# Agreement CE63/2008 (CE) Dredging Works in Kwai Tsing Container Basin and its Approach Channel – Investigation, Design and Construction

# Appendix 5.1 Marine Ecological Dive Survey Report

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# Content

# Executive Summary

- Carrying out a marine benthic survey is part of the environmental requirements of Governmental approval for any works involving the Hong Kong sea shore. This survey should identify any sensitive communities within the area likely to be impacted by the works.

- On 11th December 2009, Oceanway Corporation Limited carried out Spot Diving Surveys in all areas shown on the map in Appendix A.

- Following up from the Spot Dive Data collected, two REA Surveys were carried out in areas that contained stony corals.

- From all of the data collected a total of twenty hard coral species were identified in the survey areas. Species from four genera of gorgonians, two species of ahermatypic corals and at least two species of soft corals from the genera *Dendronephthya* spp.

- The status of the species recorded is shown in the table below:

| Species | Status | Reference |
|---|---|---|
| **Alcyoniina Group** | | |
| *Dendronephthya* spp. | Widespread | Note 1 |
| **Scleraxonia Group** | | |
| *Echinogorgia* sp. | Common | Note 1 |
| *Echinomuricea* sp. | Uncommon | Note 1 |
| *Euplexaura* spp. | Widespread | Note 1 |
| *Guaiagorgia* sp. | Localized | Note 2 |
| **Hermatypic Scleractinia** | | |
| *Montipora peltiformis* | Common | Note 3 |
| *Psammocora superficialis* | Abundant | Note 3 |
| *Psammocora haimeana* | Uncommon | Note 3 |
| *Coscinaraea n sp.* | Uncommon | Note 3 |
| *Pavona decussata* | Abundant | Note 3 |
| *Favia speciosa* | Abundant | Note 3 |
| *Favia rotumana* | Abundant | Note 3 |
| *Favites pentagona* | Dominant | Note 3 |
| *Favites chinensis* | Dominant | Note 3 |
| *Favites abdita* | Dominant | Note 3 |
| *Goniastrea aspera* | Common | Note 3 |
| *Platygyra acuta* | Dominant | Note 3 |
| *Plesiastrea versipora* | Abundant | Note 3 |
| *Oulastrea crispata* | Common | Note 3 |
| *Leptastrea purpurea* | Abundant | Note 3 |
| *Leptastrea pruinosa* | Abundant | Note 3 |
| *Cyphastrea serailia* | Dominant | Note 3 |
| *Porites luta* | Dominant | Note 3 |
| *Goniopora columna* | Abundant | Note 3 |
| *Goniopora stutchburyi* | Common | Note 3 |

| Species | Status | Reference |
|---|---|---|
| **Ahermatypic Scleractinia** | | |
| *Tubastraea faulkneri* | Common | Note 4 |
| *Paracycyathus rotundatus* | Localized | Note 2 |

Note 1. Soft Corals and Sea Fans. K. Fabricius & P. Alderslade.

Note 2. Agriculture, Fisheries and Conservation Department information.

Note 3. Field Guide to Hard Corals of Hong Kong. Agricultural, Fisheries & Conservation Department.

Note 4. Corals of the World. JEN Veron.

- All of the hard corals recorded were in good health. Appendix C contains the CoralWatch graphs for all transects with more than two colonies recorded.

- From the Spot Dive results, two REA surveys were carried out at Green Island and Kau Yi Chau. The positions of these surveys are shown in Appendix D. From this data, areas of 1% coral cover were identified.

- Recommended mitigation measures include keeping the amount of sediment generated to a reasonable level by the use of correctly positioned sediment curtains and designing a suitable monitoring programme to ensure that the hard coral colonies at Green Island and Kau Yi Chau do not become overstressed during the work

- Selected photographs are in Appendix F.

# 1. Introduction

The coral communities of Hong Kong are known as incipient reefs and are not typical of other high-latitude, non-reefal locations such as eastern and western Australia. Incipient reef coral areas have no calcium carbonate framework as a foundation for the corals, instead corals attach directly onto boulders and bedrock, forming simple pseudo fringing coral communities. Local coral communities are dominated by faviid species with massive, encrusting and foliaceous growth forms and 84 species from 28 genera having been recorded. These corals tolerate wide annual fluctuations in water temperature (12-30℃) and salinity (20-35‰) (Cope 1982) and periodic typhoons.

Most of the shallow (2~5m depth) marine areas in Hong Kong with reasonable amounts hard substratum have a veneer of corals attached. Soft corals and gorgonians sometimes occupy suitable hard substratum in deeper areas. Species makeup varies and depends upon the environmental parameters of the area. For the area surveyed, similar surveys carried out in nearby areas and past surveys in the same areas have already identified the species recorded in this survey.

Most areas surveyed had a very low coral cover. However, the areas around Green Island and Kau Yi Chau did have hard coral cover over 5%. Both of these areas also had reasonable populations of gorgonians and soft corals. This was also true for the quarry rock anti-collision buffers protecting the Tsing Yi overpass at survey locations 1 and 2. **Appendix A** showed the location details.

# 2. Methodology

## 2.1 Introduction

The Three Tier Coral Survey Methodology was first adapted for use in Hong Kong by the Oceanway in the late 1990's. Basically the concept is for a series of surveys to be carried out, each providing more detail than the previous. The interesting feature of the methodology is that certain conditions in a low tier survey may trigger a more thorough investigation by a survey that is basically a higher tier. The higher tier survey designed to collect a more detailed information data set than a lower tier survey.

## 2.2 Spot Dive Survey

The Spot Dive Survey methodology has suitably trained and qualified SCUBA divers swimming at random depths along predetermined transects noting several characteristics of any coral communities encountered. Surface parameters like temperature, time and date information are recorded before the dive begins. Parameters like estimated number of species, coral cover, partial mortality and the presence of any rare corals are recorded during the actual dive.

Divers also note anything significantly different about the coral areas encountered. Features like non-typical reef structures, unusual coral species associations, unique or peculiar assemblages of the local Incipient Reef formations, and reefs that are almost completely dominated by one particular species.

Dives were conducted in and around as per the map in **Appendix A**. Data was recorded on water proof paper during the dive in preparation for a later consolidation in a Preliminary Survey Report (this document). Once all of the Spot Dive Survey data was collected on an area, then this information is summarized and a decision is made as to whether or not an REA dive is also required for that area.

## 2.3 CoralWatch Survey

The CoralWatch (South China Sea Version) is also carried out to determine the current health of the coral communities encountered. This survey technique provides a simple method of monitoring the condition of hard corals by the use of simple graded colour charts underwater. The University of Queensland, Australia, was responsible for developing this survey methodology. The colour charts are a standard and are based upon the actual colours of bleached and healthy corals. Each colour square corresponds to a concentration of symbionts (zooxanthellae) contained in the coral tissue and this is directly related to the coral's condition. The process is simple, accurate and non-invasive. Individual coral colony stress may then be identified rapidly.

All recorded corals were surveyed using the standard Chinese CoralWatch Chart. A total of ten coral colonies were examined in situ and the lightest and darkest colour match was determined. Data was recorded on prepared underwater sheets for later analysis. Care was taken to avoid the colour of the tips of the corals since there can be a delay in the colouration due to the required up-take time for zooxanthellae to enter the coral tissue.

CoralWatch data was collected for each transect. The numerical difference, the colour score, was calculated for each colony. These data are presented for each colony, and then grouped into the corresponding blanching categories with the percentage of corals in each category determined. This data

was then averaged so that the figure for Cumulative Average calculated.

## 2.4 Rapid Ecological Assessment (REA) Survey

The Rapid Ecological Assessment (REA) methodology was first detailed in DeVantier et al. 1998. The survey is a two tier approach for underwater survey to assess the sub-littoral substrata and benthic organisms in an area. This methodology has been modified to suit Hong Kong conditions (Oceanway 2002) and has become a standardized and widely adopted way to establish ecological baseline conditions. Two levels of information are recorded in a ~2m wide swath, 1m either side of a 100m long tape.

- Tier I assesses the relative cover of major benthic groups and substrata.
- Tier II provides an inventory of sedentary / sessile benthic taxa, which are also ranked in terms of their abundance in the community at the survey site.

Data is recorded by experts who are experienced in the field identification of sedentary / sessile benthic taxa, particularly corals.

