	
Top of presumed moderately decomposed rock	+/- 3 m	(EGS, July 2002:11)
Horizontal accuracy	+/- 1 m	(EGS, July 2002:3)

7.0 Results

The following interpretation of the results are based on the EGS interpretations supplied in the preliminary July 2002 report, both from the text of the report and supporting charts. It is important to note that the interpretation of the raw data was skewed towards fulfilling Leighton Contractor's engineering requirements for the laying of the pipeline and the construction of the berth. Therefore the subtle signs of shipwrecks or other cultural formations of interest were not looked for.

7.1 Interpretation of the seabed

Generally the seabed is smooth. Seabed levels are shallow at Sha Chau, approximately -10 m, and close to the reclaimed edge of the mainland, approximately -7 m. In the area of the proposed berth, water depth ranges from -18 m to -7 m. The deepest part of the route is approximately 1 km from the mainland, in the middle of Urmston Road. Here water depths reach -21 m.

Generally the surface of the seabed is composed of various mixtures of sand and clay with patches of gravel throughout, especially at the centre of the deepest part of Urmston Road (see **Appendix C**). The presence of coarser sediments in this area could be reflection of the strength of the tidal current, up to 1.5 kn, and estuarine flows from the Pearl River (Hydrographic Office, 2002:CD). Thermo clines have also been reported in the area, caused by colder and lighter fresh water flows from the Pearl River passing over the denser salt water (Gillon, pers. comm. 6/9/02). This environment would result in finer grained sediments being transported away.

Resting upon the surface are extensive scatters of dumped debris, especially at the western end of the proposed pipeline route and in the centre of Urmston Road. The whole area is scored by trawler and anchor scars.

More specifically, the seabed around the area of the proposed berth is composed of clayey, gravely sediments littered with relatively small patches of dumped material. Some very long anchor scars were also present at the time of the geophysical survey.

For the first half of the proposed pipeline route, up 2 km from the mainland, the seabed drops from -7 m to -21 m, approximately 1 km from shore, before rising gradually to -10 m towards the west, forming a natural trench or channel. The seabed composition is generally of sandy gravels with sections of more clayey sediments closer to shore and where the seabed begins to rise to the west. In the deepest part of this area there are exposed coarser sediments in the form of gravels and even possibly boulders. This, as mentioned above, could be a reflection of

current and river flow velocity. Within this area are also what has been interpreted as being patches of dumped debris. There are numerous anchor and trawl scars throughout.

The second half the proposed pipeline route, up to 2 km from Sha Chau, the seabed is relatively flat, approximately – 10 m. This is due to the dredging of a navigation channel from Urmston Road to the turning circle for current fuel vessel berthing area at Sha Chau. This was carried out six years ago (Gillon, pers. comm. 6/9/02). Consequently, the seabed shows numerous signs of what has been interpreted as anchor scars. Closer to the current Sha Chau berths the seabed is composed of gravel sediments and boulders. Throughout this area there are dense concentrations of dumped debris.

7.2 Interpretation of the stratigraphy

The marine geological succession within the study area is as follows:

Marine deposits (Holocene)

The Hang Hau formation

Soft silty clays and clayey silts with frequent broken shell within the matrix.

Alluvium (Pleistocene)

Chek Lap Kok formation

Firm to stiff sandy silty clays or compact to dense clayey silty sands. Gravels and cobbles are common.

Grade V completely decomposed rock

Firm to stiff clays or compact to dense sands and gravels (residual soil).

Grade III moderately decomposed interpreted rock (Jurassic/Cretaceous)

Fine to medium granite.

For the first half of the proposed pipeline route, up 2 km from the mainland, the soft marine deposits range in thickness from 7 to 10 m (see **Appendix D**). Within the marine deposits, at the base of the Urmston Road 'channel' there is a horizon interpreted as a more reflective, coarser strata of material, possibly a mixture of natural and cultural. Also within this marine deposit are what appear to be discrete mounds of what has been interpreted as 'dumped materials'. Such a phenomenon is to be expected in an area such as this where dense materials would sink through the soft marine sediments, the process accelerated by scouring around objects caused by tide and river flow as well sediments placed into suspension from typhoons.

The second half the proposed pipeline route, up to 2 km from Sha Chau, the trend continues, where the marine sediment deposits reach 10 m in thickness. This stratum decreases in thickness closer to Sha Chau where the Grade III rock is closer to the surface of the seabed. A number of horizons composed of sorted coarser marine sediments (may be shell) or possibly even cultural material can be discerned within the marine sediments. What has been interpreted as dumped material within the marine sediment has increased in both frequency and dimension. Some of these anomalies appear to be exposed.

8.0 Potential for the condition and detect ability of the potential submerged cultural resource

Two primary environmental factors within the study area have an impact on the site formation processes of cultural materials deposited on the seabed. These are the soft marine stratum and tide and river flow velocities.

With regards to shipwrecks, in particular wooden hulled vessels, the predicted site formation process is as follows:

- Vessel comes to rest on seabed.
- Depending on the size of the vessel, the cargo and the shape of the hull, the wreck will sink into the mud up to a certain level.
- Biological processes will commence immediately, attacking the exposed timbers and other organic elements of the wreck. This will lead to the weakening of the hull integrity and eventual disappearance of the organic elements above the seabed.
- Relatively strong tidal and river flows will cause localised scouring around cultural objects, which will bury them deeper into the marine sediments.
- Large waves caused by typhoons will raise sediments into suspension, thereby resulting in cultural objects sinking further into the marine sediments.

The above mentioned processes pre-disposes towards shipwrecks, at least those with wooden hulls becoming buried over time. Therefore the logical conclusion to this would be that the older the wreck, the deeper it could be buried. The depth of burial within the context of the study area would be to the top of the alluvium of the Chek Lap Kok formation, this stratum appears relatively dense and solid enough to resist penetration by a wreck.

The typical wreck site appearance/characteristics would be the bulk of the remains of the wreck to be situated below the seabed surface. Large inorganic materials that would have been located in the upper part of a vessel, such as the anchor, cannon, winch/capstan, ship's oven/cauldron and even cargo and ballast may be visible above the seabed. A classic 'wreck shape' would not be expected unless the vessel's cargo was completely composed of inorganic materials. More than likely a composition of small to large objects would be visible in a more or less discrete concentration. Scouring and periodic large storms may expose from time to time organic elements signifying the continual process of deterioration of a shipwreck site. Such organic elements may include the frames of the hull exposed only perhaps less than a metre above the seabed. More recent wrecks, especially those constructed from steel, will obviously retain their 'ship shape' longer and be more identifiable.

This same process described above would hold true for ballast mounds, in that the bulk of the mound could be expected to be buried. Moorings of any age are not expected to be visible above the surface. The Sha Chau Buoy shown in Appendix E is depicted as being a large reflective object which does not protrude above the seabed for any appreciable distance.

Cultural behaviour within the study area will have had the effect of scrambling wreck sites and masking their presence. Dragging anchors and trawling will result in wreck material being spread over a wider area therefore distorting any symmetrical patterns on the seabed which may point to a wreck or ballast mound. On the other hand such activities may also result in the 'ploughing up' of buried cultural material.

The process of dredging would have a destructive effect on the cultural material it encounters but if the process does not reach solid rock or in the case the Chek Lap Kok formation, it may also reveal material that had been buried previously. This could be the case for the dredging that took place for the navigation channel from Urmston Road to Sha Chau. Here the dredging was limited to a depth of -10 m (Gillon, pers. comm. 6/9/02).

The dumping of material, mostly construction debris, on the seabed throughout the study area has the effect of masking the presence of the subtle signs of a shipwreck. This has been a major problem in the choosing of targets for this MAI.

9.0 Targets

9.1 Process of choosing targets

The process of choosing the targets for the field investigation of the MAI took two forms;

- assessing side scan sonar data
- assessing seismic reflection data

Side scan sonar data

The interpretation of the side scan sonar data as presented in the EGS July 2002 preliminary report was sufficient to give an overall view of the seabed topography. However EGS staff interpreting these records were not required to look for possible remains of cultural significance, nor are they trained to identify such sites. It may be that some of the areas marked as "dumped materials/debris" may be in fact the remains of a shipwreck.

To try and identify possible remains of cultural significance the raw side scan sonar data had to be examined. This was done by the author, with the assistance of Nathan Richards, a maritime archaeologist sub-contracted to Cosmos Archaeology Pty Ltd, in the EGS offices at Quarry Bay. Approximately 30 km of side scan data on paper logs were examined. Signatures of interest, such as single objects of some relief, symmetrical shapes, or collection of shapes, either with some relief or not, were tagged. At this stage of the process the signatures within the study area within 2 km of Sha Chau and close to the mainland were chosen with consideration to the recent activities that have taken place, i.e. dredging and reclamation.

Once the first round of interpretation was completed the targets were then placed on a printed out track plot of the geophysical survey, the targets being identified with the corresponding unique track plot number. This was done as the side scan sonar traces overlapped considerably. Hence, duplicate or triplicate images of the same target were removed. A further 'culling' process took place where targets tagged in the first round of interpretation were re-assessed, being either deleted or kept.

With a reduced target list, the digitised image of the targets were brought up on a computer screen which are stored in EGS in-house software. EGS staff then calculated the dimensions and position of the target, as Hong Kong Metric Grid (1980). At this stage some further 'uncertain' targets were deleted. The side scan sonar images were then saved as .jpeg files and the position data converted to WGS 84 using EGS in-house software and stored in Excel. All this information was presented to the author on a CD.

Seismic reflection data

The raw data collected for the sub-bottom profiling was not examined. This is because of the difficulty in interpreting these anomalies coupled with the knowledge that manner in which this part of the survey was conducted was not conducive to the detecting of the subtle signs of shipwrecks, such as timber, under the top stratum of the seabed.

The sub-bottom information in the charts provided in the EGS July 2002 preliminary report was sufficient for sub-surface targets of interest to be identified.

9.2 Target list

The targets chosen for the field investigation component, Task 3, of the MAI are presented in the tables below. The targets, in relation to the seabed and stratigraphy, are shown in Appendices C and D while the side scan sonar images are to be found in Appendix E.

The side scan sonar targets have also been tagged with their corresponding track plot number. This has been done so that they could easily be retrieved from the EGS files. For buried targets, 'SS' denotes sub-surface.

The exposed or side scan images chosen as targets are mostly single objects with some relief. It is anticipated that they may be the large inorganic components of a wreck. Locating these targets to identify them and then conducting a circular search around them may reveal signs of the existence of a wreck; sign that could not be readily picked up by side scan sonar. Other targets include areas where there are concentrations of small objects, which could typify ballast. Some targets, such as T20(1646), are a series of highly reflective 'spots' of little or no relief, which form a pattern. This is what would be expected to be seen of hull frames poking through the seabed. With all these targets chosen they are all likely to be of cultural in origin but it should be expected that they could be recently deposited debris.

Ten sub-surface targets were chosen for examination. Most of these targets lie in the areas that have been dredged for the navigation channel. They are relatively large and long and may be possibly geological in character. Some of them however are close to the surface and/or exposed and may warrant some examination. SS1 and SS2 appear to be discrete mounds of material rather than natural deposits. SS1 however is over 1.5 m below the surface and may not be able to be investigated using diver based excavation techniques. SS2 is closer to the surface and may even be exposed. Nevertheless diver based excavation in this part of the study area would be difficult given the water depth, -21 m, the busy water traffic above and current.

Target no.	Track plot I.d. no.	App. depth	Length (m)	Width (m)	Height (m)	Latitude	Longitude	comments
1	161	15	4.49	1.69	1.02	22°21.6969 N	113°55.8047 E	High relief, round object.
2	94	11	3.61	0.6	0.46	22°21.8016 N	113°55.5420 E	Linear object with relief and associated derbhis
3	1066	19	5.17	3.42	0.12	22°21.9319 N	113°55.3823 E	Straight lines forming rectangular shape. No height
4	2106	20	3.41	2.73	0.37	22°21.8761 N	113°55.3324 E	Identified in EGS July 2002 report. Square object in scoured hole.
5	1345	20	2.79	1.97	0.09	22°21.8764 N	113°55.3266 E	Round object, no relief
6	1426	21	2.62	2.01	0.14	22°21.8731 N	113°55.3039 E	Square object
7	1082	21	2.16	1.5	0.16	22°21.8374 N	113°55.2917 E	Identified in EGS July 2002 report. Thin linear object in scour pit.
8	1705	21	3.54	2.36	0.32	22°21.8854 N	113°55.2449 E	Single linear object with some scouring.
9	2130	21	7.09	3.5	0	22°21.7610 N	113°55.2314 E	Large rectangular object with 2 high points
	1331 corner1		0	0	0	22°21.8467 N	113°55.2209 E	
	1331 corner2		0	0	0	22°21.8323 N	113°55.1966 E	
10	1331 center	21	0	0	0	22°21.8273 N	113°55.2181 E	Scatter of small objects.
	1331 corner3		0	0	0	22°21.8050 N	113°55.2161 E	
	1331 corner4		0	0	0	22°21.8190 N	113°55.2417 E	
11	1449b	21	2.57	0.78	0.1	22°21.7355 N	113°55.1666 E	Small rectangular shaped object.
	1693 corner1		0	0	0	22°21.8317 N	113°55.1579 E	
	1693 corner2		0	0	0	22°21.8182 N	113°55.1703 E	
12	1693 center	21	0	0	0	22°21.8203 N	113°55.1542 E	Scatter of small objects.
	1693 corner3		0	0	0	22°21.8104 N	113°55.1491 E	
	1693 corner4		0	0	0	22°21.8199 N	113°55.1411 E	
13	1449a	21	2.4	1.64	0.44	22°21.7387 N	113°55.1526 E	Small irregular shaped object.
14	2020b	21	2.72	1.51	0.2	22°21.7272 N	113°55.1386 E	Single linear object with some scouring.
15	2141	21	1.2	1.48	0.32	22°21.7267 N	113°55.1385 E	Large rectangular object with 2 high points?
16	1320	21	2.3	3.17	0.52	22°21.7757 N	113°55.1322 E	Small rectangular object with scouring.
17	2020a		2.62	1.27	0.52	22°21.7559 N	113°55.1128 E	Two rectangular objects.
18	1315	21	2.48	1.52	0.43	22°21.7516 N	113°55.0924 E	Large square object
19	2147	21	2.09	3.02	0.29	22°21.7059 N	113°55.0877 E	Tear shaped object in scour pit.
20	1646	18	9.11	1.51	0	22°21.5489 N	113°54.8145 E	Row of evenly spaced dots. No relief.
21	1861	12	3.56	0.43	0.25	22°21.3475 N	113°54.6156 E	Linear object with relief.
22	1624	12	1.93	1.5	0.29	22°21.4281 N	113°54.6022 E	Small linear object.
23	2232	11	1.31	1.3	0.47	22°21.2838 N	113°54.4938 E	Small circular shaped object.
24	1547	11	2.9	0.9	0.65	22°21.2869 N	113°54.4931 E	Regular shaped object.
25	1896	10	3.36	2.23	0	22°21.1642 N	113°54.3376 E	Straight sided object. No relief.
26	2488	10	0	0	0	22°21.1485 N	113°53.6575 E	Large area of dark reflective material. No relief.
Calibrations								
Navigation Buoy (Sha Chau 1			5.07	6.26	0	22°21.1653 N	113°54.1355 E	

Table 1: List of exposed targets

Target	App. depth	Depth below sea bed (m)	Length (m)	Width (m)	Height (m)	Latitude	Longitude	Comments
SS1	19	2.5	30	?	4	22°21.9263 'N	113°55.3930 'E	
SS2	21	exposed?	18	?	2.5	22°21.8318 'N	113°55.2557 'E	
SS3	11	1.5	10	?	2	22°21.3028 'N	113°54.4866 'E	
SS4	10	1.5	16	?	2.5	22°21.1768 'N	113°54.2940 'E	
SS5a	10	1.5 - 2.0	-	-	-	22°21.1533 'N	113°53.8880 'E	transect dive
SS5b	10	1.5 - 2.0	-	-	-	22°21.1723 'N	113°54.2154 'E	transect dive
SS6	9	2	68	?	2	22°21.1422 'N	113°53.7145 'E	
SS7	9	1.5	28	?	2	22°21.1388 'N	113°53.6341 'E	
SS8a	9	exposed	-	-	-	22°21.2399 'N	113°53.5081 'E	transect dive
SS8b	9	exposed	-	-	-	22°21.1982 'N	113°53.5408 'E	transect dive
SS9	9	exposed	14	?	4	22°21.2317 'N	113°53.4766 'E	
SS10	10	1	24	?	2	22°21.2175 'N	113°53.4243 'E	

Table 2: List of sub-surface targets

10.0 Impact of development on potential submerged cultural resource

The excavation of a trench, through the use of a trailer dredge, up to 7 m below the seabed and up to 20 m wide will have the effect of destroying and/or removing any cultural material in its path.

The construction of the berth, based on available information, should not be as overwhelmingly destructive to a site as it involve the driving in of piles. Obviously cultural material in the path of a pile will be destroyed however the overall footprint of this part of the development and its dispersed nature will have less of an impact on the submerged cultural resource.

11.0 Impact Assessment.

In accordance with EIAO Technical Memorandum Annex 19 Clauses 2.6 to 2.9, an impact assessment is required to measure the effects of the development on sites of cultural heritage. This study has not identified any archaeologically important objects as guided by EIAO Technical Memorandum Annex 19 Clause 2.1 (see **Section 5.4**). What has been identified has been the following:

- There is some potential for archaeologically important objects to be present within the study area.
- A number of physical features have been identified within the study area, which may have archaeological potential and thereby be of archaeological importance.

An impact assessment, as defined in EIAO Technical Memorandum Annex 19, cannot be made at this stage. With the above facts stated, the EIAO Technical Memorandum Annex 19 Clause 2.5, requires that where *....sources of information prove to be inadequate or where the proposed project area has not been adequately studied before, field surveys and site investigations shall be conducted to assemble the necessary data.*

The outline and methodology of the field survey is presented in **Section 12.0**. The objective of the field survey is to establish whether the identified anomalies or targets, which may have archaeological potential, are archaeologically important.

12.0 Measures to be taken to assess targets of archaeological potential

The Guidelines for Marine Archaeological Investigation, Clause 4.1, states that *a field evaluation programme [be planned] to acquire more detailed data on areas identified as having archaeological potential.* The field evaluation programme will attempt to establish whether the identified anomalies or targets, which may have archaeological potential, are archaeologically important using the following accepted marine archaeological practices;

1. Visual Diver Survey
2. Watching Brief.

1/ Visual Diver Survey

The visual diver survey should incorporate the following aims:

- * *Examination of the targets identified with the side scan sonar.*

This would be done by divers conducting a circular search for each anomaly.

- * *Examination of some of the sub-surface targets.*

This would be carried out by using a waterlift or dredge.

2/ Watching Brief

The Guidelines for Marine Archaeological Investigation, Clause 4.3, states that an archaeological watching brief should *...focus work on the areas of greatest archaeological potential. Careful monitoring of the dredging operations would enable immediate identification and salvage of archaeological material. If archaeological material is found, the AMO should be contacted immediately to seek guidance on its significance and appropriate mitigation measures would be prepared*

Based on the assessment of the sub-surface anomalies in Section 9.2, the areas of the most likely archaeological potential are in the vicinity of SS1 and SS2. With this in mind a watching brief should focus on these two anomalies.

If in the course of the Diver Visual Survey and Watching Brief the identified targets of archaeological potential are identified as archaeologically important, as guided in Clause 2.1 of Annex 19 of the EIAO TM, then an immediate impact assessment is required. The impact assessment would follow the guidelines as set out in EIAO TM, Annex 19 Clauses 2.6 to 2.9.

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Reports

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EGS, July 2002 *Permanent Aviation Fuel Facility: Area 38 to Sha Chau. Pipeline Route and Berthing Facilities – Geophysical and Hydrographic Survey. Preliminary Report. EGS Job no. HK173302. Prepared for Leighton Contractors (Asia) Limited.*

Mouchel, April 2002 *Environmental Assessment Services for Permanent Aviation Fuel Facility: Environmental Impact Assessment Report.*

Personal communications

Gillon, Brian Project Manager, Leighton Contractors (Asia) Limited.

CD

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Appendix A

Guidelines for Marine Archaeological Investigation (MAI)

Standard practice for MAI should consist of for separate tasks, i.e.

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

(1) Baseline Review

- 1.1 A baseline review should be conducted to collate the existing information in order to identify the potential for archaeological resources and, if identified, their likely character, extent, quality and value.
- 1.2 The baseline review will focus on known sources of archive data. It will include :
 - a. Geotechnical Engineering Office (GEO) – the Department holds extensive seabed survey data collected from previous geological research.
 - b. Marine Department, Hydrographic Office – the Department holds a substantial archive of hydrographic data and charts.
 - c. The Royal Naval Hydrographic Department in the UK – the Department maintains an archive of all survey data collected by naval hydrographers.
- 1.3 The above data sources will provide historical records and more detailed geological analysis of submarine features which may have been subsequently masked by more recent sediment deposits and accumulated debris.

(2) Geophysical Survey

- 2.1 Extensive geophysical survey of the study area should deploy high resolution boomer, side scan sonar and an echo sounder. The data received from the survey would be analysed in detail to provide :

- a. Exact definition of the areas of greatest archaeological potential.
- b. Assessment of the depth and nature of the seabed sediments to define which areas consist of suitable material to bury and preserve archaeological material.
- c. Detailed examination of the boomer and side scan sonar records to map anomalies on the seabed which may be archaeological material.

(3) *Establishing Archaeological Potential*

- 3.1 The data examination during Task 1 and 2 will be analysed to provide an indication of the likely character and extent of archaeological resources within the study area. This would facilitate formulation of a strategy for investigation.
- 3.2 The results would be presented as a written report and charts. If there is no indication of archaeological material there would be no need for further work.

(4) *Remote Operated Vehicle (ROV)/Visual Diver Survey/Watching Brief*

- 4.1 Subject to the outcome of Task, 1, 2 and 3, accepted marine archaeological practice would be to plan a field evaluation programme to acquire more detailed data on areas identified as having archaeological potential. The area of archaeological interest can be inspected by ROV or divers. ROV or a team of divers with both still and video cameras would be used to record all seabed features of archaeological interest.
- 4.2 Owing to the heavy marine traffic in Hong Kong, the ROV/visual diver survey may not be feasible to achieve the target. If that is the case, an archaeological watching brief is the most appropriate way to monitor the dredging operations in areas of identified high potential to obtain physical archaeological information.
- 4.3 A sampling strategy for an archaeological watching brief would be prepared based on the results of Task 1, 2 and 3 to focus work on the areas of greatest archaeological potential. Careful monitoring of the dredging operations would enable immediate identification and salvage of archaeological material. If archaeological material is found, the AMO should be contacted immediately to seek guidance on its significance and appropriate mitigation measures would be prepared.
- 4.4 If this task is undertaken, the results would be presented in a written report with charts.

Appendix B Environmental Impact Assessment Ordinance, Technical memorandum – Annexes 10 and 19

Downloaded from <http://www.epd.gov.hk/epd/eia/legis/index3.htm>

ANNEX 10 : CRITERIA FOR EVALUATING VISUAL AND LANDSCAPE IMPACT, AND IMPACT ON SITES OF CULTURAL HERITAGE

1. Criteria for Assessment of Visual and Landscape Impact

- 1.1 The evaluation of landscape and visual impact may be classified into five levels of significance based on type and extent of the effects concluded in the EIA study:
- a. The impact is beneficial if the project will complement the landscape and visual character of its setting, will follow the relevant planning objectives and will improve overall and visual quality;
 - b. The impact is acceptable if the assessment indicates that there will be no significant effects on the landscape, no significant visual effects caused by the appearance of the project, or no interference with key views;
 - c. The impact is acceptable with mitigation measures if there will be some adverse effects, but these can be eliminated, reduced or offset to a large extent by specific measures;
 - d. The impact is unacceptable if the adverse effects are considered too excessive and are unable to mitigate practically;
 - e. The impact is undetermined if significant adverse effects are likely, but the extent to which they may occur or may be mitigated cannot be determined from the study. Further detailed study will be required for the specific effects in question.

2. Criteria for Assessment of Impact on Sites of Cultural Heritage

- 2.1 The criteria for evaluating impact on sites of cultural heritage include:
- 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.

ANNEX 19: GUIDELINES FOR ASSESSMENT OF IMPACT ON SITES OF CULTURAL HERITAGE AND OTHER IMPACTS

1. General

- 1.1 The annex describes the commonly adopted approaches and methodologies for assessment of impact on sites of cultural heritage and other environmental issues. The methodologies may vary from case to case, depending on the nature of the issues and the latest development in methods and techniques.

2. Impact on Sites of Cultural Heritage

- 2.1 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.**

Baseline Study

- 2.2 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.

Methodology

- 2.3 The best information shall be assembled for the assessment of the identified sites of cultural heritage. The entry point shall be the Antiquities and Monuments Office, public libraries and archives and tertiary institutions.

- 2.4 The assessment shall provide detailed geographical, historical, archaeological, ethnographical and other cultural data. Published papers, records, archival and historical documents as well as oral legends shall also be consulted.
- 2.5 In cases where the above sources of information prove to be inadequate or where the proposed project area has not been adequately studied before, field surveys and site investigations shall be conducted to assemble the necessary data.

Impact Assessment

- 2.6 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.
- 2.7 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.
- 2.8 Total destruction must be taken as the very last resort in all cases and shall only be recommended with a meticulous and careful analysis balancing the interest of preserving the archaeological, historical, architectural and other cultural values as against that of the community as a whole.
- 2.9 Assessment of impacts on sites of cultural heritage shall also take full account of, and follow where appropriate, the Guidelines for Landscape and Visual Impact Assessment at Annex 18.

Mitigation Measures

- 2.10 Mitigation measures shall not be recommended or taken as *de facto* means to avoid conservation and preservation of sites of cultural heritage. They must be proved beyond all possibilities to be the only practical course of action.
- 2.11 Designs, layouts, external treatments, colour and texture of materials, but not limiting to such, shall be worked out for the integration of the sites of cultural heritage to be preserved in whole or in part into the proposed project.

- 2.12 For total destruction, a comprehensive and practical rescue plan must be worked out. This is also applicable to sites of cultural heritage where only partial preservation is proposed.
- 2.13 Annex 18 also applies.
- 2.14 A practical programme and funding proposal for the implementation of the recommended mitigation measures shall be included as part of the assessment. These shall form an integral part of the overall development programme and financing of the proposed project. Competent professionals must be engaged to design and carry out the mitigation measures.

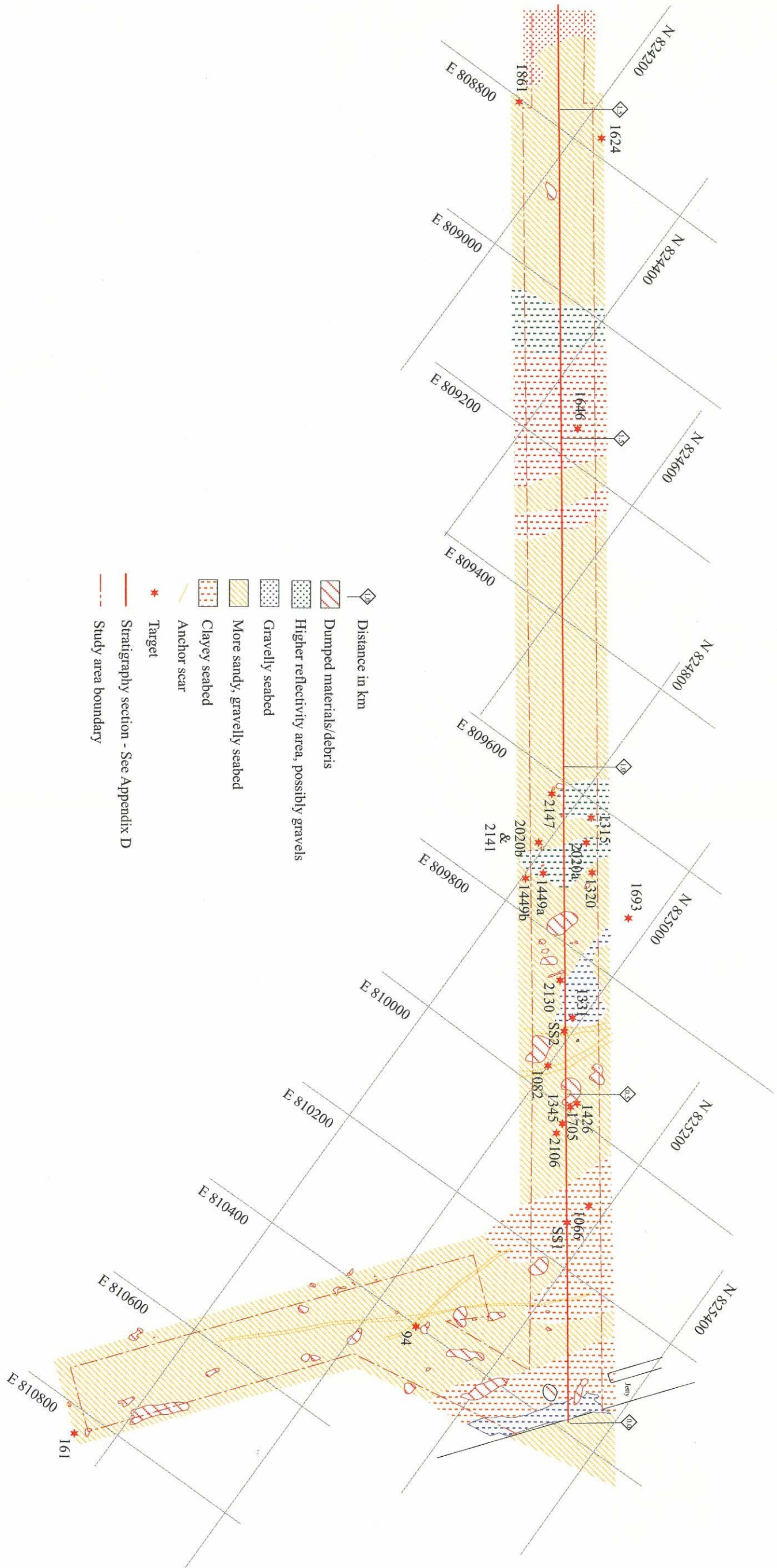
3. Potential Contaminated Land Issues

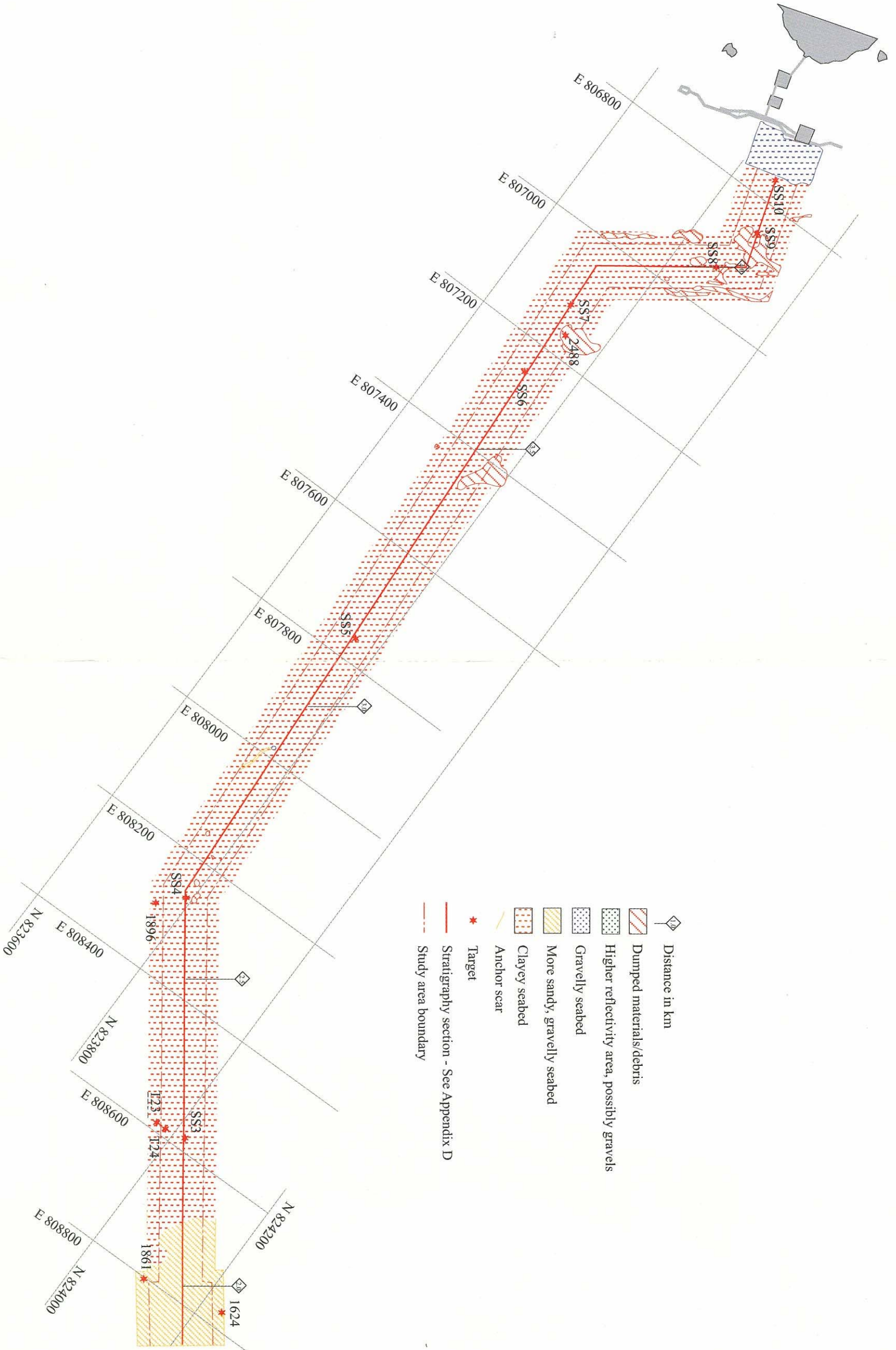
- 3.1 For all development and redevelopment projects listed under Schedule 2, Part I and Schedule 3, the applicant who is preparing an EIA report as stipulated in Clause 6 of the Environmental Impact Assessment Ordinance, shall give consideration to historical land uses which have the potential to cause or have caused land contamination. Such uses include, but are not limited to, the following:
- a. oil installations including oil depots and petrol filling stations
 - b. gas works
 - c. power plants
 - d. shipyards/boatyards
 - e. chemical manufacturing/processing plants
 - f. steel mills/metal workshops
 - g. car repairing and dismantling workshops
 - h. dumping ground and landfill
- 3.1.1 If the above land uses are identified, the applicant shall submit, as part of the EIA report, a Contamination Assessment Plan (CAP) to the Director for endorsement prior to conducting a contamination assessment of the site.
- 3.1.2 Based on an endorsed CAP, the applicant shall conduct a contamination assessment and compile a Contamination Assessment Report (CAR) for the Director's review. During the preparation of the CAR, if land contamination is confirmed, a Remediation Action Plan (RAP) shall be prepared. the RAP and the CAR shall be submitted as a combined report to the Director for approval, referencing the corresponding CAP.

- 3.1.3 Upon approval of the CAR/RAP, the applicant shall clean up the contaminated site according to the approved RAP, prior to any development or redevelopment of the site.
- 3.1.4 The preparation of CAP, CAR, or CAR/RAP reports shall be based on the relevant published Practice Note for Professional Persons or guidelines issued by the Director.
- 3.2 For all decommissioning projects as designated under Schedule 2, Part II, the above requirements apply regardless of the historical land use.
- 3.3 For development or re-development projects adjacent to landfill, the applicant shall note the following additional specific requirements when the need for a landfill gas (LFG) hazard assessment is confirmed:
 - a. carry out a LFG hazard assessment to evaluate the degree of risk associated with the proposed development;
 - b. design suitable precautionary / protection measures to render the proposed development as safe as reasonably practicable;
 - c. ensure that the precautionary / protection measures will be implemented and constructed in accordance with the design;
 - d. establish a maintenance and monitoring programme for ensuring the continued performance of the implementation protection measures.

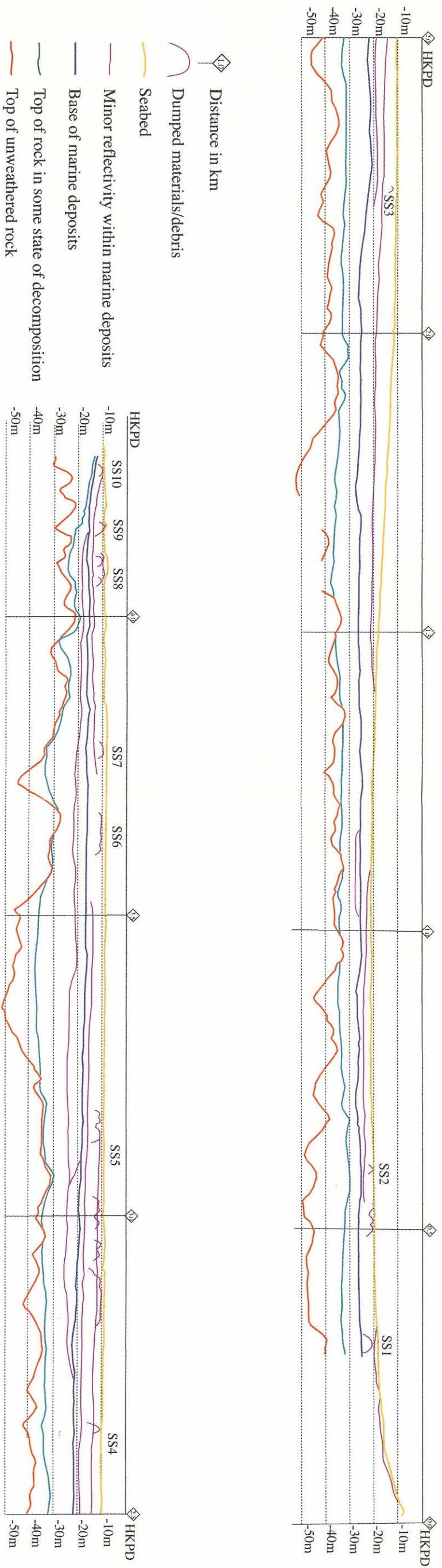
The LFG hazard assessment shall be carried out and completed for submission to the Director for vetting at the early planning stage of the project. The early completion of the assessment study will ensure that the identified protection measures be considered and incorporated in to the overall design process for the proposed development.

Appendix C Charts of the study area showing seabed topography

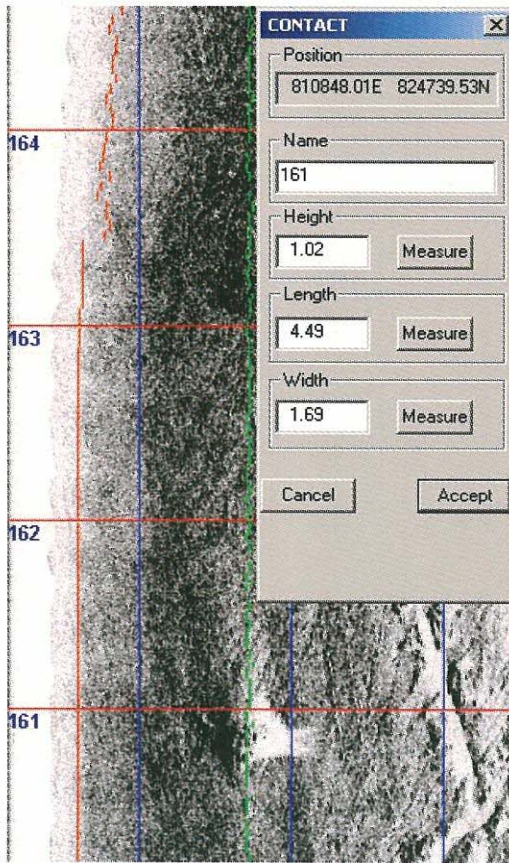




Appendix D Charts of the study area showing seabed stratigraphy

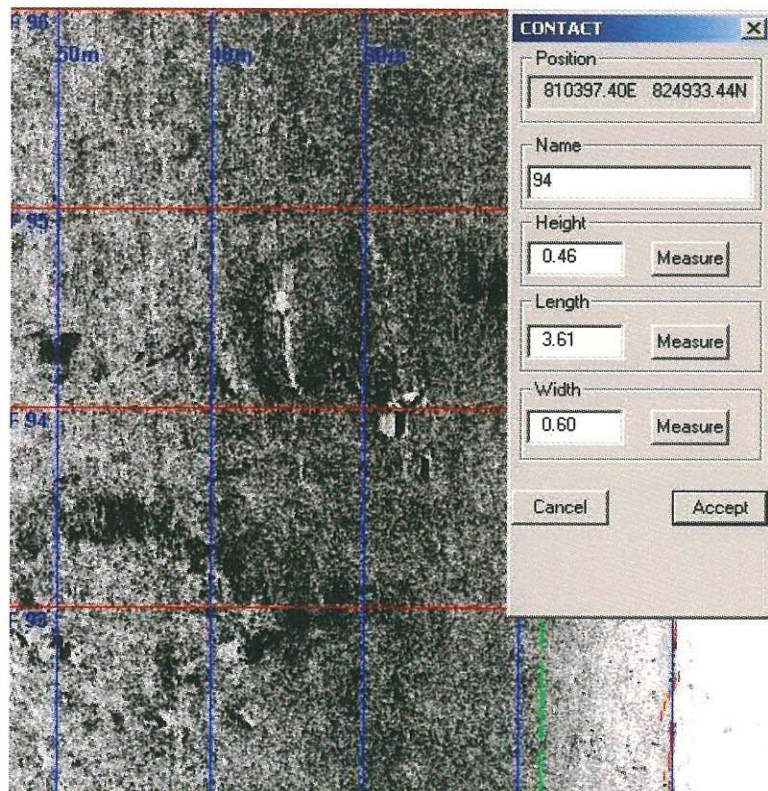


Appendix E Side scan sonar images of targets



Target 1

Target 2



CONTACT

Position
810123.67E 825174.43N

Name
1066

Height
0.12 Measure

Length
5.17 Measure

Width
3.42 Measure

Cancel Accept

Target 3

CONTACT

Position
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Name
2106

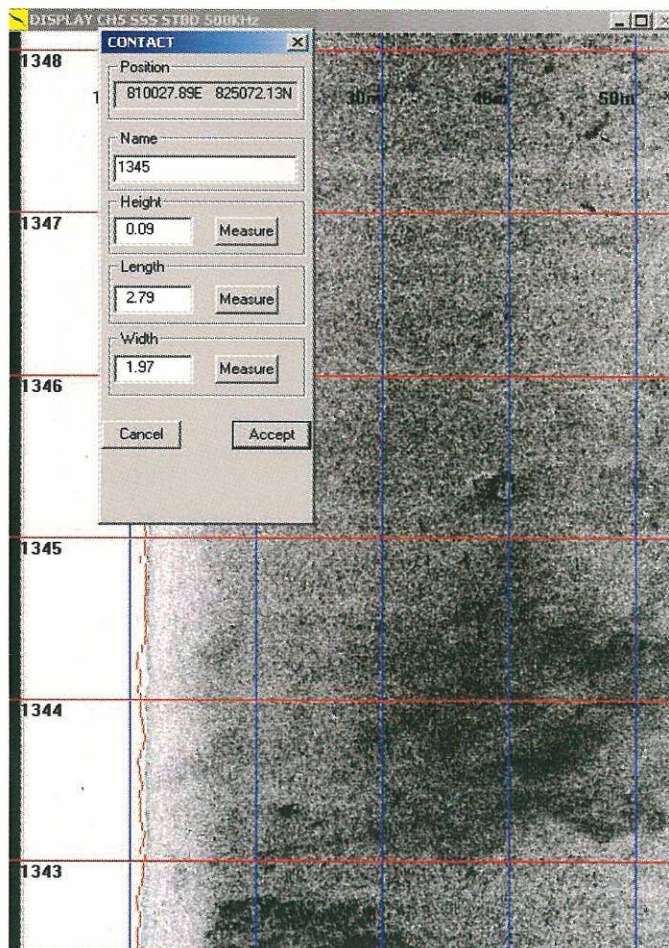
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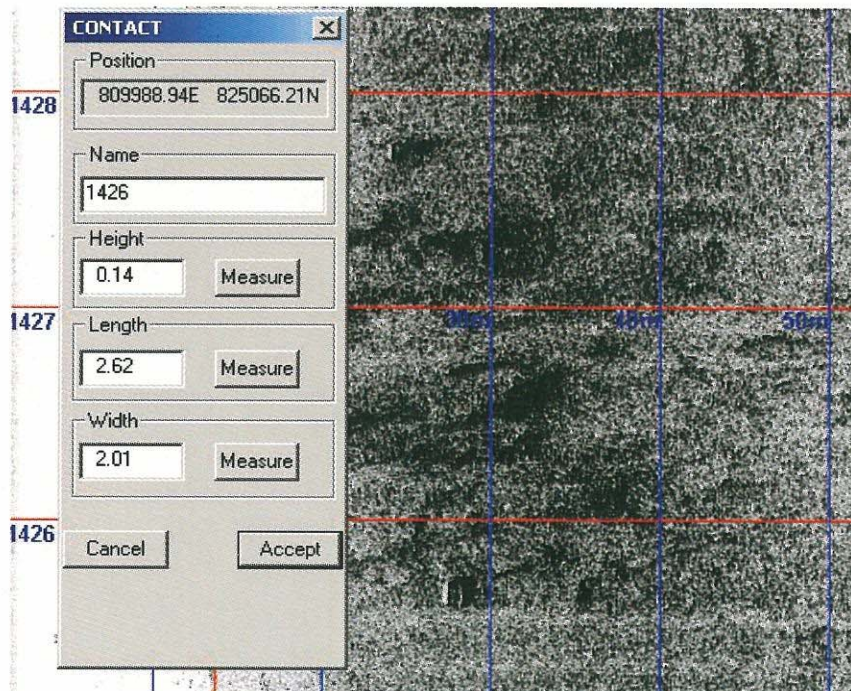
Cancel Accept

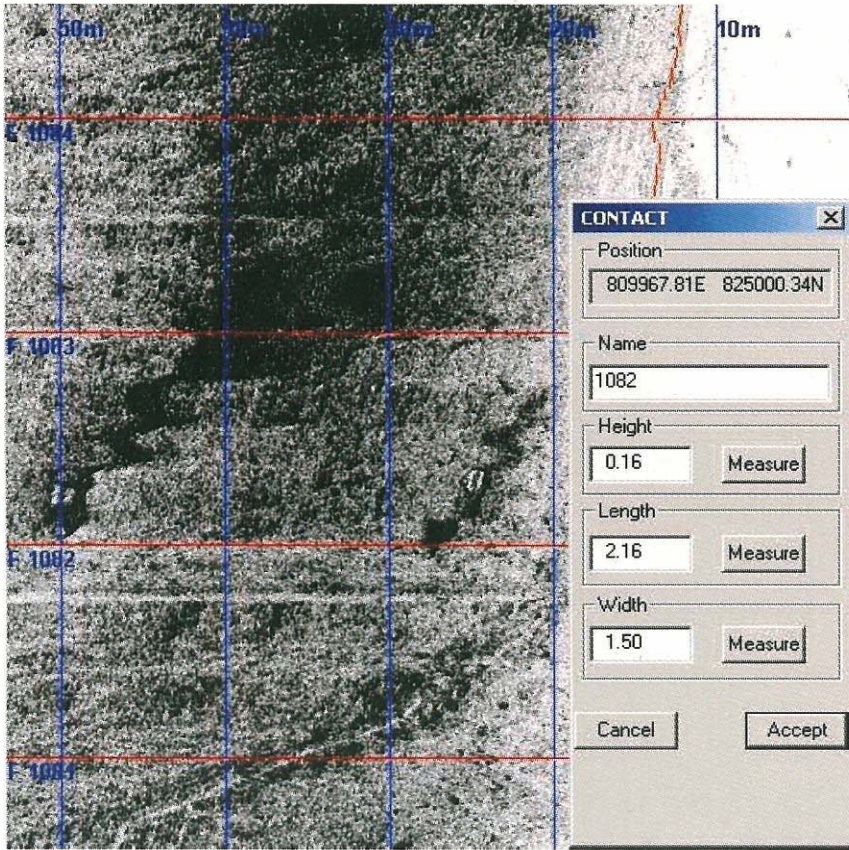
Target 4



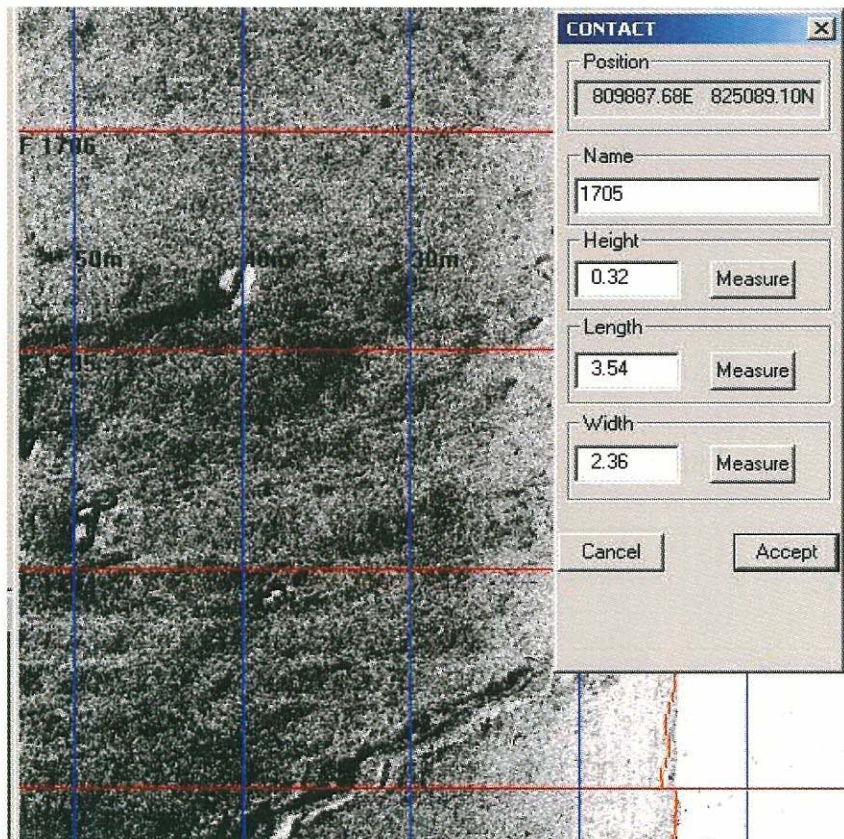
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Target 6

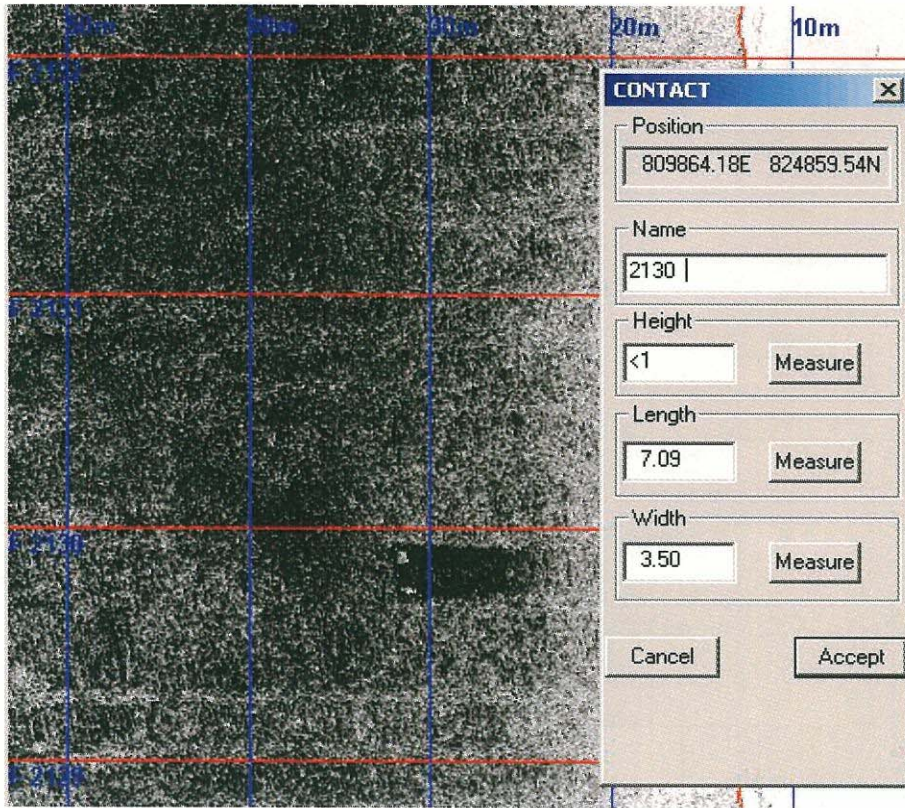




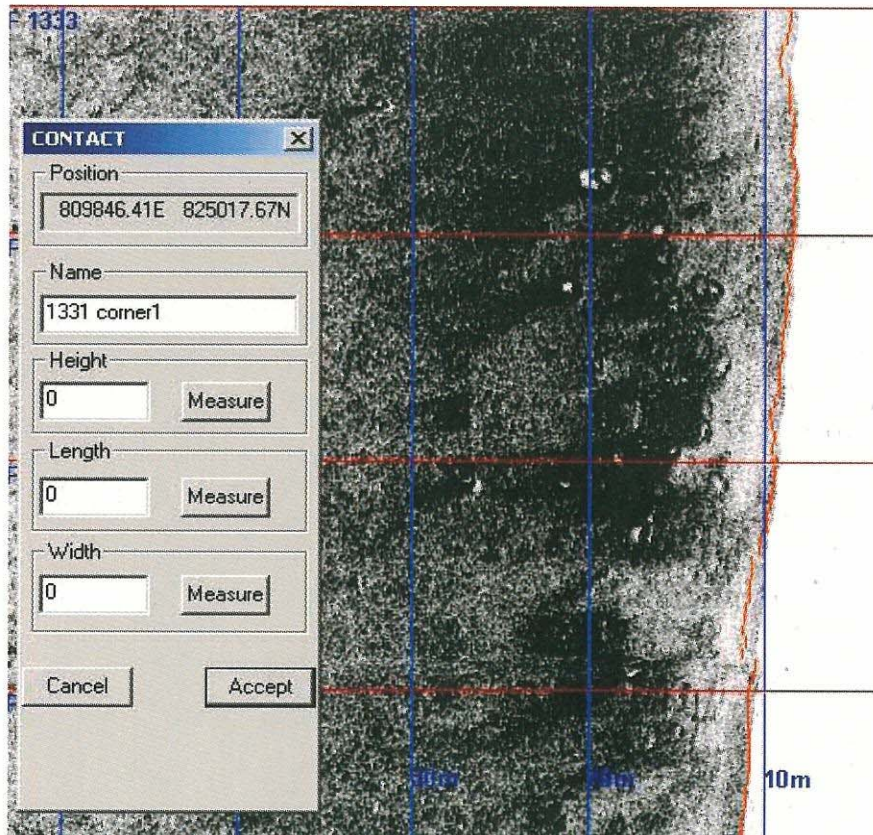
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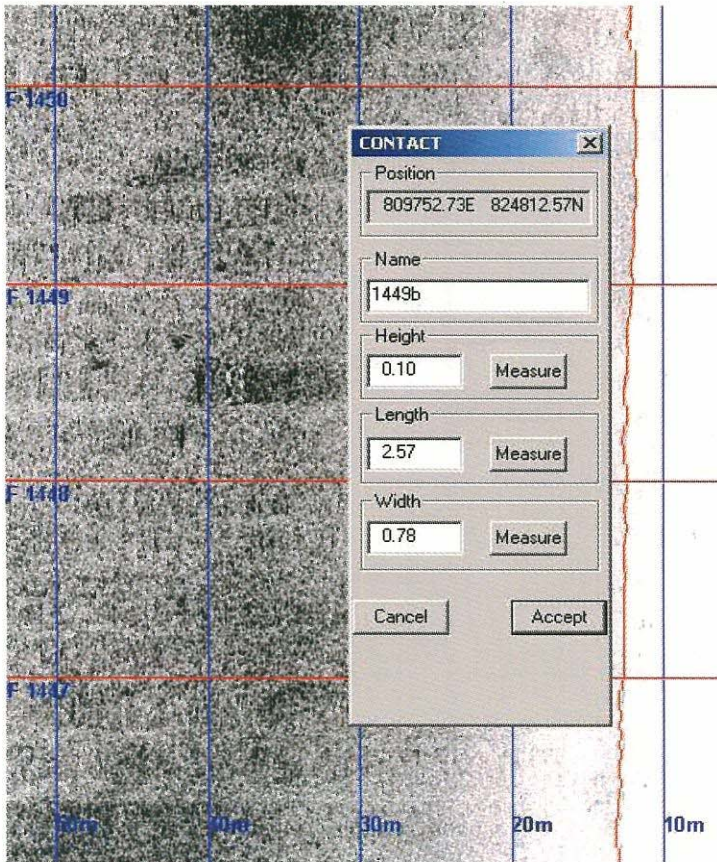
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Target 9

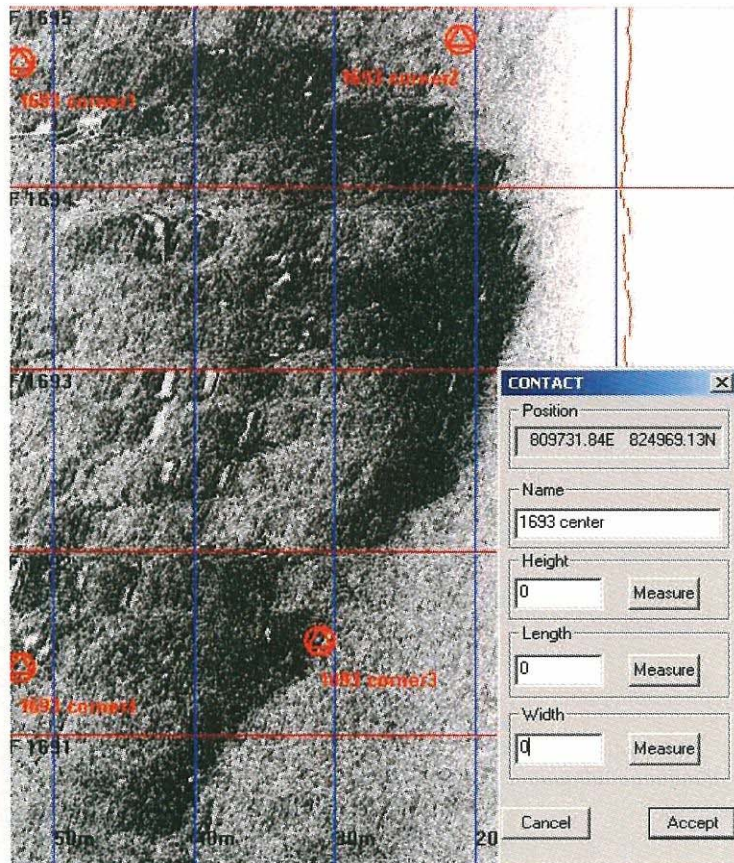


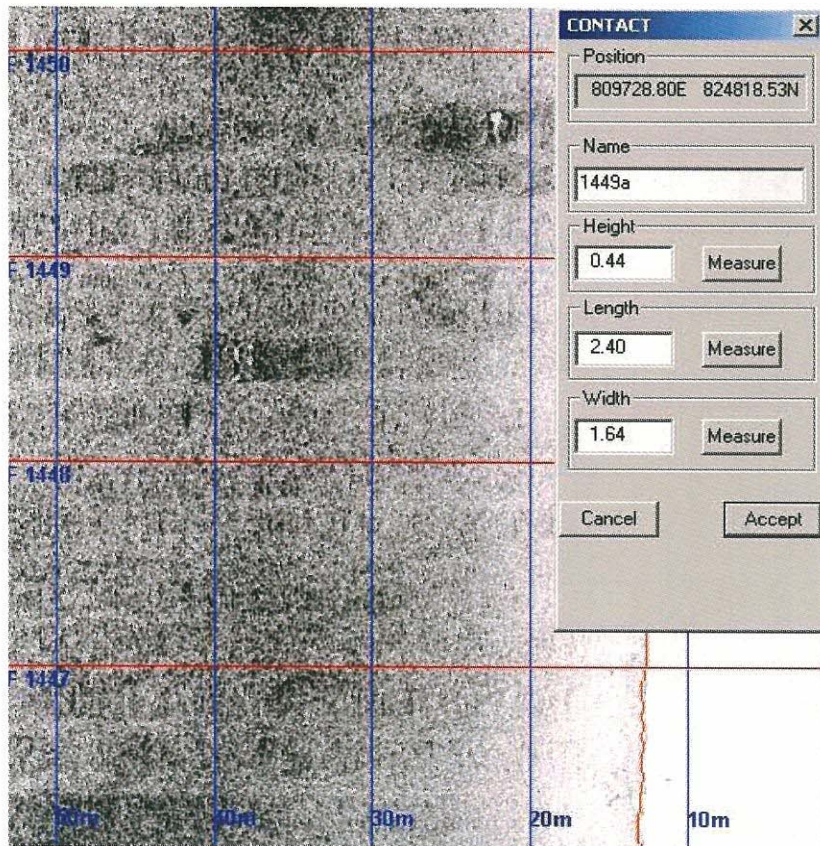
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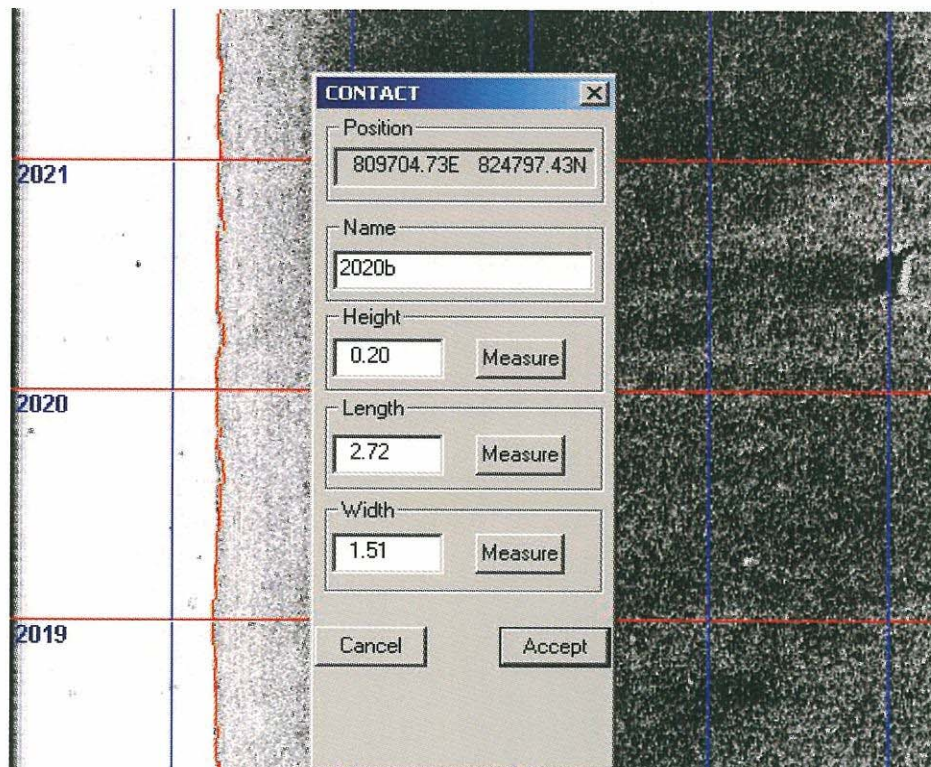
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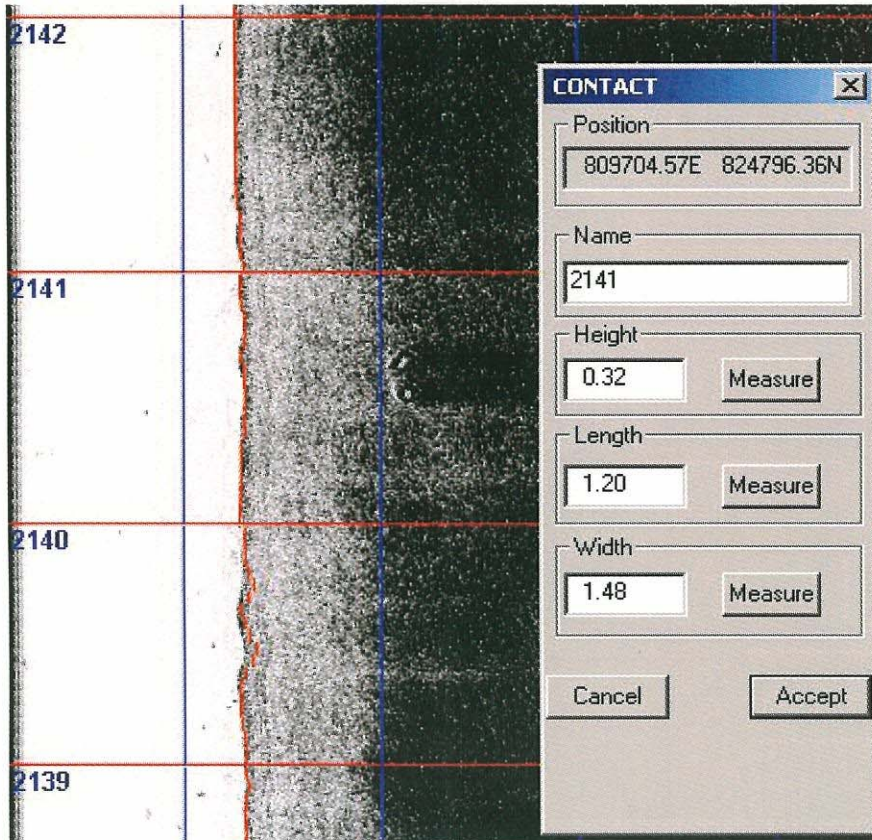




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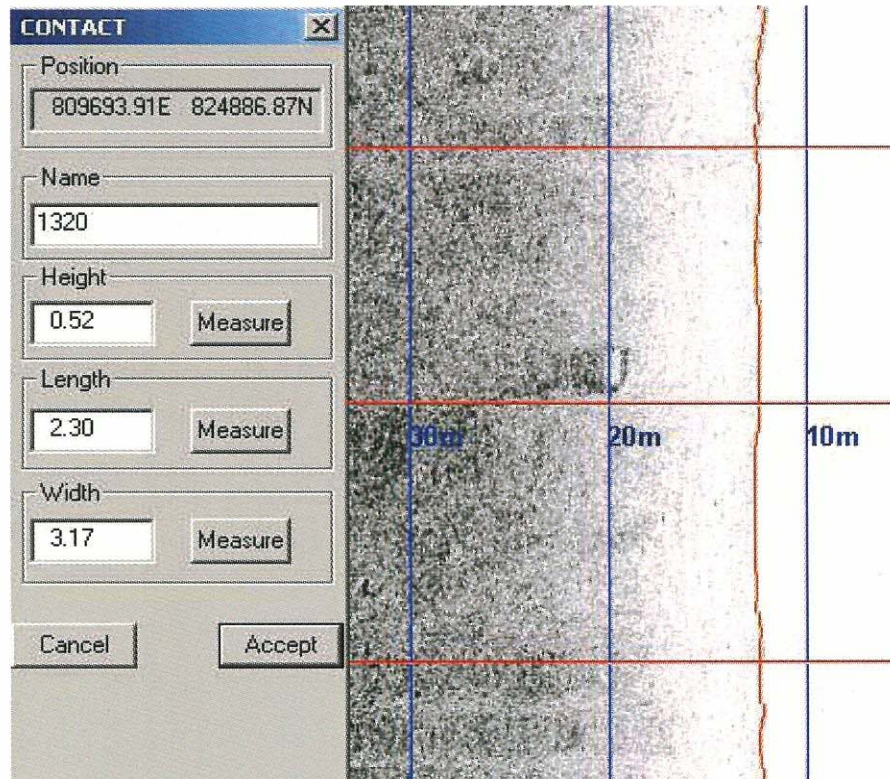


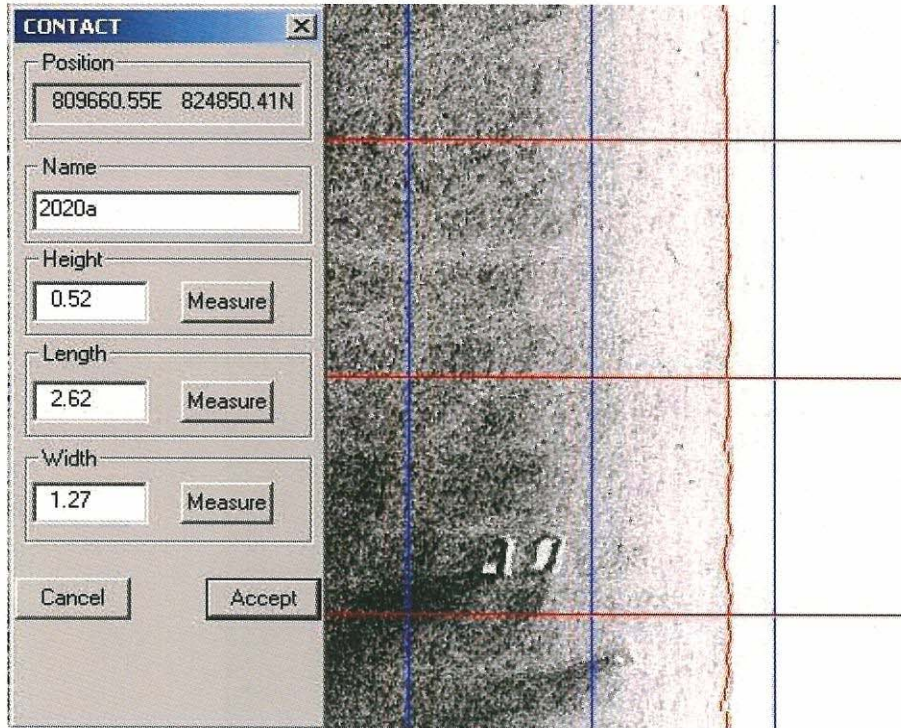
Target 14



Target 15

Target 16





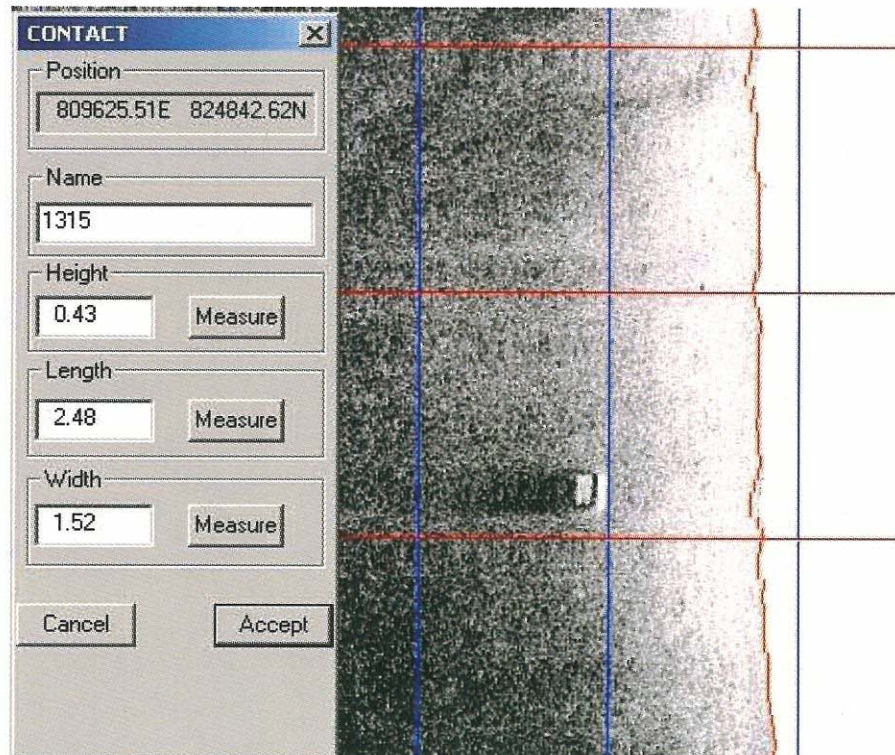
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- Name: 2020a
- Height: 0.52 (with a 'Measure' button)
- Length: 2.62 (with a 'Measure' button)
- Width: 1.27 (with a 'Measure' button)
- Buttons: 'Cancel' and 'Accept'

The background image shows a grid with red and blue lines. A small, dark, rectangular feature is visible in the lower-left quadrant of the grid, corresponding to the 'CONTACT' data.

Target 17

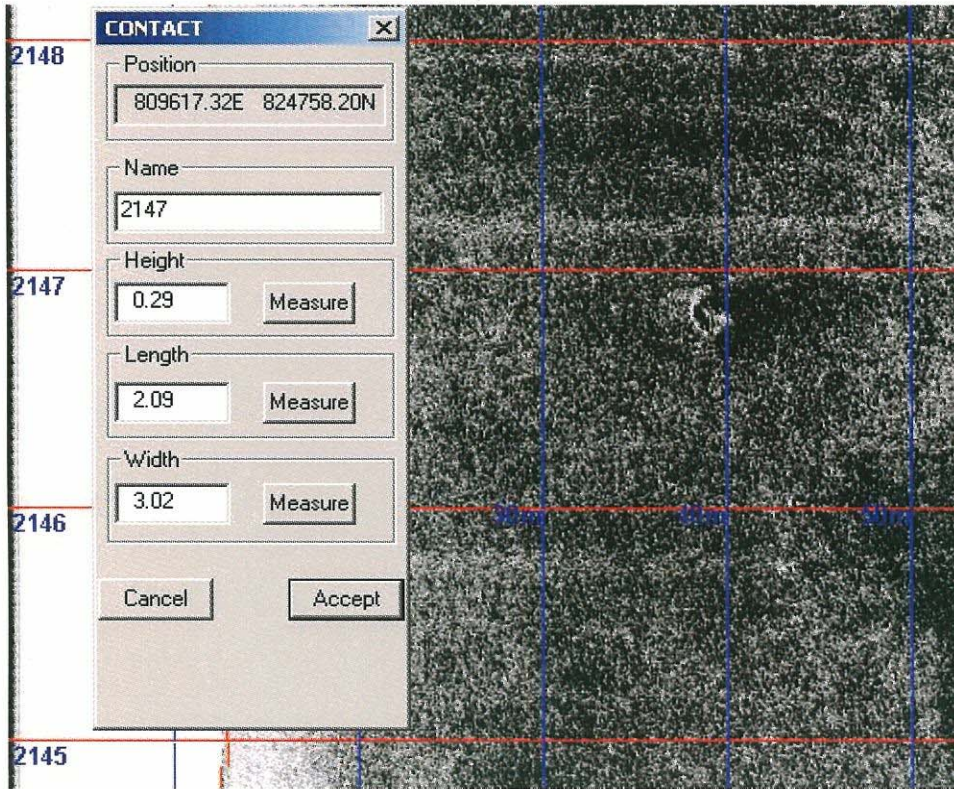
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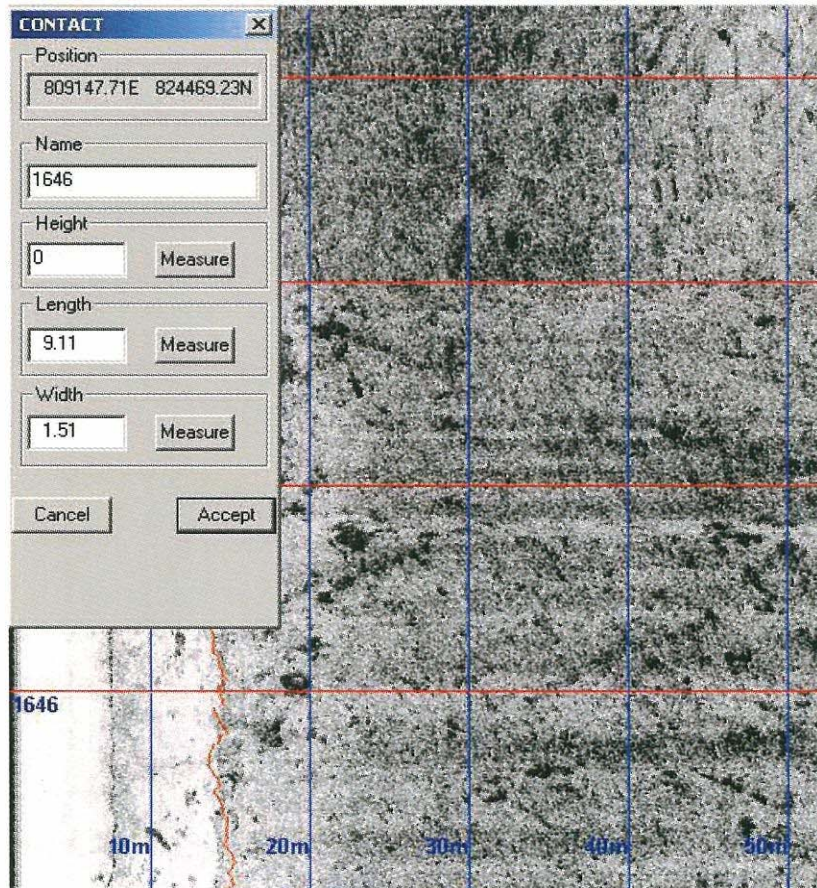
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- Length: 2.48 (with a 'Measure' button)
- Width: 1.52 (with a 'Measure' button)
- Buttons: 'Cancel' and 'Accept'

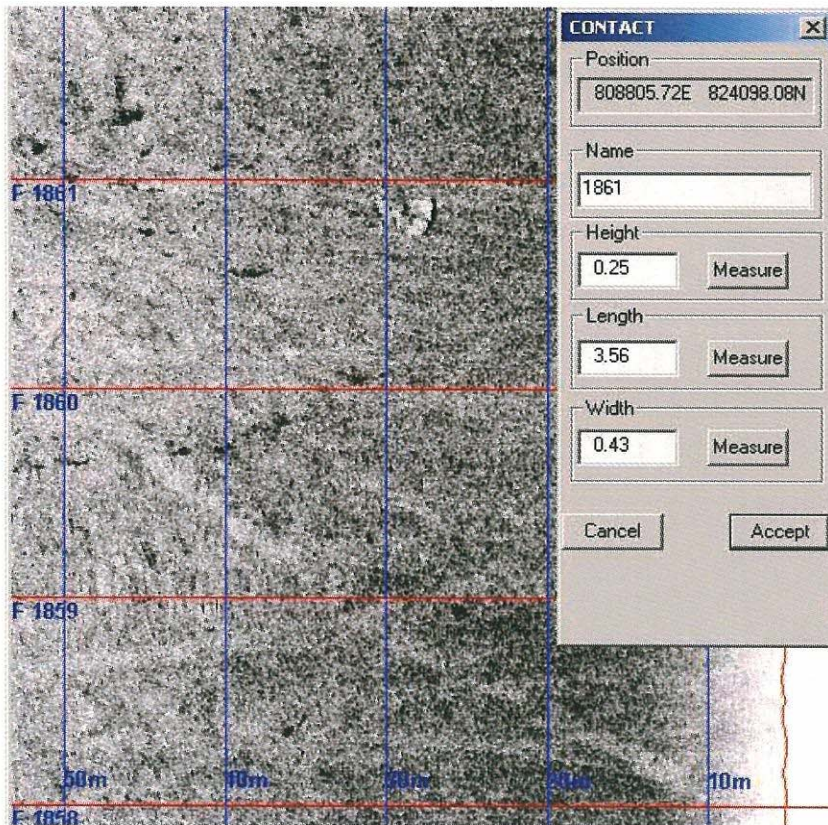
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Target 19

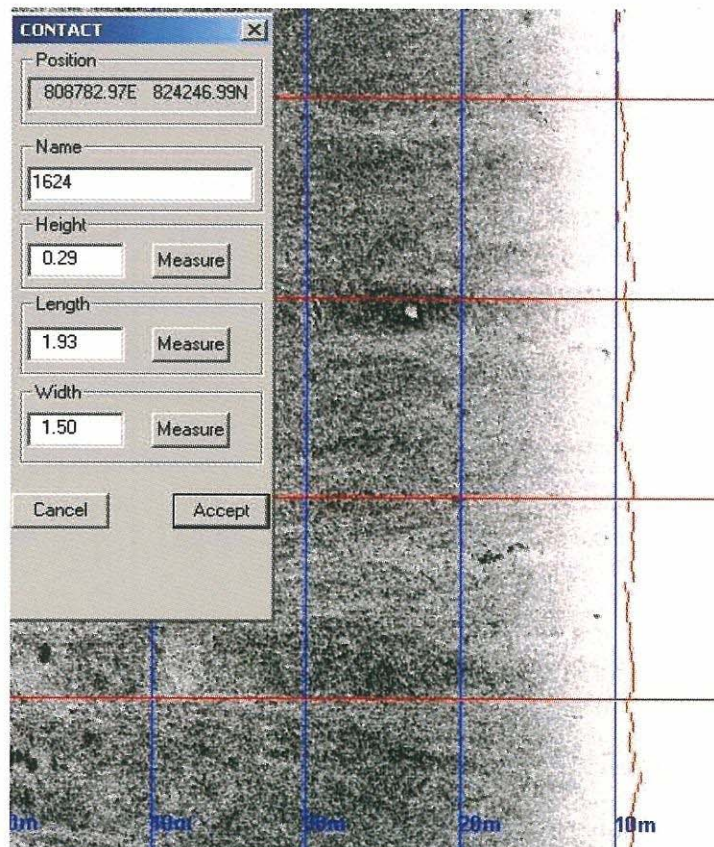


Target 20



Target 21

Target 22



CONTACT

Position
808596.34E 823981.03N

Name
2232

Height
0.47 Measure

Length
1.31 Measure

Width
1.30 Measure

Cancel Accept

232

231

230

Target 23

CONTACT

Position
808595.13E 823986.66N

Name
1547

Height
0.65 Measure

Length
2.90 Measure

Width
0.90 Measure

Cancel Accept

30m

20m

10m

Target 24

CONTACT [X]

Position
808327.87E 823760.77N

Name
1896

Height
0 [Measure]

Length
3.36 [Measure]

Width
2.23 [Measure]

Cancel [Accept]

Target 25

Target 26

CONTACT [X]

Position
807160.11E 823733.87N

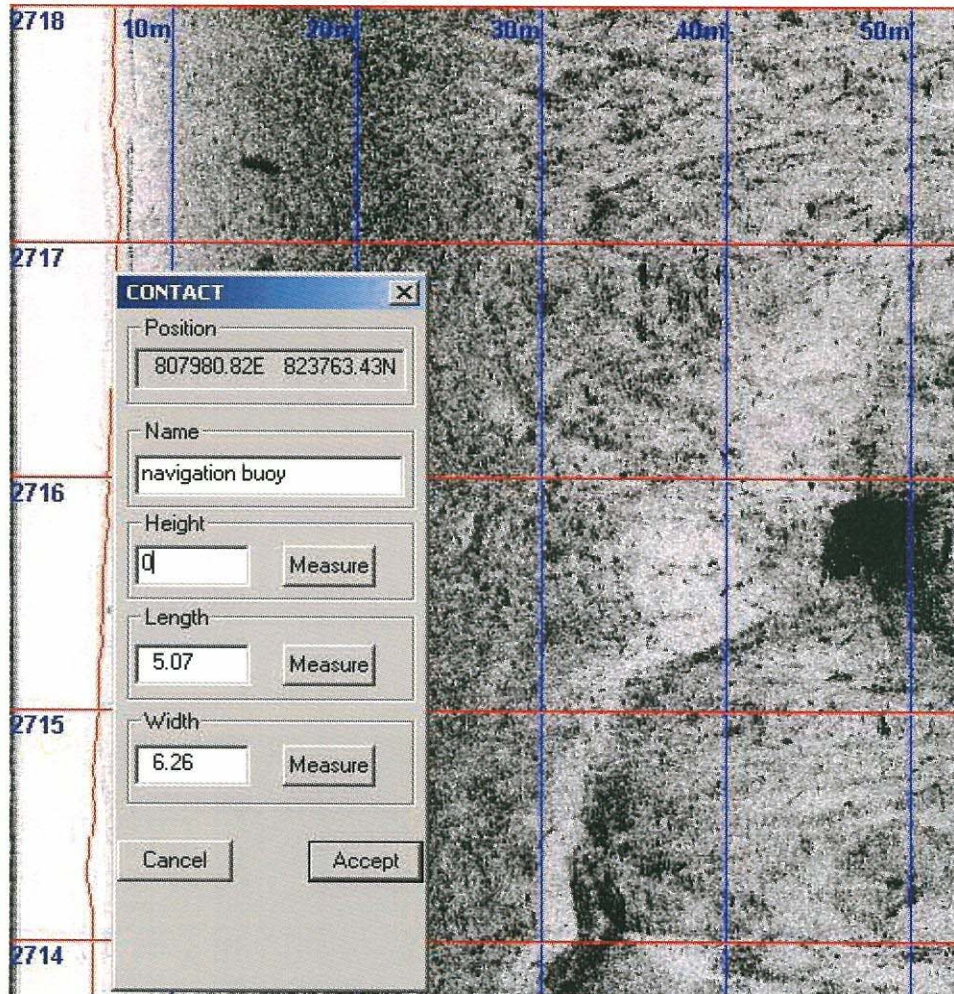
Name
2488

Height
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Length
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Width
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Navigation Buoy

Permanent Aviation Fuel Facility Area 38 to Sha Chau

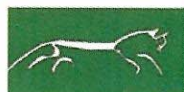
Pipeline Route and Berthing Facilities

Marine Archaeological Investigation

TASK 4 Dive survey and impact evaluation

Hong Kong SAR

APRIL 2004



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**Permanent Aviation Fuel Facility
Area 38 to Sha Chau
Pipeline Route and Berthing Facilities:**

Marine Archaeological Investigation;

Task 4.1

Dive Survey and Impact Evaluation

4th to 13th November 2002

Prepared for;

Archaeo-Environments Limited **HONG KONG**

By;

Cosmos Coroneos

APRIL 2004

J02/13

Preface

This report presents the results of the MAI Visual Diver Survey conducted in November 2002. Included with the report are scanned photographs and a copy of the report on in pdf format.

In October 2002, a draft report called *Marine Archaeological Investigation – Review of Geophysical Data* was submitted to the client. This report fulfilled Task 3 of the MAI process. Earlier drafts of this report referred to October 2002 study. In May 2003, the October 2002 report was revised to include an exegesis of the measures to be taken to assess the archaeological potential of the identified anomalies. Other changes to the original October 2002 report include the changing of the original report title to - *Marine Archaeological Investigation Task 3 – Assessment of Archaeological Potential* - as well superficial corrections. It is this report in its final format that is referred to throughout this study.

Acknowledgements

I am indebted to Leung Hing Shun, Ngkin Hung and Chung Chiu Kai, divers sub-contracted to Keliston Marine, for their efforts in overcoming what were very tough diving conditions.

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Abbreviations

AMO	Antiquities and Monuments Office
EIAO	Environmental Impact Assessment Ordinance
HKMD	Hong Kong Marine Department
MAI	Marine Archaeological Investigation
SS	Sub surface anomaly or target
T	Target, surface
TM	Technical Memorandum

Summary

This report complies with conditions within Environmental Permit 139/2002/A, 3.4 by "...submission of dive survey results and recommendations to avoid, minimize or mitigate archaeological impact".

From three of the 26 targets dived, target nos. 13, 14 and 16, timber planks and ceramics of an undetermined age were recovered. Continued detailed investigation failed to reveal further evidence indicating the presence of a shipwreck. Instead from the additional artefacts recovered it seemed more likely that the seabed in this location was comprised of dumped material, that may have originated from a littoral site, which also may have consisted of some relatively old houses.

The artefacts recorded, and their association with recently dumped debris fields - a common occurrence throughout the Urmston Road area, was considered to be of minimal cultural heritage significance. Therefore no measures to mitigate the impact of the development on these artefacts are required.

However the sub-surface anomalies identified in the geophysical survey could not be examined during the Visual Diver Survey and therefore it has been recommended that a Watching Brief be implemented during the excavation of the pipe trench. Their likelihood of having being of cultural heritage significance is considered low to very low and therefore other means of pre-dredging investigation were not considered warranted. Hence their cultural heritage significance can only be assessed if they are identified during the course of the implementation of the development.

Recommendations

Recommendation 1:

No mitigation measures required with regards to the impact of the development to the artefacts recorded in the vicinity of T4, T5, T6, T8, T9, T10 and T19 (See Figures 5a and 5b).

Recommendation 2

During the dredging of the pipe trenches, a Watching Brief be implemented which will have the following components:

- * Dredge operators to be made aware of the possible presence of significant cultural heritage material along the pipeline routes and are to report to the AMO any unusual resistance and/or the recovery of timbers, anchors or other wreck related material
- * A marine archaeologist to be on board during dredging in the vicinity of SS1 and SS2 in the event of any unusual resistance occurring or blockages which require the dredge head to be brought on deck for clearing and examination.
- * Dredging to cease in the nominated areas, SS1 and SS2, after 3 and 1 metres of sediment have been removed respectively. Divers, under the supervision of a marine archaeologist, are then to examine the trench for possible cultural remains of significance.

Recommendation 3

If in the course of the Watching Brief the identified targets of archaeological potential are identified as archaeologically important, as guided by Clause 2.1 of Annex 19 of the EIAO TM, then an immediate impact assessment is required. The impact assessment would follow the guidelines as set out in EIAO TM, Annex 19 Clauses 2.6 to 2.9.

Recommendation 4

Any changes, additions, alterations to the development proposal, as it relates to the disturbance of the seabed, and as it is presented in this report, should be assessed by a marine archaeologist so as to determine whether any additional archaeological work is required.

1.0 Introduction

1.1 Background

This report has been produced in compliance with EP 139/2002/A for proposed construction of a permanent aviation fuel facility (PAFF) for Chek Lap Kok airport. The proposed development will link with the existing marine terminal at Sha Chau, which is connected by pipeline to the airport (EGS, July 2002 : 1) (Figure 1).