### 2.4.1 Tier I : Categorisation of benthic cover

For each transect, ecological and substratum attributes should be categorised and ranked. The required attributes are detailed as follows:

Table 2.1: Tier I Benthic Attribute Categories

| Ecological Attributes | Substratum Attributes |
|---|---|
| Hard Corals | **Hard substrata** |
| Dead coral | Bedrock / continuous pavement |
| Octocorals (Soft corals black and gorgonians) | Boulder blocks (diam. >50cm) |
| Anemone beds | Boulder blocks (diam. <50cm) |
| Dead standing corals | Rubble |
| Other benthos (sponges, zoanthids, ascidians and bryozoans) | Other |
| Macro-algae | **Soft substrata** |
| | Sand |
| | Mud / Silt |
| | Mud |

Table 2.2: Tier I Ordinal Ranks of Percentage Cover of Benthic Attributes

| Rank | Percentage Cover |
|---|---|
| 0 | None recorded |
| 0.5 | 1-5% |
| 1 | 6-10% |
| 2 | 11-30% |
| 3 | 31-50% |
| 4 | 51-75% |
| 5 | 76-100% |

Note: For substratum attributes, it is preferable to record actual estimates of cover. The percentage of hard substrata vs soft substrata can be provided (e.g. 80% and 20% respectively). The percentage cover of the types of hard or soft substrata could also then be presented (e.g. bedrock pavement 60%, rubble 20%, sand 15%, mud/silt 5%). Similarly, recording and presenting actual estimates of, for instance, hard and soft coral cover may be more informative (e.g. <1%) and is also approach adopted by similar recent survey reports.

Table 2.3: Taxonomic inventory Identification

| Taxon Abundance Rank | Abundance |
|---|---|
| 0 | Absent |
| 1 | Rare |
| 2 | Uncommon |
| 3 | Common |
| 4 | Abundant |
| 5 | Dominant |

The taxon categories were ranked in terms of relative abundance of individuals, rather than the contribution to benthic cover along each transect. The ranks are visual assessments of abundance, rather than quantitative counts of each taxon. Representative photos of organisms were also taken.

### 2.4.2 Results Presentation

The results of the REA Survey are presented in table form to allow an easy comparison between the different sites investigated.

## 2.5 References

DeVantier, L.M., G. De'Ath, T.J., Dome, E. Turak 1998. Ecological Assessment of a complex natural system. A case study from the Great Barrier Reef. *Ecological Applications* 8. 480-496.

Oceanway Corporation Ltd. 2002. Underwater Survey in Coastal Waters of Hong Kong. Unpublished report submitted to the Hong Kong Agriculture, Fisheries and Conservation Department, Hong Kong SAR Government.

# 3. Results

## 3.1 Introduction

The survey was carried out on the 11th December 2009. The weather was sunny with some cloudy intervals. The air temperature was 25°C. Water temperatures varied between 21°C in water shallower than 3m and 19°C down to 8m depth. The sea was calm (<10cm wavelets) with only boat wash causing anything bigger. Surface salinity was 31ppt. At 2m depth it was measured to be 32ppt. From this data the weather condition was suitable to carry out this survey, and the general water parameters were not abnormal.

## 3.2 Spot Dive Results

The Spot Dive surveys recorded a total of 10 different species of hermatypic hard corals, 6 different species of gorgonians, 2 different species of ahermatypic corals and 2 species of soft coral. These results were in line with the results of other surveys carried out in the same or nearby areas in the past.

The location of the Spot Dives carried out for this survey is shown in **Appendix A**. Below is a summary of the results followed by a detailed description of each transect. The raw data for the Spot Dives is in **Appendix B**.

### 3.2.1 Summary of Spot Dive Data Recorded

A summary of the Spot Dive Survey Results is shown in **Table 3.1** below. The corresponding dive numbers is shown on the map in **Appendix A**. The rows highlighted are those transects that an REA Survey was also carried out. The raw data is in **Appendix B**

Table 3.1: The Summary Results for the Corals recorded in the Spot Dive Survey

| Dive No. | No. Hard Species | % Cover | No. Gorg. Species | % Cover | No. Aherm Species | % Cover | No. Soft Species | % Cover | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| T1 | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% | Along Seawall |
| T2a | 0 | 0% | 6 | <5% | 2 | <1% | 2 | <1% | Quarry Rock Pillar Protection |
| T2b | 0 | 0% | 1 | <1% | 0 | 0% | 1 | <1% | Along Seawall. |
| T3 | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% | On Pillars |
| T4 | 0 | 0% | 1 | <1% | 0 | 0% | 1 | <1% | On Pillars |
| T5 | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% | On Pillars |
| T6 | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% | On Pillars |
| T7 | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% | On a Dolos Seawall |
| T8 | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% | On a Dolos Seawall |
| T9 | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% | On a Dolos Seawall |
| T10 | 12 | <5% | 5 | <5% | 1 | <1% | 1 | <5% | Natural Shoreline (Green Island) |
| T11 | 19 | <10% | 5 | <10% | 1 | <1% | 1 | <1% | Natural Shoreline (Kau Yi Chau) |

Hard hermatypic corals were recorded along the natural shoreline surveyed. Gorgonian, ahermatypic and soft corals were also recorded in the areas of natural coastline and a few of the artificial structures surveyed.

### 3.2.2 Transect T1

The location of this transect is shown in **Appendix A**. The area surveyed was along a vertical concrete seawall. The transect followed the seawall for 100m, with divers changing depth regularly looking for and recording corals and other selected marine animals and plants.

Depths along the seawall varied from 5m to 6.9m. The seabed along this transect consisted of very soft mud and rubbish. There was a lot of discarded material along the bottom of the wall. Further out the seabed gently sloped to ~11m depth towards the centre of the channel.

Scattered clumps of *Perna viridis* and some large oysters were the main bivalves recorded in this area. Sponges and tunicates were also recorded as was the encrusting cheilostome bryozoan *Schizoporella errata*. Several different species of encrusting sponges were also observed. Several unhealthy colonies of the stinging hydroid *Lytocarpus philippinus* were recorded attached to the seawall. There were also clumps of *Bugula* sp. recorded as well. There was no coral recorded along this transect.

### 3.2.3 Transect T2a & b

The location of this transect is shown in **Appendix A**. Actually there are two very different substratum in this area. One is a quarry rock barrier installed to protect the support pillars of an overpass (2a), the other is a concrete seawall (2b). The coral community in each of these two locations was very different and therefore is described separately. The transect along the seawall was 100m long, the transect around the pillar barrier was shorter at about 50m.

Depths along the seawall varied from 3.0m to 3.6m. The seabed along this transect consisted of very soft mud and rubbish. There was a lot of discarded material along the bottom of the wall. Further out the seabed gently sloped to ~11m depth towards the centre of the channel.

Depths along the rock barrier were deeper at 6.9m. The seabed consisted of mud but did not have any rubbish, as had been the case with the seawall. As with the seawall, further out the seabed gently sloped to ~11m towards the centre of the channel.

The seawall transect recorded five colonies of the gorgonian coral *Guaiagorgia* sp. and one single colony of *Dendronephthya* sp. Other animals recorded included clumps of *Perna viridis* and some large oysters. Tunicates were also recorded as was the encrusting cheilostome bryozoan *Schizoporella errata*. Several different species of encrusting sponges were also observed. Several unhealthy colonies of the stinging hydroid *Lytocarpus philippinus* were recorded attached to the seawall. There were also clumps of *Bugula* sp. recorded as well. There was no coral recorded along this transect.

The rock barrier transect was very different. Six species of Gorgonian from the genera *Echinogorgia* sp, *Echinomuricea* sp., *Euplexaura* spp.and *Guaiagorgia sp*. were recorded along with two species of ahermatypic coral *(Tubastraea faulkneri and Paracycyathus rotundatus*) and two species of soft corals from the genera *Dendronephthya* spp. All corals were patchy with some very dense areas recorded. As with the seawall, the other animals recorded were *Perna viridis*, large oysters, sponges and tunicates were also recorded as was *Schizoporella errata*. There were fewer species of encrusting sponges, the stinging hydroid *Lytocarpus philippinus* and *Bugula* sp.

### 3.2.4 Transect T3

The location of this transect is shown in **Appendix A**. The area surveyed was up and down the support pillars of the pier structure in that area. Four adjacent pillars were selected in between the birthed ships unloading containers at that time.

The pillars penetrated the seabed at about 13m. The visibility also dropped to about 20cm at about 7m. The amount of marine life also substantially decreased after 9m. The seabed was soft mud. It was not possible to observe very much detail of the seabed in this location.

Scattered clumps of *Perna viridis* and some oysters (large and small) were the main bivalves recorded in this area. Tunicates were also recorded as well as the very occasional stinging hydroid *Lytocarpus philippinus*. *Bugula* sp. and *Schizoporella errata* were also recorded as were several different species of sponges. There was no coral recorded along this transect.

### 3.2.5 Transect T4

The location of this transect is shown in **Appendix A**. The area surveyed was up and down the support pillars of the pier structure in that area. Four adjacent pillars were selected in between the birthed ships unloading containers at that time.

The pillars penetrated the seabed at about 12m. The visibility also dropped to about 20cm at about 6m. The amount of marine life also substantially decreased after 9m. The seabed was soft mud. It was not possible to observe very much detail of the seabed in this location.

Two colonies of the gorgonian *Guaiagorgia* sp. and four colonies of the soft coral *Dendronephthya* sp. were recorded on one pillar during this survey. Scattered clumps of *Perna viridis* and some oysters (large and small) were the main bivalves recorded in this area. Tunicates were also recorded as well as the very occasional stinging hydroid *Lytocarpus philippinus*. *Bulga* sp. and *Schizoporella errata* were also recorded as were several different species of sponges.