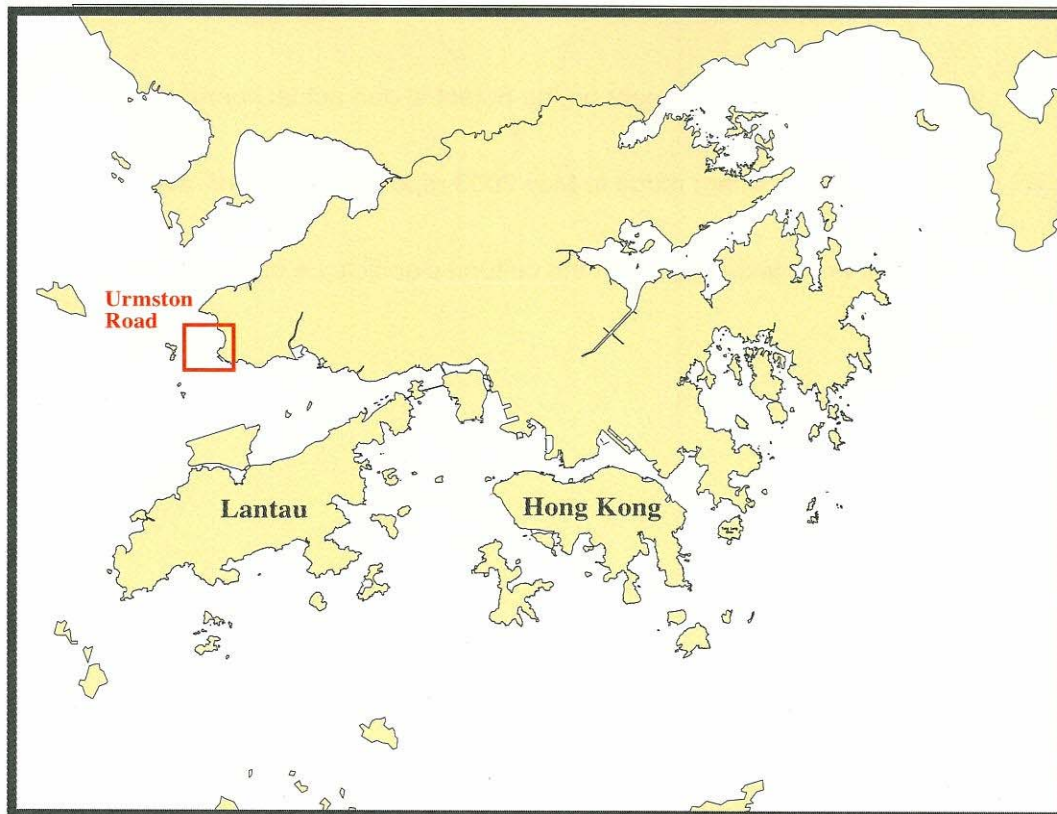


Figure 1 Area map

In accordance with the Environmental Impact Assessment Ordinance (EIAO) and the requirements of the Antiquities and Monuments Office, a marine archaeological investigation (MAI) was requested. This MAI has been undertaken in compliance with the Guidelines for Marine Archaeological Investigation, which details a four step process, detailing practice, procedures and methodology, which must be undertaken in determining the potential and presence of the submerged cultural resource as well as identifying mitigation measures. These four steps are:

- (1) Baseline Review,
- (2) Geophysical Survey,
- (3) Establishing Archaeological Potential based on the findings of (1) and (2).
- (4) Remote Operated Vehicle (ROV)/Visual Diver Survey/Watching Brief.

Mouchel completed Task 1, a baseline review of the potential for the existence of the submerged cultural resources, in April 2002. The geophysical survey, Task 2, was carried out in June 2002 by EGS. Cosmos Archaeology prepared Task 3, the establishment of archaeological potential, in October 2003 (which was updated in May 2003).

This document is primarily a report on the Visual Diver Survey component of the marine archaeological investigation, Task 4.1. Based on the findings of the Visual Diver Survey and recent information as to the nature of the development, reviews of;

- the impact of the development on the potential and actual submerged cultural resource;
- the Impact Assessment made in May 2003 report *Assessment of Archaeological Potential* and;
- measures to be taken establish the cultural significance of the sub-surface anomalies;

are also presented in this document.

1.2 Development proposal

The proposed development, as it will impact the submerged cultural resource, involves three distinct components (Figure 2);

- 1/ the construction of an offshore berth to the south east of Shui Wing Steel
- 2/ the laying of a submarine pipeline from the PAFF, a fuel tank farm to be constructed at Tuen Mun Area 38, to the existing facility at Sha Chau
- 3/ the laying of a submarine pipeline from the proposed berth, to the proposed PAFF constructed at Tuen Mun Area 38.

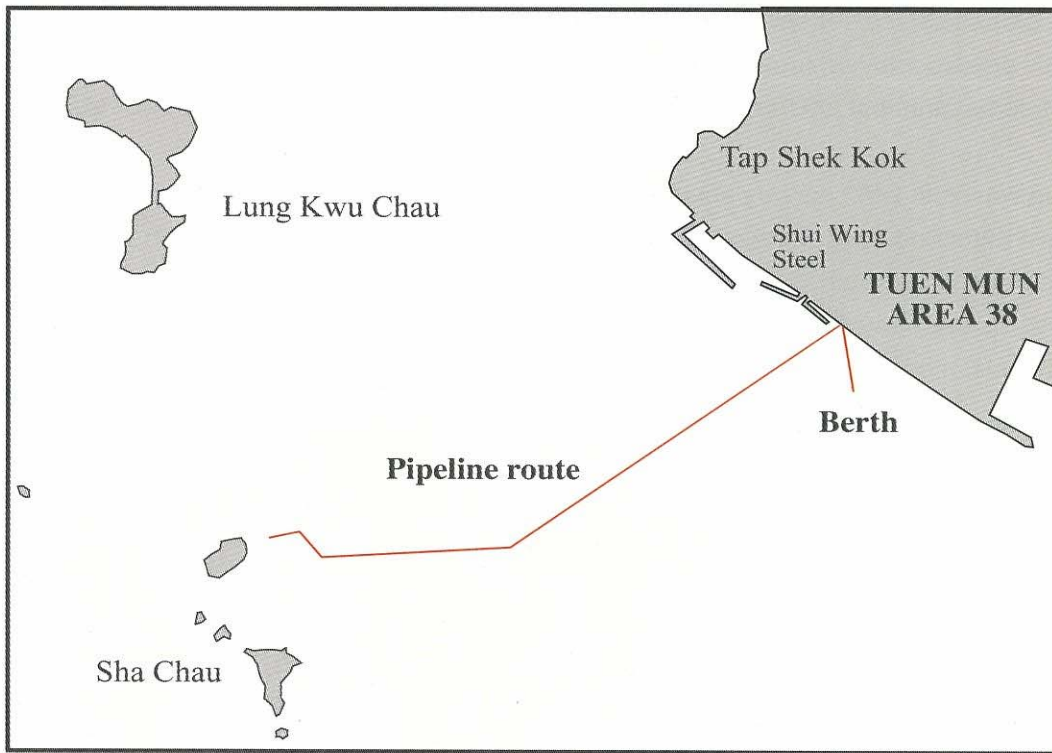


Figure 2 Proposed development

The berth will be positioned approximately 200 m from the existing reclamation (Mouchel, April 2002:9-12).

The twin pipeline from the PAFF to Sha Chau will be in a trench, which will be approximately 3.0 to 3.5 m in depth and 3.5 m wide at its base, and up to 20 m wide at the surface of the seabed (Mouchel, April 2002:9-12). Where the pipeline crosses Urmston Road, the depth of the pipeline may increase to 7 m below the seabed. The trench for the pipeline from the proposed berth will be 11 m wide at the base and 16 m wide at the seabed surface (Mouchel, April 2002).

Part of the route of the pipeline, the last 2 km before reaching Sha Chau, will follow the navigation channel from Urmston Road, which was dredged six years previously (Gillon, pers. comm. 6/9/02).

The pipeline trench will be created using a trailer dredge, a process whereby water is jetted into the seabed and the resulting suspended sediments are sucked away (Gillam, pers. comm. 6/9/02).

It is anticipated that the berth will be constructed on a base of piles driven into the seabed.

1.3 MAI – Task 1 : Baseline review

The cultural heritage assessment identified a number of historic episodes and trends, which have left archaeological remains within the study area (Mouchel, April 2002). These events can be broadly divided into two broad categories, that of Tuen Mun being a centre for trade and coastal defense and that of Urmston Road as being an open anchorage and a main trade route.

Tuen Mun was in the 16th century known as a port (Figure 3). Its origins as such a settlement could have extended as far back as the Tang Dynasty, 618 to 907 AD. Tuen Mun was the final stage for many vessels, arriving from Persia, India, Arabia and later Europe, with the southwest monsoons, before moving up the Pearl River to Canton. The importance of Tuen Mun was such that the Nan Han based a naval unit there after the collapse of the Tang Dynasty.

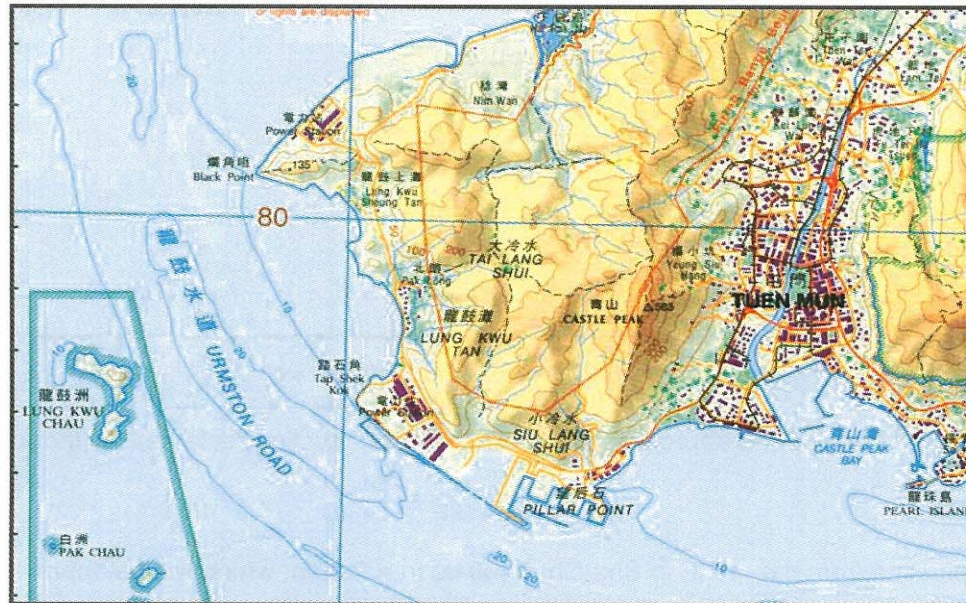


Figure 3 Area showing Tuen Mun and Urmston Road

Interest in Tuen Mun was not confined to the Chinese, for in the 16th century the port was occupied by the Portuguese for eight years. The Portuguese were routed from the area in 1521 when a small fleet of one warship and three unarmed sailing vessels were burnt and destroyed by the commander of the local Imperial forces.

Toward the end of the 16th century, mounting attacks by pirates devastated the coastal regions

of China's provinces. Though eventually repelled, ports like Tuen Mun never recovered and went into decline.

The decline in Tuen Mun as a trade and gathering place for foreign vessels did not alter Urmston Road's advantages as a natural open anchorage. Vessels continued, though in diminished numbers, to anchor at Urmston Road throughout the 17th and 18th centuries. With the increase of western trade to China at the end of the 18th and early 19th centuries the area was a favourite anchorage for European and North American vessels. The anchorage however was not completely safe from the elements as it is recorded that one typhoon sunk, destroyed and/or dismasted eleven vessels. The anchorage declined in use with the establishment of Hong Kong, though opium smugglers used it sometime after.

1.4 MAI – Task 2 and 3 : Marine geophysical survey and assessment of archaeological potential

Based on the available historical information presented in the baseline review, it was extrapolated that the following site types can be expected to be found within the study area:

- 1/ Shipwrecks
- 2/ Ballast mounds
- 3/ Mooring anchors

(Archaeo-Environments Ltd, May 2003:Section 4.2)

It was also assessed that the expectation of the presence of such wrecks within the study area could be expected to be very low, with a slight increase in frequency closer to shore, at each end of the study area (Archaeo-Environments Ltd, May 2003:Section 4.3). Ballast mounds and mooring anchors were considered to be more likely to be present and in greater numbers than shipwrecks, but the overall expected frequency of these site types were expected to be low.

The examination of the results of the geophysical survey conducted by EGS of the proposed pipeline route and berth for the Permanent Aviation Fuel Facility for Chep Lap Kok revealed 26 surface and 10 sub-surface anomalies of potential archaeological interest (Archaeo-Environments Ltd, May 2003).

The study did not identify any archaeologically important objects as guided by EIAO Technical Memorandum Annex 19 Clause 2.1 and as a consequence an impact assessment, as defined in EIAO Technical Memorandum Annex 19, could not be made. With the above facts stated, the EIAO Technical Memorandum Annex 19 Clause 2.5, requires that where *....sources of information prove to be inadequate or where the proposed project area has not been adequately studied before, field surveys and site investigations shall be conducted to assemble the necessary data.* Furthermore, Task 4.1 of the Marine Archaeological Investigation process

requires that a field evaluation programme be established to acquire more detailed data on areas identified as having archaeological potential.

Within the framework of the Marine Archaeological Investigation guidelines it was recommended that the exposed targets and selected sub-surface targets be examined through a Visual Diver Survey, using diver based investigation techniques, and that the remaining sub-surface targets be subject to a watching brief at the time of the construction of the pipe trench.

1.5 Objectives and scope of the Visual Diver Survey

The objectives of the Visual Diver Survey were to

- 1/ establish whether the identified anomalies or targets, which may have archaeological potential, are archaeologically important.
- 2/ gather relevant data from which to make an Impact Assessment and;
- 3/ gather relevant data from which to refine the existing recommendations on the watching brief.

These objectives conform with both the EIAO and Guidelines for MAI, the former stating that where *....sources of information prove to be inadequate or where the proposed project area has not been adequately studied before, field surveys and site investigations shall be conducted to assemble the necessary data* EIAO Technical Memorandum Annex 19 Clause 2.5) and latter stating that *a field evaluation programme [be planned] to acquire more detailed data on areas identified as having archaeological potential* (Guidelines for Marine Archaeological Investigation, Clause 4.1).

Though the assessment of the geophysical assessment recommended that that selected sub-surface targets be examined using diver based investigation techniques it was deemed at the time of the survey that this was not possible due to the diving conditions (see **Section 3.3**). Therefore the scope of the Visual Diver Survey was limited to the exposed targets.

2.0 Methodology

2.1 Defining the study area (Figure 4)

The study area for this component of the MAI comprises of the area of the proposed berth and the route of the two pipelines. The boundary of the study area with regards to the pipeline route from the PAFF to Sha Chau is a corridor, 100 m, wide. The length of this corridor is approximately 4.5 km.

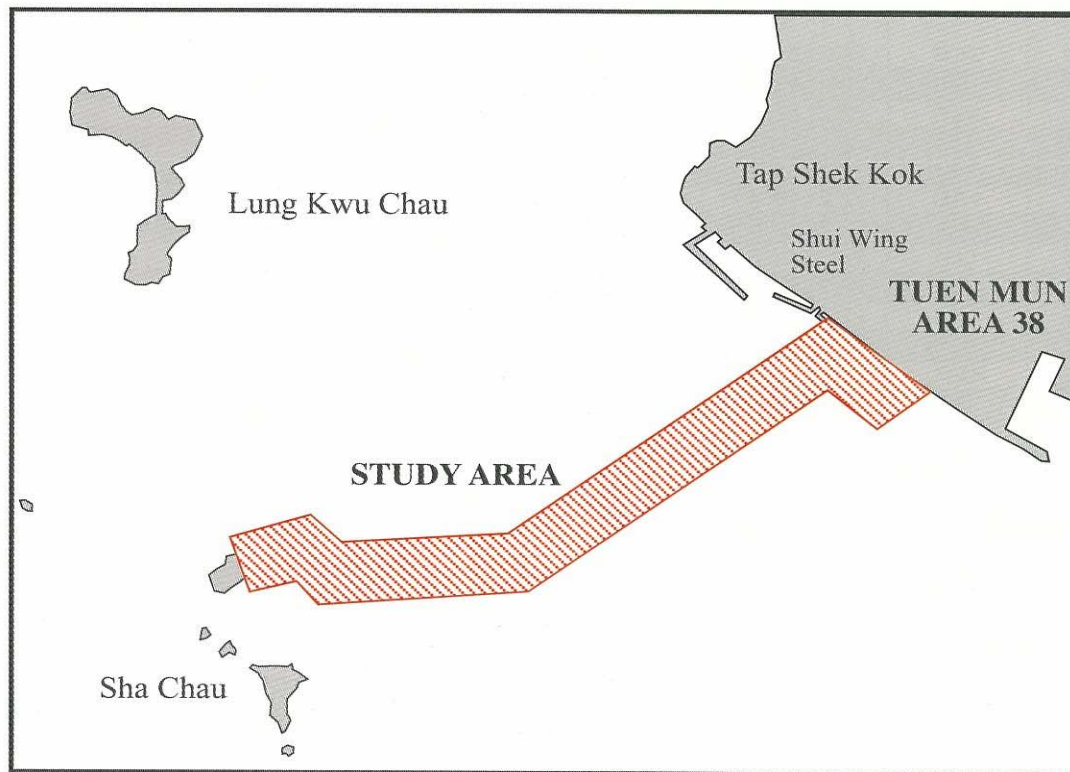


Figure 4 The study area

The corridor width of the study area was set at 100 m for two reasons:

- 1/ It corresponded with the width of the side scanned path conducted by EGS. It was decided to keep this width for the study area to not only stay consistent with the area surveyed using remote sensing techniques, but also to provide a sufficient buffer should the route be slightly altered due to obstructions or other reasons.
- 2/ The presence of a shipwreck would be subtle and difficult to interpret from the geophysical data presented and that the remains of the wreck could be spread over a wide area. It is possible that tangible signs of a wreck may be discerned and identified some distance from the proposed pipeline route but considerable portions, unidentifiable unless visually/physically inspected, may lay across the axis of the proposed route, exposed and/or buried.

2.2 The targets

The targets for the field investigation were those exposed targets identified in the review of the geophysical survey data (Archaeo-Environments Ltd, May 2003). They are presented in Table 1 and Figure 5a and 5b.

Target no.	Track plot l.d. no.	Latitude	Longitude	comments
1	161	22°21.6969 'N	113°55.8047 'E	High relief, round object.
2	94	22°21.8016 'N	113°55.5420 'E	linear object with relief and associated derbily
3	1066	22°21.9319 'N	113°55.3823 'E	Straight lines forming rectangular shape. No height
4	2106	22°21.8761 'N	113°55.3324 'E	Identified in EGS July 2002 report. Square object in scoured hole.
5	1345	22°21.8764 'N	113°55.3266 'E	Round object, no relief
6	1426	22°21.8731 'N	113°55.3039 'E	Square object
7	1082	22°21.8374 'N	113°55.2917 'E	Identified in EGS July 2002 report. Thin linear object in scour pit.
8	1705	22°21.8854 'N	113°55.2449 'E	Single linear object with some scouring.
9	2130	22°21.7610 'N	113°55.2314 'E	Large rectangular object with 2 high points
10	1331	22°21.8273 'N	113°55.2181 'E	Scatter of small objects.
11	1449b	22°21.7355 'N	113°55.1666 'E	Small rectangular shaped object.
12	1693	22°21.8203 'N	113°55.1542 'E	Scatter of small objects.
13	1449a	22°21.7387 'N	113°55.1526 'E	Small irregular shaped object.
14	2020b	22°21.7272 'N	113°55.1386 'E	Single linear object with some scouring.
15	2141	22°21.7267 'N	113°55.1385 'E	Large rectangular object with 2 high points?
16	1320	22°21.7757 'N	113°55.1322 'E	Small rectangular object with scouring.
17	2020a	22°21.7559 'N	113°55.1128 'E	Two rectangular objects.
18	1315	22°21.7516 'N	113°55.0924 'E	Large square object
19	2147	22°21.7059 'N	113°55.0877 'E	Tear shaped object in scour pit.
20	1646	22°21.5489 'N	113°54.8145 'E	Row of evenly spaced dots. No relief.
21	1861	22°21.3475 'N	113°54.6156 'E	linear object with relief.
22	1624	22°21.4281 'N	113°54.6022 'E	Small linear object.
23	2232	22°21.2838 'N	113°54.4938 'E	Small circular shaped object.
24	1547	22°21.2869 'N	113°54.4931 'E	Irregular shaped object.
25	1896	22°21.1642 'N	113°54.3376 'E	Straight sided object. No relief.
26	2488	22°21.1485 'N	113°53.6575 'E	Large area of dark reflective material. No relief.

Table 1 Exposed targets

The exposed or side scan images chosen as targets were mostly single objects with some relief. It was anticipated that they may be the large inorganic components of a wreck. It was thought that locating these targets to identify them and then conducting a circular search around them may have revealed signs of the existence of a wreck; signs that could not be readily picked up by side scan sonar. Other targets included areas where there were concentrations of small objects, which could typify ballast. Some targets, such as Target 20 (1646), were a series of highly reflective 'spots' of little or no relief, which formed a pattern. This is what would be expected to be seen of hull frames poking through the seabed. With all these targets chosen they were all likely to be of cultural in origin but also were expected to be recently deposited debris.

Targets 21 to 26 were in the area which had been dredged six years ago (Archaeo-Environments Ltd, 2002:22). Because the process does not reach solid rock as in the case the Chek Lap Kok formation, it was possible that material that had been buried previously may have been exposed.

Figure 5a Chart showing exposed targets in eastern section of study area

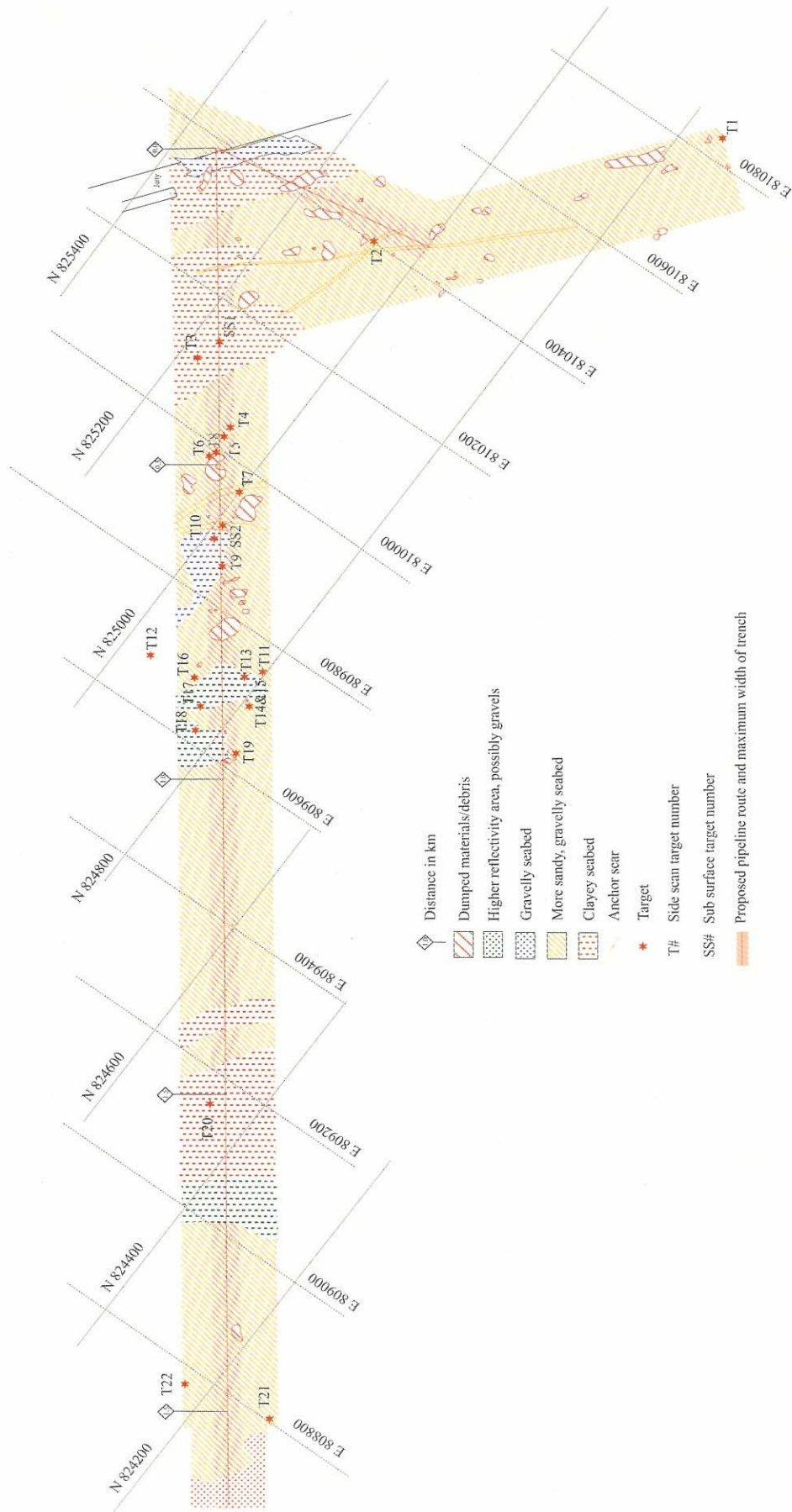
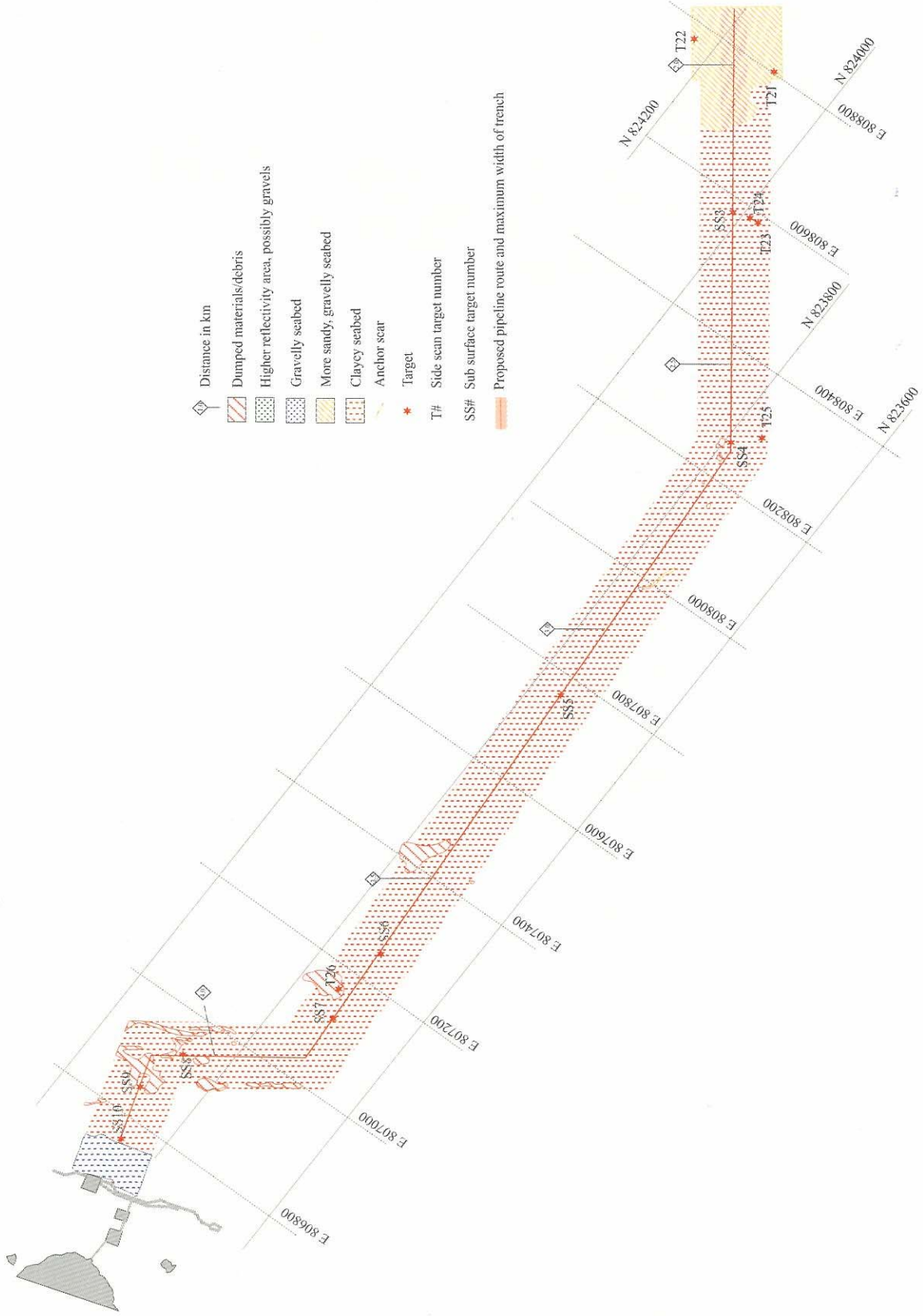


Figure 5b Chart showing exposed targets in western section of study area



2.3 Search techniques

The diver based search technique used for this field investigation was the circular search method. The diver, by swimming around fix point holding a line, fulfilled two forms of search; a visual search of the seabed within visibility and a snag search. Snag search refers to a moving survey line 'snagging' any object protruding from the seabed. This form search was considered the optimum type given the anticipated very low water visibility.

The diameter of the circular search is usually dictated by two factors:

- The stated margin of error in the position as stated by the GPS
- Water visibility.

Most GPS units display a margin of error for any given position. If all is working well with satellite cover and reception, this margin of error is usually less than +/- 10 m. Therefore to reflect and compensate for this margin of error, a circular search diameter would need to be 20 m at least, or a 10 m radius.

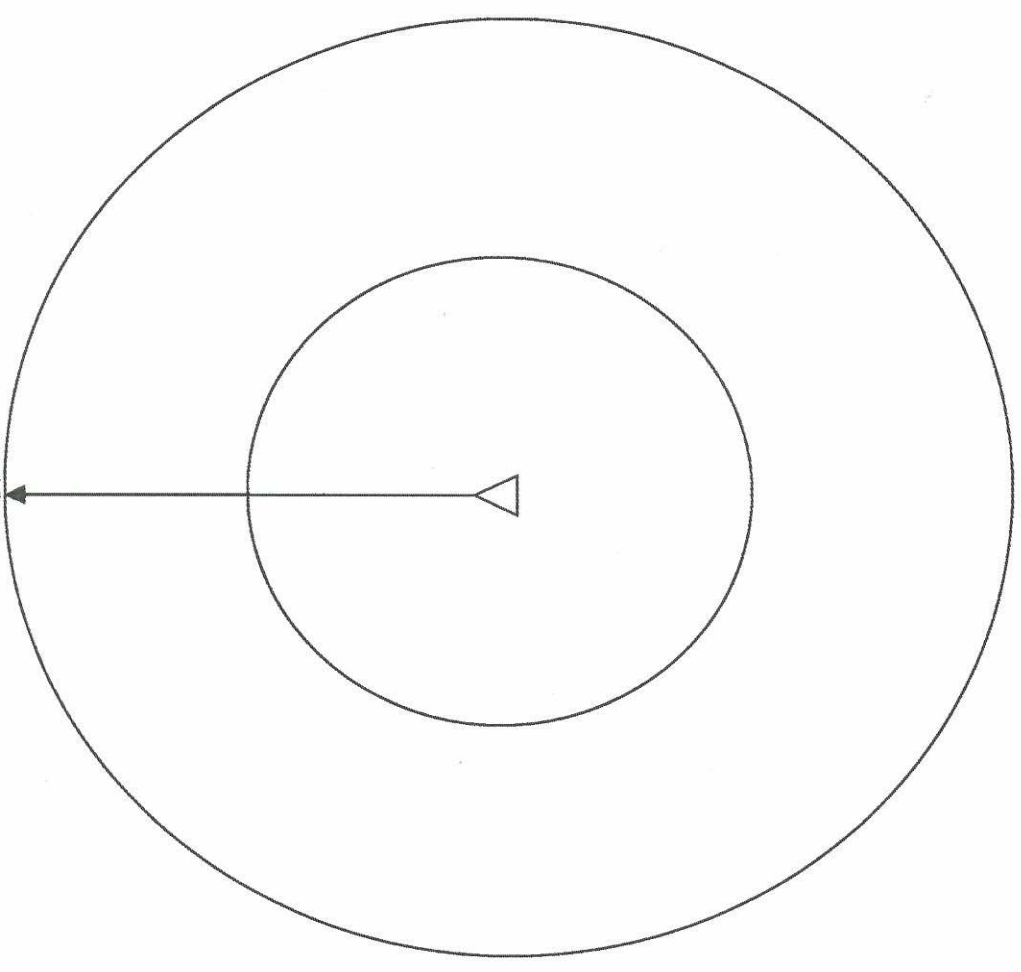
With regards to water clarity, if the visibility is 5 m, then the radius would be set at 5 m. A second, wider, circle could be undertaken by the same diver, if bottom time permits. In the case of the example given above, the diver could then move out to 15 m from the centre and re-commence the circuit. The radius therefore of the search would be 20 m. However this method of circular search incorporate a practical water visibility distance, which allowed for a visual diver inspection of the seabed as well as conducting a snag search.

With regards to Urmston Road the anticipated water visibility was considered to be less than 1 m. It would therefore be impractical to conduct a circular search on a visual basis for all the targets in the time allocated. Because of this, the diameter of the circular search was to be dictated only by the margin of error stated by the GPS.

2.4 Recording techniques

All dives relating to the search for, or recording of the targets were accompanied by an underwater dive slate upon which was fixed a proforma (Figure 6). Overlaying the proforma was draughting film upon which the diver could write on using a pencil. Once the dive was completed the draughting film was replaced with a clean sheet. The notes on the drafting film were then transformed onto a paper version of the proforma.

UNIT ID	DATE	LOCATION			
START TIME:	FINISH:	TOTAL TIME (MIN):	RECORDER	PARTNER	
WATER VISIBILITY (METRES)	SEABED VISIBILITY	SPACING (METERS)			



The diagram illustrates a circular search dive proforma. It features two concentric circles centered on a point. A vertical line with an arrowhead at the top points to the center of the circles. A horizontal line with an arrowhead at the right end points to the top of the inner circle, with the letter 'N' positioned above the arrowhead, indicating North. The larger outer circle represents the search area, and the smaller inner circle represents the diver's path.

Figure 6 Circular search dive proforma

The proforma contained essential fields that had to be filled out. These were:

Target i.d.
Date
Location
Start, finish and total dive times,
Diver name,
Water visibility,
Seabed visibility.

Seabed visibility refers to how much of the seabed was obscured by vegetation, rocks or other material. For this investigation this field was redundant because of the zero water visibility encountered.

The bulk of the space on the proforma was devoted to graphic depicting either a circular search or a transect. The depth of the dive was recorded in the triangle at the centre of the circle. The radius of the circular search was written along one of the circles while if the diver extended the search, the second diameter was written on the second circle.

Seabed target descriptions, as well as other cultural material observed were noted inside and outside the graphic. The survey line used was weighted and marked every two metres so it was possible for the diver to note the location of features of interest relative to the line. Also recorded on the proforma was the stated accuracy of the GPS position at the time and the distance the buoy was dropped from GPS position.

Because of the anticipated poor visibility within the study area, recording using video and photography were not relied on.

2.5 Assessment of Significance

The significance of the artefacts observed(felt!), recovered and recorded have been assessed by the following:

- * That under Section 10 of the *Antiquities and Monuments Ordinance (Cap. 53)* a relic (defined as a moveable object made, shaped, painted, carved, inscribed or otherwise created, manufactured, produced or modified by human agency before the year 1800, whether or not it has been modified, added to, or restored after the 1799) can be afforded protection by the Government.

- * That the Criteria for Cultural Heritage Impact Assessment (CCHIA), provided by the Home Affairs Bureau stress that preservation in totality must be taken as the first priority. Projects undertaken are not to cause excessive impact on archaeologically and historically significant sites unless there are adequate protection and mitigation measures, or a satisfactory rescue plan is proposed.
- * The AMO considers all pre – 1950s buildings and structures to be historical and deserving of protection. Post 1950s buildings and structures can also be afforded the same consideration for preservation, if of high architectural and historical significance. From this it can be possibly interpreted that shipwrecks may be considered as 'structures'.
- * That under Clause 2.1 of the EIAO Technical Memorandum 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.**

3.0 Conduct of investigation

3.1 Dates and Personnel

The field investigation took place between the 4th and 12th November. The diving took place over seven days, the 6th and 7th November being rest days because of the predicted strong currents in the study area. Dive support was provided by Keliston Marine. The personnel were:

Cosmos Coroneos	supervising maritime archaeologist
Leung Hing Shun	dive supervisor – Keliston Marine
Ngkin Hung	diver – Keliston Marine
Chiu Kai Chung	diver – Keliston Marine

3.2 Conduct of diving

Prior to the commencement of the field investigation the Hong Kong Marine Department was notified. A Marine Department Notice (MDN No. 135 of 2002) was issued on the 1st November, which noted the coordinates within which the survey was to be conducted. The reason for issuing the MDN was for safety reasons. There is a high volume of shipping which passes through Urmston Road daily. At the start of each day the Hong Kong Marine Department was contacted and supplied the coordinates of where the diving was to take place. When the diving was completed the Hong Kong Marine Department was contacted again and informed that the team was leaving the work area.

Dive support was provided by Keliston Marine. All diving was carried out using surface supplied breathing apparatus (SSBA). Put simply, the diver received air through a hose from the surface. The air was pumped to the diver using an air compressor, after having passed through a dive panel which monitored the air pressure. Attached to the air hose was a 'pneumo' hose where by the divers depth could be monitored, a safety line, for lifting, and a 'comms' wire for two way communication between the diver and the surface. These lines and hoses, the 'umbilical', were attached to a harness which the diver wore. Attached also to the harness was a small air cylinder which the diver could switch on should the air supply from the surface fail. The diver wore a 'Band' mask, a full face mask which allowed the diver to talk.

The use of SSBA was essential for safety purposes. In an environment where there was the possibility of fishing nets on the bottom a regular air supply was important in case the diver became snagged. Also the erratic nature of the surrounding water traffic meant that there was always the possibility of the need for the diver to be brought up at a moments notice.

3.3 Diving Conditions

The environmental conditions within the study area affected the conduct of the investigation. These conditions could be separated into the following primary factors:

- * Visibility
- * Depth
- * Current
- * Silt seabed

Visibility

For the majority of the targets water visibility was zero. Therefore the divers could not rely on a visual scan of the seabed to find objects of interest.

** Depth*

For the majority of the targets the water depth exceeded 21 m. This had an impact on a divers bottom time. The bottom time for each diver had to be balanced with the amount of targets that had to be dived each day. For deep targets, over 21 m, the maximum bottom time was 15 min. This gave the diver time to complete one circular search and to conduct some sub-surface probing.

Current

The study area was subjected to relatively strong tidal currents, which made diving with an umbilical very difficult, tiring and therefore dangerous for the diver. For this reason diving was restricted to certain periods of slack water. These periods of slack water were determined using available tide predictions and the local knowledge of the master of the sampan.

Mud seabed

The very soft mud seabed over much of the study area meant that divers had to probe, by means of driving their arm into the mud, to locate objects. Very few objects were found to protrude from the seabed.

3.4 Conduct of locating targets

The investigation approach consisted of inputting the location coordinates into a hand held GPS. The coordinates used were those supplied in the review of geophysical survey data (Cosmos Archaeology, May 2003). The target was reached aboard a sampan. For the GPS to work effectively, in guiding the team to a nominated target, the sampan had to be moving at a constant speed over the water. On approaching the target, the GPS reading would give a distance to the target of + x.x m with the arrow pointing in one direction followed by a new reading of + x.x m with the arrow pointing in the opposite direction. This indicated that the target had been overshoot. Therefore it was not possible to stop directly over the target without considerable time being spent. To overcome this constraint, the operator of the GPS waited till the reading was at + 5 m before calling out for the buoy to be dropped. The time delay, or meters traveled given that the sampan was in motion, between the operator calling and the buoy being dropped was considered to be sufficient to bring the sampan as close as possible over the target. This system has successful for other similar dive inspections in Hong Kong (Archaeo-Environments Ltd, January 2003).

As stated in **Section 2.3 Search techniques**, the diameter of the circular search was to be dictated by the margin of error displayed by the GPS. However the water depth for most of the targets, over 20 m, meant that the diameter of the circle had to be of a dimension that would enable the diver to do a complete circuit with limited sub-surface probing (see **Section 3.3**). As the majority of GPS readings gave a margin of error that averaged +/- 9.3 m (see **Section 4.2.1**)

and that the stated horizontal accuracy of the coordinates given was +/- 1m (EGS, July 2002:3), the combined margin of error was set at between +/- 10 and 11 m. The radius of the circular searches were therefore set at a standard 12 m, or 24 m diameter.

Because of the 0 m visibility conditions, only targets which were supposedly protruding from the seabed were searched for. This was because the time taken to search a circular area, 24 m in diameter, at depth, by physically touching and probing the whole of the seabed within the circle would have taken possibly a whole day or more.

3.5 Conduct of recording

A diver was nominated to descend and conduct a circular search of the seabed using a survey line. This form of search combined two forms of diver investigation; a sub-seabed probing transect and a snag search, where the survey line would snag any object protruding from or sitting on the seabed.

Due to the limitation of bottom time for the deeper targets, the circular search was mostly limited to one circuit at 12 m and limited probing. In instances where some further investigation was warranted on a particular target, the diver's bottom time was doubled enabling him to do two circuits around the marker buoy, one at 6m and the other at 12m as well as more sub-seabed probing.

When a diver completed his search and came up he was interviewed by Cosmos Coroneos. A dive proforma was filled out for each dive. Artefacts and other objects recovered with described and the more relevant ones photographed. All objects recovered were returned to the sea on the last day of diving with the exception of two ceramic fragments which have been passed onto Archaeo-environments Ltd for further analysis.

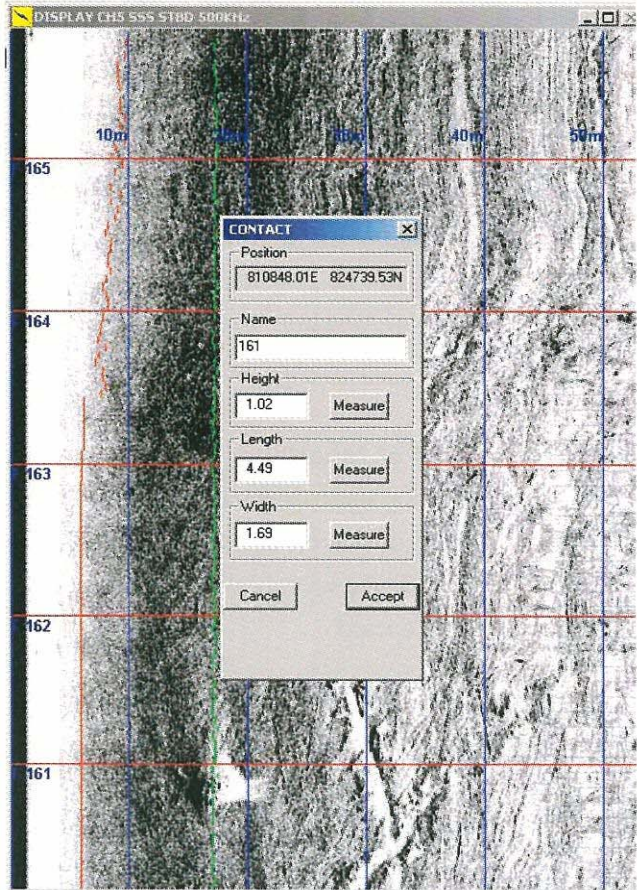
For the purposes of this report 'artefact' refers to cultural objects or natural objects that have been moved or re-deposited, such as dumped stone debris. No attempt was made to use underwater photography or video due to the zero visibility experienced on site.

4.0 Results of investigation

4.1 Target descriptions

Target 1 (161)

Diver(s): Ngkin Hung
Date(s): 4/11/02
GPS accuracy: +/- 9.6 m
Timings: 12:18 – 1:05 (47 min)
Depth: 20 m
Water visibility: 0 m
Max. Search diameter: 24 m
Current: On surface, W-E <1kn. On seabed, mid-strength W-E.
Weather: N 10-15kn
Seabed description: Flat, mud.



Probing under the seabed found fragments of concrete, rock, glass and building tiles.

Discussion

The target was a 1 m high round object. It was not identified.

Finds

Type	No.	Comments	Dimensions	Photo id
Window glass	2	-	-	02/710
Small iron ring	1	-	-	02/710
Bamboo	1	Fragment	-	02/710
Concrete	many	-	-	02/712
Tiles and mortar	1	From exterior of a building.	-	

All artefacts discarded



Figure 7 Target 1 : 02/712 - Rocks and wood (scale 0.10m intervals)

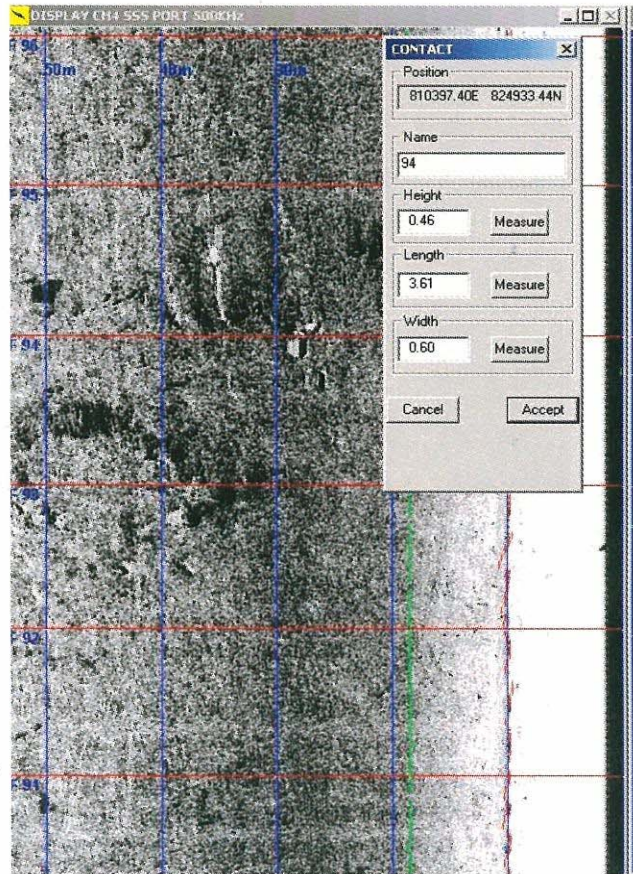
Assessment of significance

The artefacts recorded are consistent with material recently removed from a terrestrial, urban or semi-urban, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.

Target 2 (94)

Divers: Chung Chiu Kai
Date: 4/11/02
GPS accuracy: +/- 12.4 m
Timings: 11:14 to 11:36 (22 min)
Depth: 22 m
Water visibility: 0 m
Max. Search diameter: 16 m
Current: Seabed, strong, W-E
Weather: N 10 - 15 kn
Seabed description: Flat, mud



On the seabed were felt concrete fragments with rio-bar protruding and some stone. Frequency of material decreased with distance from the centre of the circular search area. The top of the concrete was level with the seabed.

Discussion

The target was a scatter of debris protruding up to 0.5 m from the seabed. The scatter was located but was level with the seabed.

Finds

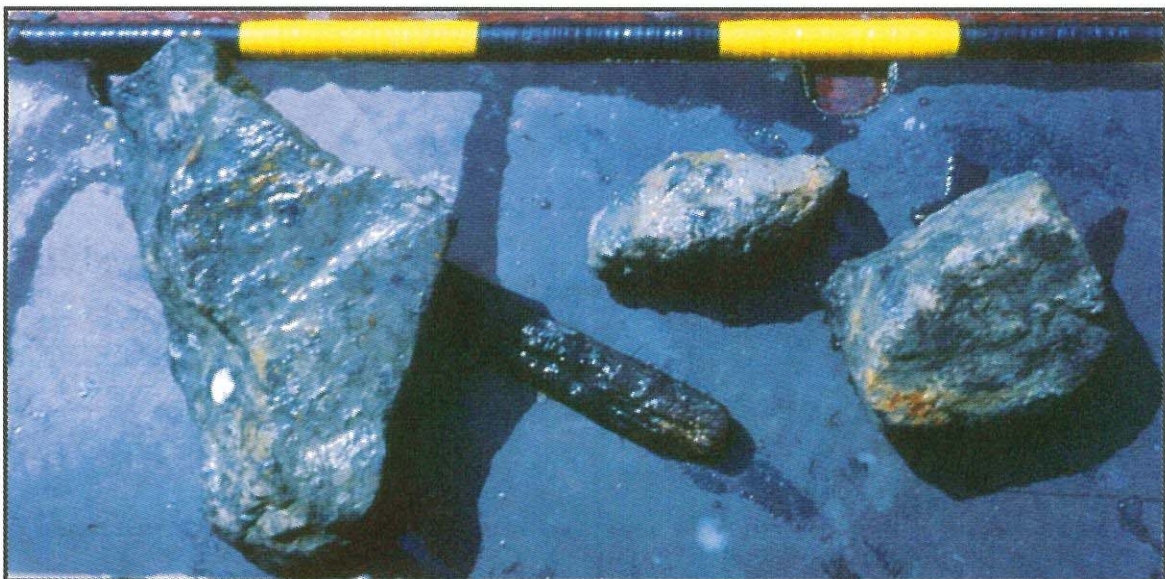


Figure 8 Target 2 : 02/708 - Rocks and shell (scale 0.10m intervals)

Type	No.	Comments	Dimensions	Photo id
Granite	3	Small angular fragments	-	02/708
Wood	1	Small fragments	-	02/708

All artefacts discarded

Assessment of significance

The artefacts recorded are consistent with material recently removed from a terrestrial, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.

Target 3 (1066)

Divers: Leung Hing
Shun

Date: 4/11/02

GPS accuracy: +/- 10.1 m

Timings: 13:40 to 13:52
(12 min)

Depth: 23 m

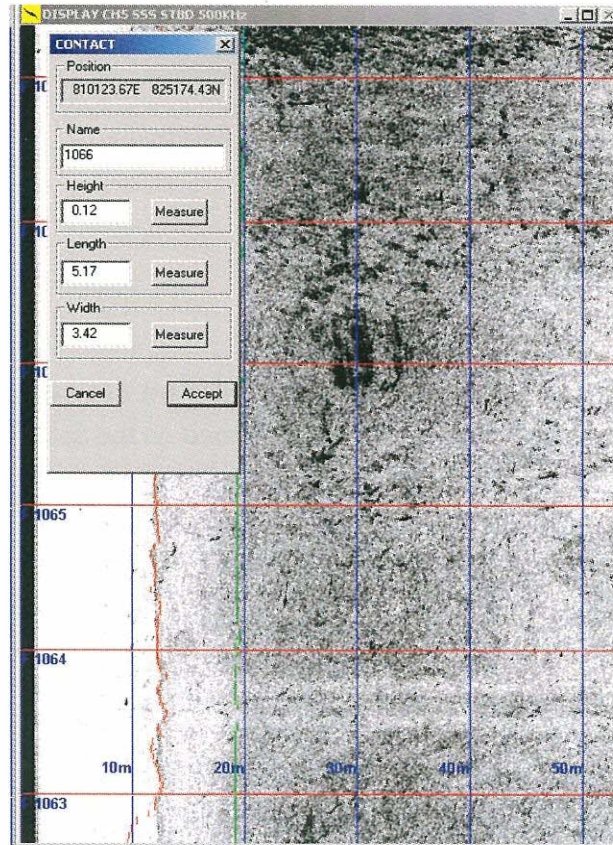
Water visibility: 0 m

Max. Search diameter: 32 m

Current: Seabed, very strong, W - E

Weather: N < 5 kn

Seabed description: Flat, mud



Discussion

The target was a series of straight lines of reflective material on the seabed forming a rectangle with no height above the surface. They were not identified. This feature was close to SSI.

Finds

Target 3				
Type	No.	Comments	Dimensions	Photo id
Iron	3	Fragment. Thin walled with remnants of green paint. Some sort of cladding.	< 0.10 m	

All artefacts discarded

Assessment of significance

The artefacts recorded appear to be the remains of a fitting or cladding from a watercraft. There was not sufficient related material evidence recorded to indicate the presence of a shipwreck. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.

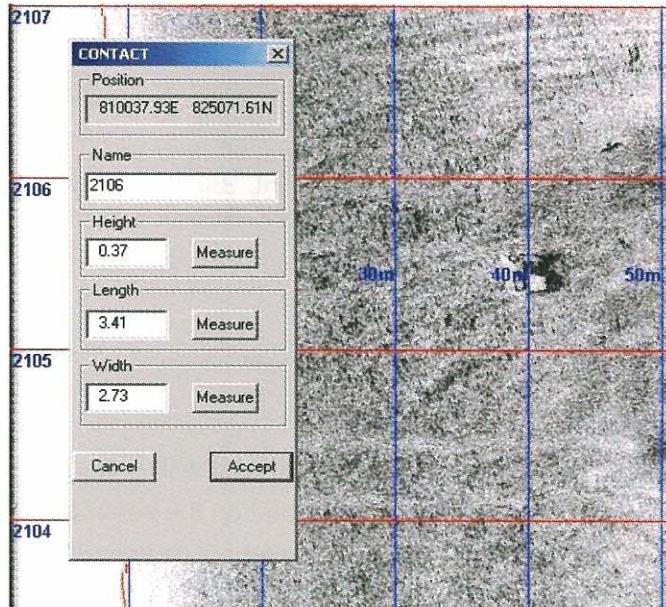
Target 4 (2106)

Divers: Chung Chiu
Kai x 2 and
Ngkin Hung

Date: 5/11/02 x 2
and
12/11/02

GPS accuracy: not recorded,
+/- 8.9 m and
+/- 8.9 m

Timings: 10:04 to 10:24
(20 min)
14:50 to 15:06
(16 min)
09:36 to 09:56
(15 min)



Depth: 22.7 m, 23 m and 21 m

Water visibility: 0 m

Max. Search diameter: 24 m (incomplete), 16 m and 24 m

Current: Very strong, W – E (5/11/02).

Weather: N 5 kn (5/11/02) and NW < 5 kn (12/11/02)

Seabed description: Mostly flat, slightly undulating. Mud with occasional small stones.

Three dives were conducted on this target. The first dive could not be completed due to strong currents on the seabed. The current was so strong during the second dive that the buoy was dragged eastwards for more than 10 m. During this second dive it was noted that the seabed was slightly different in that the mud was so compact that it could not be penetrated by hand. This would support the notion that the second dive was not on this target.

In this first dive a large tyre, 1.5 m dia., was felt on the seabed. Probing in both dives reached 0.5 m under the seabed where soft mud was still felt.

Discussion

The target was a squared object in scoured hole. Seabed was undulating and mud with occasional small stone. The tyre located may have been what was targeted but the side scan target was 3.4 x 2.7 m in size.

Finds

Type	No.	Comments	Dimensions	Photo id
Stones, small	5	Angular granite	-	
Bitumen	1	Fragment of old road surface	-	
Wood	1	Fragment. Badly waterworn	-	02/795
Timber	1	Fragment. Recent with melted plastic adhered to it.	-	02/798

All artefacts discarded

Assessment of significance

The artefacts recorded are consistent with material recently removed from a terrestrial, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.

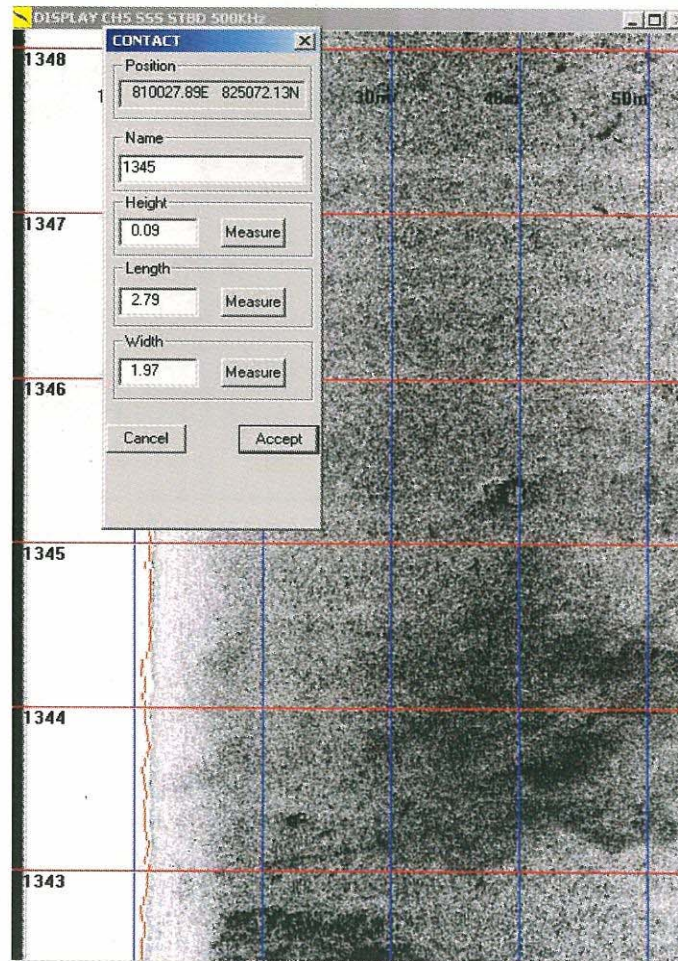
Target 5 (1345)

Divers: Ngkin Hung
Date: 5/11/02
GPS accuracy: +/- 10.6 m
Timings: 12:28 to 12:42 (14 min)
Depth: 25 m
Water visibility: 0 m
Max. search diameter: 24 m
Current: Strong
Weather: N < 5 kn
Seabed description: Flat, mud.

Probed to 0.5 m under the seabed.

Discussion

The target was a round object with no relief. It was not identified. The artefacts found were recovered from up to 0.5 m below the seabed surface.



Finds

Type	No.	Comments	Dimensions	Photo id
Timber	2	Worked. No fastenings or nail holes observed. Most substantial timber appears to have been a beam and slightly concave.	Largest piece 0.26 x 0.05 x 0.03 m	02/719
Rock, small	many	Angular, both quartz and granite.	-	02/722

All artefacts discarded



Figure 9 Target 5 : 02/719 – wood fragments (scale 0.10m intervals)

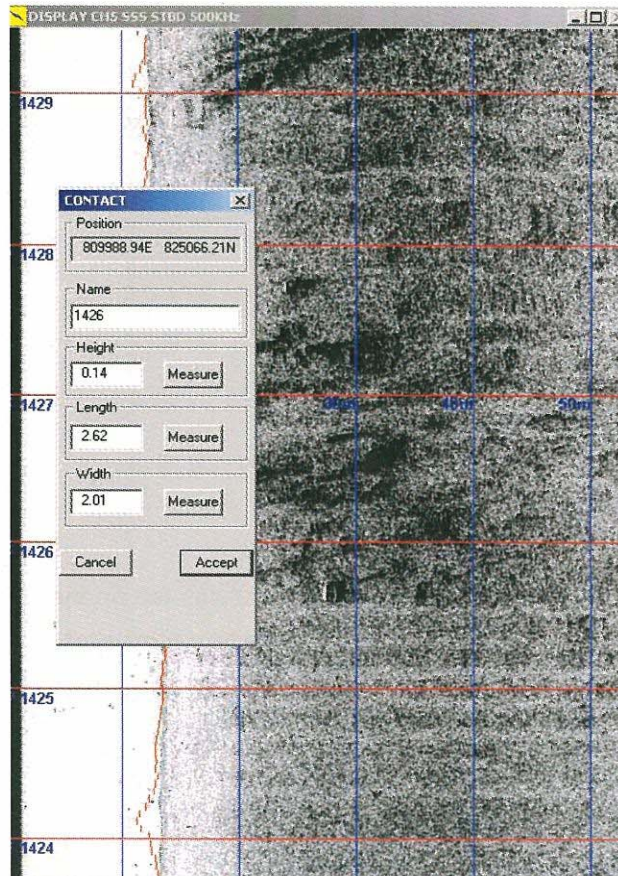
Assessment of significance

There is little that could be assessed from the artefacts recorded. The timbers do not appear to be associated with a shipwreck because of the lack of obvious fastenings and easily recognizable shape. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as the;

- * function and date of manufacture and deposition could not be determined.

Target 6 (1426)

Divers: Ngkin Hung
Date: 8/11/02
GPS accuracy: +/- 8.9 m
Timings: 13:36 to 13:50 (14 min)
Depth: 22 m
Water visibility: 0 m
Max. search diameter: 24 m
Current: -
Weather: NW 5 kn
Seabed description: Flat. Mud in one half of the search area with a scatter of shell and small stone in the other half.



In the search where the seabed surface was mud, probing penetrated to 0.1 to 0.3 m where a layer of shell, small stones and concrete was reached.

Discussion

The target was a small squared object. It was not identified. The side scan interpretation of the seabed in this area was designated as dumped material or debris. A layer of concrete, stone and shell was found under the seabed.

Finds

Type	No.	Comments	Dimensions	Photo id
Small stone	many	Angular, granite.	-	
Concrete	1	-	-	
Tar?	many	-	-	
Stainless steel	1	Bracket of some kind.	-	

All artefacts discarded

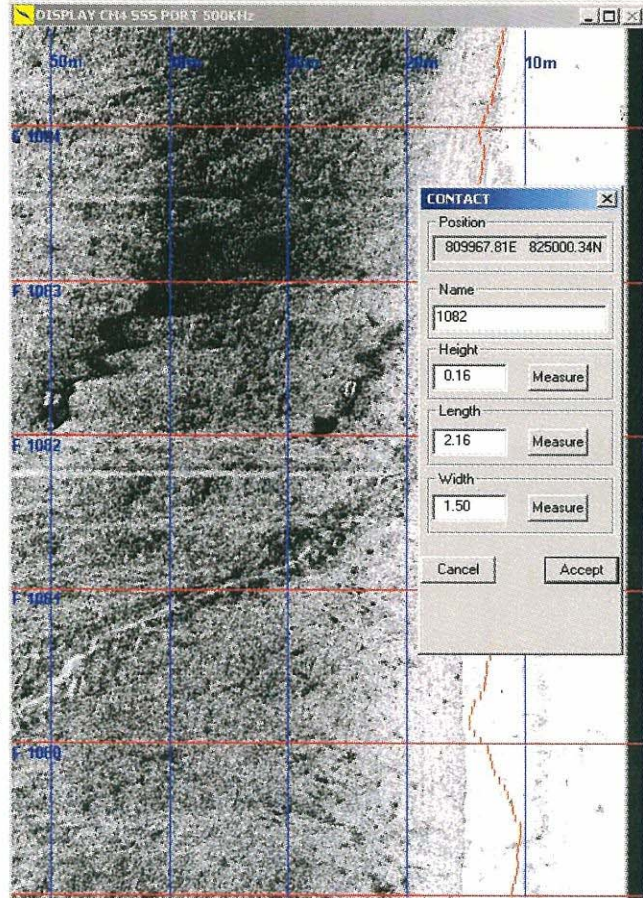
Assessment of significance

The artefacts recorded are consistent with material recently removed from a terrestrial, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.

Target 7 (1082)

Divers: Ngkin Hung
Date: 8/11/02
GPS accuracy: +/- 8.6 m
Timings: 14:11 to 14:27
 (16 min)
Depth: 22 m
Water visibility: 0 m
Max. search diameter: 24 m
Current: -
Weather: W 5 kn
Seabed description: Flat, mud.



A large fragment of cement was felt on the surface. Probing ceased when a layer of coarser sediments with shell and concrete fragments, 0.1 to 0.3 m below the seabed was reached.

Discussion

The target was a thin linear object and associated scour pit. It was not identified.

Finds

Type	No.	Comments	Dimensions	Photo id
Coarse pebbly gravels	many	-	-	
Compacted silt or cement	many	-	-	
Stone	1	possibly pumice	-	
Shell	many	-	-	

All artefacts discarded

Assessment of significance

The artefacts recorded are consistent with material recently removed from a terrestrial, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.

The shell and coarser sediments appear to be part of the natural environment.

Target 8 (1705)

Divers: Chung Chiu
Kai

Date: 8/11/02

GPS accuracy: +/- 8.1 m

Timings: 14:47 to
15:06 (19
min)

Depth: 21 m

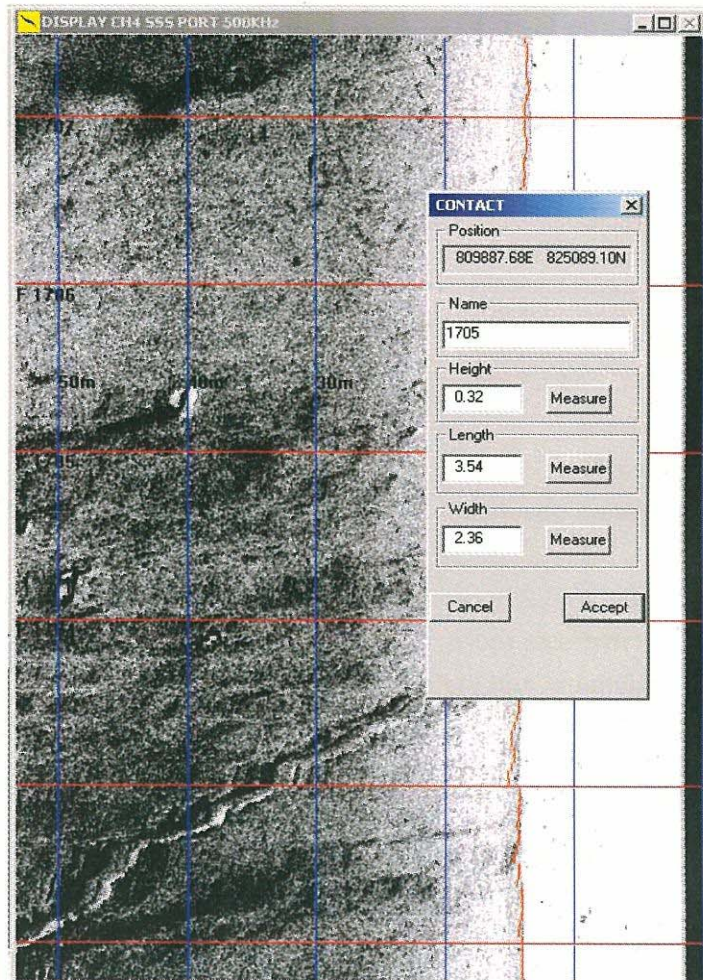
Water visibility: 0 m

Max. search diameter: 24 m

Current: -

Weather: calm

Seabed description: Flat, mud.



At 0.1 m below the seabed surface a layer of coarser sediments was felt.

Discussion

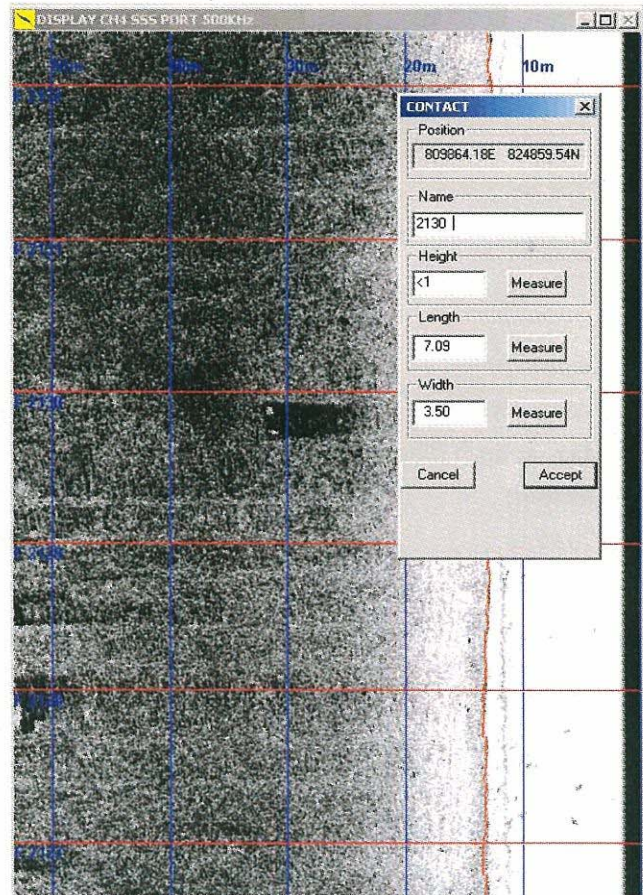
The target was a thin linear object and associated scour pit. It was not identified. The side scan interpretation of the seabed in this area was designated as dumped material or debris. Such material was found 0.1 m under the flat mud seabed.

Finds

Nothing recovered or found.

Target 9 (2130)

Divers: Chung Chiu Kai
Date: 8/11/02
GPS accuracy: +/- 9.1 m
Timings: 3:24 to 3:39
 (15 min)
Depth: 21 m
Water visibility: 0 m
Max. search diameter: 24 m
Current: -
Weather: NW 5 kn
Seabed description: Flat, mud.



At 0.1 to 0.2 m below the seabed surface was felt mid-size rocks, >0.1 to <0.2 m, coarser sediments and the occasional large rock of up to 1.0 m diameter.

Discussion

The target was a large rectangular object with 2 high points. It was not identified. The side scan sonar interpretation of the seabed in this area was designated as 'gravelly'. However these gravelly sediments were felt at 0.1 to 0.2 m below the seabed.

Finds

Type	No.	Comments	Dimensions	Photo id
Rocks	many	Mid-sized	-	
Compact silt or rotten cement?	many	When broken apart core was of a fine grained homogeneous grey, fine grained sediment.	-	

All artefacts discarded

Assessment of significance

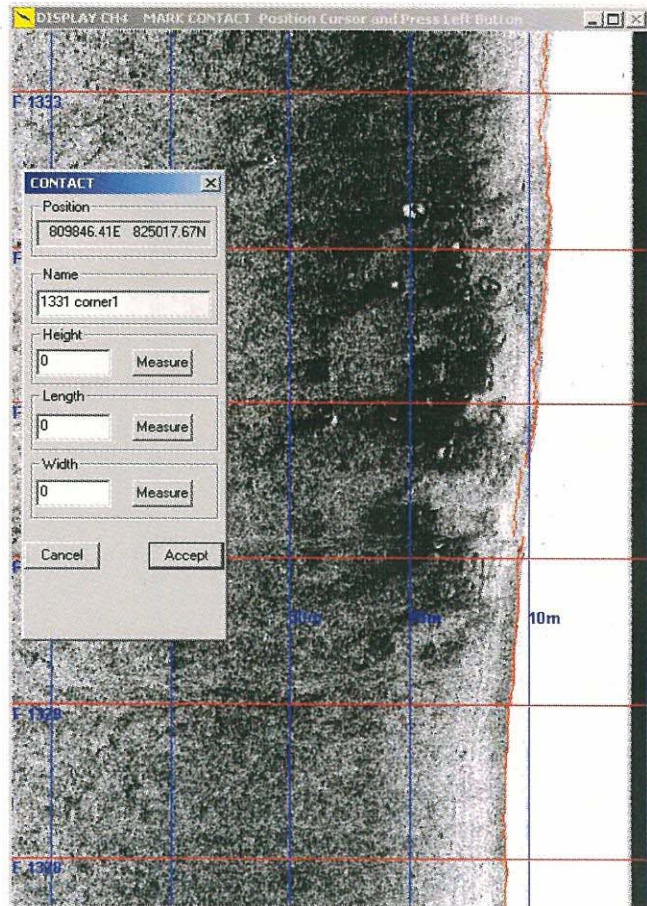
The artefacts recorded are consistent with material recently removed from a terrestrial, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.

The rock recorded could either be dumped or part of a natural stratum within the Urmston Road area.

Target 10 (1331)

Divers: Chung Chiu Kai
Date: 9/11/02
GPS accuracy: +/- 7.4 m
Timings: 08:10 to 08:24
 (14 min)
Depth: 22 m
Water visibility: 0 m
Max. search diameter: 24 m
Current: Mid depth, strong
Weather: N <5 kn
Seabed description: Undulating. Rock rubble.



The average size of the rocks felt within the search area was 0.6 to 0.7 m.

Discussion

The target was a scatter of small objects. These were found on the seabed surface.

Finds

Type	No.	Comments	Dimensions	Photo id
Rock	3	Angular, granite	-	02/725
Ceramic	1	Fragment. White porcelain, rectangular. Wash basin or cistern. Modern.	0.30 x 0.20 x 0.09 m	02/727 02/730

All artefacts discarded



Figure 10 Target 10 : 02/730 – Porcelain fragment of a modern wash basin or cistern (scale 0.10m intervals)

Assessment of significance

The artefacts recorded are consistent with material recently removed from a terrestrial, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.

Target 11 (1449b)

Divers: Chung Chiu Kai, Ngkin Hung, Chung Chiu Kai

Date: 9/11/02 and 12/11/02 x 2

GPS accuracy: not recorded, +/- 8.9 m, not recorded

Timings: 08:44 to 08:51 (7 min)
09:04 to 09:18 (14 min)
10:23 to 10:52 (29 min)

Depth: 22 m and 23 m x 2

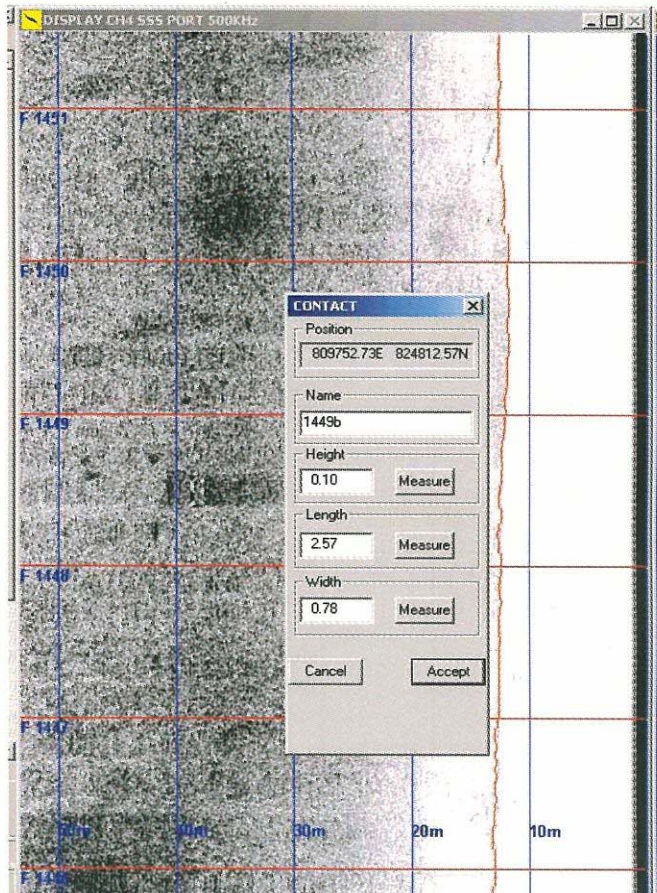
Water visibility: 0 m

Max. search diameter: Dive aborted, 24 m and 24 m (not completed)

Current: 9/11/02 - strong

Weather: 9/11/02 – N 5 kn 12/11/02 - calm

Seabed description: Flat, mud with some oyster shell and small stones.



Three dives were undertaken in this area. This was because the first dive had to be aborted because of strong current. The third dive was a more intensive investigation which arose out of the findings of the second dive.

The divers were able to penetrate by hand up to 0.5 below the seabed. They came onto a compact sand layer mixed with shell.

Discussion

The target was a small rectangular shaped object. It was not identified. The side scan sonar interpretation of the seabed in this area was designated as being of one of high reflectivity, possibly gravels. Though the seabed had some shell and small rocks, a more compact layer was reached at 0.5 m below the seabed.

A significant and diverse amount of artefacts were recovered, the composition of which was similar to 13(1449a), 15(2141) and 16(1320).

Finds

Type	No.	Comments	Dimensions	Photo id
Oyster shell	many	Both bowl and cap.	Largest piece was 0.23 m in length.	02/737
Iron corrosion products	many	-	-	
Rock	1	Granite/marble	-	02/732
Iron ring	1	The outer rim of the ring has a groove with one lip more extended than the other. Possibly part of a pulley.	Diameter – 0.08 m. Thickness – 0.05 and width – 0.04 m	
Ceramic cup.	1	Near complete Base thrown on wheel and body made by hand. Very poorly made. Light brown fabric with brown slip. Signs of deliberate round hole in side of body. For pouring?	Diameter of base – 0.065 m. Diameter of rim – 0.06 Height of vessel 0.055 m.	02/794
Barnacle	1	Large. Not local to area. Must have been deposited in this location by cultural means.	0.05 m in length	
Porcelain cup	1	Half complete. Recent manufacture.		
Brick	1	Fragment.		
Bottle	1	Almost complete. "milk bottle" shape. Clear glass.		
Synthetic object	1	Fragment. Possibly bakelite.		
Aluminium rod.	1	Had fabric attached. Curtain rod?	0.55 m in length and 0.02 m in diameter.	
Iron rod	1	Fragment. Covered in concretion.		
Weakly bonded cement or compacted silt.	2			02/738
Iron	1	Fragment. Wrought iron. Also almost graphitised.		
Rock	1			

All artefacts discarded with the exception of the ceramic cup (see **Appendix III**).



Figure 11 Target 11 : Poorly made ceramic cup (scale 0.10m intervals)

Assessment of significance

The artefacts recorded were of mostly recent objects with some objects of undetermined age. The poorly made ceramic cup is considered to be of a type of 'village ware' of an undetermined age and provenance (Day, pers. comm. 5/3/03). This artefact, and those others recovered, seem consistent with material recently removed from an urban, or semi-urban, terrestrial, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context,
- * of recent manufacture and deposition or
- * of an undeterminable date of manufacture.

The oyster shell appears to naturally occur within the Urmston Road the area.

Target 12 (1693)

Divers: Ngkin Hung
Date: 9/11/02
GPS accuracy: +/- 9.1 m
Timings: 14:23 to 14:40 (17 min)
Depth: 24 m
Water visibility: 0 m
Max. search diameter: 24 m
Current: Mid-strength
Weather: SSE 15 kn
Seabed description: Flat, mud.

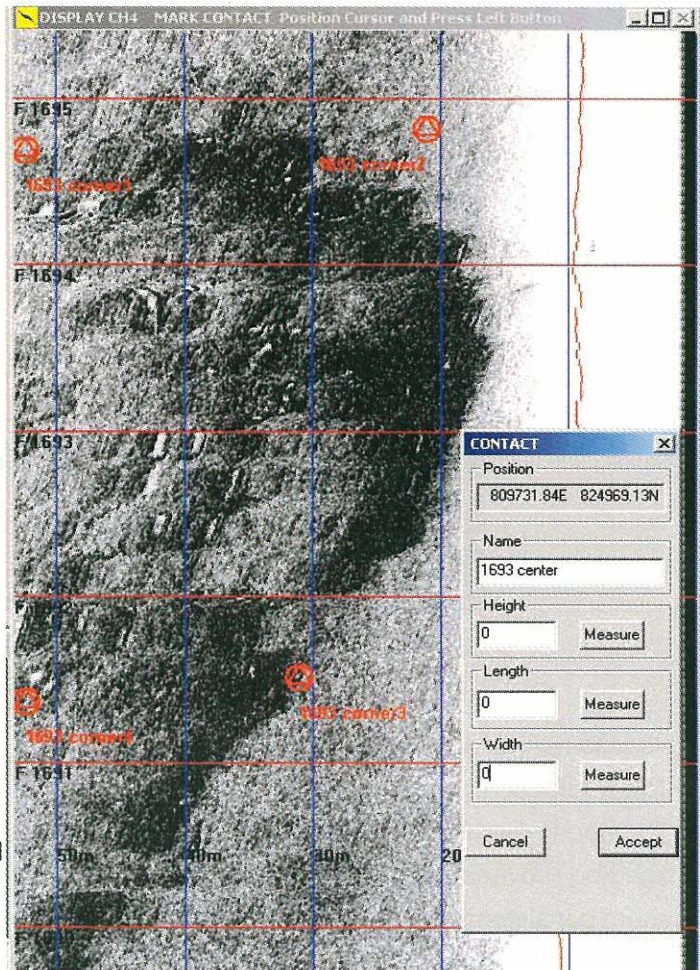
Hand probing was stopped by a layer of small stone and shell 0.2 to 0.4 m under the seabed.

Discussion

This target was not in the area interpreted by EGS.

Finds

Nothing recovered or found.



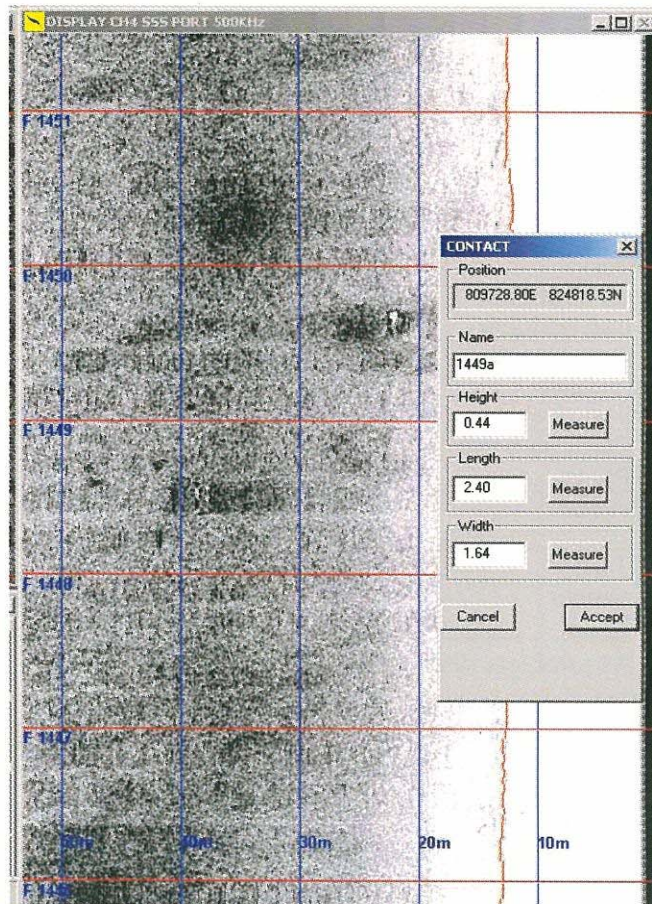
Target 13 (1449a)

Divers: Ngkin Hung
Date: 9/11/02
GPS accuracy: +/- 9.9 m
Timings: 15:07 to 15:23
 (17 min)
Depth: 24 m
Water visibility: 0 m
Max. search diameter: 24 m
Current: -
Weather: SSE 15 kn
Seabed description: Flat, mud.

During the conduct of the circuit, the survey line snagged wood poking out of the seabed. This turned out to be a fragment of a plank. Another timber was found near a 0.75 m depression in the seabed. At the base of the depression a rock was located, approximately 1.0 m in diameter.

Discussion

The target was a small irregular rectangular shaped object. It could possibly have been the rock which was located. The side scan sonar interpretation of the seabed in this area was designated as being of one of high reflectivity, possibly gravels, however the seabed was flat and mud.



Finds

Type	No.	Comments	Dimensions	Photo id
Stone	3	One basalt fragment and two quartzite fragments.	-	
Oyster shell	many	-	Longest example - 0.36 m	02/740
Iron concretions	2	-	-	02/743
Iron nodules	3	Most likely slag.	-	02/744
Compacted silt nodules			-	
Iron sheet	1	Cast remaining only. All iron corroded.	-	02/745
Perfume bottle	1		-	02/746
Plywood	1		-	
Wood	1	Possibly worked. Worm eaten. Unclear.	0.33 x 0.15 x 0.03 m	02/748
Timber	1	Fragments.	-	
Timber	1	Plank. Worm eaten. Has one straight edge. No fastenings.	0.7 x 0.1 x .03 m	02/749

All artefacts discarded

Assessment of significance

The timber fragments recorded from this search unit did not appear to be associated with a ship wreck. The artefacts recorded are consistent with material recently removed from a terrestrial, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.

Target 14 (2020b)

Divers: Chung Chiu Kai
and Ngkin Hung

Date: 9/11/02 and
11/11/02

GPS accuracy: not recorded
and +/- 8 m

Timings: 15:49 to 16:06
(17 min)
15:50 to 16:27
(37 min)

Depth: 24 m

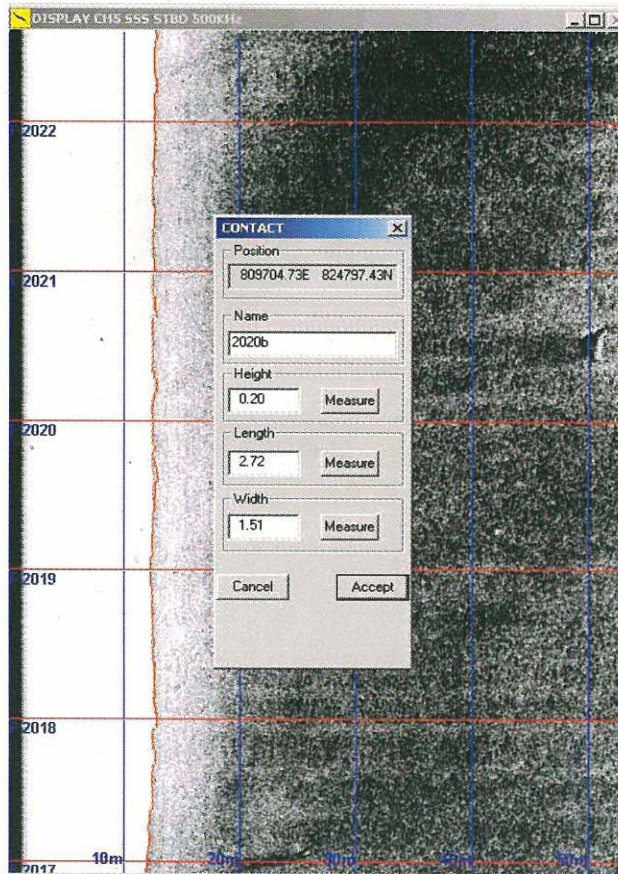
Water visibility: 0 m

Max. search diameter: 24 m

Current: -

Weather: SSE 5 kn and
NW < 5kn

Seabed description: Flat, mud.



Two dives were conducted in this area, the second one involving a more intensive search. Hand probing up to 0.2 to 0.3 m below the seabed surface reached a dense layer of shell, compact sediments and some small stone.

Discussion

The target was a single linear object with some scouring. It was not identified. The side scan sonar interpretation of the seabed in this area was designated as being of one of high reflectivity, possibly gravels, however this deposit was found at 0.2 m below the seabed surface.

Finds

Figure 12 Target 14 : 02/
752 - Section of branch/
trunk junction. (scale 0.10m
intervals)





Figure 13 Target 14 : Nodules of rock or weak cement? (scale 0.10m intervals)

Type	No.	Comments	Dimensions	Photo id
Ceramic, stoneware	1	Base and body. Grey fabric with brown slip. Container for fluids.	0.09 x 0.03 m With wall thickness 3 mm	02/750
Timber	1	Fragments. Part of branch/trunk junction. Had been cut. Signs of burning. Possibly 'grown knee'.	0.47 x 0.25 x 0.12 m	02/752
Barnacle	1	-	-	
Oyster and spiral shell	many	-	Longest example - 0.32 m	02/792
Stone	1	Quart-like.	-	
Soft stone or compacted silt.	1	Dark grey	-	
Rubber hose	1	Green in colour. Iron rod inside hose	-	
Nodules of rock or weak cement?	many		-	02/793
Brick	many	Fragments	-	
Compacted silt nodules coated in iron corrosion products	many		-	

All artefacts discarded with the exception of the fragment of stoneware ceramic (see **Appendix V**).



Figure 14 Target 14 : Fragment of stoneware. (scale 0.10m intervals

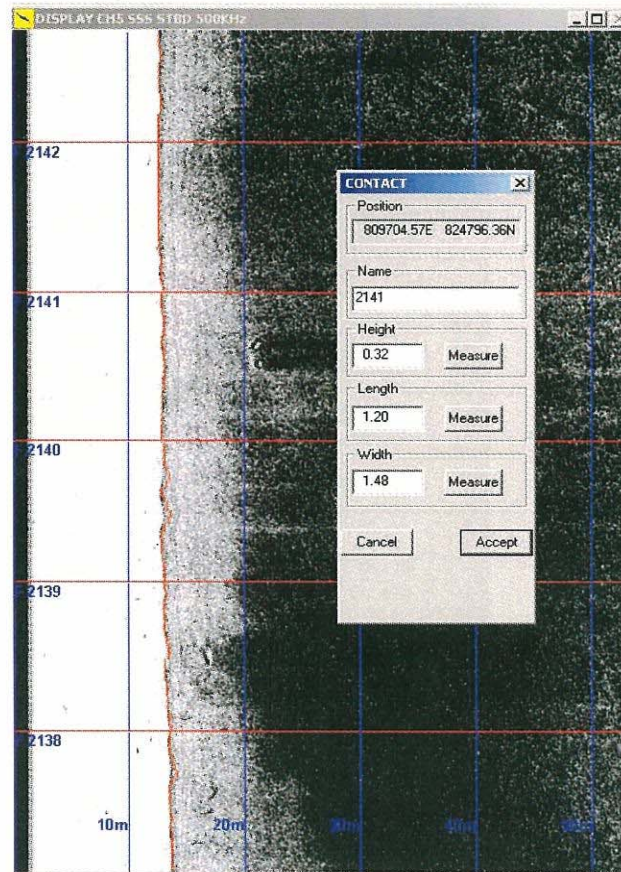
Assessment of significance

The timber fragment, which was the junction of a branch with the trunk, had been cut and burnt. It had the superficial appearance of a 'grown knee' which is a timber form commonly used in ship construction. However the absence of fastenings and other obvious wooden vessel construction elements made any argument that this timber was associated with a shipwreck difficult to sustain. The ceramic fragment of stoneware is considered to be of a type of 'village ware' of an undetermined age and provenance (Day, pers. comm. 5/3/03). For the most part the artefacts recorded are consistent with material recently removed from a terrestrial, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.

Target 15 (2141)

Divers: Chung Chiu Kai
 Date: 11/11/02
 GPS accuracy: +/- 8.4 m
 Timings: 14:51 to 15:26
 (35 min)
 Depth: 23 m
 Water visibility: 0 m
 Max. search diameter: 24 m
 Current: -
 Weather: NW < 5 kn
 Seabed description: Flat, mud.



This target was very close to Target 14. A large tyre, 1.5 m in diameter, and a smaller one of 0.5 m diameter were felt on the surface. Hand probing could only reach 0.2 m below the seabed before compact sediments were felt.

Discussion

The target was a large rectangular shaped object with some high points. This may have been the tyre that was located. The side scan sonar interpretation of the seabed in this area was designated as being of one of high reflectivity, possibly gravels, however this deposit was found at 0.2 m below the seabed surface.