### 3.2.6 Transect T5

The location of this transect is shown in **Appendix A**. The area surveyed was up and down the support pillars of the pier structure in that area. Four adjacent pillars were selected in between the birthed ships unloading containers at that time.

The pillars penetrated the seabed at about 14m. The visibility also dropped to about 20cm at about 7m. The amount of marine life also substantially decreased after 8m. The seabed was soft mud. It was not possible to observe very much detail of the seabed in this location.

Scattered clumps of *Perna viridis* and some oysters (large and small) were the main bivalves recorded in this area. Tunicates were also recorded as well as the very occasional stinging hydroid *Lytocarpus philippinus*. *Bugula* sp. and *Schizoporella errata* were also recorded as were several different species of sponges. There was no coral recorded along this transect.

### 3.2.7 Transect T6

The location of this transect is shown in **Appendix A**. The area surveyed was up and down the support

pillars of the pier structure in that area. Four adjacent pillars were selected in between the birthed ships unloading containers at that time.

The pillars penetrated the seabed at about 13m. The visibility also dropped to about 20cm at about 6m. The amount of marine life also substantially decreased after 9m. The seabed was soft mud. It was not possible to observe very much detail of the seabed in this location.

Scattered clumps of *Perna viridis* and some oysters (large and small) were the main bivalves recorded in this area. Tunicates were also recorded as well as the very occasional colony of the stinging hydroid *Lytocarpus philippinus*. *Bugula* sp. and *Schizoporella errata* were also recorded as were several different species of sponges. There was no coral recorded along this transect.

### 3.2.8 Transect T7

The location of this transect is shown in **Appendix A**. The area surveyed is along a semi-sheltered section of seawall dolosse immediately inside the entrance to the container port. This section of seawall was followed for 100m.

The dolosse appear to be relatively new with very little settled on them at all. There was plenty of unoccupied habitat. The very occasional small sponge was the only sessile animal recorded along the transect. There was a thin layer of silt over all of the exposed surfaces of the submerged dolosse. There were no corals recorded along this transect.

### 3.2.9 Transect T8

The location of this transect is shown in **Appendix A**. The area surveyed is along a semi-sheltered section of seawall dolosse immediately inside the entrance to the container port. This section of seawall was followed for 100m.

The dolosse appear to be relatively new with very little settled on them at all. There was plenty of unoccupied habitat. The very occasional small sponge was the only sessile animal recorded along the transect. A small amount of *Bugula* sp. was also observed. There was a thin layer of silt over all of the exposed surfaces of the submerged dolosse. There were no corals recorded along this transect.

### 3.2.10 Transect T9

The location of this transect is shown in **Appendix A**. The area surveyed is along an exposed section of seawall dolosse immediately outside the entrance to the container port. This section of seawall was followed for 100m.

Unlike the areas of dolosse investigated in the previous two areas, these dolosse seem to have been in place for a longer period of time. There was still plenty of unoccupied habitat, however there were both new and past recruits observed.

Scattered clumps of small *Perna viridis* were scattered on the exposed substratum. Sponges and the very occasional colony of the stinging hydroid *Lytocarpus philippinus*. *Bugula* sp. and *Schizoporella errata* were also observed. There were no corals recorded along this transect.

### 3.2.11 Transect T10

The location of this transect is shown in **Appendix A**. The area surveyed was the northern and north-western side of Green Island. This area consists of an area of natural rocky shore line. The transect consisted of one 200m zig zag pattern dive. Depths were from 1m to 6.9m.

The seabed was quite varied with patches of sand and rubble in the shallower areas and mud with silt or sand in deeper areas. There were rocks and boulders of assorted sizes scattered throughout the area with some areas of exposed pavement. There was a considerable amount of rubbish scattered around in the area including large objects like truck tyres. There were also a lot of ghosted fishing nets recorded during the Spot Dives.

This area was much more established in terms of sessile benthos. There were seven species of hard hermatypic coral recorded in this area. The species recorded are identified in the REA Survey results. Along with this five species of gorgonian from the genera *Echinogorgia* sp, *Echinomuricea* sp. and *Euplexaura* spp. were recorded along with one species of ahermatypic coral *(Paracycyathus rotundatus*) and one species of soft coral from the genera *Dendronephthya* sp. All corals were patchy with some dense areas recorded.

There were clusters of large and small *Perna viridis* and several species of oysters. Several species of sponges, including the golf ball sponge was recorded. Other animals included anemones, tunicates recorded as well as the stinging hydroid *Lytocarpus philippinus*. *Bugula* sp. and *Schizoporella errata* were also recorded in large numbers. The long spine sea urchin *Diadema setosum* was recorded in this area. A thin layer of silt covering most of the substratum.

### 3.2.12 Transect T11

The location of this transect is shown in **Appendix A**. The area surveyed was the eastern side of Kau Yi Chau. This area consists of an area of natural rocky shore line. The transect consisted of one 200m zig zag pattern dive. Depths were from 1m to 9.1m.

The seabed was quite varied with patches of sand and rubble in the shallower areas. There was a large patch of boulders in the centre of the area surveyed. Mud with silt or sand in deeper areas. There were rocks and boulders of assorted sizes scattered throughout the area with some areas of exposed pavement. There was rubbish scattered around in the area including some large metal sections that were probably the remains of a shipwreck.

This area was much more established in terms of sessile benthos. There were ten species of hard hermatypic coral recorded in this area. The species recorded are identified in the REA Survey results. Along with this five species of gorgonian from the genera *Echinogorgia* sp, *Echinomuricea* sp. and *Euplexaura* spp. were recorded along with one species of ahermatypic coral *(Paracycyathus rotundatus*) and one species of soft coral from the genera *Dendronephthya* sp. All corals were patchy with some dense areas recorded.

There were clusters of large and small *Perna viridis* and several species of oysters. Several species of sponges, including the golf ball sponge was recorded. Other animals included anemones, tunicates recorded as well as the stinging hydroid *Lytocarpus philippinus*. *Bugula* sp. and *Schizoporella errata* were also recorded in large numbers. The long spine sea urchin *Diadema setosum* was recorded in this area. A thin layer of silt covering most of the substratum.

## 3.3 CoralWatch Survey Results

### 3.3.1 Summary of CoralWatch Data Recorded

The CoralWatch results for all of the transects with more than 2 colonies are in **Table 3.2** below. CoralWatch gives the general coral health.

Table 3.2: The Summary Results of the CoralWatch Survey

| Dive No. | Cumulative Average | Remarks |
|---|---|---|
| T1 | ~ | No hard coral |
| T2a | ~ | No hard coral |
| T2b | ~ | No hard coral |
| T3 | ~ | No hard coral |
| T4 | ~ | No hard coral |
| T5 | ~ | No hard coral |
| T6 | ~ | No hard coral |
| T7 | ~ | No hard coral |
| T8 | ~ | No hard coral |
| T9 | ~ | No hard coral |
| T10 | 4.09 | 7 Species |
| T11 | 4.55 | 17 Species |

The value of Cumulative Average is a measure of the health of the coral. It is an ordinate based value that varies between 1 (very poor health) to a maximum value of 6 (maximum health). For Hong Kong values above 3.50 are normal. Values below that normally indicate the area has some stress. The CoralWatch Graphs for all transects with hard corals are in **Appendix C**.

## 3.4 REA Results

### 3.4.1 Summary of the REA Data Recorded

A total of two REA transects were carried out. One at T10 and another at T11. All of the other areas investigated did not contain enough corals to warrant an REA, except perhaps for T2a. However the latter was too small.

**Table 3.3** compares the results of the REA surveys at each location. As expected there is not that much difference with these results.

Table 3.3: Summary of the Tier 1 results. Recorded ranks of percentage cover from Table 2.1 & 2.2

| Parameter / Station | REA 1 | REA 2 |
|---|---|---|
| **Average Depth (m)** | 2.4 | 1.95 |
| **Exposure (1~4)** | 4 | 4 |
| **Sediment (0~3)** | 2 | 2 |
| | | |
| **% cover soft corals (live)** | 5 | 5 |
| **% cover hard corals (live)** | 15 | 10 |
| | | |
| **Hard Substrate (% of total)** | 80 | 70 |
| Bed rock (% of HS) | 5 | 5 |
| Large boulders (% of HS) | 5 | 5 |
| Rocks(% of HS) | 75 | 80 |
| | | |
| **Soft Substrate (% of total)** | 0 | 0 |
| Sand (% of SS) | 0 | 0 |
| Silt/mud (% of SS) | 0 | 0 |
| Mud (% of SS) | 0 | 0 |
| | | |
| **Slope (flat = 0, vertical = 4)** | 2 | 1 |
| | | |
| **Visibility (m)** | 1.5 | 1.5 |
| **Salinity (ppt)** | 31 | 31 |
| **Temp (ºC)** | 21 | 21 |