Finds

Type	No.	Comments	Dimensions	Photo id
Oyster and spiral shell	many	Oyster shell smaller and rounder than those observed in other survey units.	-	02/779
Rock	3	Two quartz-like and basalt-like fragment.	-	02/787
Coral, dead	1	Fragment. Would have been transported to this location.	-	
Iron	1	Fragment	-	
Iron concretion	1	-	-	
Iron 'slag'	many		-	
Brick	1	Hard fired sandstock. Large barnacle growing on it. Seabed environment not suited for this marine animal. Must have arrived in the area with the brick.	0.23 x 0.09 x 0.05 m	02/788

All artefacts discarded

Assessment of significance

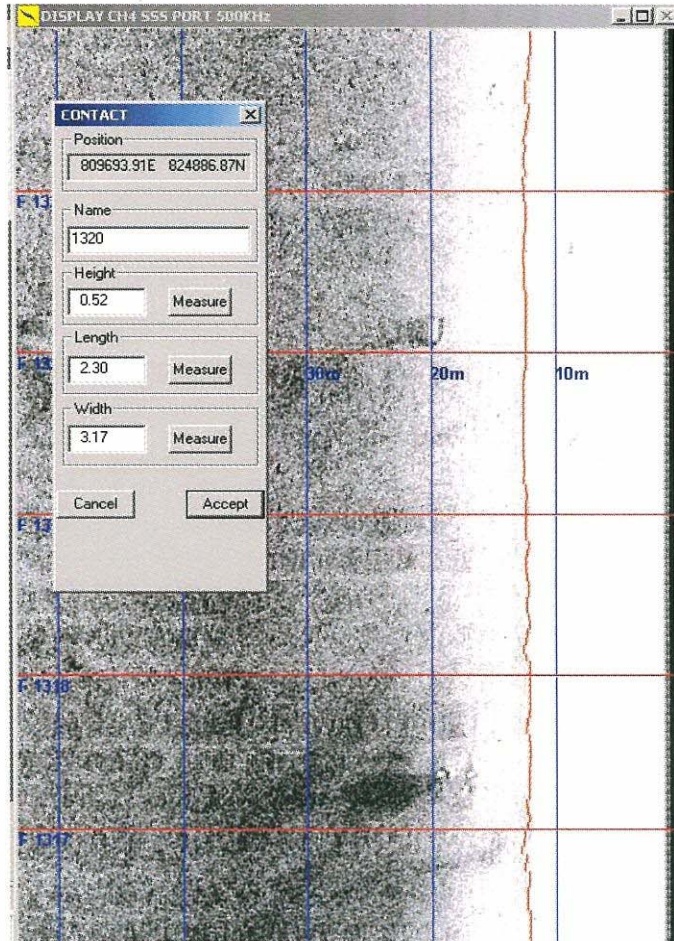
The artefacts recorded are consistent with material recently removed from a terrestrial, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.

The oyster shell appears to naturally occur within the Urmston Road the area.

Target 16 (1320)

Divers: Ngkin Hung
Date: 10/11/02
GPS accuracy: +/- 9.3 m
Timings: 14:34 to 14:53 (19 min)
Depth: 24 m
Water visibility: 0 m
Max. search diameter: 24 m
Current: Slight
Weather: SE 10 kn
Seabed description: Flat, mud.



Probing 0.3 m below the seabed reached a layer of sand, small stone, and occasional large oyster shell.

Discussion

The target was a small rectangular shaped object with some scouring around it. It was not identified.

Finds

Type	No.	Comments	Dimensions	Photo id
Oyster shell	many		Largest example 0.35 m long.	02/756
Iron concretion with Timber attached.	1	Timber fragment is worked as a wooden rod which could be a dowell or trenail.	Diameter of 'dowell' 0.025 m. Exposed length - 0.05 m.	
Timber plank	1	Very worn. Has some straight edges with iron staining. A circular section was cut of one section which may have been for a pipe to pass through. One end sawn.	0.51 x 0.09 m. Width of hole 0.05 m.	02/761

All artefacts discarded



Figure 15 Target 16 : Timber plank (scale 0.10m intervals)

Assessment of significance

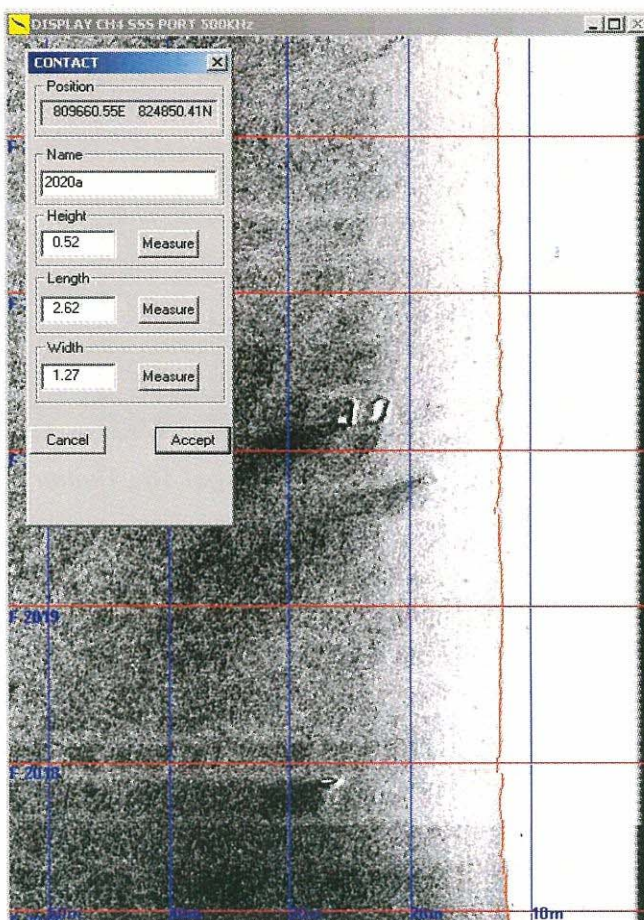
The timber fragments recovered, the plank and the 'dowell' are timber form commonly used in ship construction. However the absence of fastenings on the plank and other obvious wooden vessel construction elements made any argument that these timbers were associated with a shipwreck difficult to sustain. For the most part the artefacts recorded are consistent with material recently removed from a terrestrial, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.

The oyster shell appears to naturally occur within the Urmston Road the area.

Target 17 (2020a)

Divers: Ngkin Hung
Date: 10/11/02
GPS accuracy: +/- 9.3 m
Timings: 15:11 to 15:24 (13 min)
Depth: 24 m
Water visibility: 0 m
Max. search diameter: 24 m
Current: -
Weather: SE 10 kn
Seabed description: Flat, compact mud.



Probing could only penetrate 0.1 m below the seabed before coming onto compact sediments. At this level were felt the occasional oyster shell and small stone.

Discussion

The targets were two small rectangular shaped objects. They were not identified. The side scan sonar interpretation of the seabed in this area was designated as being of one of high reflectivity, possibly gravels. Though the seabed was relatively compact, this deposit was found at 0.1 m below the seabed surface.

Finds

Type	No.	Comments	Dimensions	Photo id
Glass, window	1	Blue colour.	-	02/768

All artefacts discarded

Assessment of significance

The fragment of blue window glass could have either been associated with a broken window from a vessel passing overhead or could be associated with terrestrial cultural material dumped on the seabed. On its own, it has minimal cultural heritage significance.

Target 18 (1315)

Divers: Chung Chiu
Kai

Date: 10/11/02

GPS accuracy: +/- 9.1 m

Timings: 15:47 to
16:02 (15 min)

Depth: 24 m

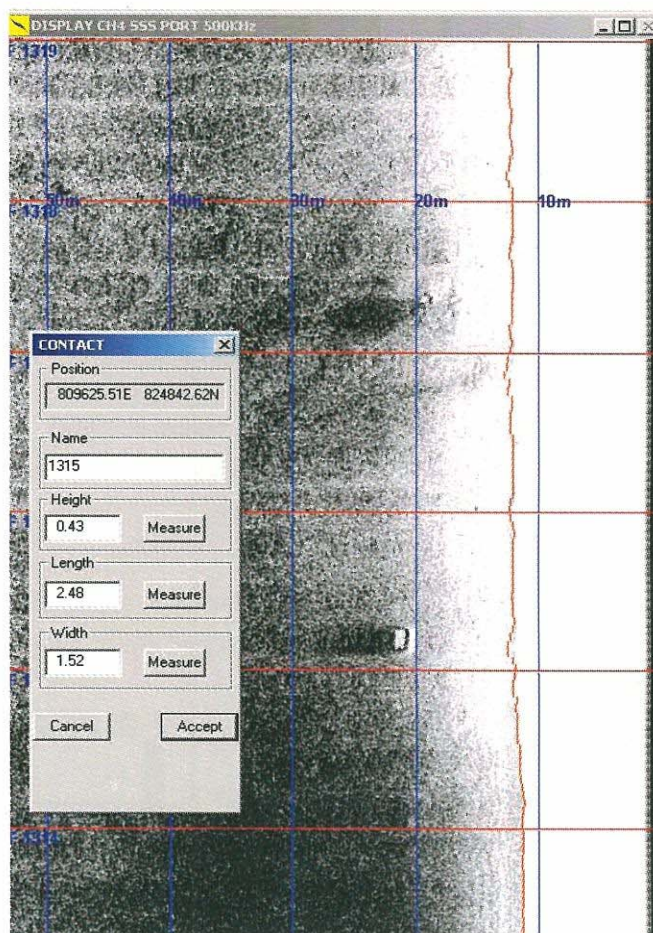
Water visibility: 0 m

Max. search diameter: 24 m

Current: -

Weather: SE < 10 kn

Seabed description: Flat, compact mud.



The compact nature of the sediments prevented any hand probing.

Discussion

The target was a large rectangular shaped object. It was not identified. The side scan sonar interpretation of the seabed in this area was designated as being of one of high reflectivity, possibly gravels. The seabed consisted of compact mud.

Finds

Type	No.	Comments	Dimensions	Photo id
Rocks	2	One rock was a basalt river pebble and the other porpus and white.	-	
Iron 'slag' concretion	1		-	
Timber	1	Dark hardwood. Bevelled and checked. Not on seabed for very long.	0.24 x 0.18 x 0.04 m	

All artefacts discarded

Assessment of significance

The artefacts recorded are consistent with material recently removed from a terrestrial, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.

Target 19 (2147)

Divers: Chung Chiu Kai
Date: 10/11/02
GPS accuracy: +/- 8.1 m
Timings: 16:21 to 16:34 (13 min)
Depth: 24 m
Water visibility: 0 m
Max. search diameter: 24 m
Current: -
Weather: SE 10 kn
Seabed description: Flat except where rocks were protruding the seabed. Compact mud.

Large rocks, 1.0 to 2.0 m diameter were found in the centre of the circle search. Also found in amongst the rocks were rope and pvc pipe. No probing was carried out due to the compact nature of the sediments.

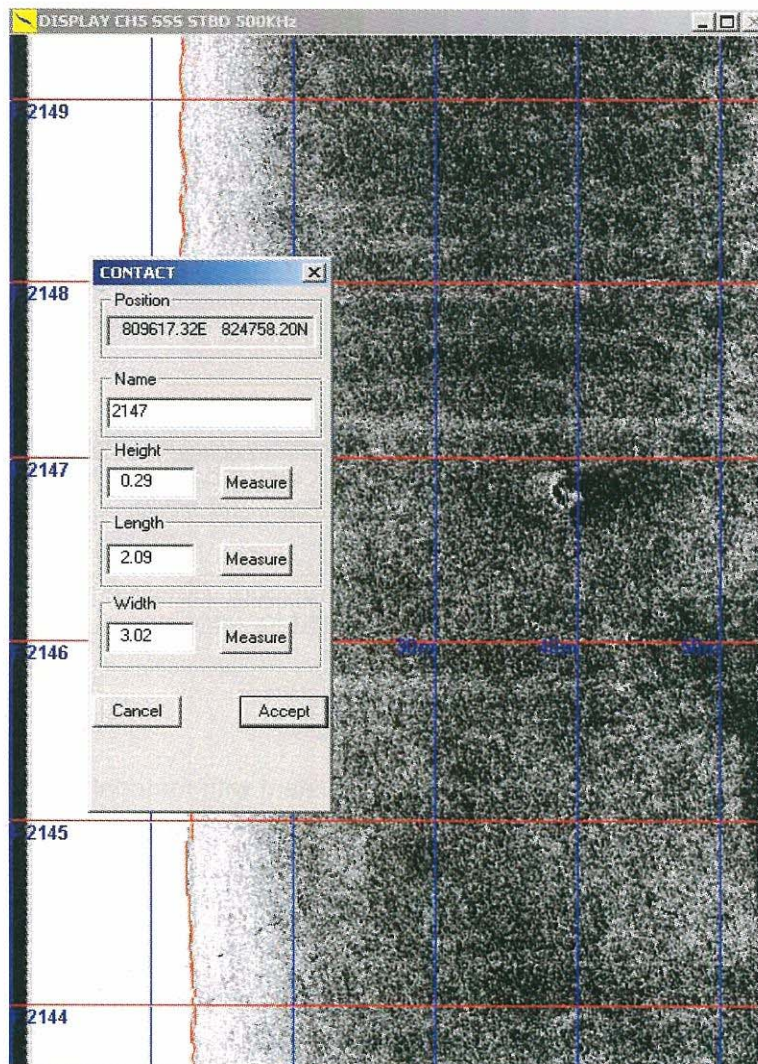
Discussion

The target was a tear shaped object in a scour pit. The large rocks found may have been the anomaly.

Finds

No artefacts recovered. The artefacts recorded are consistent with material recently removed from a terrestrial, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.



Target 20 (1646)

Divers: Chung Chiu Kai
Date: 13/11/02
GPS accuracy: +/- 8.5 m
Timings: 09:06 to 09:26 (20 min)
Depth: 18 m
Water visibility: 0.2 m
Max. search diameter: 24 m
Current: -
Weather: NE < 5kn
Seabed description: Flat, mud.

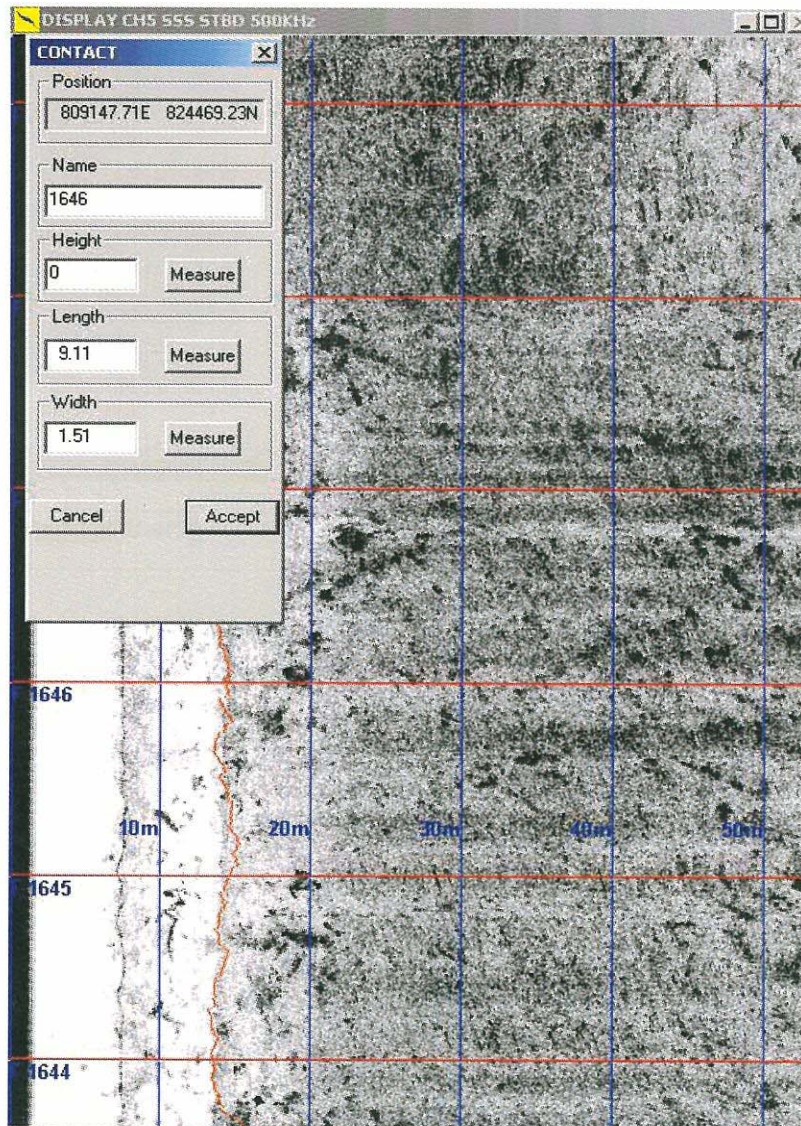
Hand probed to 0.2 m, nothing found.

Discussion

The target was a row of evenly spaced dots, the sort of formation that would be expected of frames from a wreck. They were not identified.

Finds

No artefacts found or recovered.



Target 21 (1861)

Divers: Chung
Chiu Kai

Date: 12/11/02

GPS accuracy: +/- 9.7 m

Timings: 11:20 to
11:34 (14 min)

Depth: 12 m

Water visibility: 0.3 m

Max. search diameter: 24 m

Current: -

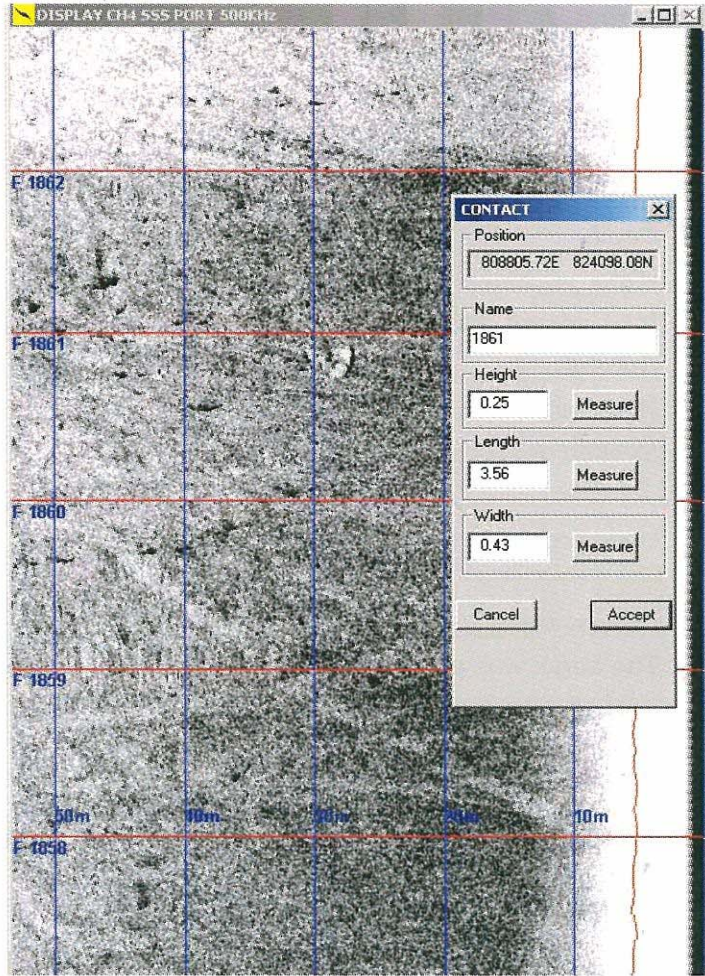
Weather: Calm to W
5 kn

Seabed description: Flat, mud.

Hand probed to 0.5 m.

Discussion

The target was a linear shaped object protruding 0.25 m above the seabed. It was not identified.



Finds

Type	No.	Comments	Dimensions	Photo id
Brick	2	Fragments.	-	
Bottle	1	Neck and shoulder fragment of brown beer bottle	-	

All artefacts discarded

Assessment of significance

The artefacts recorded are consistent with material recently removed from a terrestrial, environment and recently dumped on the seabed. These artefacts, and the 'site' which they form, are of minimal cultural heritage significance as they are;

- * relatively common within a Hong Kong context and,
- * of recent manufacture and deposition.

The oyster shell appears to naturally occur within the Urmston Road the area.

Target 22 (1624)

Divers: Chung Chiu Kai
Date: 13/11/02
GPS accuracy: +/- 10 m
Timings: 09:54 to 10:06 (12 min)
Depth: 13 m
Water visibility: 0.2 m
Max. search diameter: 24 m
Current: -
Weather: NE 5 kn
Seabed description: Flat, mud.

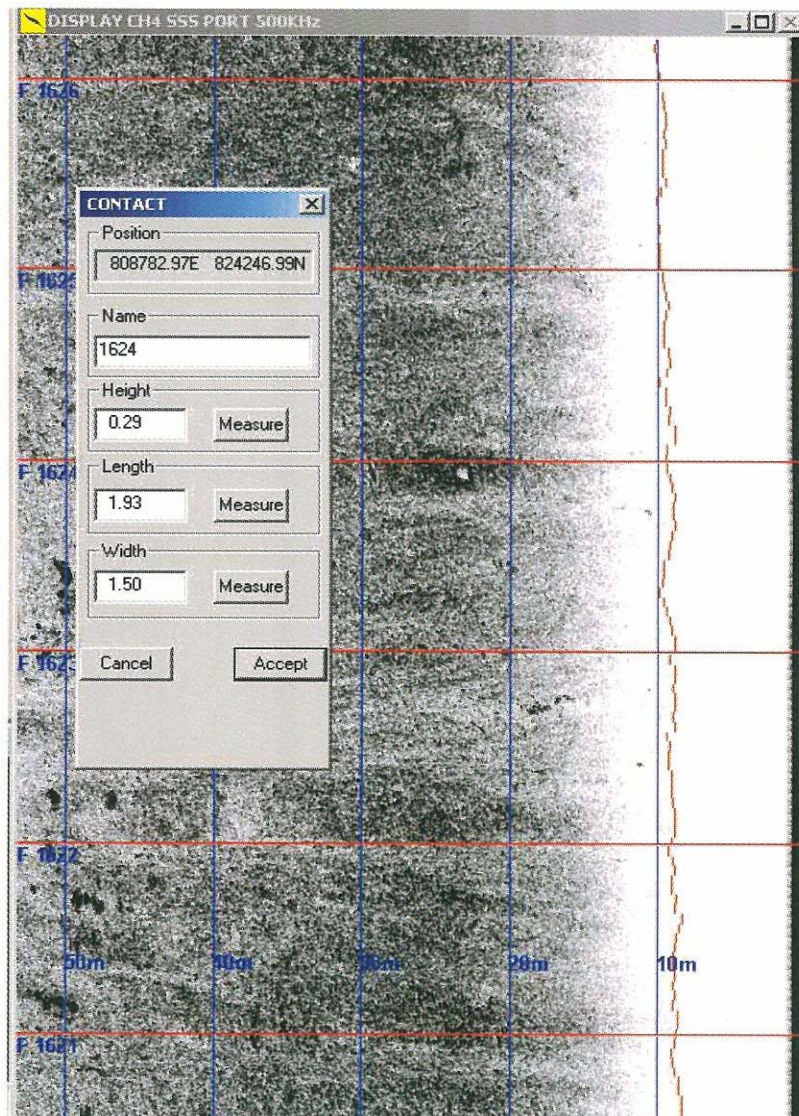
Hand probed to 0.2 m, nothing found.

Discussion

The target was a small linear shaped object protruding 0.29 m above the seabed. It was not identified.

Finds

No artefacts found or recovered.



Target 23 (2232)

Divers: Ngkin Hung
Date: 13/11/02
GPS accuracy: not recorded
Timings: 10:29 to 11:36 (11 min)
Depth: 12 m
Water visibility: 0.2 m
Max. search diameter: 24 m
Current: -
Weather: Calm
Seabed description: Flat, mud.

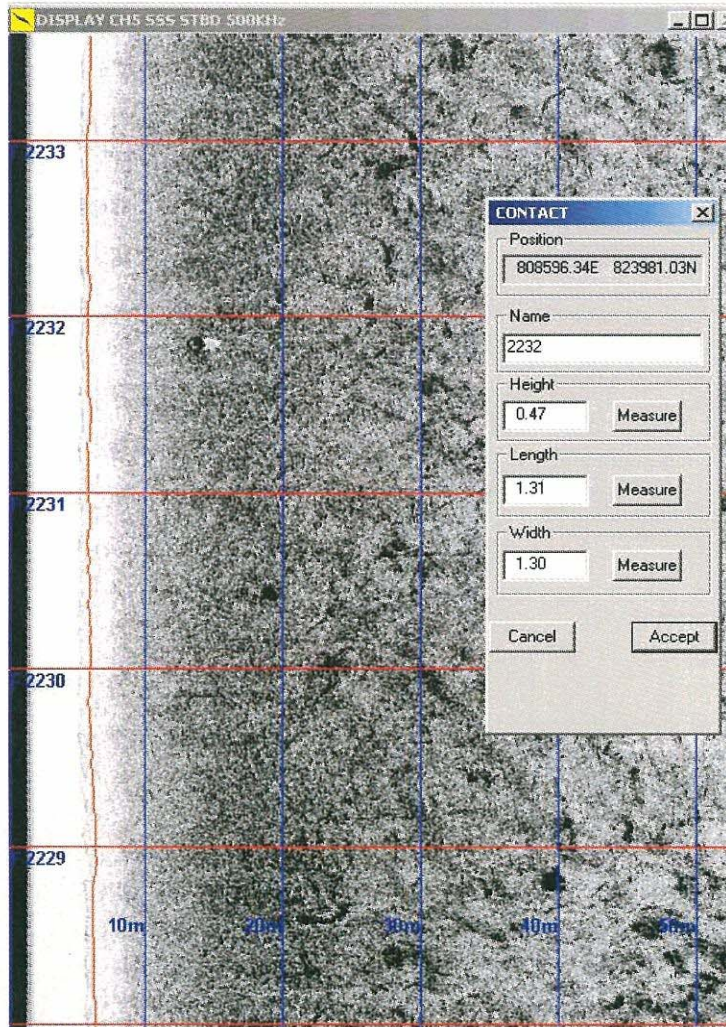
Hand probed to 0.5 m, nothing found.

Discussion

The target was a small circular shaped object protruding 0.47 m above the seabed. It was not identified.

Finds

No artefacts found or recovered.



Target 24 (1547)

Divers: Ngkin Hung
Date: 5/11/02
GPS accuracy: not recorded
Timings: 13:11 to 13:45 (34 min)
Depth: 13 m
Water visibility: 0 m
Max. search diameter: 24 m
Current: Strong on surface and mid strength on seabed.
Weather: NW < 5kn
Seabed description: Flat, mud.

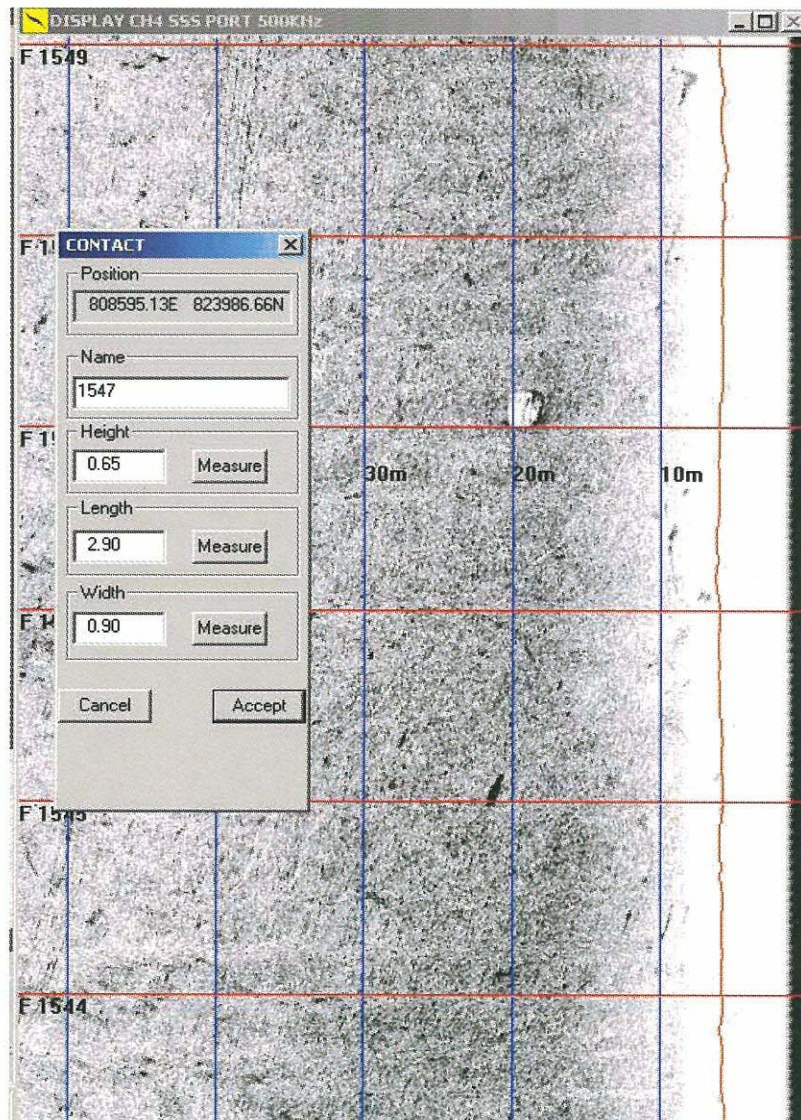
Hand probed to 0.5 m, nothing found.

Discussion

The target was a linear shaped object protruding 0.25 m above the seabed. It was not identified.

Finds

No artefacts found or recovered.



Target 25 (1896)

Divers: Ngkin Hung
Date: 5/11/02
GPS accuracy: +/- 8.6 m
Timings: 14:05 to 14:19 (14 min)
Depth: 12 m
Water visibility: 0 m
Max. search diameter: 24 m
Current: Mid strength
Weather: NW 5 kn
Seabed description: Flat, mud.

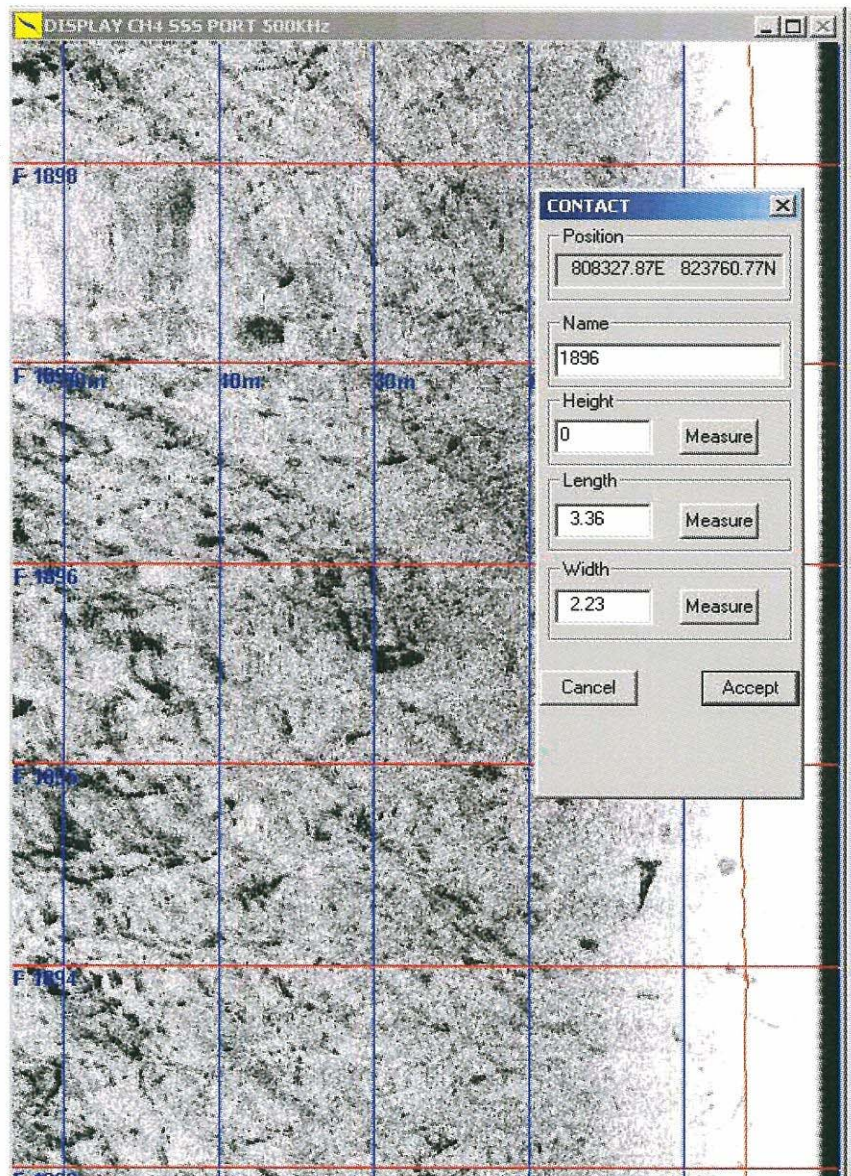
Hand probed to 0.5 m, nothing found, with the exception of small fragments of granite.

Discussion

The target was a straight sided object with no relief. It was not identified.

Finds

No artefacts recovered.



Target 26 (2488)

Divers: Ngkin Hung
Date: 13/11/02
GPS accuracy: +/- 12.6 m
Timings: 10:54 to 11:12 (16 min)
Depth: 9 m
Water visibility: 0.5 m
Max. search diameter: 24 m
Current: -
Weather: Calm
Seabed description: Flat, mud.

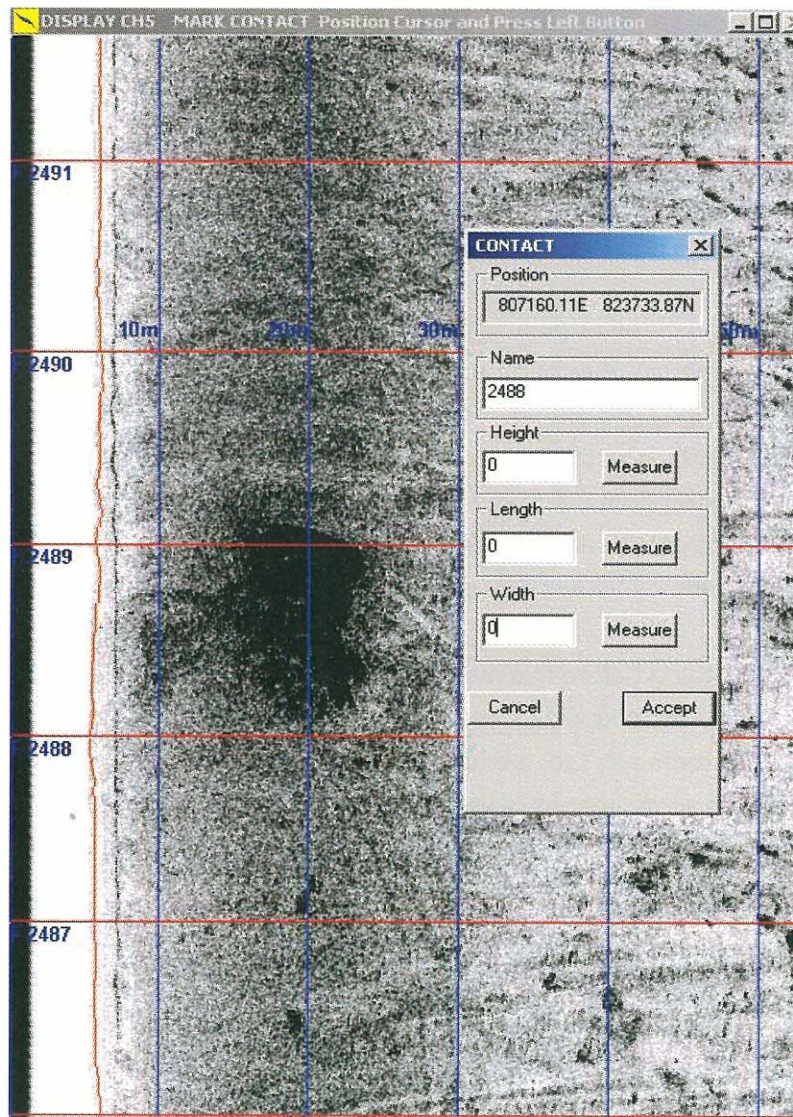
Hand probed to 0.5 m, nothing found.

Discussion

The target was a large area of dark reflective material with no relief. It was not identified.

Finds

No artefacts found or recovered.



4.2 Discussion

4.2.1 Review of search methods

A number of the objects or shapes in the side scan sonar images that were chosen as targets, were not identified. There are a number of possibilities why this may have occurred. These are as follows;

- o Targets not dived on
- o Nature of the targets
- o Natural environment
- o Nature of remote sensing

Targets not dived on

The methods used in the locating of the targets have been described in **Section 3.4**. The process of the dropping of the buoy over the target was designed to compensate for the fact that the sampan had to be moving for the GPS to work effectively. The set radius of the circular search, 12 m, was designed to compensate for the combined average margin of error and side scan sonar error stated by EGS. The details of each of the circular searches are presented in Table 2.

For all of the targets, with exception of Target no. 26, the radius of the circular search was within the margin of error parameters. The variable here is the distance that the buoy was dropped from the GPS stated position. This should in all cases be less than 5 m from the target. For most the searches, the combination of the margins of error and the distance that the buoy was dropped from the target exceeded the radius of the searches. It would be very unlikely that all the targets that were not identified were located on the extreme fringes of the margin of error, with the maximum 5 m distance from the buoy added on.

As stated before this method has been used with success in other projects where the buoys were dropped within less than 2 metres of low relief targets of a relatively small size (Archaeo-Environments Ltd, January 2003). It should be noted that when the targets depicted in the side scan sonar images were identified, the buoy had been dropped close to the centre of the object or object scatter, i.e. Target no. 2(94), 4(2106) and 10(1331).

Nature of the targets

The nature of the targets should also be taken into consideration. Some of them may have been ephemeral, that is light-weight objects that were traveling along the seabed with the current at the time of the geophysical survey.

Target no.	Target id	Date	GPS error (+/- m)	EGS error (+/-m)	Total margin of error	Search radius	overlap (m)	Buoy dropped
1	161	4/11/02	9.6	1	10.6	12	1.4	<4
2	94	4/11/02	12.4	1	13.4	16	2.6	<5
3	1066	4/11/02	10.1	1	11.1	16	4.9	<5
4	2106	5/11/02	not recorded	1		12	12	<5
4	2106	5/11/02	8.9	1	9.9	8	-1.9	<4.69
4	2106	12/11/02	8.9	1	9.9	12	2.1	<5
5	1345	5/11/02	10.6	1	11.6	12	0.4	<5
6	1426	8/11/02	8.9	1	9.9	12	2.1	<5.82
7	1082	8/11/02	8.6	1	9.6	12	2.4	<5.82
8	1705	8/11/02	8.1	1	9.1	12	2.9	<5
9	2130	8/11/02	9.1	1	10.1	12	1.9	<5
10	1331	9/11/02	7.4	1	8.4	12	3.6	<5
11	1449b	9/11/02	not recorded	1		not recorded		<5
11	1449b	12/11/02	not recorded	1		6	6	<5
11	1449b	12/11/02	8.9	1	9.9	12	2.1	<5
12	1693	9/11/02	9.1	1	10.1	12	1.9	<5
13	1449a	9/11/02	9.9	1	10.9	12	1.1	<5
14	2020b	9/11/02	not recorded	1		12	12	<5
14	2020b	11/11/02	8	1	9	12	3	<5
15	2141	11/11/02	8.4	1	9.4	12	2.6	<5
16	1320	10/11/02	9.3	1	10.3	12	1.7	<5
17	2020a	10/11/02	9.3	1	10.3	12	1.7	<5
18	1315	10/11/02	9.1	1	10.1	12	1.9	<5
19	2147	10/11/02	8.1	1	9.1	12	2.9	<5
20	1646	13/11/02	8.5	1	9.5	12	2.5	<5
21	1861	12/11/02	9.7	1	10.7	12	1.3	<5
22	1624	13/11/02	10	1	11	12	1	<5
23	2232	13/11/02	not recorded	1		12	12	<5
24	1547	5/11/02	not recorded	1		12	12	<5
25	1896	5/11/02	8.6	1	9.6	12	2.4	<2.9
26	2488	13/11/02	12.6	1	13.6	12	-1.6	<5
			Average		Average		Average	
			9.284		10.284		3.3633	

Table 2 Details of circular searches

Natural environment

Another explanation may be tied to the observations of the seabed during the survey. In many instances where the interpretation of the side scan sonar images defined areas of more reflective sediments or debris, such as T2(94), T8(1705), T9(2130), T11(1449b) and T14(2020b), a flat soft muddy seabed was encountered. In almost all cases, a harder substrate comprised of compact sediments, shell and rock were found after probing through the mud for 0.1 m or more. This could reflect the dynamic nature of the sea floor where a combination of current and river flow could result in the burial, and possible periodic exposure, of a harder substrate and consequently objects. This observation supports the theory put forward in the assessment of the geophysical survey that cultural objects deposited in Urmston Road would be become buried with time (Archaeo-Environments Ltd, May 2003).

Nature of remote sensing

One explanation which would need to be confirmed with EGS, and that is, that side scan sonar signal penetrated the softer sediments, thereby recording the harder substrates 0.1 to 0.5 m under the seabed. If this is a possibility, it has implications on the divers ability to 'snag' objects on the seafloor. Most of these objects were less than 0.5 m high, and so may have been covered with the soft sediments, penetrated and undetected by the side scan sonar signal, thereby making them 'unsnagable'.

When reading through the above discussion, the very challenging environmental conditions should be taken into account. The divers were limited in their ability to detect objects on the seabed by a combination of limited bottom time, zero visibility in the majority of cases and the presence of strong current. Given these ever-present constraints in this area it should be considered that the methodology used and its application was appropriate given the conditions.

The inability to recognise or identify the objects/shapes observed in the side scan images during the circular searches was not of great concern. This is because none of the side scan sonar images were immediately identifiable as being conclusively part of a shipwreck. If they had been, repeated dives would have been made to locate and identify the object/shape. As stated in the May 2003 report, *Assessment of Archaeological Potential*, it was predicted that the appearance/characteristics of the typical wreck site, in the Urmston Road environment, would be that the bulk of the remains of the wreck would be situated below the seabed surface (Archaeo-Environments Ltd, May 2003). Large inorganic materials that would have been located in the upper part of a vessel, such as the anchor, cannon, winch/capstan, ship's oven/cauldron and even cargo and ballast may be visible above the seabed. A classic 'wreck shape' would not be expected unless the vessel's cargo was completely composed of inorganic materials. More than likely a composition of small to large objects would be visible in a more or less discrete concentration. Scouring and periodic large storms may expose from time to time organic elements signifying the continual process of deterioration of a shipwreck site. Such organic elements may include the frames of the hull exposed only perhaps less than a metre above the seabed. More recent wrecks, especially those constructed from steel, will obviously retain their 'ship shape' longer and be more identifiable.

With the above in mind, it is then logical to assume that the sum total remains of a shipwreck would not be a small square or round object protruding from the seabed. Other signs of shipwreck would be close by to such a feature, either too small to be picked up by the side scan sonar or just under the seabed. The circular searches with the hand probing determined whether there were any remains of a shipwreck close to the objects/shapes observed in the side scan sonar images. In all cases the material recovered was consistent with dumped debris.

As stated in **Section 3.4 Conduct of locating targets** the 0 m visibility conditions for most of the study area, only targets which were supposedly protruding from the seabed were searched for. Sub-surface targets, SS2, SS8 and SS9 appear to have been exposed but no objects protruding from the seabed were observed near the locations of the sub-surface anomalies in the side scan sonar images.

Recommendation 2 in the May 2003 report, Assessment of Archaeological Potential, stated that

A diver based examination of some of the sub-surface targets be undertaken using dive based excavation techniques.

In discussions with the commercial divers before the commencement of the dive inspection it was considered unpractical and possibly dangerous to conduct diver based excavation within Urmston Road without additional precautions and expenses. The reasoning for this was based on the following:

- β Anticipated strong tidal currents
- β Need for anchoring - so as to operate a water lift with effectiveness and safety - which would make obtaining permission from the Hong Kong Marine Department (HKMD) more problematical.
- β Uncertainty as to the nature of the sub-surface anomalies so as to justify the expense required to undertake a safe and effective diver based sub –surface examination (i.e. more time spent on site, satisfaction of HKMD requirements as to vessel size and equipment, possible need to deploy caisson for diver to work within...).

The currents would have had the following effects on such a diver based excavation:

- o A water hose would have added to the drag acting on the diver with even the mildest of current; the depth multiplying the effect of the drag. This would have limited the amount of excavation that could have been carried out on any given day, as the slack water window was less than 1 hour, and usually once, possibly twice, per day.
- o The strength of the current at the height of the tide would have probably partially backfilled the excavated area at each change of tide. It could be expected that 1 to 4 such change of tides would take place before divers were able to get back in the water to excavate.

To be taken into consideration, that to excavate, diver based, down to 1 or more metres would require the diameter of the hole at the seabed surface to be at least 2 m in diameter. Such is

the physical nature of excavation in silt underwater. A considerable amount overburden (= time) would have to be moved to be able to observe/touch the targets.

It should be mentioned that probing would locate an anomaly but would not reveal any more information about it, given the amount of modern debris scattered within the study area. Uncovering the anomaly was to be the only way to assess it's archaeological potential.

As mentioned above, the physical limitations could have been overcome through the expenditure of more money. However this was not considered justified given the likelihood that the sub surface anomalies were likely to be geological formations, at the western end, or recent cultural deposits – SS1 and SS2 (Archaeo-Environments Ltd, May 2003).

It was considered that SS1 and SS2 could possibly have archaeological potential, however it was reasoned that the occurrence of significant cultural remains, such as a shipwreck, within the study area would be "very low" (Archaeo-Environments Ltd, May 2003). Therefore there was not enough evidence to justify the request for additional funds to undertake safe diver based sub-surface investigations.

During the dive inspection, the concerns concerning current strength and water visibility were found to have been conservative. Water visibility in the vicinity of SS1 and SS2 was zero and this made the task of excavation all the more difficult. Discussions with the divers, who have experience in the area, on how best to examine the sub-surface anomalies said it would be better (in terms of safety and cost) to examine the targets after dredging to nominated depths above the target. This form of archaeological inspection or watching brief is acceptable to the AMO.

4.2.2 Artefacts

With regards to the objects recorded they fall into 4 broad categories:

- Natural material most likely local to the area – such as oyster shell
- Natural material that has been deposited in the area – such as stone and possibly coral and barnacles.
- Cultural material of recent date and known function – such as drink cans, concrete and plastic.
- Cultural material of an undetermined date and/or unknown function – such as some timber pieces and some ceramic.

Most of the objects described in Section 4.1 can be attributed to the first 3 categories. The poorly made ceramic cup from T11(1449b) and the stoneware fragment from T14(2020b) have

been ascribed to being of undetermined age and provenance. Similarly the determination of the age of the timbers could not be done with confidence as the usual indicator of age, marine borer infestation, is not reliable in this case. The relative small amount of marine borer infestation on the timbers could either be due to recent deposition on the seabed or quick burial within the marine muds – an effective way of retarding marine borer infestation.

4.2.3 Contexts

The timbers recovered from T13(1449a), T14(2020b) and T16(1320) did not have any evidence of fastenings which would have been an indication that they may have been from a wreck. The association of these objects with modern artefacts, as well as building material such as bricks, suggests that the area from where these objects were recovered was a dump; most likely originating from the demolition of a building(s). The variety of rocks found during the survey could well be associated with the ballast predicted to be within the study area. However the lack of a discernable mound or other arrangement of rock, as well as the presence of recently dumped material across most of the study area, makes the assignment of the rocks as being associated with ship's ballast very difficult.

The presence of barnacles from T14(2020b) and T15(2141) as well as coral from the latter target is of some assistance in interpreting the cultural remains recorded during the Visual Dive Survey. It is known that barnacles and coral grow/grew in the waters of North West Lantau and that they have been reported in Urmston Road (Kennish, fax:27/1/03). However there is a case to present that states these marine animals were transported to the area with the above mentioned cultural material. This case is based on the following;

- To the consultant's experience (having dived on many coral reefs) it is very unlikely to find hard coral growing on a silt seabed and in zero visibility.
- One large barnacle was found on a brick that was buried in the silt. To the consultant's experience, and those of the divers, the brick would not have been on the seabed surface long enough for a barnacle of such size to grow on it.
- The coral and barnacles recovered were dead.
- The frequency of the occurrence of the barnacles and coral was very low, not high enough to consider them to be local to the area. This contrasts with the finds of two barnacles on the objects recovered with the sub-surface stratum of mud oyster (dead) observed throughout the study area.

It can be surmised further that these cultural materials may have been dredged from a littoral site. The occurrence of coral and barnacles growing in the waters of north west Lantau is interesting as this may be the possible provenance for the dumped material recovered during the Visual Dive Survey.

The scenario that a wreck may be in the area which has been covered by dumped material is a possibility. However the fact that no sections of identifiable and coherent wreck structure makes this scenario very unlikely. The upright timber snagged in T13(1449a) - precisely what is anticipated in searching for a shipwreck, was a loose piece of wood.

4.2.4 Cultural Significance

The Visual Diver Survey did not conclusively identify the remains of a shipwreck, ballast or mooring anchors – the site types of some cultural significance predicted to be within the study area. The bulk of the material recorded is associated with the common practice of dumping construction materials and demolished structures onto the seabed. The significance of these cultural deposits therefore lies in their direct relationship with the development and economy of Hong Kong in the last half of the twentieth century. The recorded artefacts are representative of this phenomenon and form part of extensive debris fields across the Urmston Road area. Of the artefacts recorded during the Visual Diver Survey, none could be considered to be defined as ‘relics’ under the *Antiquities and Monuments Ordinance* nor could they be considered to be of more than minimal cultural significance as they do not display uncommon, rare or unique archaeological and historical values (Table 3).

Target no.	Examined?	Site type	Cultural heritage significance
1	Yes	Recently dumped terrestrial/littoral material	Minimal
2	Yes	Recently dumped terrestrial/littoral material	Minimal
3	Yes	Recently dumped terrestrial/littoral material	Minimal
4	Yes	Recently dumped terrestrial/littoral material	Minimal
5	Yes	Could not be determined	Minimal
6	Yes	Recently dumped terrestrial/littoral material	Minimal
7	Yes	Recently dumped terrestrial/littoral material	Minimal
8	Yes	Nothing found	No assessment
9	Yes	Recently dumped terrestrial/littoral material	Minimal
10	Yes	Recently dumped terrestrial/littoral material	Minimal
11	Yes	Recently dumped terrestrial/littoral material	Minimal
12	Yes	Nothing found	No assessment
13	Yes	Recently dumped terrestrial/littoral material	Minimal
14	Yes	Recently dumped terrestrial/littoral material	Minimal
15	Yes	Recently dumped terrestrial/littoral material	Minimal
16	Yes	Recently dumped terrestrial/littoral material	Minimal
17	Yes	Recently dumped material	Minimal
18	Yes	Recently dumped terrestrial/littoral material	Minimal
19	Yes	Recently dumped terrestrial/littoral material	Minimal
20	Yes	Nothing found	No assessment
21	Yes	Recently dumped terrestrial/littoral material	Minimal
22	Yes	Nothing found	No assessment
23	Yes	Nothing found	No assessment
24	Yes	Nothing found	No assessment
25	Yes	Nothing found	No assessment
26	Yes	Nothing found	No assessment

Table 3 Summary of exposed targets

5.0 Review of Impact Assessment

5.1 Impact of development on the submerged cultural resource

The greater part of the study area formed a corridor 50 m on either side the proposed pipeline route from Tuen Mun Area 38 to Sha Chau. The rationale for the size of the study area was discussed in **Section 2.1**.

For the *MAI Task 3 Assessment of Archaeological Potential* report (Archaeo-Environments Ltd May 2003) and for the implementation of the Visual Diver Survey, the proposed pipeline routes depicted in the graphics for this report (Figures 5a and 5b) and the previously mentioned report (Archaeo-Environments Ltd May 2003:Appendix C), were considered to be subject to alteration. Since the completion of the Visual Diver Survey it has been confirmed in that the pipeline routes depicted in this and in the May 2003 report will be the final and true alignments (margin notes by B. Gillon in Kennish, fax:9/4/03).

As described in **Section 1.2** the anticipated width of the pipe trenches will be up to 20m. It should be noted that an increase in the depth of the pipe trenches to a projected 7m for part of their length, may result in the width of the trenches being greater than 20m. With the available information however, the width of the pipe trenches have been depicted in Figures 5a and 5b at 20m.

From these figures it can be seen that the following will be impacted:

Exposed Targets	T4, T5, T6, T8, T9, T10 and T19
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The impact of the excavation of the pipe trench(es) on these targets (or sites) will be the total destruction of their archaeological values.

As already stated the maximum anticipated depth of the pipe trench will be 7 m. The deepest of the 10 identified sub-surface anomalies, SS1, lies 2.5 m below the sea bed. It is therefore very likely that all 10 sub-surface targets will be impacted by the excavation of the pipe trenches (Table 4).

The impact of the excavation of the pipe trench(es) on these targets (or sites) will be the partial if not total destruction of their archaeological values.

In the *Assessment of Archaeological Potential* report (May 2003) it was assessed that the impact of the construction of the berth, based on available information, would not be as overwhelmingly destructive to a site as it involve the driving in of piles. Obviously cultural material in the path of a pile will be destroyed however the overall footprint of this part of the development and its dispersed nature will have a minimal impact on the submerged cultural resource.

Target	App. depth	Depth below sea bed (m)	Length (m)	Width (m)	Height (m)	Latitude	Longitude	Comments
SS1	19	2.5	30	?	4	22°21.9263 'N	113°55.3930 'E	
SS2	21	exposed?	18	?	2.5	22°21.8318 'N	113°55.2557 'E	
SS3	11	1.5	10	?	2	22°21.3028 'N	113°54.4866 'E	
SS4	10	1.5	16	?	2.5	22°21.1768 'N	113°54.2940 'E	
SS5a	10	1.5 - 2.0	-	-	-	22°21.1533 'N	113°53.8880 'E	transect dive
SS5b	10	1.5 - 2.0	-	-	-	22°21.1723 'N	113°54.2154 'E	transect dive
SS6	9	2	68	?	2	22°21.1422 'N	113°53.7145 'E	
SS7	9	1.5	28	?	2	22°21.1388 'N	113°53.6341 'E	
SS8a	9	exposed	-	-	-	22°21.2399 'N	113°53.5081 'E	transect dive
SS8b	9	exposed	-	-	-	22°21.1982 'N	113°53.5408 'E	transect dive
SS9	9	exposed	14	?	4	22°21.2317 'N	113°53.4766 'E	
SS10	10	1	24	?	2	22°21.2175 'N	113°53.4243 'E	

Table 4 Sub surface targets

5.2 Impact assessment

The examined exposed targets T4, T6, T9, T10 and T19 have been assessed to be of minimal cultural heritage significance, while T5 and T8 could not be assessed as nothing could be found (**Section 2.5** and **4.1**). Therefore in applying the criteria for cultural heritage impact assessment as set out in EAIO TM Annex 19 the appropriate actions to be taken in response to the development can be ascertained:

Clause 2.6: 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.

This should not be applicable on account of;

- the minimal cultural significance of the artefacts recorded,
- the inaccessibility of the submerged cultural resource and that,
- the artefacts recorded are associated with recently dumped materials which form extensive debris fields (see Figures 5a and 5b). Therefore the impact of the development on the submerged cultural resource as represented in dumped construction and demolished construction materials on the seabed, within the Urmston Road area will be minimal.

Clause 2.7: 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.

This should not be applicable on account of;

- the minimal cultural significance of the artefacts recorded and that,
- the artefacts recorded are associated with recently dumped materials which form extensive debris fields (see Figures 5a and 5b). Therefore the impact of the

development on the submerged cultural resource as represented in dumped construction and demolished construction materials on the seabed, within the Urmston Road area will be minimal.

Clause 2.8 : Total destruction must be taken as the very last resort in all cases and shall only be recommended with a meticulous and careful analysis balancing the interest of preserving the archaeological, historical, architectural and other cultural values as against that of the community as a whole.

This should not be applicable on account of;

- the minimal cultural significance of the artefacts recorded,
- that the level of recording carried out in the Visual Diver Survey is sufficient in relation to their significance and that,
- the artefacts recorded are associated with recently dumped materials which form extensive debris fields (see Figures 5a and 5b). Therefore the impact of the development on the submerged cultural resource as represented in dumped construction and demolished construction materials on the seabed, within the Urmston Road area will be minimal.

Clause 2.9: Assessment of impacts on sites of cultural heritage shall also take full account of, and follow where appropriate, the Guidelines for Landscape and Visual Impact Assessment at Annex 18.

This should not be applicable on account of;

- the artefacts recorded are underwater in a volatile, ever-changing environment and in zero visibility conditions.

It can therefore be concluded that with respect to the impact of the development on the artefacts recorded in T4, T5, T6, T8, T9, T10 and T19 no mitigation measures are required.

With regards to the identified sub-surface targets to be impacted by the proposed development, no impact assessment can be made at present as they have not been identified as archaeologically important as guided by EIAO Technical Memorandum Annex 19 Clause 2.1 (see **Appendix II**). The reasons as to why the sub-surface targets were not examined in the Visual Diver Survey has been presented in **Section 4.2.1**. What has been ascertained has been the following:

- There is some potential for sites of significant cultural heritage to be present within the study area.

- A number of sub-surface physical features have been identified within the study area, which may have archaeological potential and thereby be of archaeological importance.

With the above facts stated, the EIAO Technical Memorandum Annex 19 Clause 2.5, requires that where *....sources of information prove to be inadequate or where the proposed project area has not been adequately studied before, field surveys and site investigations shall be conducted to assemble the necessary data.*

The outline and methodology in establishing whether the sub-surface targets which may have archaeological potential are archaeologically important is presented in the following section, **Section 5.3.**

5.3 Measures to be taken to assess targets of archaeological potential

The Guidelines for Marine Archaeological Investigation, Clause 4.1, states that *a field evaluation programme [be planned] to acquire more detailed data on areas identified as having archaeological potential.* This is to be done for the identified sub-surface targets by using accepted marine archaeological practices such as a Watching Brief. For reasons as to why these sub-surface targets could not be examined in the Visual Diver Survey see **Section 4.2.1.**

The Guidelines for Marine Archaeological Investigation, Clause 4.3, states that an archaeological watching brief should *...focus work on the areas of greatest archaeological potential. Careful monitoring of the dredging operations would enable immediate identification and salvage of archaeological material. If archaeological material is found, the AMO should be contacted immediately to seek guidance on its significance and appropriate mitigation measures would be prepared*

Most of the sub-surface targets are in the areas that have been dredged for the navigation channel (Archaeo-Environments Ltd, May 2003). They are relatively large and long and may be possibly geological in character. SS1 and SS2 appear to be discrete mounds of cultural material rather than natural formations. Based on these observations and assessments, the areas with most likely archaeological potential are in the vicinity of SS1 and SS2. With this in mind a Watching Brief should focus on these two anomalies.

References

Reports

- Archaeo-Environments Ltd January 2003 *The revised scheme of South East Kowloon Development - Marine Archaeological Investigation, Field Investigation 23rd to 28th September 2002.*
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Government Documents

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Personal Communications

- Day, Dr. Chris Director, Archaeo-Environments Ltd
- Gillon, Brian Project Manager, Leighton Contractors (Asia) Limited.
- Kennish, Dr. Robin Technical Director, Environmental Resources Management.

Appendix I Guidelines for Marine Archaeological Investigation (MAI)

Standard practice for MAI should consist of for separate tasks, i.e.

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

(1) Baseline Review

- 1.1 A baseline review should be conducted to collate the existing information in order to identify the potential for archaeological resources and, if identified, their likely character, extent, quality and value.
- 1.2 The baseline review will focus on known sources of archive data. It will include :
 - a. Geotechnical Engineering Office (GEO) – the Department holds extensive seabed survey data collected from previous geological research.
 - b. Marine Department, Hydrographic Office – the Department holds a substantial archive of hydrographic data and charts.
 - c. The Royal Naval Hydrographic Department in the UK – the Department maintains an archive of all survey data collected by naval hydrographers.
- 1.3 The above data sources will provide historical records and more detailed geological analysis of submarine features which may have been subsequently masked by more recent sediment deposits and accumulated debris.

(2) Geophysical Survey

- 2.1 Extensive geophysical survey of the study area should deploy high resolution boomer, side scan sonar and an echo sounder. The data received from the survey would be analysed in detail to provide :
 - a. Exact definition of the areas of greatest archaeological potential.

- b. Assessment of the depth and nature of the seabed sediments to define which areas consist of suitable material to bury and preserve archaeological material.
- c. Detailed examination of the boomer and side scan sonar records to map anomalies on the seabed which may be archaeological material.

(3) Establishing Archaeological Potential

- 3.1 The data examination during Task 1 and 2 will be analysed to provide an indication of the likely character and extent of archaeological resources within the study area. This would facilitate formulation of a strategy for investigation.
- 3.2 The results would be presented as a written report and charts. If there is no indication of archaeological material there would be no need for further work.

(4) Remote Operated Vehicle (ROV)/Visual Diver Survey/Watching Brief

- 4.1 Subject to the outcome of Task, 1, 2 and 3, accepted marine archaeological practice would be to plan a field evaluation programme to acquire more detailed data on areas identified as having archaeological potential. The area of archaeological interest can be inspected by ROV or divers. ROV or a team of divers with both still and video cameras would be used to record all seabed features of archaeological interest.
- 4.2 Owing to the heavy marine traffic in Hong Kong, the ROV/visual diver survey may not be feasible to achieve the target. If that is the case, an archaeological watching brief is the most appropriate way to monitor the dredging operations in areas of identified high potential to obtain physical archaeological information.
- 4.3 A sampling strategy for an archaeological watching brief would be prepared based on the results of Task 1, 2 and 3 to focus work on the areas of greatest archaeological potential. Careful monitoring of the dredging operations would enable immediate identification and salvage of archaeological material. If archaeological material is found, the AMO should be contacted immediately to seek guidance on its significance and appropriate mitigation measures would be prepared.
- 4.4 If this task is undertaken, the results would be presented in a written report with charts.

Appendix II Environmental Impact Assessment Ordinance, Technical memorandum – Annexes 10 and 19

Downloaded from <http://www.epd.gov.hk/epd/eia/legis/index3.htm>

ANNEX 10 : CRITERIA FOR EVALUATING VISUAL AND LANDSCAPE IMPACT, AND IMPACT ON SITES OF CULTURAL HERITAGE

1. Criteria for Assessment of Visual and Landscape Impact

- 1.1 The evaluation of landscape and visual impact may be classified into five levels of significance based on type and extent of the effects concluded in the EIA study:
- a. The impact is beneficial if the project will complement the landscape and visual character of its setting, will follow the relevant planning objectives and will improve overall and visual quality;
 - b. The impact is acceptable if the assessment indicates that there will be no significant effects on the landscape, no significant visual effects caused by the appearance of the project, or no interference with key views;
 - c. The impact is acceptable with mitigation measures if there will be some adverse effects, but these can be eliminated, reduced or offset to a large extent by specific measures;
 - d. The impact is unacceptable if the adverse effects are considered too excessive and are unable to mitigate practically;
 - e. The impact is undetermined if significant adverse effects are likely, but the extent to which they may occur or may be mitigated cannot be determined from the study. Further detailed study will be required for the specific effects in question.

2. Criteria for Assessment of Impact on Sites of Cultural Heritage

2.1 The criteria for evaluating impact on sites of cultural heritage include:

- 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.

ANNEX 19: GUIDELINES FOR ASSESSMENT OF IMPACT ON SITES OF CULTURAL HERITAGE AND OTHER IMPACTS

1. General

1.1 The annex describes the commonly adopted approaches and methodologies for assessment of impact on sites of cultural heritage and other environmental issues. The methodologies may vary from case to case, depending on the nature of the issues and the latest development in methods and techniques.

2. Impact on Sites of Cultural Heritage

2.1 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.**

Baseline Study

2.2 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.

Methodology

- 2.3 The best information shall be assembled for the assessment of the identified sites of cultural heritage. The entry point shall be the Antiquities and Monuments Office, public libraries and archives and tertiary institutions.
- 2.4 The assessment shall provide detailed geographical, historical, archaeological, ethnographical and other cultural data. Published papers, records, archival and historical documents as well as oral legends shall also be consulted.
- 2.5 In cases where the above sources of information prove to be inadequate or where the proposed project area has not been adequately studied before, field surveys and site investigations shall be conducted to assemble the necessary data.

Impact Assessment

- 2.6 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.
- 2.7 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.
- 2.8 Total destruction must be taken as the very last resort in all cases and shall only be recommended with a meticulous and careful analysis balancing the interest of preserving the archaeological, historical, architectural and other cultural values as against that of the community as a whole.
- 2.9 Assessment of impacts on sites of cultural heritage shall also take full account of, and follow where appropriate, the Guidelines for Landscape and Visual Impact Assessment at Annex 18.

Mitigation Measures

- 2.10 Mitigation measures shall not be recommended or taken as *de facto* means to avoid conservation and preservation of sites of cultural heritage. They must be proved beyond all possibilities to be the only practical course of action.

- 2.11 Designs, layouts, external treatments, colour and texture of materials, but not limiting to such, shall be worked out for the integration of the sites of cultural heritage to be preserved in whole or in part into the proposed project.
- 2.12 For total destruction, a comprehensive and practical rescue plan must be worked out. This is also applicable to sites of cultural heritage where only partial preservation is proposed.
- 2.13 Annex 18 also applies.
- 2.14 A practical programme and funding proposal for the implementation of the recommended mitigation measures shall be included as part of the assessment. These shall form an integral part of the overall development programme and financing of the proposed project. Competent professionals must be engaged to design and carry out the mitigation measures.

3. Potential Contaminated Land Issues

- 3.1 For all development and redevelopment projects listed under Schedule 2, Part I and Schedule 3, the applicant who is preparing an EIA report as stipulated in Clause 6 of the Environmental Impact Assessment Ordinance, shall give consideration to historical land uses which have the potential to cause or have caused land contamination. Such uses include, but are not limited to, the following:
 - a. oil installations including oil depots and petrol filling stations
 - b. gas works
 - c. power plants
 - d. shipyards/boatyards
 - e. chemical manufacturing/processing plants
 - f. steel mills/metal workshops
 - g. car repairing and dismantling workshops
 - h. dumping ground and landfill
- 3.1.1 If the above land uses are identified, the applicant shall submit, as part of the EIA report, a Contamination Assessment Plan (CAP) to the Director for endorsement prior to conducting a contamination assessment of the site.
- 3.1.2 Based on an endorsed CAP, the applicant shall conduct a contamination assessment and compile a Contamination Assessment Report (CAR) for the Director's review. During

the preparation of the CAR, if land contamination is confirmed, a Remediation Action Plan (RAP) shall be prepared. the RAP and the CAR shall be submitted as a combined report to the Director for approval, referencing the corresponding CAP.

- 3.1.3 Upon approval of the CAR/RAP, the applicant shall clean up the contaminated site according to the approved RAP, prior to any development or redevelopment of the site.
- 3.1.4 The preparation of CAP, CAR, or CAR/RAP reports shall be based on the relevant published Practice Note for Professional Persons or guidelines issued by the Director.
- 3.2 For all decommissioning projects as designated under Schedule 2, Part II, the above requirements apply regardless of the historical land use.
- 3.3 For development or re-development projects adjacent to landfill, the applicant shall note the following additional specific requirements when the need for a landfill gas (LFG) hazard assessment is confirmed:
 - a. carry out a LFG hazard assessment to evaluate the degree of risk associated with the proposed development;
 - b. design suitable precautionary / protection measures to render the proposed development as safe as reasonably practicable;
 - c. ensure that the precautionary / protection measures will be implemented and constructed in accordance with the design;
 - d. establish a maintenance and monitoring programme for ensuring the continued performance of the implementation protection measures.

The LFG hazard assessment shall be carried out and completed for submission to the Director for vetting at the early planning stage of the project. The early completion of the assessment study will ensure that the identified protection measures be considered and incorporated in to the overall design process for the proposed development.

Appendix III Dive log

DATE	4/11/02		5/11/02		8/11/02		9/11/02		10/11/02		11/11/02		12/11/02		13/11/02	
	Dives	minutes	Dives	minutes	Dives	minutes	Dives	minutes	Dives	minutes	Dives	minutes	Dives	minutes	Dives	minutes
Leung Hing Shun	1	12														
Ngkin Hung	1	47	3	62	2	30	2	34	2	32	1	37	2	44	2	27
Chung Chiu Kai	1	22	2	36	2	34	3	38	2	28	1	35	2	28	2	32
Total dives	3		5		4	64	5	72	4	60	2	72	4	72	4	59
Total Minutes		81		98		64		72		60		72		72		59

Total dives	Total minutes	Total hours
1	12	0.20
15	313	5.22
15	253	4.22
31		
	578	9.63

Appendix IV Photo Log

The images associated with this table can be found on the CD attached to this report.

ID number	Description
02/708	Target 2 - 94 - 3 fragments of rock and wood
02/710	Target 2 - 161 - window glass x 2, iron x 1, bamboo
02/712	Target 2 - 161 - rocks and concrete
02/719	Target 5 - 1345 - 2 fragments of wood
02/722	Target 5 - 1345 - rocks
02/725	Target 10 - 1331 - rocks
02/727	Target 10 - 1331 - porcelain bowl
02/730	Target 10 - 1331 - porcelain bowl
02/732	Target 11 - 1449b - rock
02/737	Target 11 - 1449b - oyster shell
02/738	Target 11 - 1449b - weakly bonded cement or compacted silt
02/740	Target 13 - 1449a - oyster shell
02/743	Target 13 - 1449a - 2 iron concretions
02/744	Target 13 - 1449a - iron nodules, possibly slag
02/745	Target 13 - 1449a - thin iron sheet. Casting left.
02/746	Target 13 - 1449a - perfume bottle, recent.
02/748	Target 13 - 1449a - wood, possibly worked. Worm eaten.
02/749	Target 13 - 1449a - plank. Badly worm eaten. No signs of fastenings. Has one straight edge still evident.
02/750	Target 14 - 2020b - ceramic, stoneware
02/752	Target 14 - 2020b - cut wood. Section of branch and trunk.
02/756	Target 16 - 1320 - oyster shell
02/761	Target 16 - 1320 - timber plank
02/768	Target 17 - 2020a- blue window glass
02/779	Target 15 - 2141 - oyster shell
02/787	Target 15 - 2141 - iron fragment
02/788	Target 15 - 2141 - brick
02/792	Target 14 - 2020b - oyster shell
02/793	Target 14 - 2020b - nodules of rock or weak cement
02/794	Target 11 - 1449b - ceramic cup.
02/795	Target 4 - 2106 - wood fragment
02/798	Target 4 - 2106 - wood with plastic adhered to it.

Appendix V Finds Register

頁碼 Sheet No.
 遺址名稱 Site Name:
 遺址代號 Site Code:

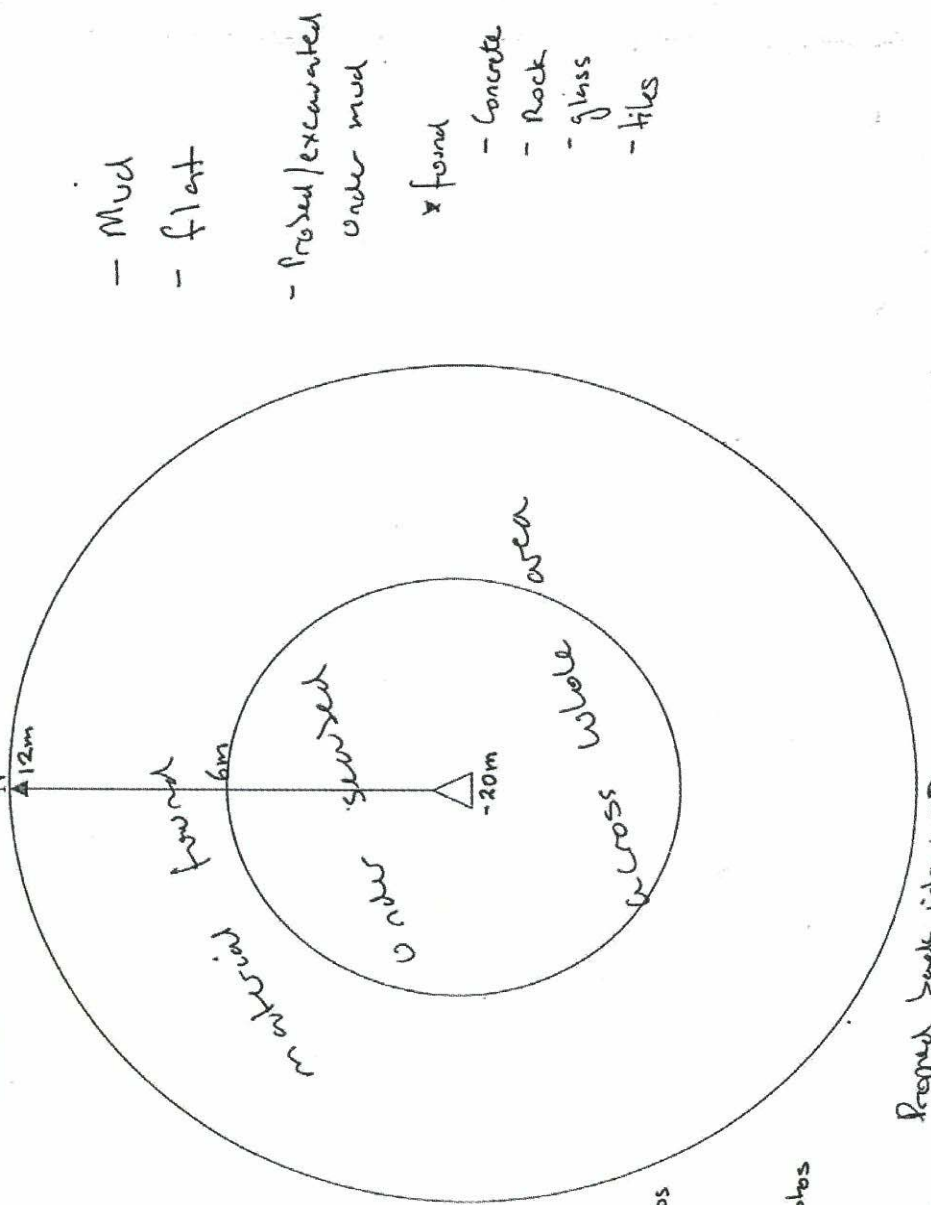
出土器物登記表
 Finds Register

香港古物古蹟辦事處考古組
 Archaeology Division
 Antiquities & Monuments Office
 Hong Kong

編號 Bag No.	埋藏層序編號 Context No.	分區編號 Grid Ref.	日期 Date	器物描述 Field Comments	交實驗室處理 To Lab.	陶器 Pottery	石類 Stone	骨器 Bone	金屬 Metal	瓷器 Porcelain	其它 Other	Initials	廢棄 Disp.
n/a	T11		12/11/02	Near complete Base thrown on wheel and body made by hand. Very poorly made. Light brown fabric with brown slip. Signs of deliberate round hole in side of body. For pouring?		X							
n/a	T14		9/11/02	Base and body. Grey fabric with brown slip. Container for fluids.		X							
				22°21.7355' N 113°55.1666' E									
				22°21.7272' N 113°55.1386' E									

Appendix VI Survey Sheets

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY 100% SPACING (METERS)



Drop - 4m
 Accuracy - 9.6m
 Surface current observed W-E
 Cn < 1kn
 Seabed current mid-strong W-E
 Brought up:
 Window glass x2 } 2 photos
 iron ring, small }
 Buried frog }
 Rocks } 2 photos
 concrete }
 Tiles + mortar } 2 photos
 from exterior of building }
 Propped back into water.

Target 1

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY 100% SPACING (METERS)

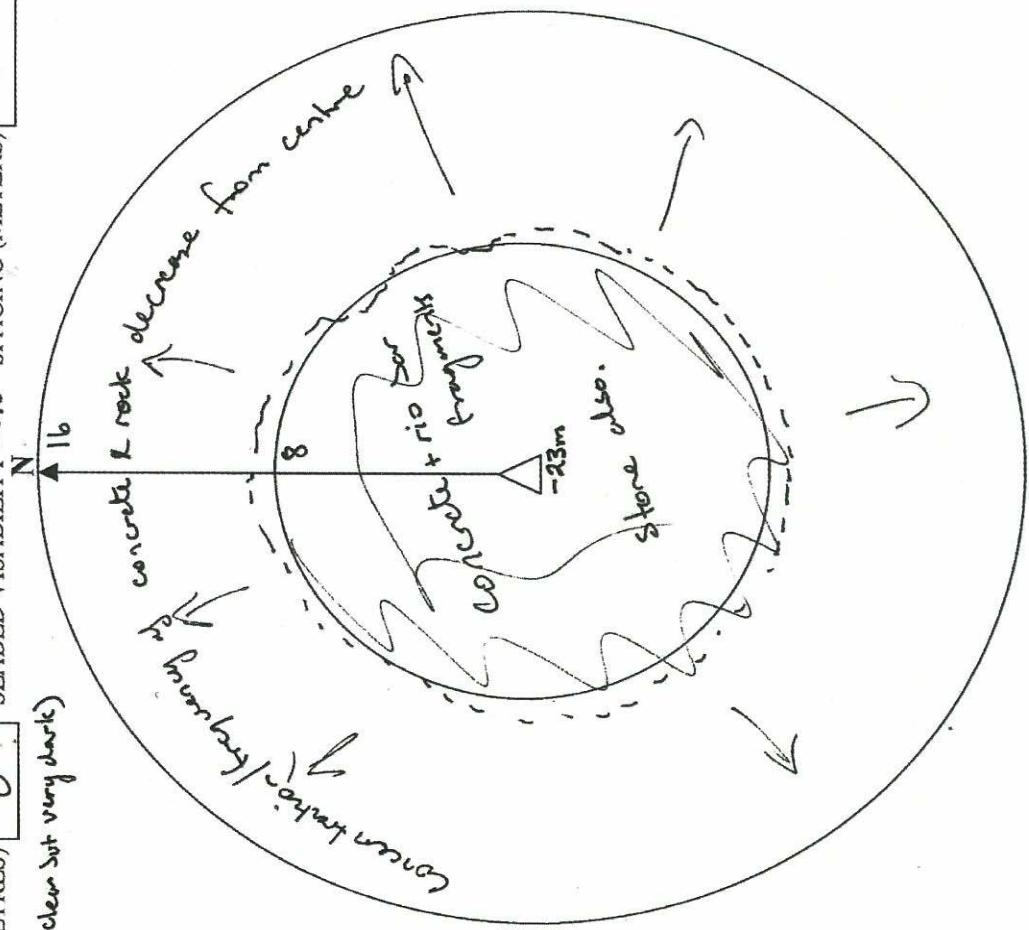
(water clear but very dark)

Prop < 5m
 Acc 12.4m
 Current, sensed
 Strong W-E

Brought up:
 - 3 small angular fragments of granite
 - small fragment of wood.
 2 photos

(Dropped bulk into water)

Target 2

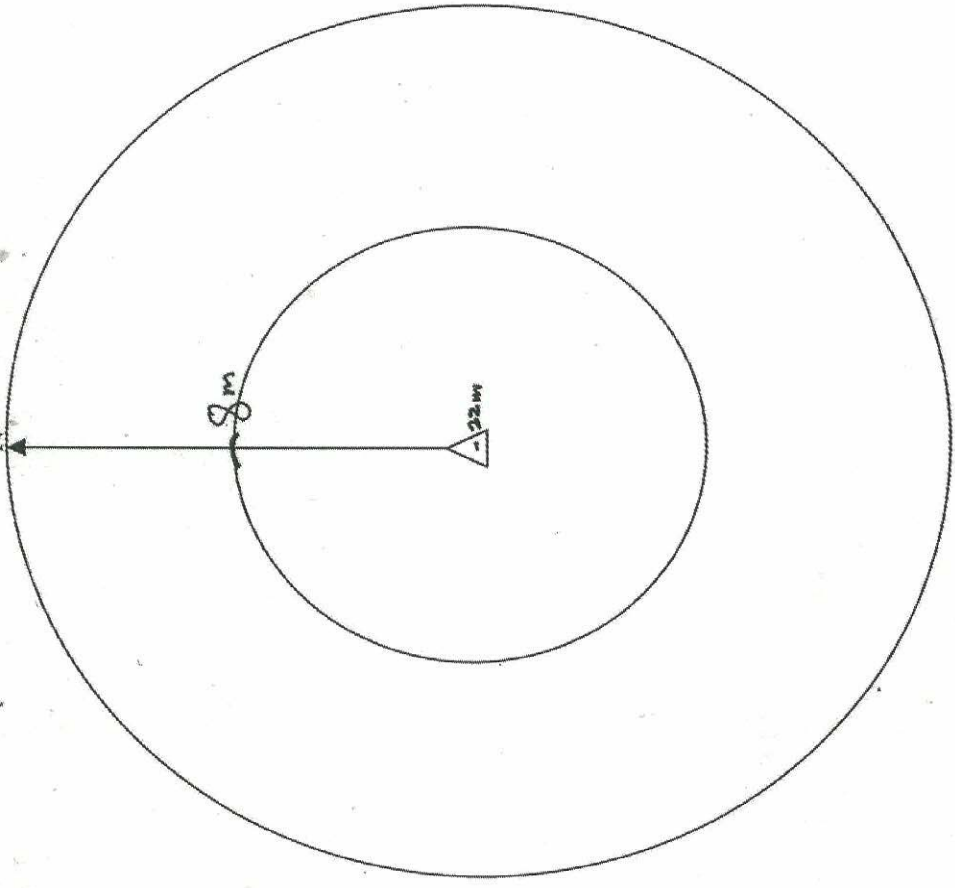


- Mud
 - flat

Top of concrete level with seabed.

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

CURRENT on seabed
 - very strong
 - E to W
 W to E
 Drop - < 5m
 Acc. - 10-1m



- MUD
 - Flat

- Nothing observed except for a few fragments of iron.
 This walked with green paint remnants

Possibly cladding of sorts

- 3 fragments < 10cm size brought up and photographed (3 shots)

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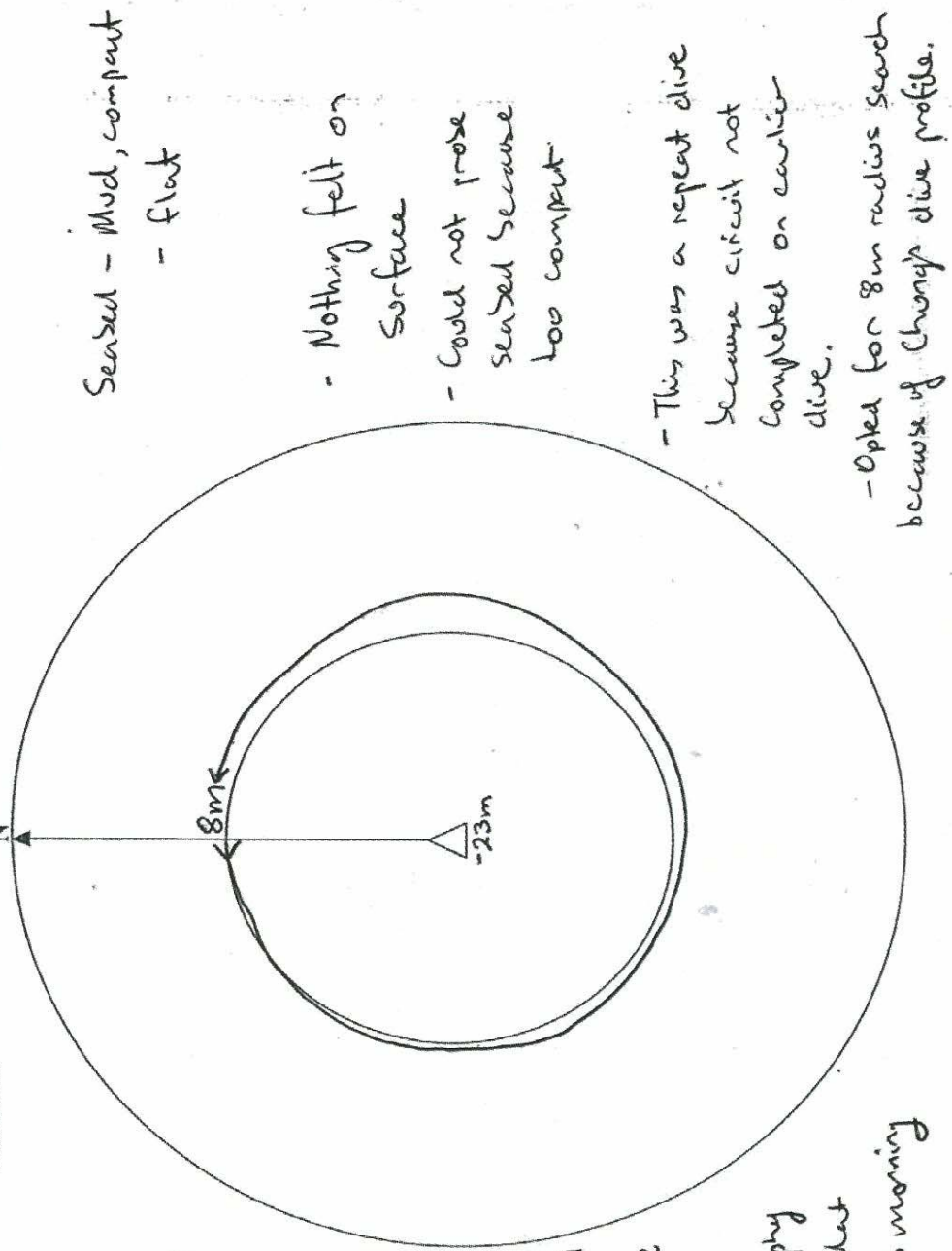
Target 3

UNIT ID: 2106 DATE: 5/11/02 LOCATION: URIMSON Rd.
 START TIME: 2:50 FINISH: 3:06 TOTAL TIME (MIN): 16 RECORDER: CHONG PARTNER:
 WATER VISIBILITY (METRES): 0 SEABED VISIBILITY (100% SPACING) (METERS):

Booy Dropped 4.69m
 GPS Acc 8.9m

Current - Very strong
 W to E

On the way down
 the line, seawise
 of the current,
 the buoy was
 dragged eastwards
 for an undetermined
 distance. An estimate
 over 10m is
 He sensed topography
 was different to what
 was dived on this morning



Target 4

UNIT ID DATE LOCATION

START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER

WATER VISIBILITY (METRES) SEABED VISIBILITY (00% SPACING (METERS))

Buoy dropped - 5m
GPS Accuracy - not recorded.

Strong current in
centre of water
column.

- Mud, compact
- flat mostly, slightly undulating

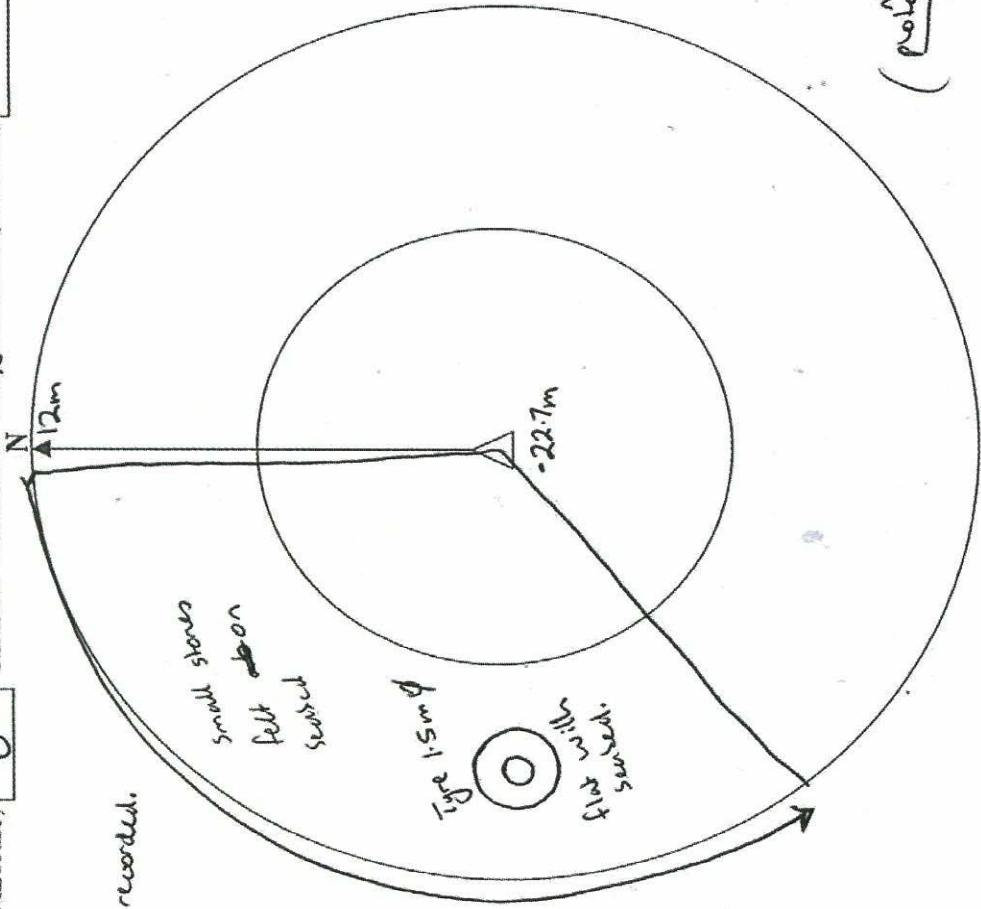
Peeling down to
0.5m

Recovered:

* Many small angular
granite stones.

* Fragment of bitumen
(old road surface!)

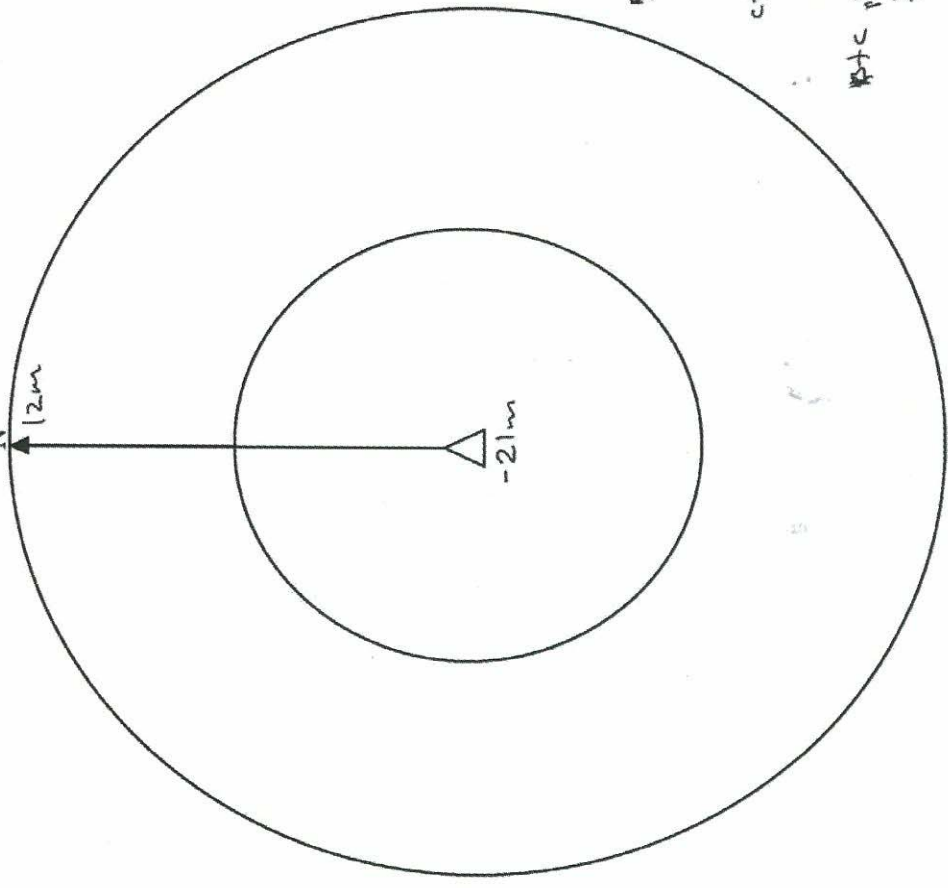
(^{Not} ~~photographed~~ ~~and~~ returned to
site seized.)