Table 3.4: Summary of the Tier 2 results. Recorded Ordinal ranks of percentage cover from Table 2.1 & 2.3

| Taxa / Station | REA 1 | REA 2 |
|---|---|---|
| **Bryazoa** | | |
| Brown/orange encrusting | 1 | 0 |
| *Bugula* sp. | 2 | 2 |
| *Schizoporella* sp. | 3 | 2 |
| **Actiniaria (sea anemonies)** | | |
| Anemone | 2 | 1 |
| Sand anemone | 2 | 2 |
| **Alcyoniina Group** | | |
| *Dendronephthya* spp. | 1 | 2 |
| **Scleraxonia Group** | | |
| *Echinogorgia* sp. | 2 | 1 |
| *Echinomuricea* sp. | 1 | 1 |
| *Euplexaura* spp. | 2 | 2 |
| **Hermatypic Scleractinia** | | |
| *Montipora peltiformis* | 1 | 0 |
| *Psammocora superficialis* | 2 | 0 |

| Taxa / Station | REA 1 | REA 2 |
|---|---|---|
| *Psammocora haimeana* | 0 | 1 |
| *Coscinaraea n sp.* | 1 | 0 |
| *Pavona decussata* | 1 | 0 |
| *Favia speciosa* | 2 | 1 |
| *Favia rotumana* | 1 | 2 |
| *Favites pentagona* | 2 | 2 |
| *Favites chinensis* | 1 | 0 |
| *Favites abdita* | 2 | 1 |
| *Goniastrea aspera* | 1 | 0 |
| *Platygyra acuta* | 1 | 0 |
| *Plesiastrea versipora* | 2 | 0 |
| *Oulastrea crispata* | 1 | 1 |
| *Cyphastrea serailia* | 3 | 0 |
| *Porites luta* | 2 | 0 |
| *Goniopora columna* | 1 | 0 |
| *Goniopora stutchburyi* | 1 | 1 |
| **Ahermatypic Scleractinia** | | |
| *Paracycyathus rotundatus* | 1 | 1 |
| **Mollusca** | | |
| *Perna viridis* | 2 | 2 |
| Oysters small | 1 | 1 |
| Oysters large | 2 | 2 |
| **Porifere (sponge)** | | |
| With profile | 1 | 0 |
| Encrusting | 3 | 3 |
| Golf ball | 1 | 1 |
| **Echinodermata** | | |
| *Diadema setosum* | 2 | 3 |
| *Echinothrix calamaris* | 2 | 2 |
| *Holothuria leucospilota* | 1 | 1 |
| **Misc.** | | |
| Coralline algae | 1 | 1 |
| *Zoanthid* spp. | 1 | 0 |
| Tunicate | 2 | 2 |

#### 3.4.1.1 REA 1 – -Kau Yi Chau

The location of this station is shown in **Appendix D**. The raw survey data is in **Appendix E**. The survey depths were between 1.3m and 3.5m with an average depth of 2.4m. All 100m of this survey was carried out along the natural coastline of Kau Yi Chau at a location that was very representative of the area as determined by the Spot Dives. Visibility was ~1.5m. Salinity was measured at 1m to be 31ppt.

There were seventeen species of hard coral recorded along the transect. Coral cover was 15% on the hard substratum between the depths of this survey. Colony sizes varied considerably and ranged from

small (<10cm$^2$) to large (>0.5m$^2$). All of the coral colonies along this transect were in good condition.

There were three species of gorgonians and one species of soft coral also recorded on this transect. One species of ahermatypic coral was also recorded.

Other associated organisms included the coralline algae *Schizoporella errata, Bugula* sp.*,* the bivalve *Perna viridis*, some small oysters, the long spine sea urchin, *Diadema setosum* and the black sea cucumber *Holothuria leucospilota*. The transect also had scattered sponges and the occasional anemone amongst the corals.

#### 3.4.1.2 REA 2 – Green Island

The location of this station is shown in **Appendix D**. The raw survey data is in **Appendix E**. The survey depths were between 1.2m and 2.7m with an average depth of 1.95m. All 100m of this survey was carried out along the natural coastline of Green Island at a location that was very representative of the area as determined by the Spot Dives. Visibility was ~1.5m. Salinity was measured at 1m to be 31ppt.

There were seven species of hard coral recorded along the transect. Coral cover was 10% on the hard substratum between the depths of this survey. Colony sizes varied considerably and ranged from small (<10cm$^2$) to large (>0.5m$^2$). All of the coral colonies along this transect were in good condition.

There were four species of gorgonians and one species of soft coral also recorded on this transect. One species of ahermatypic coral was also recorded.

Other associated organisms included the coralline algae *Schizoporella errata, Bugula* sp.*,* the bivalve *Perna viridis*, some small oysters, the long spine sea urchin, *Diadema setosum* and the black sea cucumber *Holothuria leucospilota*. The transect also had scattered sponges and the occasional anemone amongst the corals.

# 4. Recommendation

## 4.1 Overview

Two REA Surveys were carried out in the survey area to describe the major coral communities recorded in the Spot Dive Survey. Hard corals, soft corals and gorgonians were recorded at locations during this survey.

With regards to rare species, both confirmed and unconfirmed past records suggest that there were no rare corals recorded in this survey. The classification for the hard corals has been determined from the Field Guide to Hard Corals of Hong Kong by AFCD. The classification of the gorgonian and soft corals has been determined from the Soft Corals and Sea Fans by K. Fabricius & P. Alderslade (published by the Australian Institute of Marine Science). The table below (**Table 4.1**) lists the status of the coral species recorded in this survey:

Table 4.1: The Status of the Coral Species Recorded in the Dive Survey

| Species | Status | Reference |
|---|---|---|
| **Alcyoniina Group** | | |
| *Dendronephthya* spp. | Widespread | Note 1 |
| **Scleraxonia Group** | | |
| *Echinogorgia* sp. | Common | Note 1 |
| *Echinomuricea* sp. | Uncommon | Note 1 |
| *Euplexaura* spp. | Widespread | Note 1 |
| **Hermatypic Scleractinia** | | |
| *Montipora peltiformis* | Common | Note 3 |
| *Psammocora superficialis* | Abundant | Note 3 |
| *Psammocora haimeana* | Uncommon | Note 3 |
| *Coscinaraea n sp.* | Uncommon | Note 3 |
| *Pavona decussata* | Abundant | Note 3 |
| *Favia speciosa* | Abundant | Note 3 |
| *Favia rotumana* | Abundant | Note 3 |
| *Favites pentagona* | Dominant | Note 3 |
| *Favites chinensis* | Dominant | Note 3 |
| *Favites abdita* | Dominant | Note 3 |
| *Goniastrea aspera* | Common | Note 3 |
| *Platygyra acuta* | Dominant | Note 3 |
| *Plesiastrea versipora* | Abundant | Note 3 |
| *Oulastrea crispata* | Common | Note 3 |
| *Cyphastrea serailia* | Dominant | Note 3 |
| *Porites luta* | Dominant | Note 3 |
| *Goniopora columna* | Abundant | Note 3 |
| *Goniopora stutchburyi* | Common | Note 3 |
| | | |
| **Ahermatypic Scleractinia** | | |
| *Tubastraea faulkneri* | Common | Note 4 |
| *Paracycyathus rotundatus* | Localized | Note 2 |

Note 1. Soft Corals and Sea Fans. K. Fabricius & P. Alderslade.

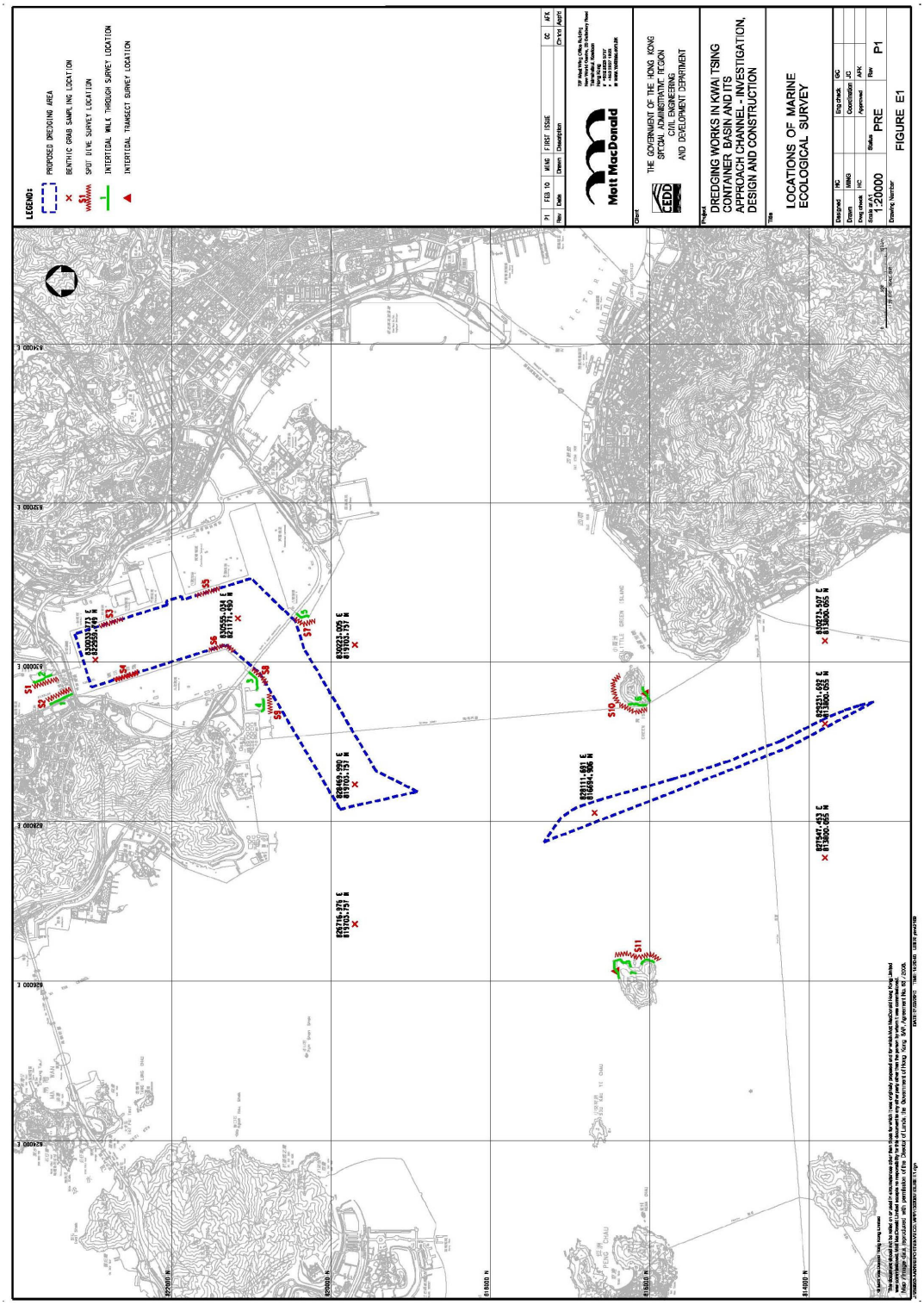
Note 2. Agriculture, Fisheries and Conservation Department information.

Note 3. Field Guide to Hard Corals of Hong Kong. Agricultural, Fisheries & Conservation Department.

Note 4. Corals of the World. JEN Veron.

# Appendices

# Appendix A. Transect Site Map


LEGEND:
PROPOSED DREDGING AREA
BENTHIC GRAB SAMPLING LOCATION
SPUT DIVE SURVEY LOCATION
INTERTIDAL WALK THROUGH SURVEY LOCATION
INTERTIDAL TRANSECT SURVEY LOCATION
Mott MacDonald
THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT
DREDGING WORKS IN KWAI TSING CONTAINER BASIN AND ITS APPROACH CHANNEL - INVESTIGATION, DESIGN AND CONSTRUCTION
LOCATIONS OF MARINE ECOLOGICAL SURVEY
1:20000
PRE
P1
FIGURE E1

# Appendix B. Spot Dive Raw Data

**Transect T1 - Sea Wall**

| Parameter | Result | Remarks |
|---|---|---|
| ***Details:*** | | Transect T1 |
| Time: | 10:22 | |
| Date: | 11.12.09 | |
| Depth: | <6.9 | |
| Visibility: | 1m | |
| ***Corals:*** | | |
| Hermatypic Hard Coral Cover: | 0% | |
| No.Species | 0 | |
| CoralWatch Health (CA): | ~ | |
| Gorgonian Coral Cover | 0% | |
| No. Species | 0 | |
| Ahermatypic Hard Coral Cover: | 0% | |
| No. Species | 0 | |
| Soft Coral Cover: | 0% | |
| No. Species | 0 | |
| Rare Coral Species: | 0 | |
| ***Other Key Species:*** | | |
| *Perna viridis* | Yes | |
| Oysters | Yes | |
| Sponges | Yes | |
| Anemones | No | |
| Tunicates | Yes | |
| *Schizoporella* sp. | Yes | |
| *Zoanthid* spp. | No | |
| *Diadema Setosum* | No | |

| Parameter | Result | Remarks |
|---|---|---|
| ***Substratum:*** | | |
| Mud / Silt: | 0% | |
| Sand: | 0% | |
| Sand & Mud: | 0% | |
| Rubble: | 0% | |
| Rocks: | 0% | |
| Boulders: | 0% | |
| Large boulders(>50cm): | 0% | |
| Pavement: | 0% | |
| Cement | 100% | |
| Angle of seabed: | ~90deg | At wall |
| | ~10deg | On seabed |
| Silt Cover thickness: | <1mm | |

Comments:

A lot of rubbish and discarded items on the seabed.
*Bulga* sp. was recorded on this dive.
*Lytocarpus philippinus* on some of the rocks and rubbish.

**Transect T2a - Quarry Rock Crash Barrier**

| Parameter | Result | Remarks |
|---|---|---|
| ***Details:*** | | Transect T2a - Rock |
| Time: | 9:45 | |
| Date: | 11.12.09 | |
| Depth: | <6.9 | |
| Visibility: | 1m | |
| ***Corals:*** | | |
| Hermatypic Hard Coral Cover: | 0% | |
| No.Species | 0 | |
| CoralWatch Health (CA): | ~ | |
| Gorgonian Coral Cover | <5% | |
| No. Species | 6 | |
| Ahermatypic Hard Coral Cover: | <1% | |
| No. Species | 2 | |
| Soft Coral Cover: | <1% | |
| No. Species | 2 | |
| Rare Coral Species: | 0 | |
| ***Other Key Species:*** | | |
| *Perna viridis* | Yes | |
| Oysters | Yes | |
| Sponges | Yes | |
| Anemones | No | |
| Tunicates | Yes | |
| *Schizoporella* sp. | Yes | |
| *Zoanthid* spp. | No | |
| *Diadema Setosum* | No | |

| Parameter | Result | Remarks |
|---|---|---|
| ***Substratum:*** | | |
| Mud / Silt: | 0% | |
| Sand: | 0% | |
| Sand & Mud: | 0% | |
| Rubble: | 0% | |
| Rocks: | 60% | |
| Boulders: | 40% | |
| Large boulders(>50cm): | 0% | |
| Pavement: | 0% | |
| Concrete | 0% | |
| Angle of seabed: | ~45deg | |
| Silt Cover thickness: | <1mm | |

***Comments:***
A lot of rubbish and discarded items like steel cables.
*Bulga* sp. was recorded on this dive.
*Lytocarpus philippinus* on some of the rocks and rubbish.
Note that large gorgonians (>40cm) were recorded.
Six species of Gorgonian were :
- *Echinogorgia* sp.
- *Echinomuricea* sp.
- *Euplexaura* spp.
- *Guaiagorgia* sp.

Two species of Ahermatypic were :
- *Tubastraea faulkneri*
- *Paracycyathus rotundatus*

Two Species of soft coral were:
- *Dendronephthya* spp.

**Transect T2b - Sea Wall**

| Parameter | Result | Remarks |
|---|---|---|
| ***Details:*** | | Transect T2a - Rock |
| Time: | 10:01 | |
| Date: | 11.12.09 | |
| Depth: | <3.6m | |
| Visibility: | 1m | |
| ***Corals:*** | | |
| Hermatypic Hard Coral Cover: | 0% | |
| No.Species | 0 | |
| CoralWatch Health (CA): | ~ | |
| Gorgonian Coral Cover | <1% | |
| No. Species | 1 | |
| Ahermatypic Hard Coral Cover: | 0% | |
| No. Species | 0 | |
| Soft Coral Cover: | <1% | |
| No. Species | 1 | |
| Rare Coral Species: | 0 | |
| ***Other Key Species:*** | | |
| *Perna viridis* | Yes | |
| Oysters | Yes | |
| Sponges | Yes | |
| Anemones | No | |
| Tunicates | Yes | |
| *Schizoporella* sp. | Yes | |
| *Zoanthid* spp. | No | |
| *Diadema Setosum* | No | |

| Parameter | Result | Remarks |
|---|---|---|
| ***Substratum:*** | | |
| Mud / Silt: | 0% | |
| Sand: | 0% | |
| Sand & Mud: | 0% | |
| Rubble: | 0% | |
| Rocks: | 0% | |
| Boulders: | 0% | |
| Large boulders(>50cm): | 0% | |
| Pavement: | 0% | |
| Concrete | 100% | |
| Angle of seabed: | ~90deg | At wall |
| | ~10deg | On seabed |
| Silt Cover thickness: | <1mm | |

***Comments:***
A lot of rubbish and discarded items on the seabed.
*Bulga* sp. was recorded on this dive.
*Lytocarpus philippinus* on some of the rocks and rubbish.
Note that large gorgonians (>40cm) were recorded.
One species of Gorgonian was :
*Guaiagorgia* sp.
One species of soft coral was:
*Dendronephthya* sp.