Target 4

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY

Case 89m
 Buoy 5m



- Mud, flat
 very soft
 - Penetrated to limit
 of arm, 0.5m, and
 still soft mud.

Recovered:

A x Small stones (x5)
 not photographed,
 thrown back

B x Badly waterworn
 wood fragment.

c x Metal tin with plastic
 on it.

etc photographed + kept for
 time being.

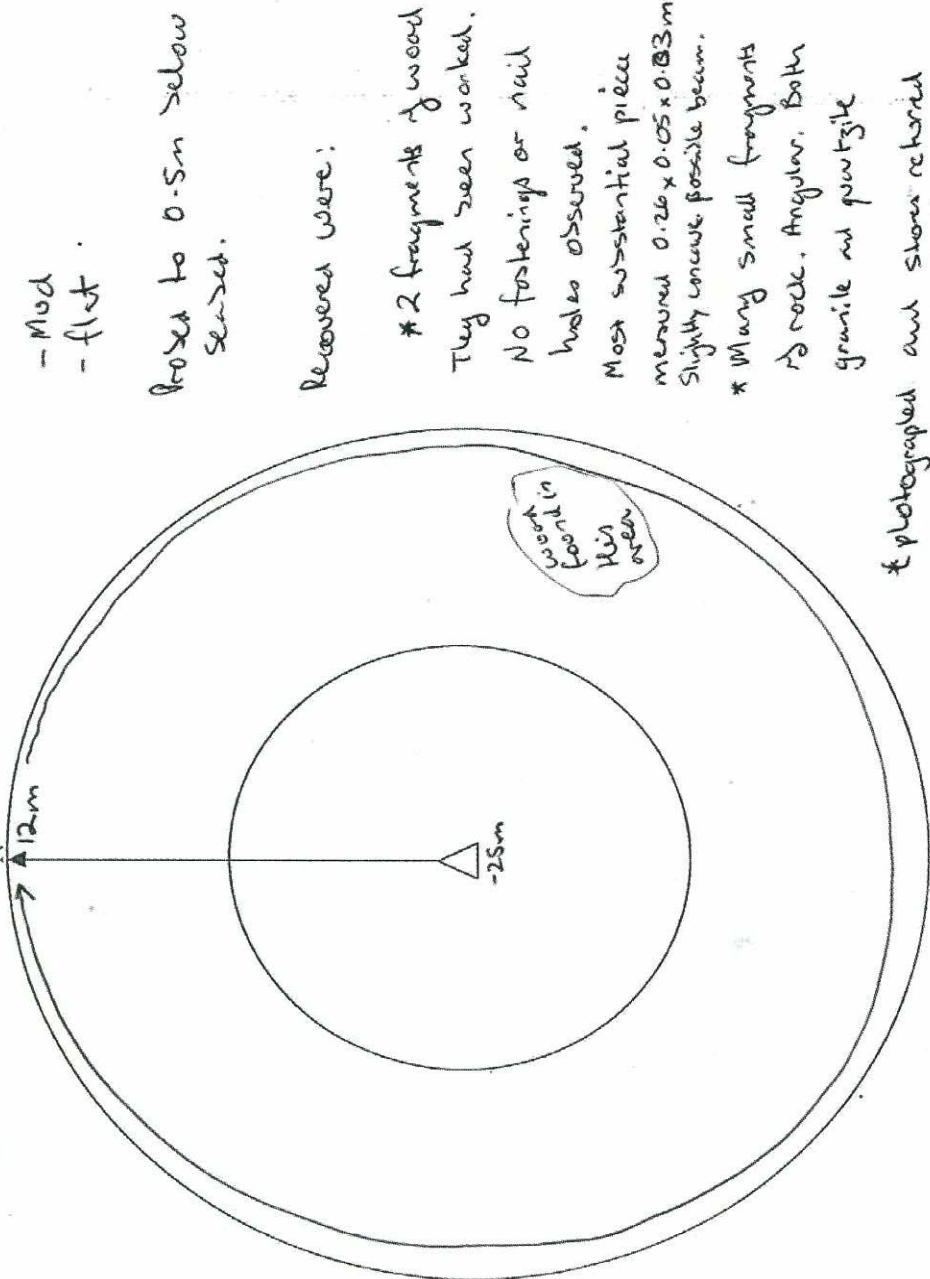
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Target 4

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

Buoy dropped - 5m
 GPS Accuracy - 10.6

Seabed Current -
 Strong



- Mud
 - flat

Probes to 0.5m below seabed.

Recovered were:

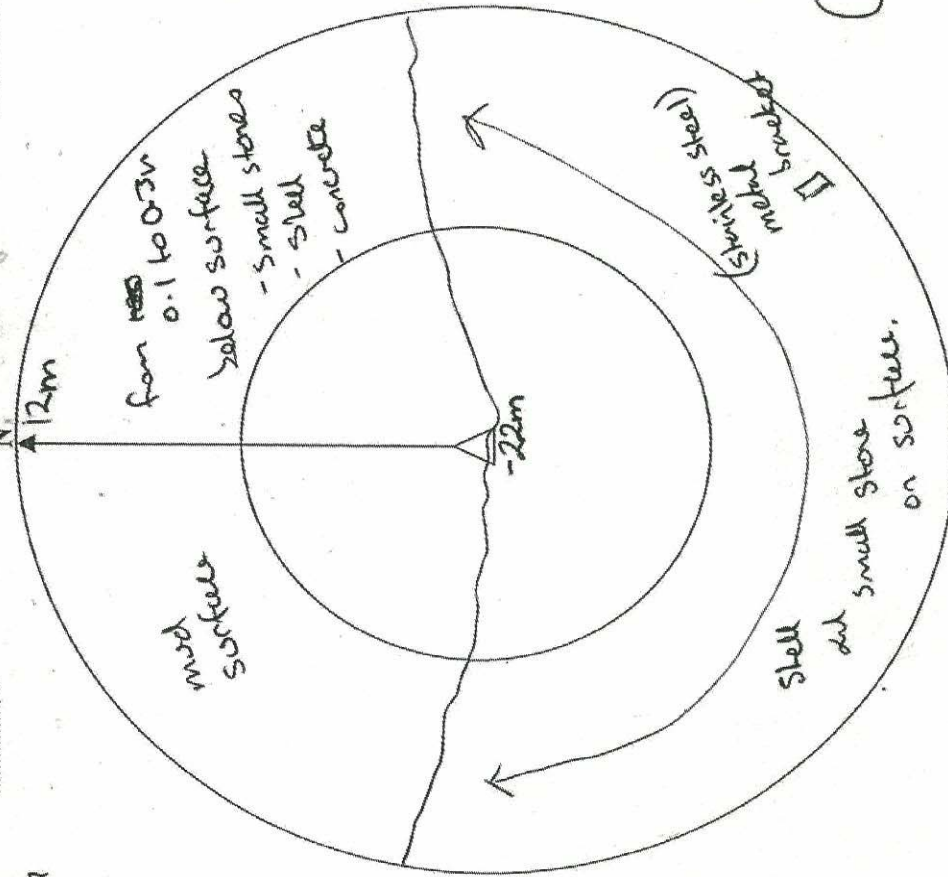
- * 2 fragments of wood They had been worked.
- NO fastenings or nail holes observed.
- Most substantial piece measured 0.26 x 0.05 x 0.03m Slightly concave possible beam.
- * Many small fragments of rock. Angular. Both granite and quartzite

* Photographed and stored returned to seabed. Wood kept for the moment

Target 5

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

GPS accuracy 8.9
 Buoy drop 5.82



- Mud
- flat

Recovered -

- small stone, angular x granite
- concrete fragment
- small pieces of what looked like bar.
- stainless steel bracket.

(Not photographed.)
 All thrown back.

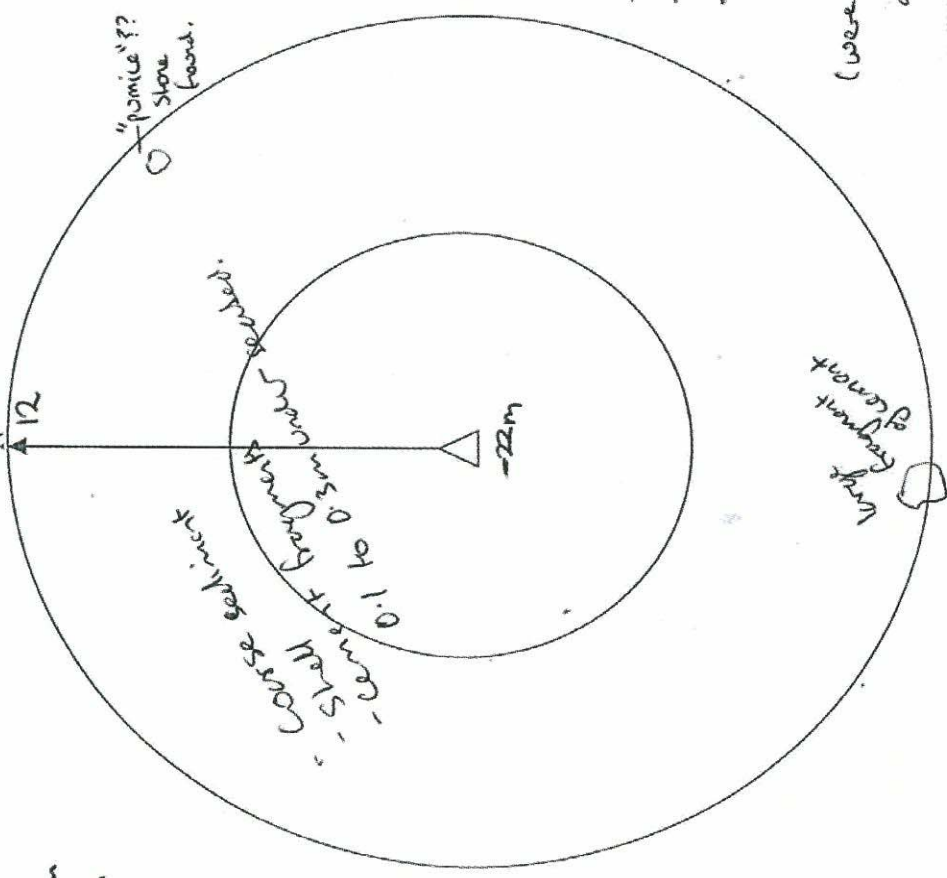
Chart published by the

Target 6

02

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY (80% SPACING (METERS))

GPS accuracy 8.6m
 Buoy drop 5.82m



Probed to 0.1 to 0.3m below seabed, to find materials.

Recovered were:

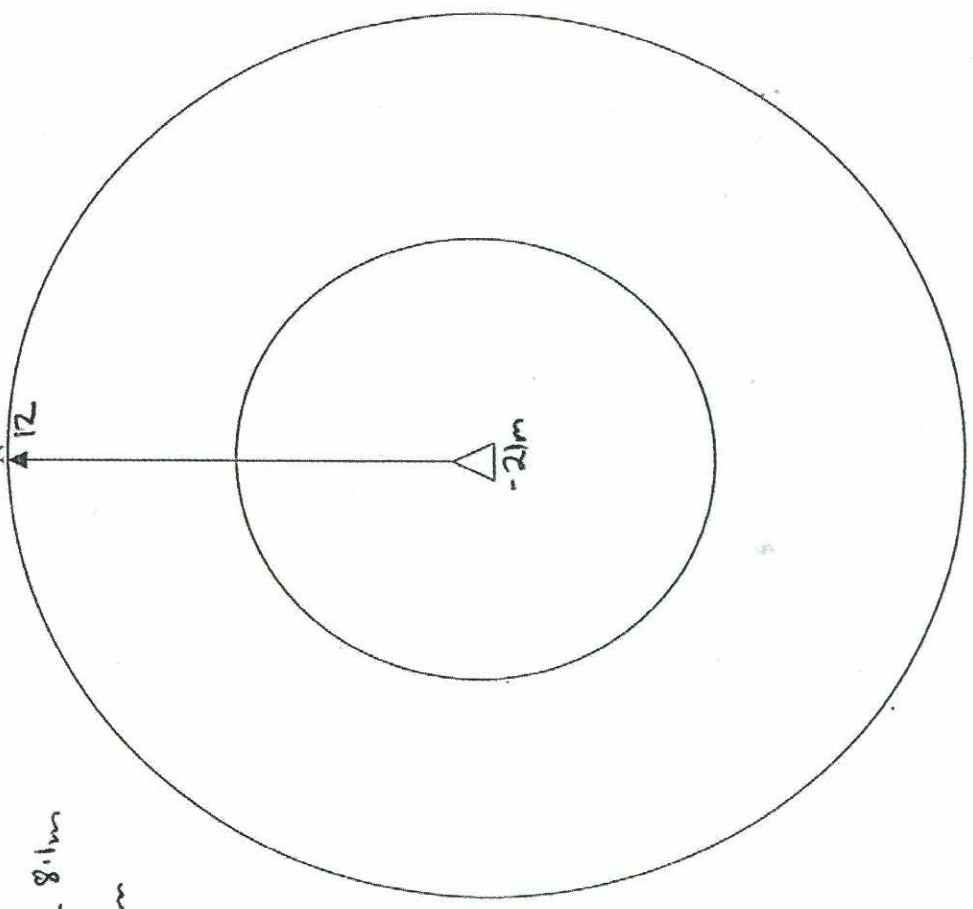
- coarse pebbly sediments
- shell
- cement
- round light weight stone, possibly pumice

(were not photographed and thrown back into water)

Target 7

UNIT ID 1705 02 LOCATION URMSTON Rd.
 DATE 8/11/68
 START TIME: 2:47 FINISH: 3:06 TOTAL TIME (MIN): 19 RECORDER CHUNG PARTNER
 WATER VISIBILITY (METRES) 0 SEABED VISIBILITY (00% SPACING (METERS))

CPS accuracy - 8.1m
 Buoy drop - 5m



- MUD
 - flat

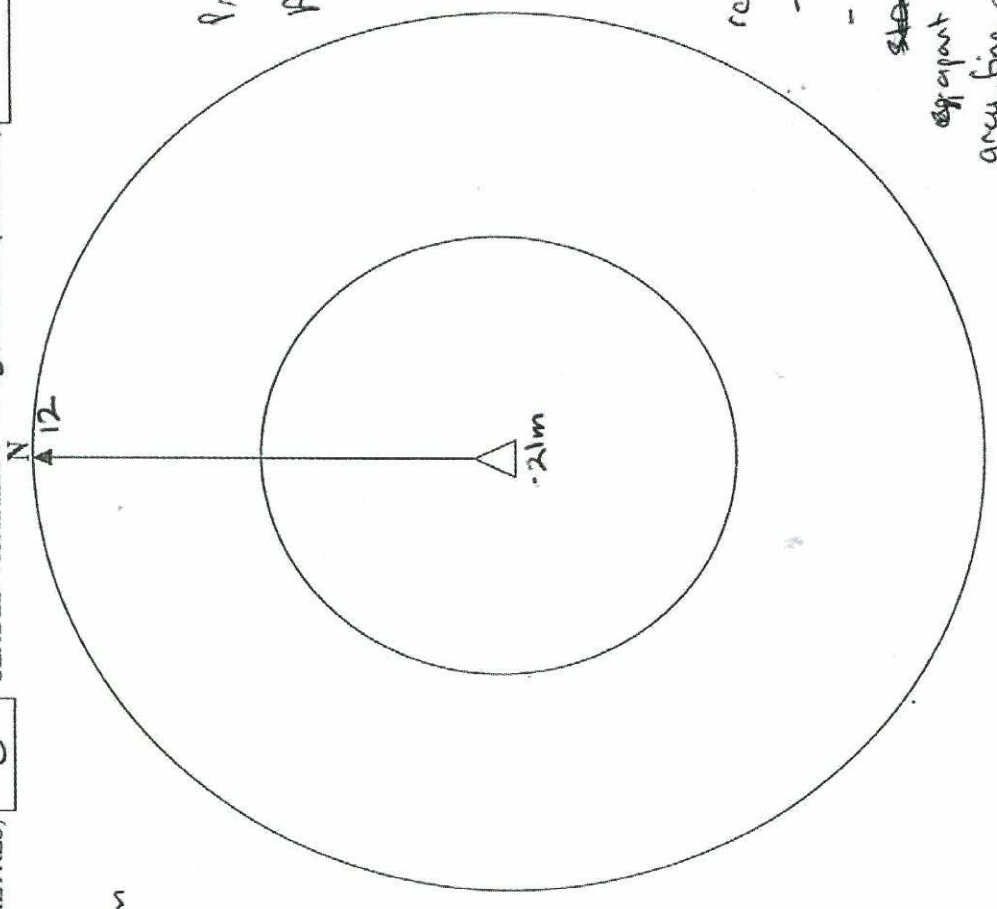
~~below~~
 At 0.1m below seabed - coarse gravels - sand.

Nothing found or brought up.

Target 8

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISABILITY (METRES) SEABED VISABILITY 100% SPACING (METERS)

GPS Acc. 9.1m
 Buoy dropped. 5m



- Mud
 - flat.
 Probed below seabed.
 At 0.1 to 0.2 felt:
 - middle size rocks
 (70-80%)
 > 0.1 < 0.2m
 - Sand
 as well as occasional
 rocks at between
 0.5 to 1.0m
 recovered:
 - some middle size rocks
 - and small cement-like
 objects. When broken
 fragment core showed homogeneous
 grey, fine grained cement as
 compacted silt?

Target 9

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

Buoy dropped. 5m
 GPS accuracy 7.4m

Current report at mid depth to be strong W to E?

x rocks - photographed. x 2
 - angular, granite
 x Basin - photographed. x 6

- Basin retained for the moment.

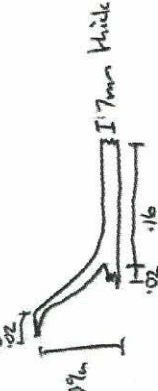
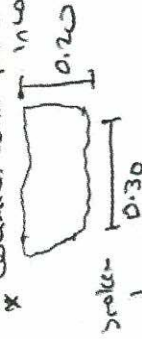
- rock rubble sealed.

- size of rock up to 0.6 to 0.7m.

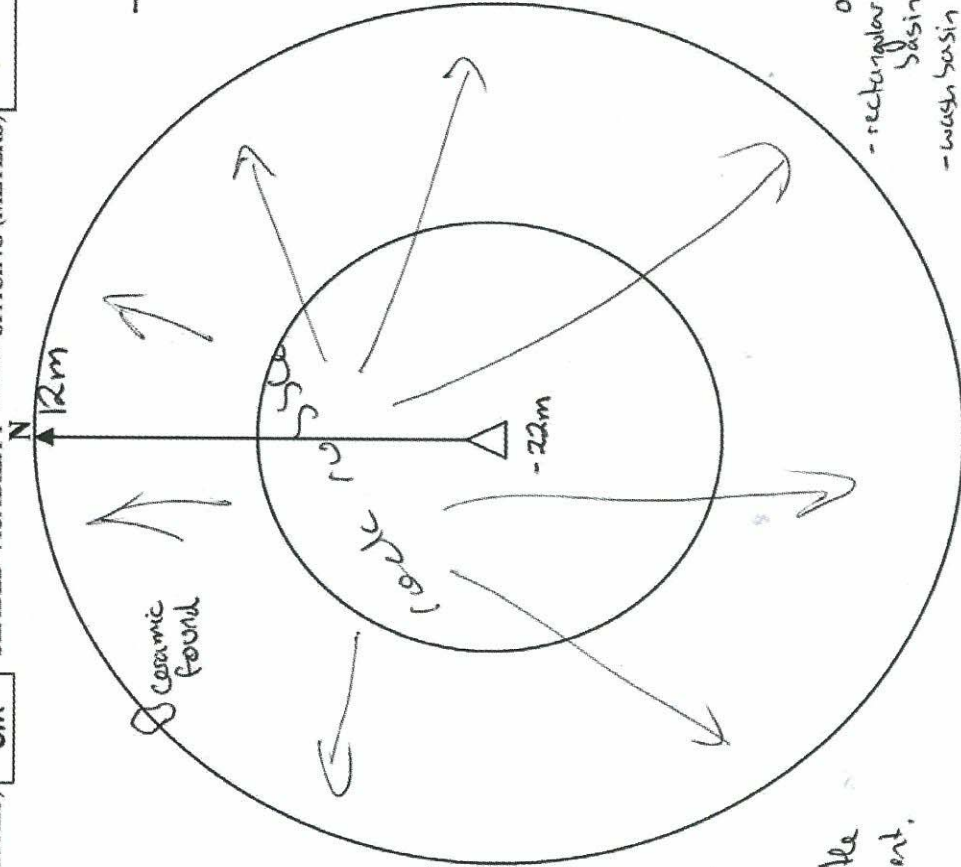
Recovered:

x 3 small rock fragments

x Ceramic. White porcelain incomplete



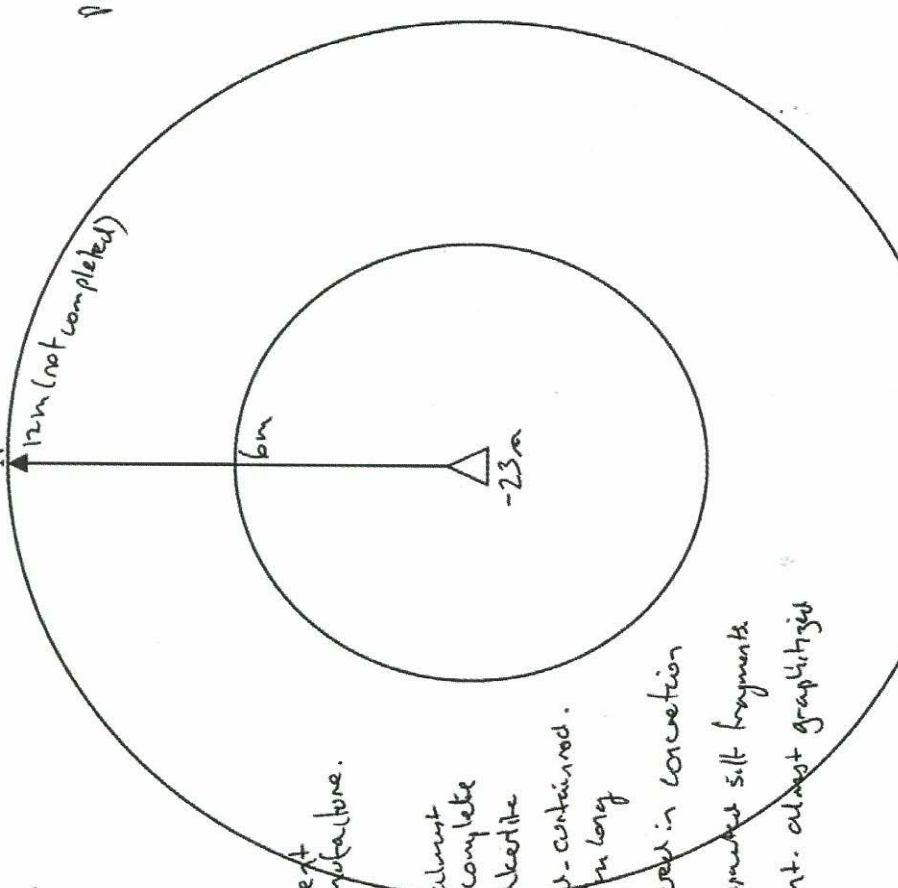
- rectangular basin
 - wash basin or Cosmos Archaeology Pty Ltd part of cistern?



Target 10

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

- Mud, flat
 Penetrated .0.2 to 0.3m
 below seabed. at this
 point slightly compact
 and lot of shells.

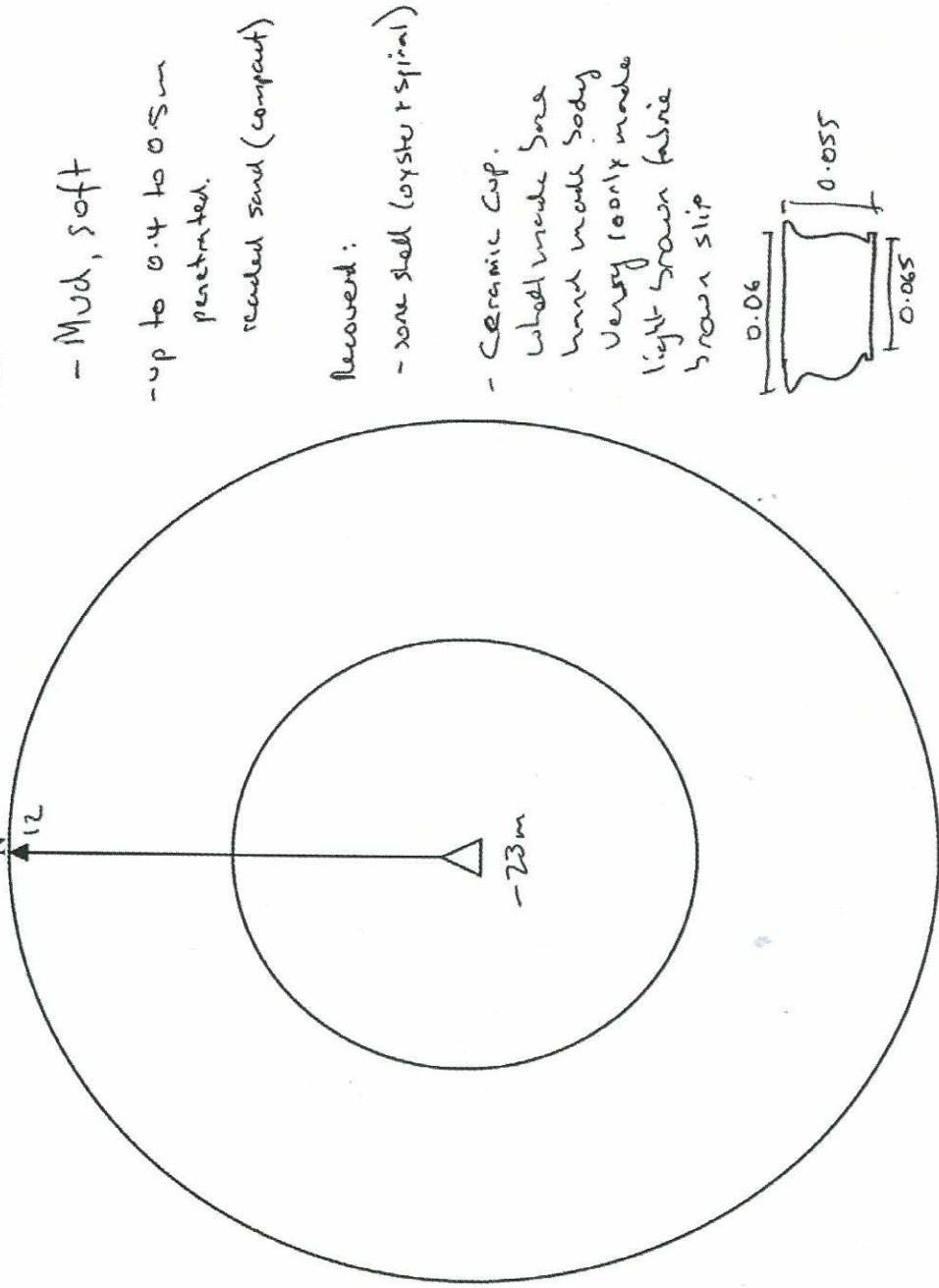


- GPS acc - Not recorded.
- Buoy - 5m.
- Recovered:
 - * oyster shell + spiral shell
 - * large binnacle, 5cm long.
 - * 1/2 small porcelain cup, recent manufacture.
 - * Brick fragment.
 - * clear glass "milk bottle" - almost complete
 - * synthetic fragment, like bakelite
 - * Al rod with fabric attached - contained rod. $\phi 0.02m$ ~ 10.57m long
 - * fragment of iron rod covered in concretions
 - * 2 large cement or concrete silt fragments
 - * 1 wrought iron fragment. almost graphitized
 - * 1 rod

- NOT PHOTOGRAPHED BECAUSE CAMERA NOT WORKING.
 - ALL thrown back.

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

GPS - 8.9m
 Buoy drop - 5m



Ceramic cup
 kept & photographed.

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UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY 50% SPACING (METERS)

Pop Buoy - 5m

Accuracy GPS - not recorded

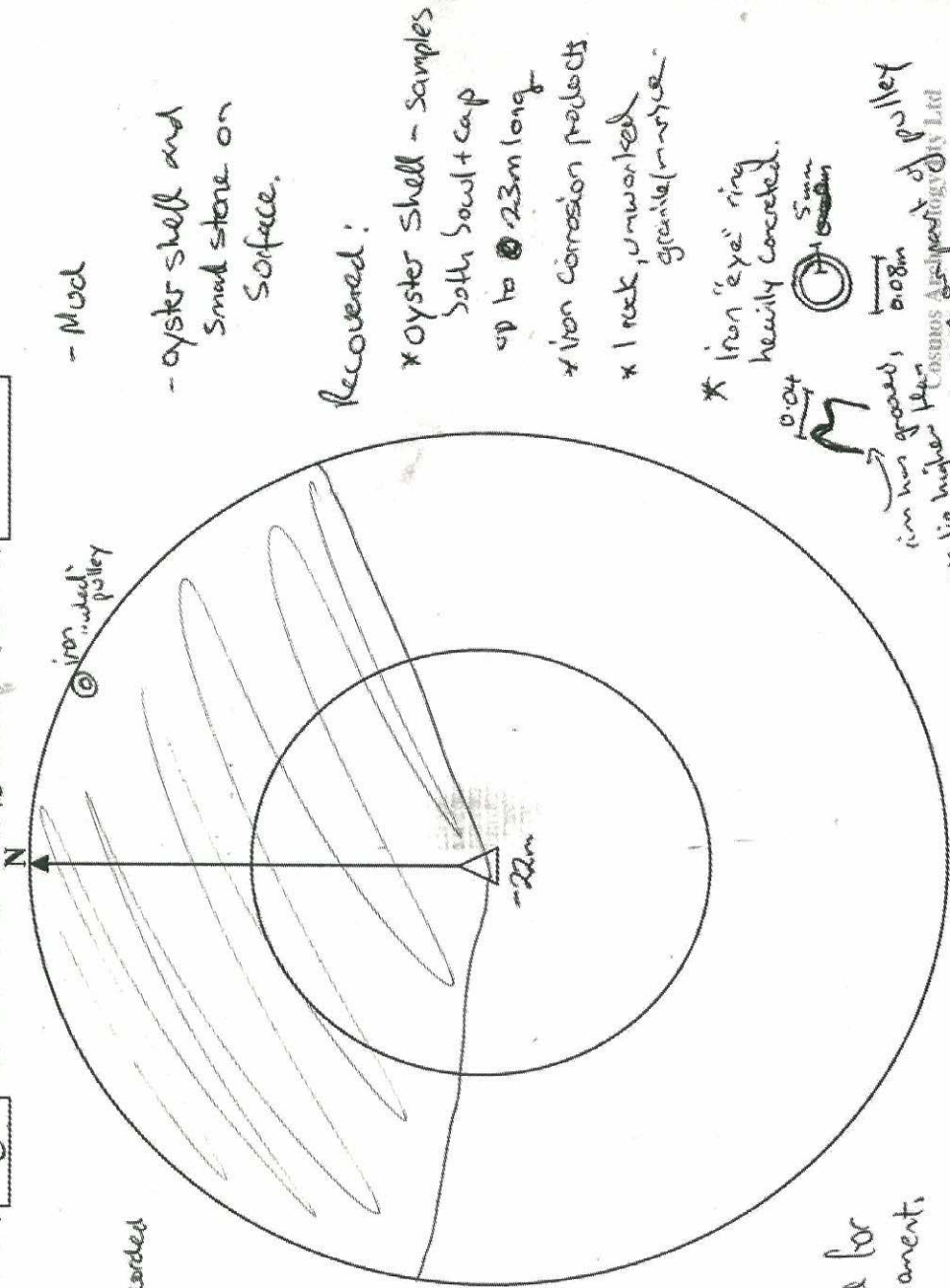
- Strong current on seabed.

- Dive aborted.

Objects photographed.

- oyster, rock & iron connections thrown south.

- Iron wheel retained for moment.



- Mud

- oyster shell and small stone on surface.

Recovered:

* Oyster shell - samples

both south & cap

up to 23m long

* iron corrosion products

* 1 rock, unworked

granite/marble

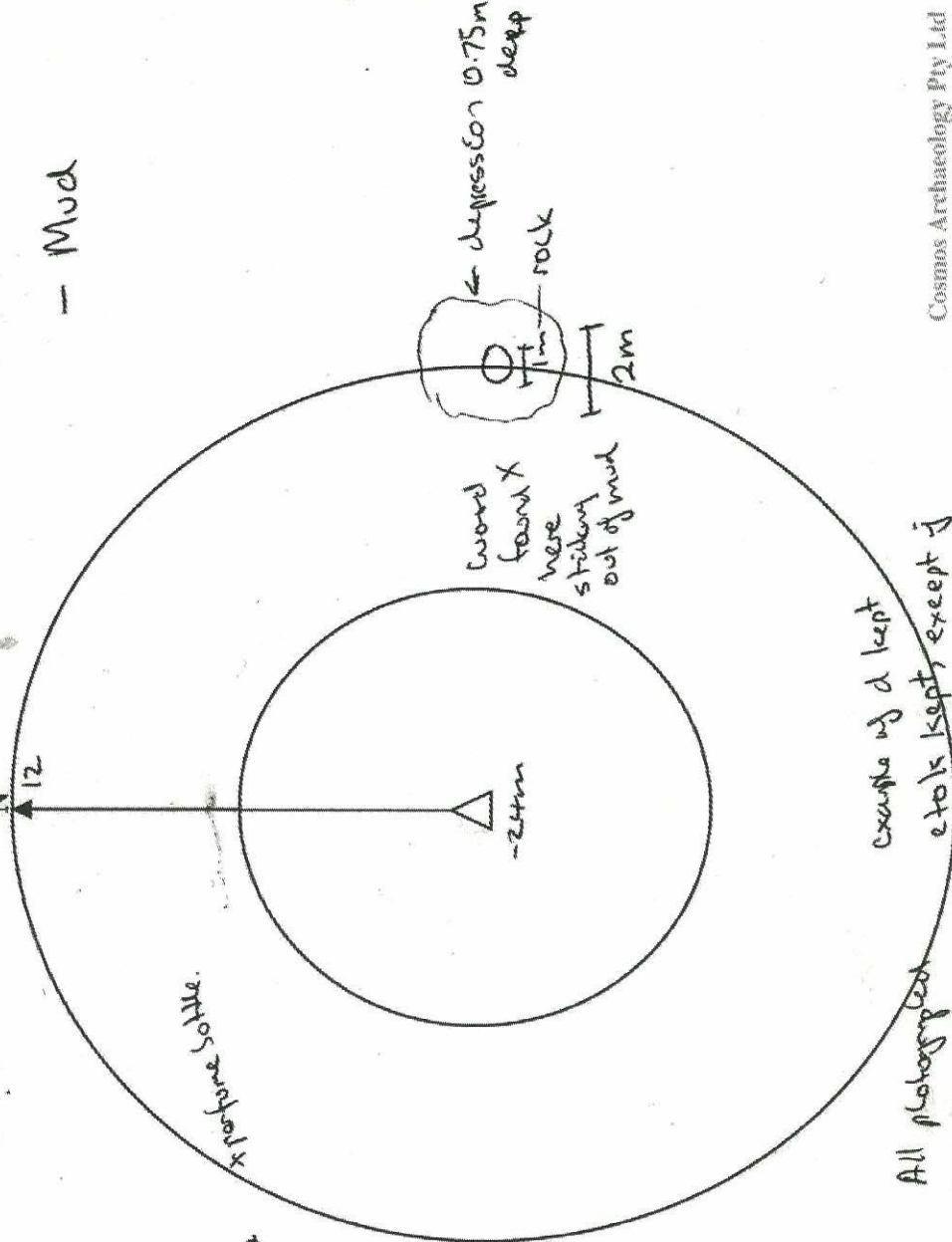
* Iron "eye" ring heavily corroded.



iron has grooves 0.08m one lip higher than other. likely eye of propeller
ASTROS Aerospace Pty Ltd

UNIT ID 1449 DATE 9/11/02 LOCATION ARMSTON RD
 START TIME: 3:07 FINISH: 3:23 TOTAL TIME (MIN): 17 RECORDER HUNU PARTNER —
 WATER VISIBILITY (METRES) 0 SEABED VISIBILITY SPACING (METERS) —

— Mud



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GPS Acc - 9.9m
 Bouy - S.Dn

Recovered:

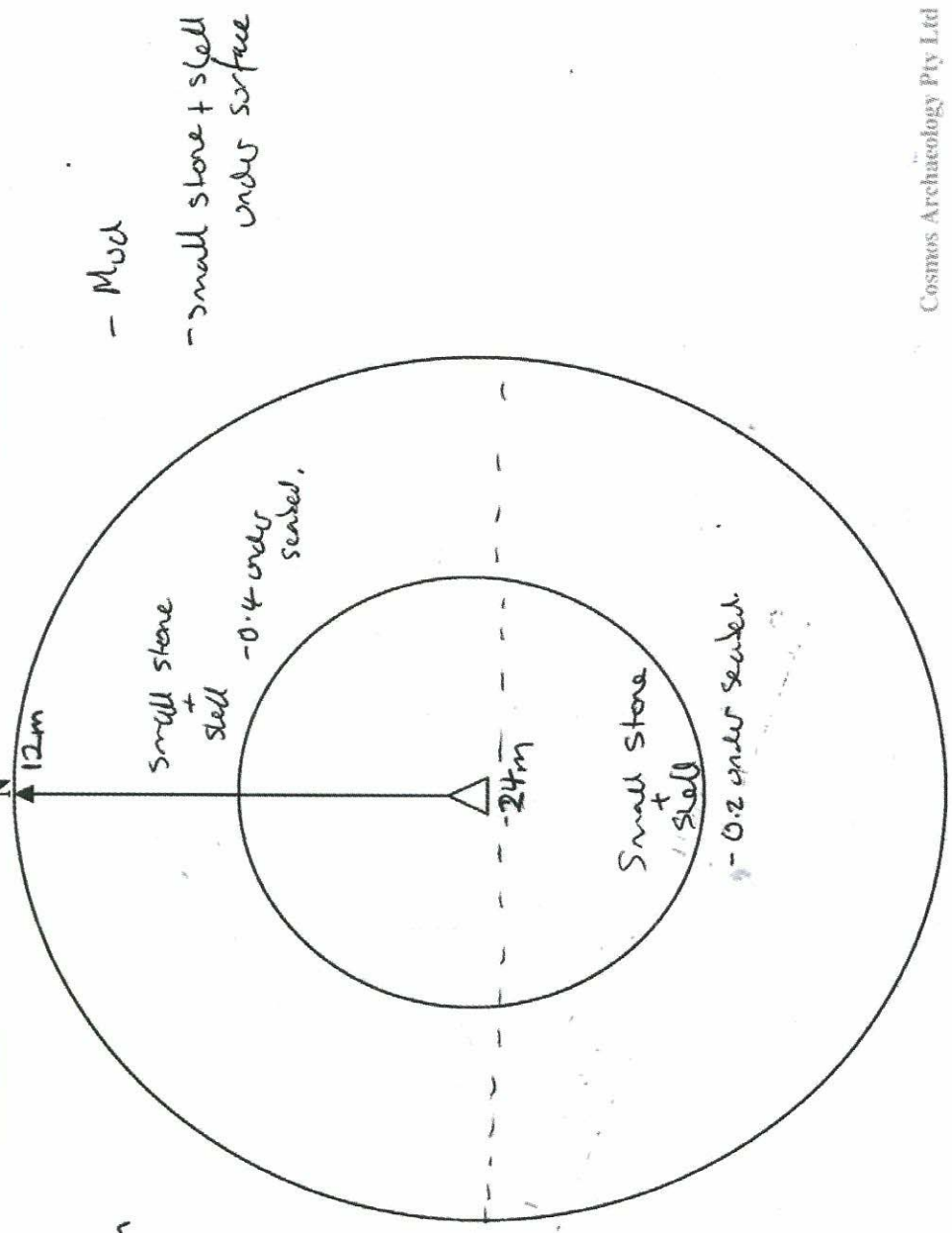
- a/ 3x stone fragments (1 basalt 2 quartz)
- b/ oyster shell, largest example 36cm
- c/ iron concretions x 2
- d/ iron nodules, mostly slag. x 3
- e/ Compacted silt nodules
- f/ thin iron sheet - casting only + iron ingot.
- g/ Pottery Siltie.
- h/ Plywood
- i/ wood, worked?
- j/ timber fragments
- k/ timber planks.

Target 11

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

Booy dropped - 5m
 GPS accuracy - 9.1m

Mid strength
 current

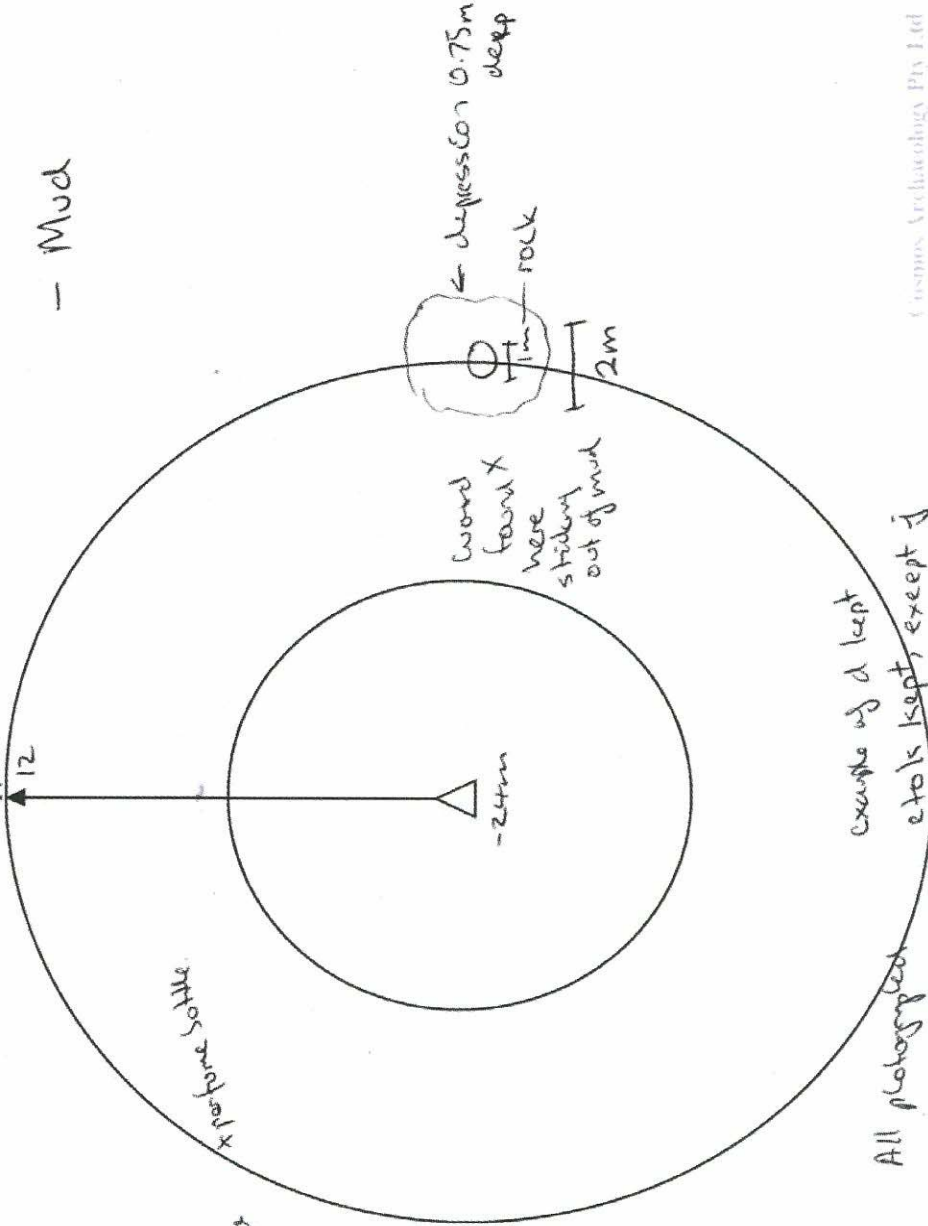


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Target 12

UNIT ID 1449 DATE 9/11/02 LOCATION WARMSTON RD
 START TIME: 3:07 FINISH: 3:23 TOTAL TIME (MIN): 17 RECORDER HUNIC PARTNER —
 WATER VISIBILITY (METRES) 0 SEABED VISIBILITY SPACING (METERS) —

— Mud



GPS Acc - 9.9m
 Bouy - S.Dm

Recovered:

- a/ 3x stone fragments (1 basalt 2 quartz)
- b/ oyster shell, largest example 36cm
- c/ iron concretions x 2
- d/ iron nodules, mostly slag, x 3
- e/ Computed silt nodules
- f/ thin iron sheet - casting only - iron ore.
- g/ Perforated bottle.
- h/ Plywood
- i/ wood, worked?
- j/ timber fragments
- k/ timber plank.