**Transect T3 - Support Pillar**

| Parameter | Result | Remarks |
|---|---|---|
| ***Details:*** | | Transect T3 |
| Time: | 10:40 | |
| Date: | 11.12.09 | |
| Depth: | <13 | |
| Visibility: | 0.5m | |
| ***Corals:*** | | |
| Hermatypic Hard Coral Cover: | 0% | |
| No.Species | 0 | |
| CoralWatch Health (CA): | ~ | |
| Gorgonian Coral Cover | 0% | |
| No. Species | 0 | |
| Ahermatypic Hard Coral Cover: | 0% | |
| No. Species | 0 | |
| Soft Coral Cover: | 0% | |
| No. Species | 0 | |
| Rare Coral Species: | 0 | |
| ***Other Key Species:*** | | |
| *Perna viridis* | Yes | |
| Oysters | Yes | |
| Sponges | Yes | |
| Anemones | No | |
| Tunicates | Yes | |
| *Schizoporella* sp. | Yes | |
| *Zoanthid* spp. | No | |
| *Diadema Setosum* | No | |

| Parameter | Result | Remarks |
|---|---|---|
| ***Substratum:*** | | |
| Mud / Silt: | 0% | |
| Sand: | 0% | |
| Sand & Mud: | 0% | |
| Rubble: | 0% | |
| Rocks: | 0% | |
| Boulders: | 0% | |
| Large boulders(>50cm): | 0% | |
| Pavement: | 0% | |
| Concrete | 100% | |
| Angle of seabed: | ~90deg | On pillars |
| Silt Cover thickness: | <1mm | |

***Comments:***
*Bulga* sp. was recorded on this dive.
*Lytocarpus philippinus* was recorded on this dive.
This dive was on 4 pillars in this area.

**Transect T4 - Support Pillar**

| Parameter | Result | Remarks |
|---|---|---|
| ***Details:*** | | Transect T4 |
| Time: | 11:23 | |
| Date: | 11.12.09 | |
| Depth: | <12m | |
| Visibility: | 0.5m | |
| ***Corals:*** | | |
| Hermatypic Hard Coral Cover: | 0% | |
| No.Species | 0 | |
| CoralWatch Health (CA): | ~ | |
| Gorgonian Coral Cover | <1% | |
| No. Species | 1 | |
| Ahermatypic Hard Coral Cover: | 0% | |
| No. Species | 0 | |
| Soft Coral Cover: | <1% | |
| No. Species | 1 | |
| Rare Coral Species: | 0 | |
| ***Other Key Species:*** | | |
| *Perna viridis* | Yes | |
| Oysters | Yes | |
| Sponges | Yes | |
| Anemones | No | |
| Tunicates | Yes | |
| *Schizoporella* sp. | Yes | |
| *Zoanthid* spp. | No | |
| *Diadema Setosum* | No | |

| Parameter | Result | Remarks |
|---|---|---|
| ***Substratum:*** | | |
| Mud / Silt: | 0% | |
| Sand: | 0% | |
| Sand & Mud: | 0% | |
| Rubble: | 0% | |
| Rocks: | 0% | |
| Boulders: | 0% | |
| Large boulders(>50cm): | 0% | |
| Pavement: | 0% | |
| Concrete | 100% | |
| Angle of seabed: | ~90deg | On pillars |
| Silt Cover thickness: | <1mm | |

***Comments:***
*Bulga* sp. was recorded on this dive.
*Lytocarpus philippinus* was recorded on this dive.
This dive was on 4 pillars in this area.
One species of Gorgonian was :
*Guaiagorgia* sp.
One species of soft coral was:
*Dendronephthya* sp.
This dive was on 4 pillars in this area.

**Transect T5 - Support Pillar**

| Parameter | Result | Remarks |
|---|---|---|
| ***Details:*** | | Transect T5 |
| Time: | 11:02 | |
| Date: | 11.12.09 | |
| Depth: | <14 | |
| Visibility: | 0.5 | |
| ***Corals:*** | | |
| Hermatypic Hard Coral Cover: | 0% | |
| No.Species | 0 | |
| CoralWatch Health (CA): | ~ | |
| Gorgonian Coral Cover | 0% | |
| No. Species | 0 | |
| Ahermatypic Hard Coral Cover: | 0% | |
| No. Species | 0 | |
| Soft Coral Cover: | 0% | |
| No. Species | 0 | |
| Rare Coral Species: | 0 | |
| ***Other Key Species:*** | | |
| *Perna viridis* | Yes | |
| Oysters | Yes | |
| Sponges | Yes | |
| Anemones | No | |
| Tunicates | Yes | |
| *Schizoporella* sp. | Yes | |
| *Zoanthid* spp. | No | |
| *Diadema Setosum* | No | |

| Parameter | Result | Remarks |
|---|---|---|
| ***Substratum:*** | | |
| Mud / Silt: | 0% | |
| Sand: | 0% | |
| Sand & Mud: | 0% | |
| Rubble: | 0% | |
| Rocks: | 0% | |
| Boulders: | 0% | |
| Large boulders(>50cm): | 0% | |
| Pavement: | 0% | |
| Concrete | 100% | |
| Angle of seabed: | ~90deg | At wall |
| Silt Cover thickness: | <1mm | |

***Comments:***
*Bulga* sp. was recorded on this dive.
*Lytocarpus philippinus* was recorded on this dive.
This dive was on 4 pillars in this area.

**Transect T6 - Support Pillar**

| Parameter | Result | Remarks |
|---|---|---|
| ***Details:*** | | Transect T6 |
| Time: | 11:45 | |
| Date: | 11.12.09 | |
| Depth: | <13m | |
| Visibility: | 0.5m | |
| ***Corals:*** | | |
| Hermatypic Hard Coral Cover: | 0% | |
| No.Species | 0 | |
| CoralWatch Health (CA): | ~ | |
| Gorgonian Coral Cover | 0% | |
| No. Species | 0 | |
| Ahermatypic Hard Coral Cover: | 0% | |
| No. Species | 0 | |
| Soft Coral Cover: | 0% | |
| No. Species | 0 | |
| Rare Coral Species: | 0 | |
| ***Other Key Species:*** | | |
| *Perna viridis* | Yes | |
| Oysters | Yes | |
| Sponges | Yes | |
| Anemones | No | |
| Tunicates | Yes | |
| *Schizoporella* sp. | Yes | |
| *Zoanthid* spp. | No | |
| *Diadema Setosum* | No | |

| Parameter | Result | Remarks |
|---|---|---|
| ***Substratum:*** | | |
| Mud / Silt: | 0% | |
| Sand: | 0% | |
| Sand & Mud: | 0% | |
| Rubble: | 0% | |
| Rocks: | 0% | |
| Boulders: | 0% | |
| Large boulders(>50cm): | 0% | |
| Pavement: | 0% | |
| Concrete | 100% | |
| Angle of seabed: | ~90deg | At wall |
| Silt Cover thickness: | <1mm | |

***Comments:***
*Bulga* sp. was recorded on this dive.
*Lytocarpus philippinus* was recorded on this dive.
This dive was on 4 pillars in this area.

**Transect T7 - Dolo Seawall**

| Parameter | Result | Remarks |
|---|---|---|
| ***Details:*** | | Transect T7 |
| Time: | 13:30 | |
| Date: | 11.12.09 | |
| Depth: | <6.3m | |
| Visibility: | 1m | |
| ***Corals:*** | | |
| Hermatypic Hard Coral Cover: | 0% | |
| No.Species | 0 | |
| CoralWatch Health (CA): | ~ | |
| Gorgonian Coral Cover | 0% | |
| No. Species | 0 | |
| Ahermatypic Hard Coral Cover: | 0% | |
| No. Species | 0 | |
| Soft Coral Cover: | 0% | |
| No. Species | 0 | |
| Rare Coral Species: | 0 | |
| ***Other Key Species:*** | | |
| *Perna viridis* | No | |
| Oysters | No | |
| Sponges | Yes | |
| Anemones | No | |
| Tunicates | No | |
| *Schizoporella* sp. | No | |
| *Zoanthid* spp. | No | |
| *Diadema Setosum* | No | |

| Parameter | Result | Remarks |
|---|---|---|
| ***Substratum:*** | | |
| Mud / Silt: | 0% | |
| Sand: | 0% | |
| Sand & Mud: | 0% | |
| Rubble: | 0% | |
| Rocks: | 0% | |
| Boulders: | 0% | |
| Large boulders(>50cm): | 0% | |
| Pavement: | 0% | |
| Concrete | 100% | |
| Angle of seabed: | ~45deg | At wall |
| Silt Cover thickness: | <2mm | |