Target 13

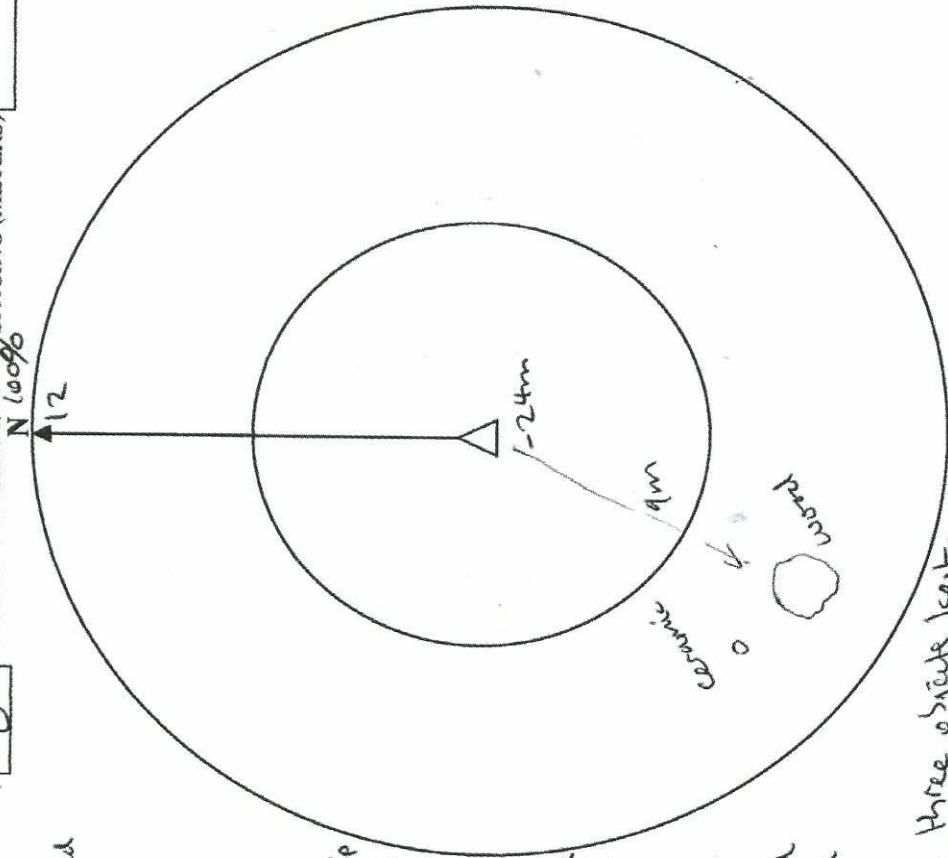
UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

Caps all. - not recorded
 Booy - 5m

Recovered:

- Ceramic. Stone ware
 - metal body. brown slip
 - metal container, fluted
 - greyish core.
- fragment of timber
 - could be branch/trunk
 - however has been cut
 - possibly grown knee.
 - Bunt.
- In area where wood
 - found was found a
 - Burnacle.

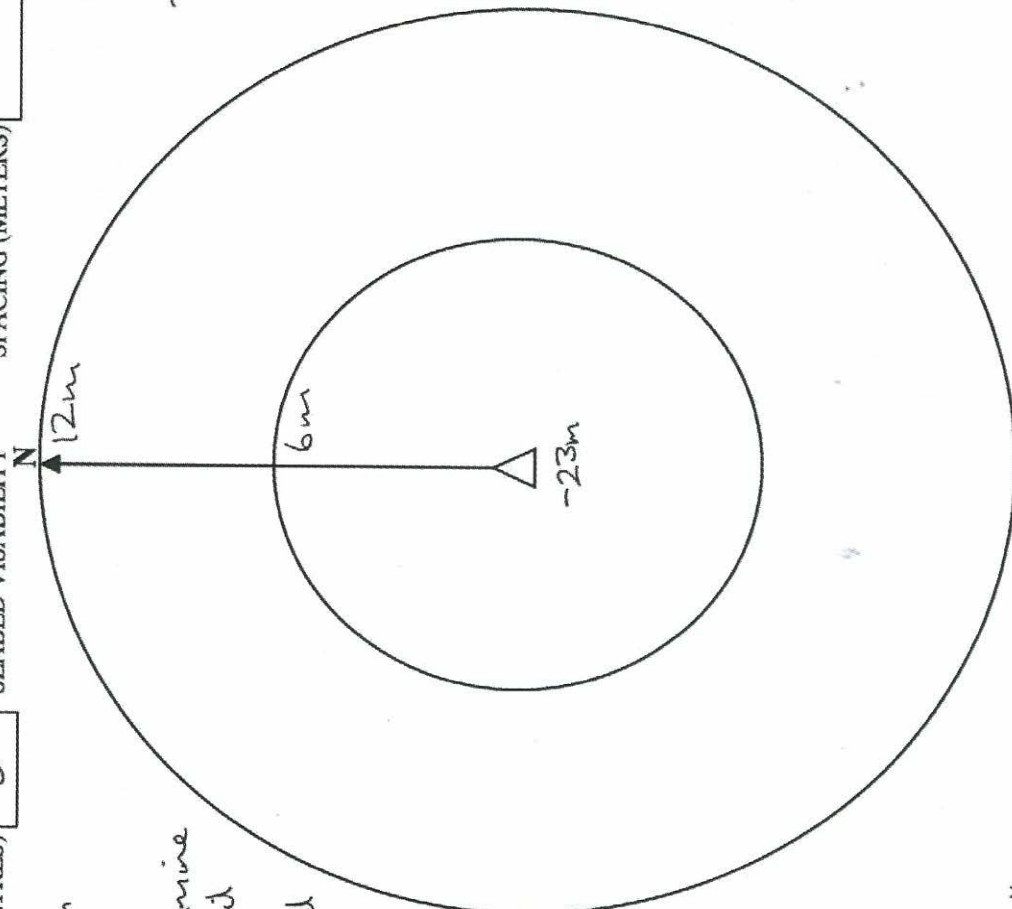
- Mud, soft.
- flat
- 0.3m under seabed.
- shell, lots of
 - not much
 - stone.
- no current.



All three objects kept.

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

- GPS accuracy - 8.0m
- Buoy drop 5m
- Repeat dive to examine area in more detail
- a) Oyster shell + spiral shell (0.32m long)
- Examples photographed.
- b) Small stone - quartz like
- c) Dark grey fine grained Stone or compact silt
- d) Rubber hose with iron rod inside
- e) Nodules of rock or concrete??
- f) Brick fragments
- g) Worn fragments.
- h) Iron corrosion coated silt nodules.



All artefacts/objects known sunk in water.

Target 14

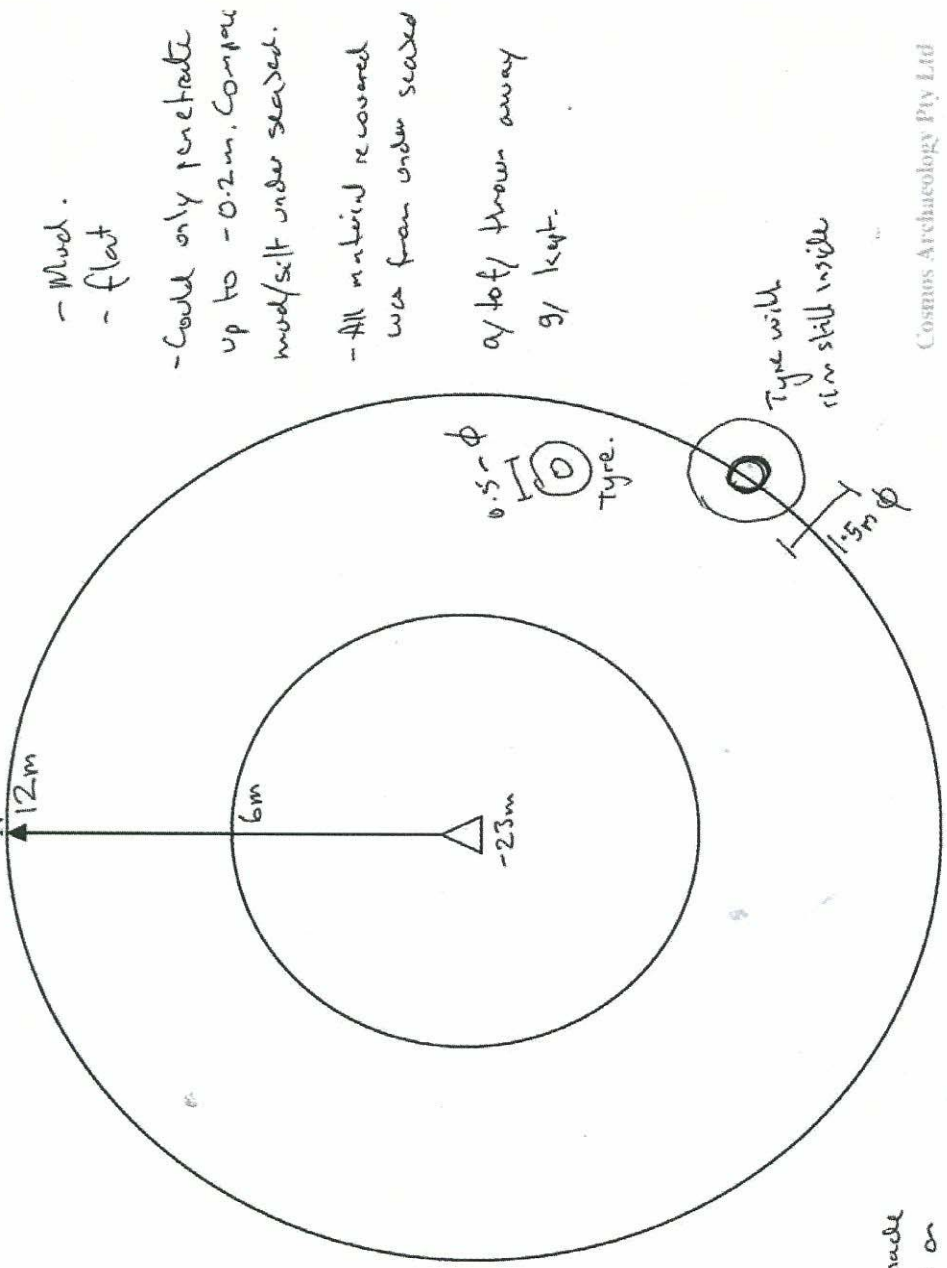
UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

Booy - 5m
 GPS - 8.4m

Recover:

- oyster shell. Smaller than those seen before. Also spiral shell. Example photographed only
- Small rocks - Quartz like X2 + Basalt-like x1.
- Coral fragment. Most have been transported here.
- 1 Iron fragment
- 1 Iron concretion
- 4 Iron 'slag', plenty of. Examples photographed only

g/Brick
 Hand fired sandstone as dry pressed. Large barnacle growing on it. Not grown on site. Brick must have been in water when barnacles grew



- Mud.
 - flat
 - could only penetrate up to -0.2m. Compou mud/silt under seabed.
 - All material recovered was from under seabed
 oyster thrown away
 g/ kept.

Tyre with rim still inside

Target 15

UNIT ID DATE LOCATION

START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER

WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

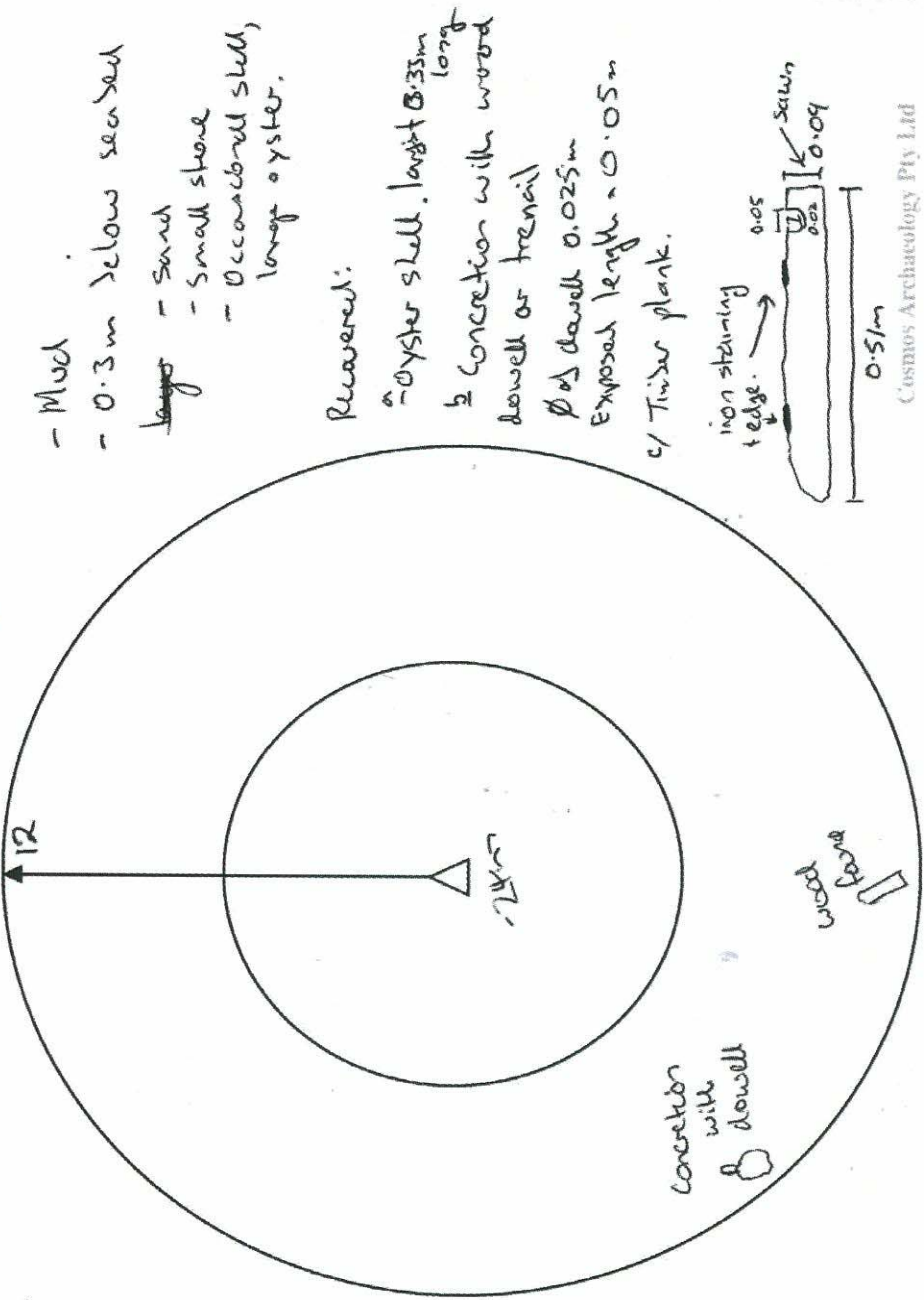
GPS accuracy 9.3 m
Divey - 5m

~~Little~~
Minor current

A/5/9 photographed
Diffs Example of 9/ only.

A/ Thrown back

B/4/ kept.



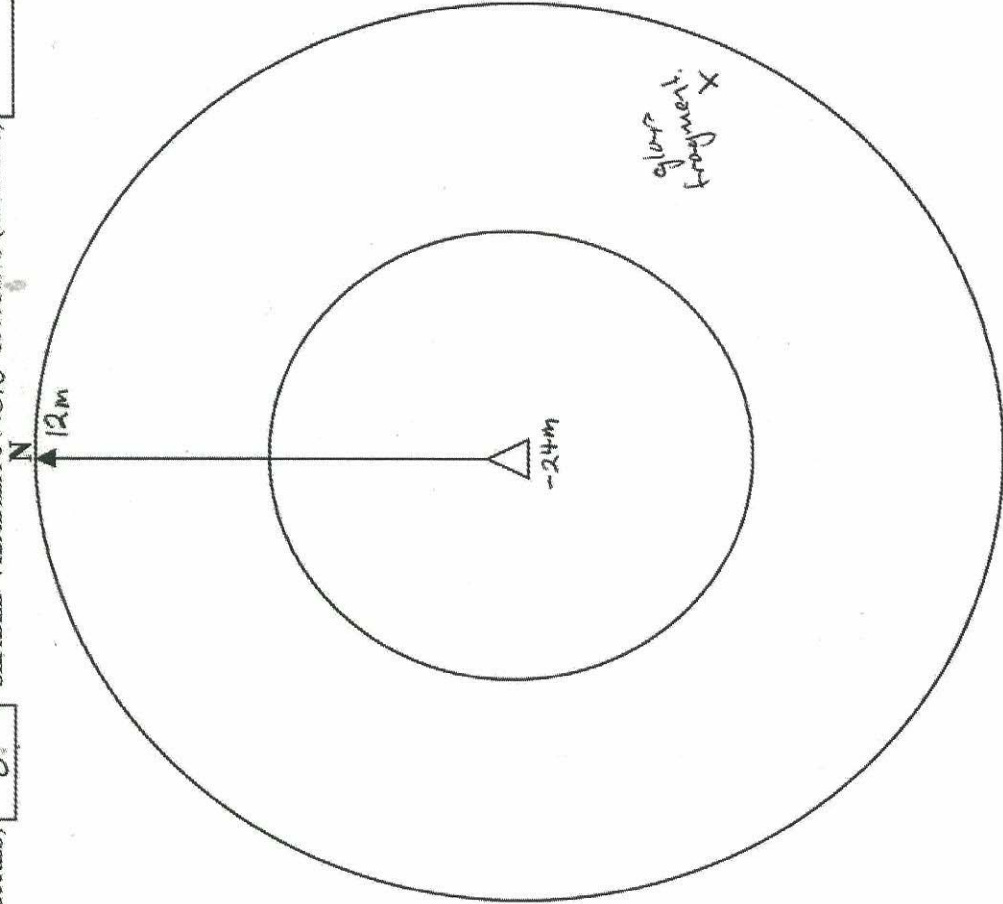
Cosmos Archaeology Pty Ltd

Target 16

UNIT ID 2020a DATE 10/11/02 LOCATION Camston Rd
START TIME: 3:11 FINISH: 3:24 TOTAL TIME (MIN): 13 RECORDER Hung PARTNER ---

WATER VISIBILITY (METRES) 0 SEABED VISIBILITY (100% SPACING (METERS)) ---

GPS 93m
Buoy 5m



- ~~Mud~~ Mud/sand compact
 - could only penetrate 0.1m below seabed.
 - occasional - oyster shell - small stone.
- Recovered:
- glass, blue, window fragment

glass
blue
window
fragment X

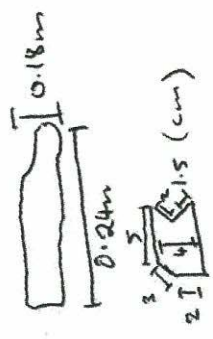
Target 17

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

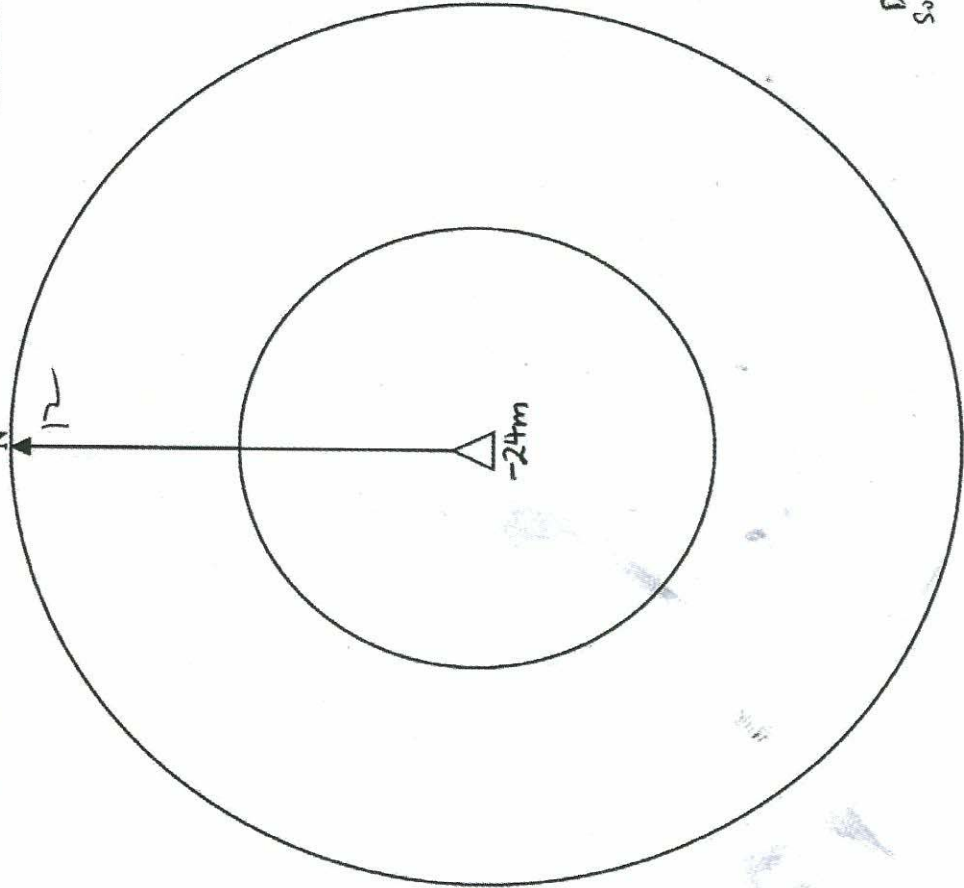
Buoy - 5m
 GPS - 9.1m

- Mud, compact
 - could not penetrate/move.

Recovered:
 2 small rocks x 2
 one was a small river pebble,
 the other a porous white
 rock.
 by Fran 'slog' connection
 c/ Trailer, Squared.
 No worm damage



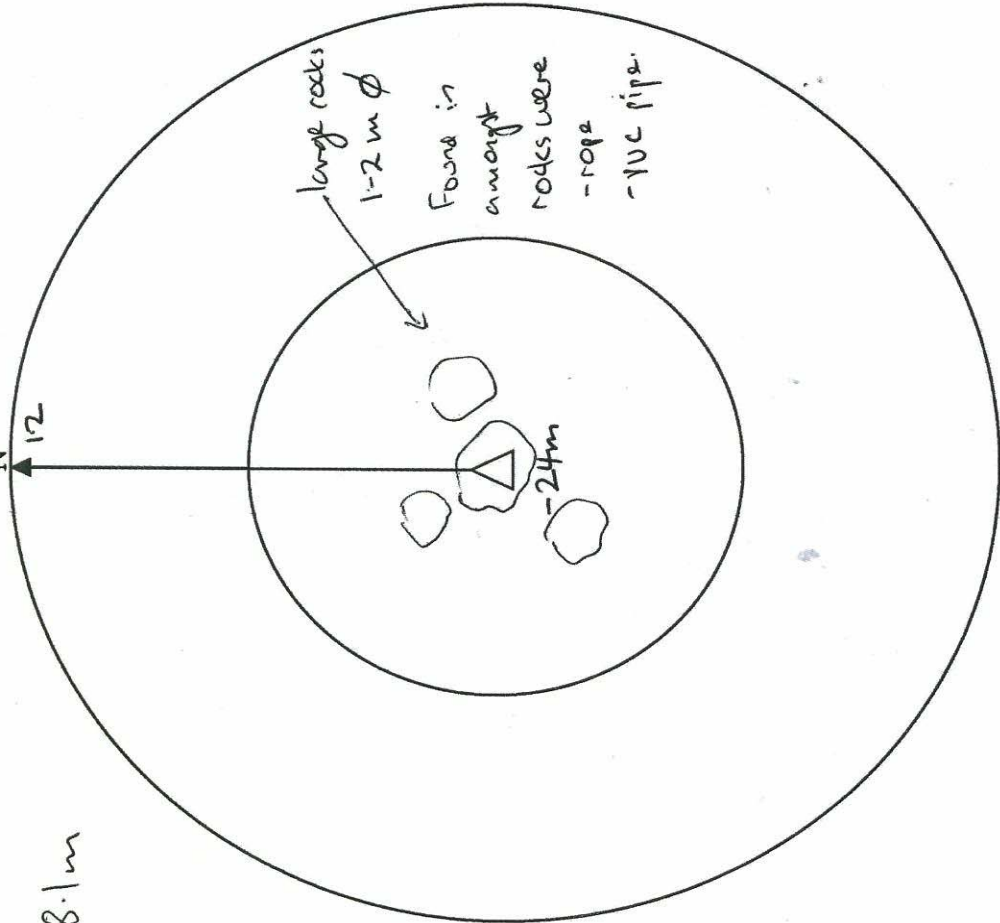
Dark hardwood, found on
 surface. Notiller very long.
 Cosmos Archaeology Pty Ltd



Target 18

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

GPS accuracy 8.1m
 Buoy = 5m



- Mud compact
- flat except where rocks are - undulating instead
- could not penetrate because mud to compact.

Target 19

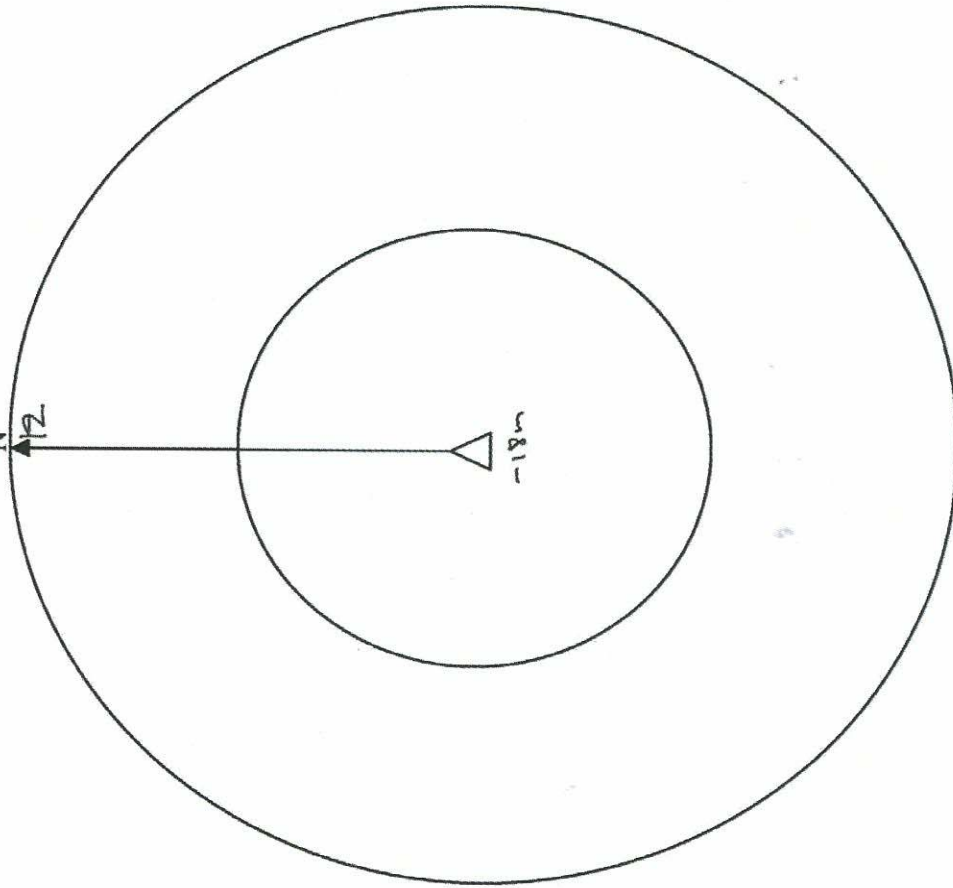
UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

GPS Acc - 8.5m

Buoy - 5m

- MUD, silt
- flat.

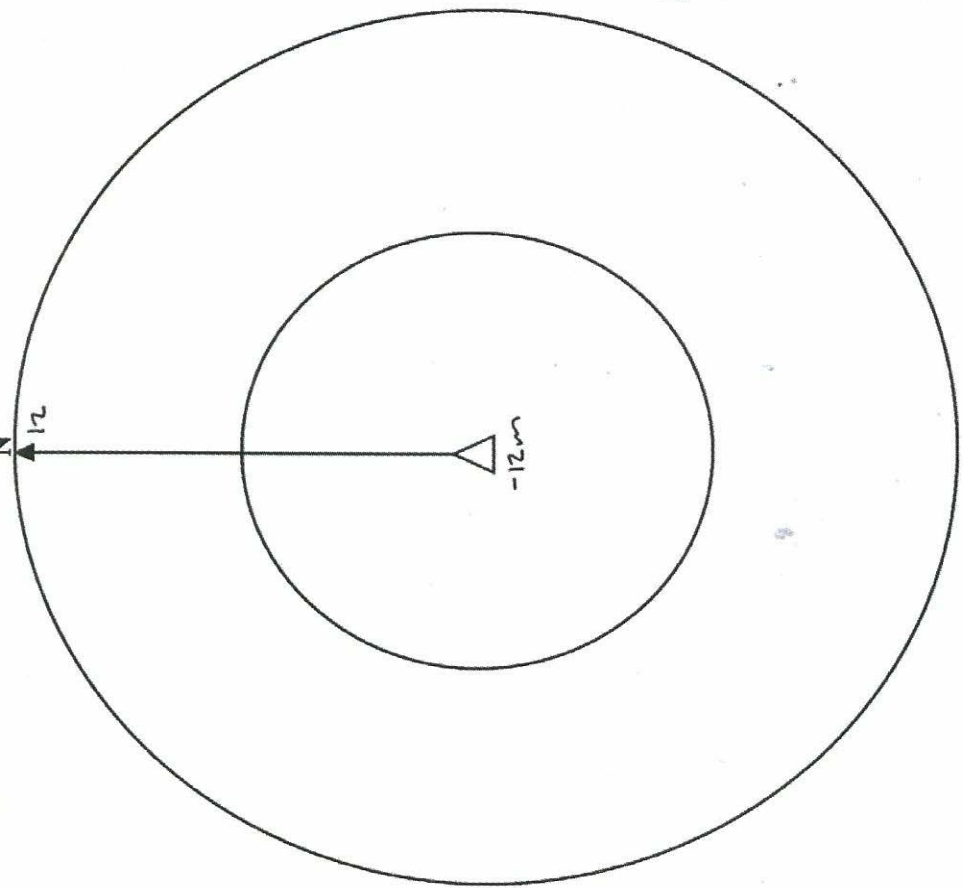
Penetrated -0.2
Nothing found.



Target 20

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

GPS. 9.7m
 Buoy 5m



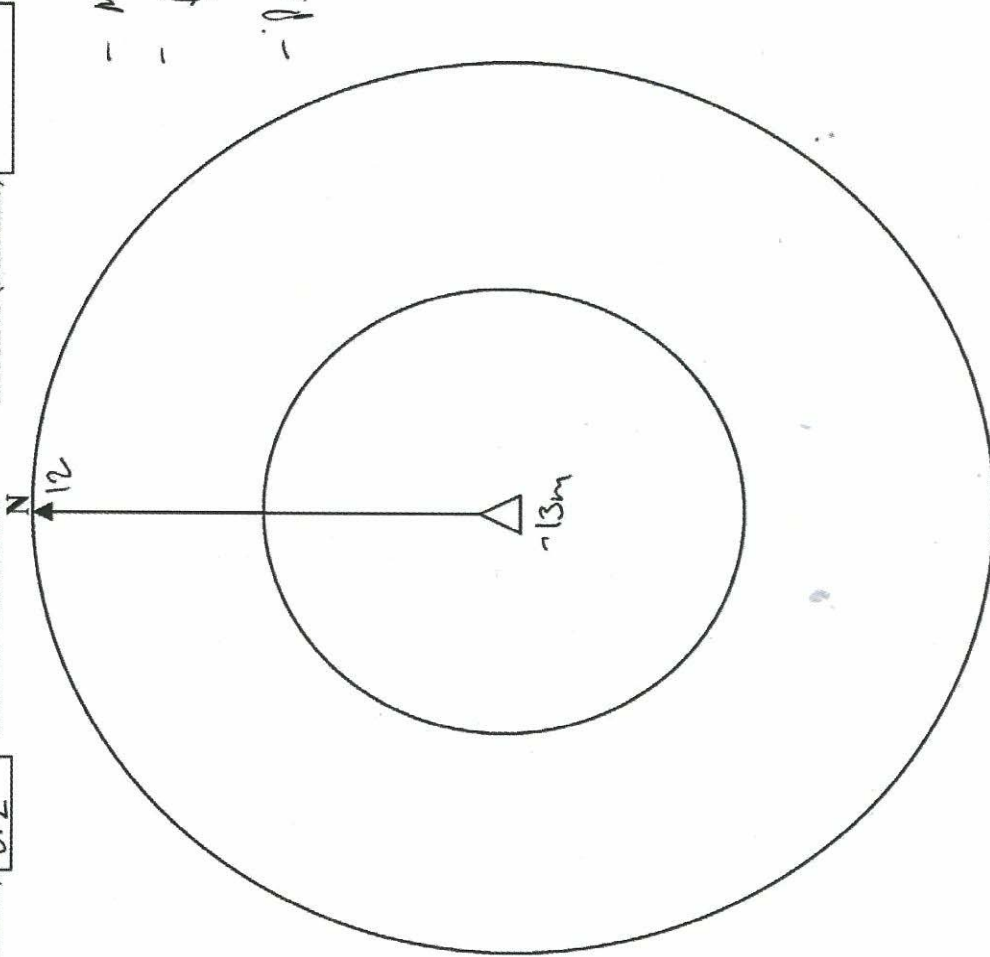
- Much
 - flat.
 Penetrated up to
 0.5m. ~~5m~~ thick
 however sandier.
 Recovered:
 2x ~~5~~ brick fragments
 1x brown beer bottle
 fragment, neck.
 Stakes.
 Artefacts known.

Target 21

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

GPS accuracy - 10m
 Buoy - 5m

- Mud
- flat
- penetrate to -0.2m
- Nothing found.

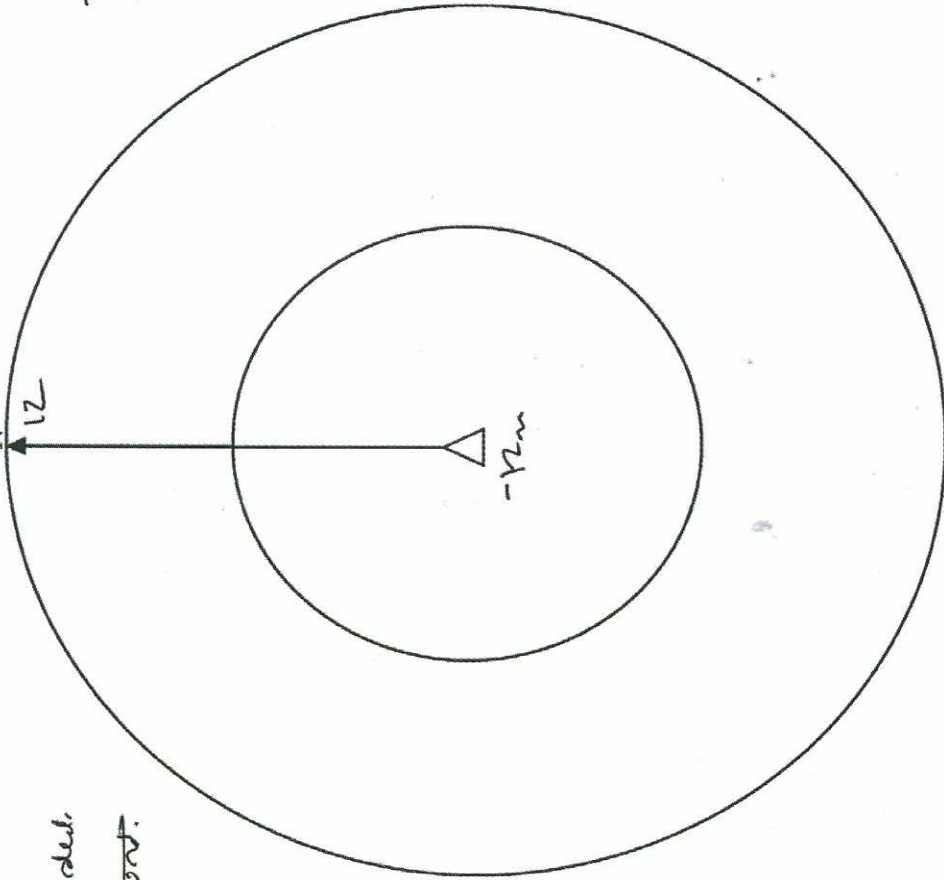


Target 22

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

GPS acc - Not recorded.
 Buoy - Nothing found.
 5m

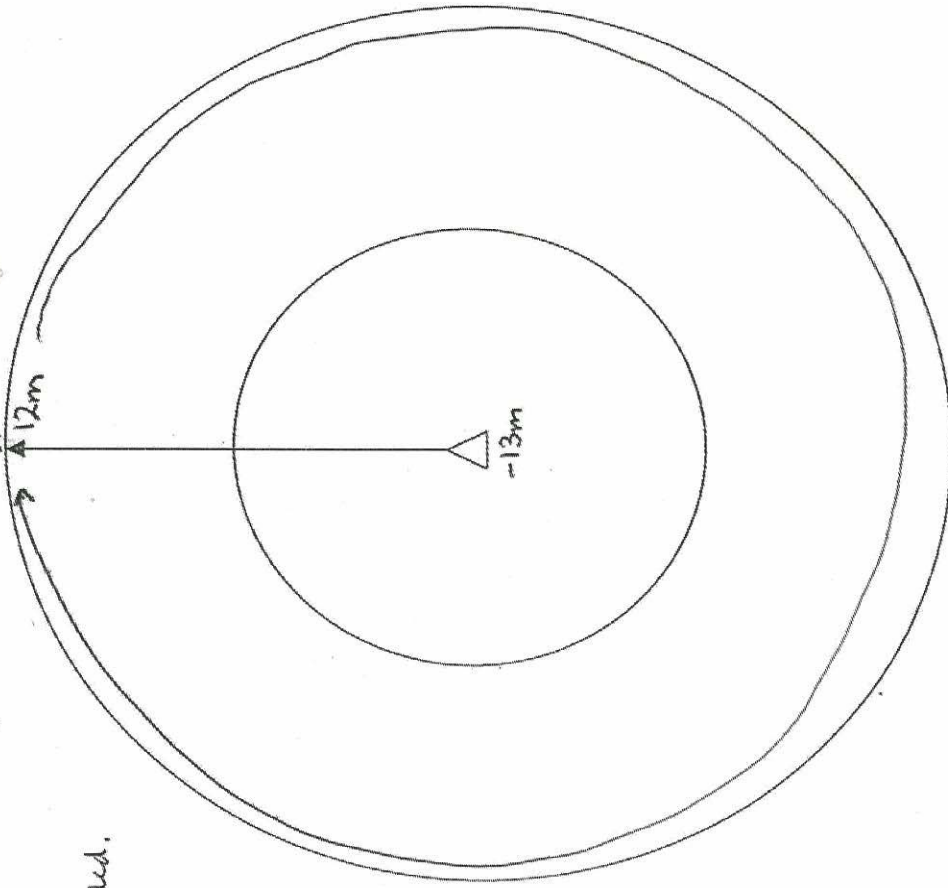
- Mud
 - Soft
 - Perchate up to
 0.5m.
 Nothing found.



Target 23

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

- Mud
- flat
- Prosed up to 80 cm
- Nothing found.



- Buoy dropped 5m
- GAS Accuracy - not recorded.
- Strong surface current.
- Mid strength seabed current

Target 24

UNIT ID DATE LOCATION

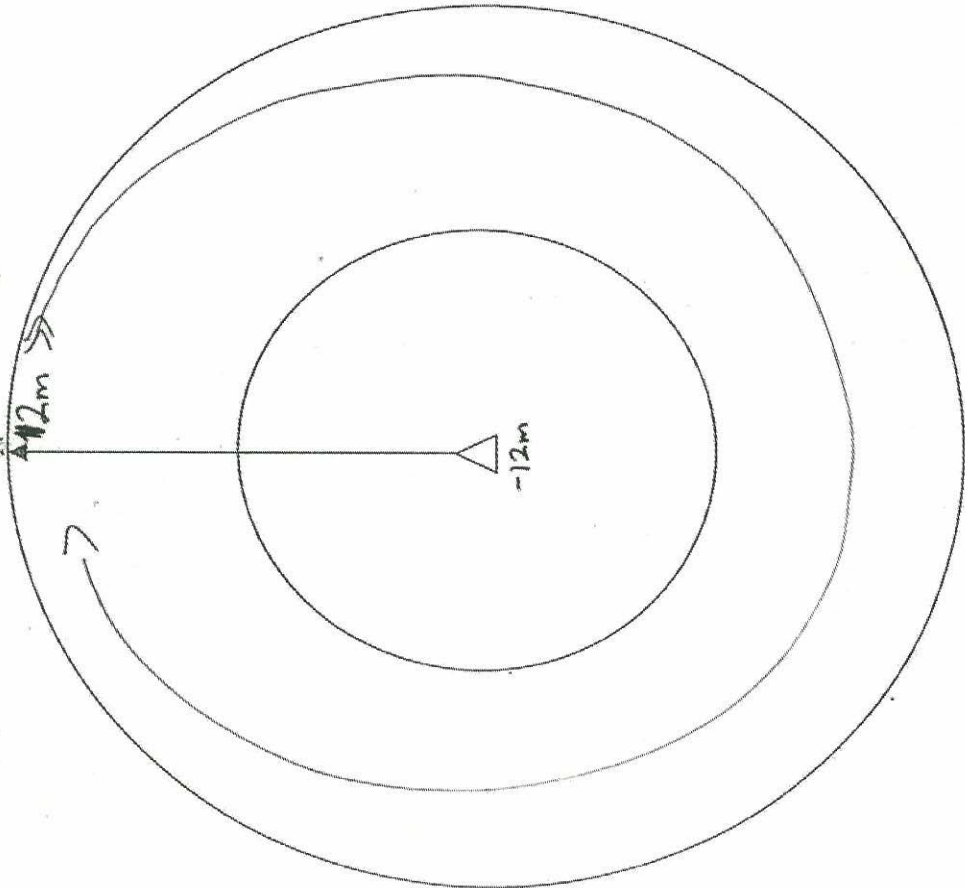
START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER

WATER VISIBILITY (METRES) SEABED VISIBILITY SPACING (METERS)

Bay dropped 2.9m

Accuracy 8.6m

Current - Medium strength



- Mud
- flat

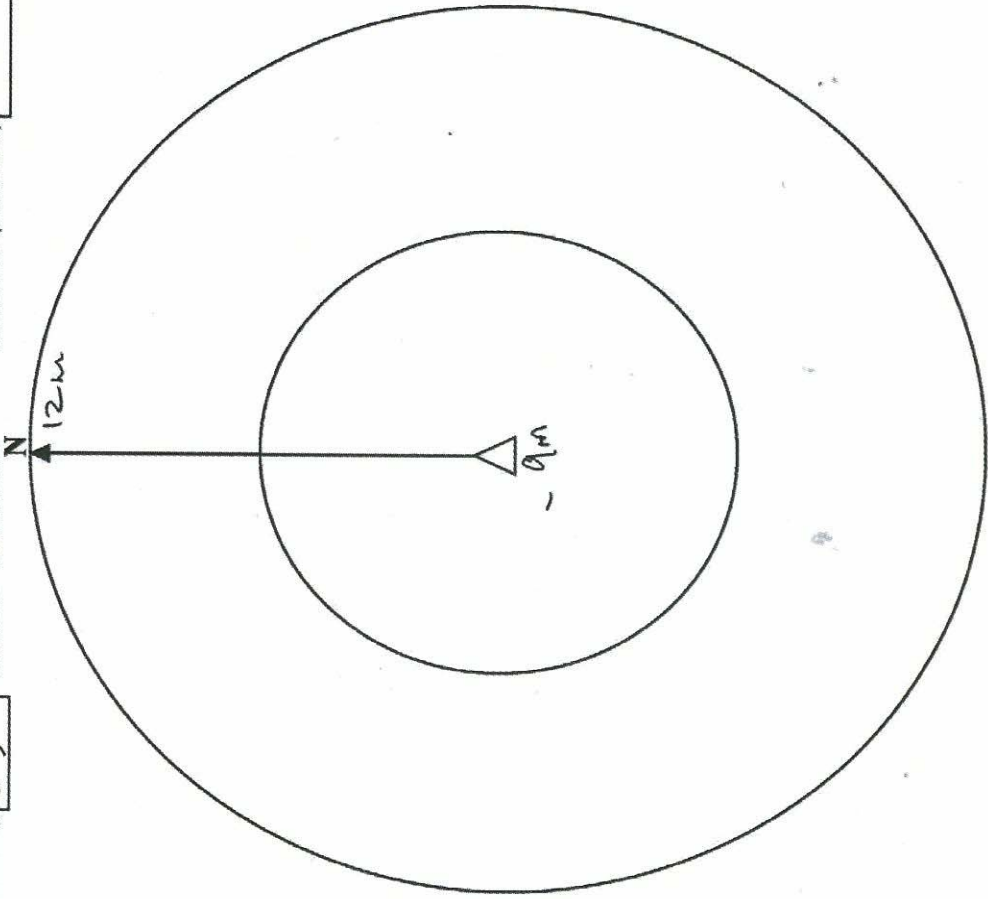
Probing to 0.5m
found little
with the
exception of
some shell and
small fragments
of stone (granite)

Target 25

UNIT ID DATE LOCATION
 START TIME: FINISH: TOTAL TIME (MIN): RECORDER PARTNER
 WATER VISIBILITY (METRES) SEABED VISIBILITY

GPS - 12.6m
 Buoy - 5m

- Mod.
 - flat
 - Penetrate up
 to 0.5m.
 No key found.



Target 26