***Comments:***
This dive was on a dolo seawall

**Transect T8 - Dolo Seawall**

| Parameter | Result | Remarks |
|---|---|---|
| ***Details:*** | | Transect T8 |
| Time: | 12:20 | |
| Date: | 11.12.09 | |
| Depth: | <5.0m | |
| Visibility: | 0.5m | |
| ***Corals:*** | | |
| Hermatypic Hard Coral Cover: | 0% | |
| No.Species | 0 | |
| CoralWatch Health (CA): | ~ | |
| Gorgonian Coral Cover | 0% | |
| No. Species | 0 | |
| Ahermatypic Hard Coral Cover: | 0% | |
| No. Species | 0 | |
| Soft Coral Cover: | 0% | |
| No. Species | 0 | |
| Rare Coral Species: | 0 | |
| ***Other Key Species:*** | | |
| *Perna viridis* | No | |
| Oysters | No | |
| Sponges | Yes | |
| Anemones | No | |
| Tunicates | No | |
| *Schizoporella* sp. | No | |
| *Zoanthid* spp. | No | |
| *Diadema Setosum* | No | |

| Parameter | Result | Remarks |
|---|---|---|
| ***Substratum:*** | | |
| Mud / Silt: | 0% | |
| Sand: | 0% | |
| Sand & Mud: | 0% | |
| Rubble: | 0% | |
| Rocks: | 0% | |
| Boulders: | 0% | |
| Large boulders(>50cm): | 0% | |
| Pavement: | 0% | |
| Concrete | 100% | |
| Angle of seabed: | ~45deg | At wall |
| Silt Cover thickness: | <2mm | |

***Comments:***
*Bulga* sp. was recorded on this dive.
This dive was on a dolo seawall

**Transect T9 - Dolo Seawall**

| Parameter | Result | Remarks |
|---|---|---|
| ***Details:*** | | Transect T9 |
| Time: | 12:56 | |
| Date: | 11.12.09 | |
| Depth: | <6 | |
| Visibility: | 1m | |
| ***Corals:*** | | |
| Hermatypic Hard Coral Cover: | 0% | |
| No.Species | 0 | |
| CoralWatch Health (CA): | ~ | |
| Gorgonian Coral Cover | 0% | |
| No. Species | 0 | |
| Ahermatypic Hard Coral Cover: | 0% | |
| No. Species | 0 | |
| Soft Coral Cover: | 0% | |
| No. Species | 0 | |
| Rare Coral Species: | 0 | |
| ***Other Key Species:*** | | |
| *Perna viridis* | Yes | |
| Oysters | No | |
| Sponges | Yes | |
| Anemones | No | |
| Tunicates | No | |
| *Schizoporella* sp. | Yes | |
| *Zoanthid* spp. | No | |
| *Diadema Setosum* | No | |

| Parameter | Result | Remarks |
|---|---|---|
| ***Substratum:*** | | |
| Mud / Silt: | 0% | |
| Sand: | 0% | |
| Sand & Mud: | 0% | |
| Rubble: | 0% | |
| Rocks: | 0% | |
| Boulders: | 0% | |
| Large boulders(>50cm): | 0% | |
| Pavement: | 0% | |
| Concrete | 100% | |
| Angle of seabed: | ~45deg | At wall |
| Silt Cover thickness: | <1mm | |

***Comments:***
*Bulga* sp. was recorded on this dive.
*Lytocarpus philippinus* was recorded on this dive.
This dive was on a dolo seawall

**Transect T10 - Natural Coastline (Green Island)**

| Parameter | Result | Remarks |
|---|---|---|
| ***Details:*** | | Transect T10 |
| Time: | 16:30 | |
| Date: | 11.12.09 | |
| Depth: | <6.9 | |
| Visibility: | 1m | |
| ***Corals:*** | | |
| Hermatypic Hard Coral Cover: | <5% | |
| No.Species | 12 | |
| CoralWatch Health (CA): | ~ | |
| Gorgonian Coral Cover | <5% | |
| No. Species | 5 | |
| Ahermatypic Hard Coral Cover: | <1% | |
| No. Species | 1 | |
| Soft Coral Cover: | <5% | |
| No. Species | 1 | |
| Rare Coral Species: | 0 | |
| ***Other Key Species:*** | | |
| *Perna viridis* | Yes | |
| Oysters | Yes | |
| Sponges | Yes | |
| Anemones | Yes | |
| Tunicates | Yes | |
| *Schizoporella* sp. | Yes | |
| *Zoanthid* spp. | Yes | |
| *Diadema Setosum* | Yes | |

| Parameter | Result | Remarks |
|---|---|---|
| ***Substratum:*** | | |
| Mud / Silt: | 10% | |
| Sand: | 5% | |
| Sand & Mud: | 25% | |
| Rubble: | 10% | |
| Rocks: | 30% | |
| Boulders: | 10% | |
| Large boulders(>50cm): | 5% | |
| Pavement: | 5% | |
| Concrete | 0% | |
| Angle of seabed: | ~20% | At seabed |
| Silt Cover thickness: | <2mm | |

***Comments:***
A lot of rubbish and discarded items on the seabed.
*Bulga* sp. was recorded on this dive.
*Lytocarpus philippinus* on some of the rocks and rubbish.
Note that large gorgonians (>40cm) were recorded.
Five species of Gorgonian were :
*Echinomuricea* spp.
*Euplexaura* sp.
*Echinogorgia* sp.
One species of Ahermatypic was :
*Paracycyathus rotundatus*
One Species of soft coral was:
*Dendronephthya* sp.
The hermatypic coral species list is in the REA Data.
Survey in area of natural coastline.

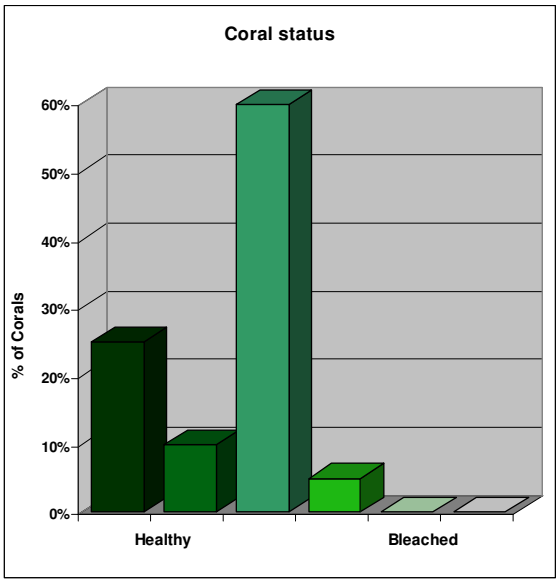
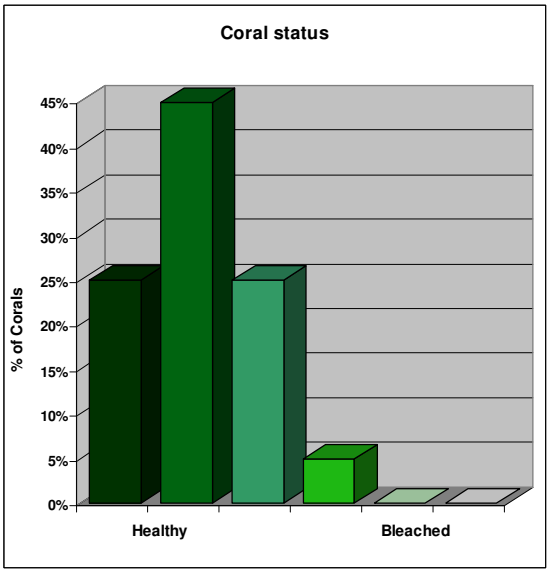
**Transect T11 - Natural Coastline (Kau Sai Chau)**

| Parameter | Result | Remarks |
|---|---|---|
| ***Details:*** | | Transect T11 |
| Time: | 14:15 | |
| Date: | 11.12.09 | |
| Depth: | <9.1 | |
| Visibility: | 1.5m | |
| ***Corals:*** | | |
| Hermatypic Hard Coral Cover: | <10% | |
| No.Species | 19 | |
| CoralWatch Health (CA): | ~ | |
| Gorgonian Coral Cover | <10% | |
| No. Species | 5 | |
| Ahermatypic Hard Coral Cover: | <1% | |
| No. Species | 1 | |
| Soft Coral Cover: | <1% | |
| No. Species | 1 | |
| Rare Coral Species: | 0 | |
| ***Other Key Species:*** | | |
| *Perna viridis* | Yes | |
| Oysters | Yes | |
| Sponges | Yes | |
| Anemones | Yes | |
| Tunicates | Yes | |
| *Schizoporella* sp. | Yes | |
| *Zoanthid* spp. | Yes | |
| *Diadema Setosum* | Yes | |

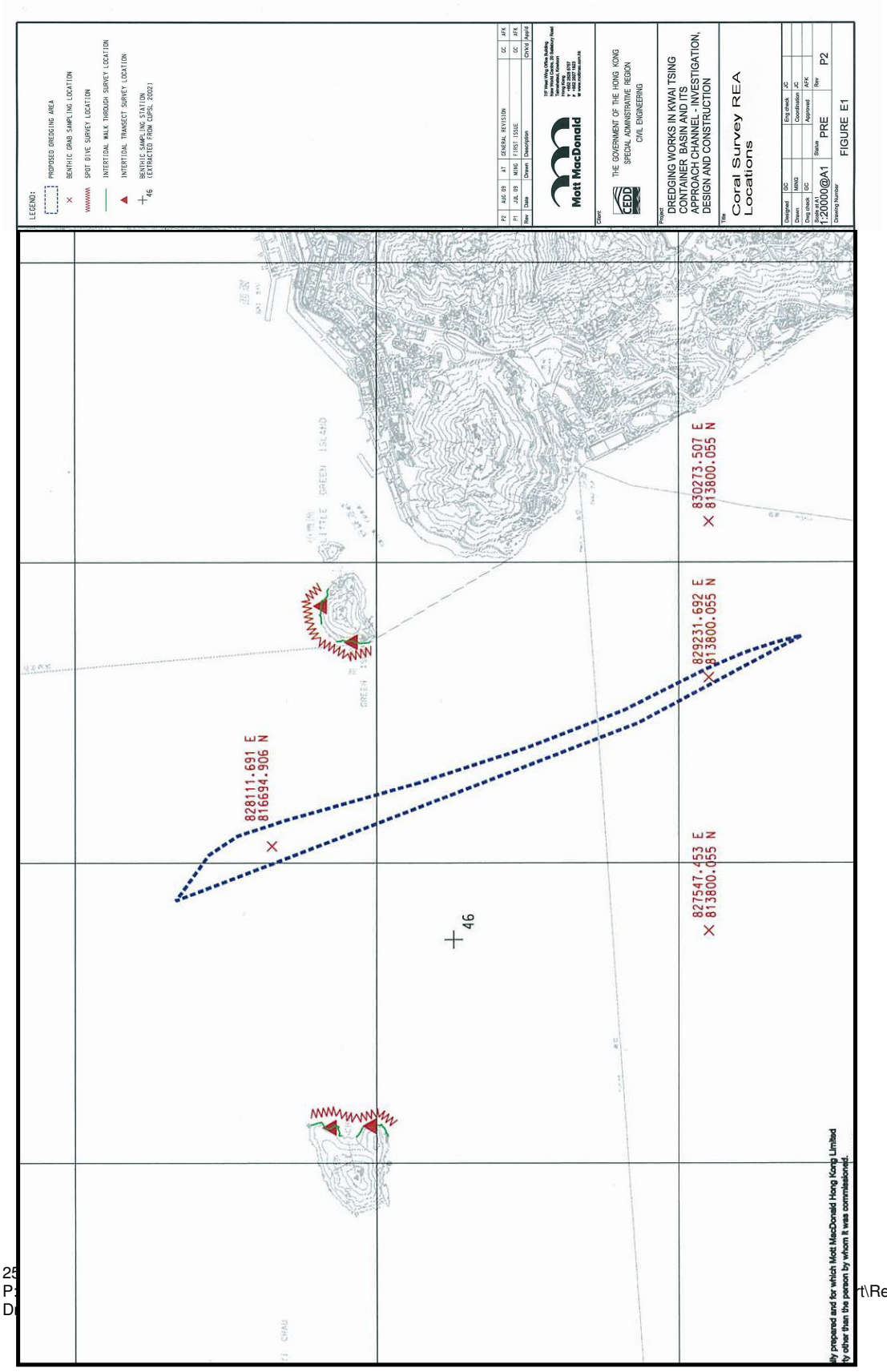
| Parameter | Result | Remarks |
|---|---|---|
| ***Substratum:*** | | |
| Mud / Silt: | 5% | |
| Sand: | 5% | |
| Sand & Mud: | 20% | |
| Rubble: | 5% | |
| Rocks: | 35% | |
| Boulders: | 15% | |
| Large boulders(>50cm): | 10% | |
| Pavement: | 5% | |
| Concrete | 0% | |
| Angle of seabed: | ~10deg | At seabed |
| Silt Cover thickness: | <2mm | |

***Comments:***
A lot of rubbish and discarded items on the seabed.
*Bulga* sp. was recorded on this dive.
*Lytocarpus philippinus* on some of the rocks and rubbish.
Note that large gorgonians (>40cm) were recorded.
Five species of Gorgonian were :
*Echinomuricea* spp.
*Euplexaura* sp.
*Echinogorgia* sp.
One species of Ahermatypic was :
*Paracycyathus rotundatus*
One Species of soft coral was:
*Dendronephthya* sp.
The hermatypic coral species list is in the REA Data.
Survey in area of natural coastline.

# Appendix C. Coralwatch Graphs

| | |
|---|---|
|  | Graph 1. Transect T10. CA = 4.09 |
|  | Graph 2. Transect T11. CA = 4.55 |

# Appendix D. REA Transect Locations


LEGEND:
PROPOSED DREDGING AREA
BENTHIC GRAB SAMPLING LOCATION
SPOT DIVE SURVEY LOCATION
INTERTIDAL WALK THROUGH SURVEY LOCATION
INTERTIDAL TRANSECT SURVEY LOCATION
BENTHIC SAMPLING STATION (EXTRACTED FROM CUPSL 2002)
46
P2 AUG 09 AT GENERAL REVISION
P1 JUL 09 KHNG FIRST ISSUE
Rev Date Drawn Description
Mott MacDonald
Client
THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION
CIVIL ENGINEERING
Project
DREDGING WORKS IN KWAI TSING CONTAINER BASIN AND ITS APPROACH CHANNEL - INVESTIGATION, DESIGN AND CONSTRUCTION
Title
Coral Survey REA Locations
Designed GC
Drawn MANG
Eng check JC
Coordination JC
Approval AFK
Drg check GC
Scale 1:20000@A1
Status PRE
Rev P2
Drawing Number FIGURE E1
828111.691 E
816694.906 N
829231.692 E
813800.055 N
830273.507 E
813800.055 N
827547.453 E
813800.055 N
46
LITTLE GREEN ISLAND
GREEN ISLAND
CHAU

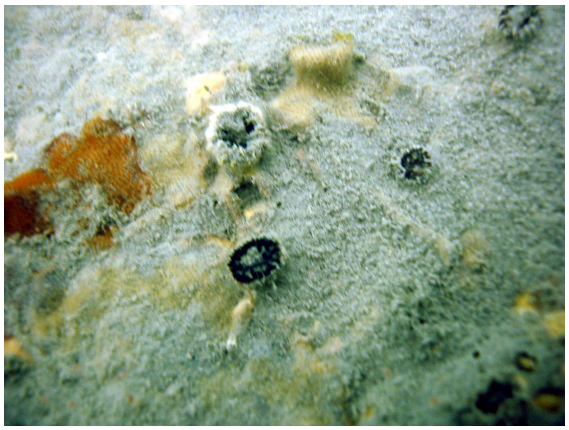
# Appendix E. REA Raw Data

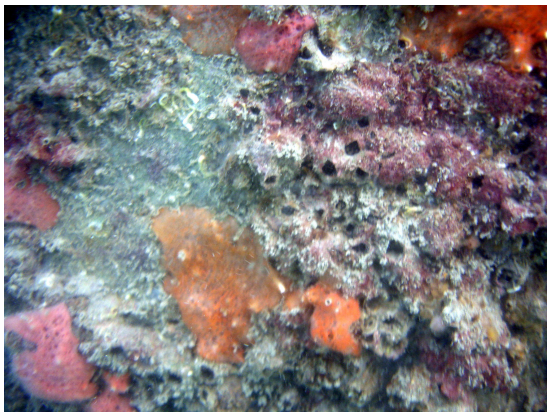
| Transect | REA 1 | REA 2 |
|---|---|---|
| **General Data** | | |
| Depth min (m) | 1.3 | 1.2 |
| Depth max (m) | 3.5 | 2.7 |
| Average (m): | 2.4 | 1.95 |
| | | |
| Exposure (1~4) | 4 | 4 |
| Sediment (0~3) | 2 | 2 |
| Slope (0=Flat, 4=vertical) | 2 | 1 |
| | | |
| Hard substratum (% of total) | 80 | 70 |
| Bed Rock (% of HS) | 5 | 5 |
| Large Boulders (% of HS) | 10 | 5 |
| Rocks(% of HS) | 75 | 80 |
| | | |
| Soft Substratum (% of total) | 20 | 30 |
| Sand (% of SS) | 25 | 30 |
| Silt/Mud (% of SS) | 50 | 50 |
| Mud (% of SS) | 25 | 20 |
| | | |
| Visibility (m) | 1.5 | 1.5 |
| Salinity (ppt) | 31 | 31 |
| Temp ºC (1m) | 21 | 21 |
| **Taxa** | | |
| **Bryazoa** | | |
| Brown/orange encrusting | 1 | 0 |
| Red encrusting | 0 | 0 |
| *Bugula* sp. | 2 | 2 |
| *Schizoporella* sp. | 3 | 2 |
| **Actiniaria (sea anemonies)** | | |
| *Anthopleura dixoniana* | 0 | 0 |
| Anemone | 2 | 1 |
| Sand anemone | 2 | 2 |
| **Alcyoniina Group** | | |
| *Dendronephthya* spp. | 1 | 2 |
| **Scleraxonia Group** | | |
| *Echinogorgia* sp. | 2 | 1 |
| *Echinomuricea* sp. | 1 | 1 |
| *Euplexaura* spp. | 2 | 2 |
| *Guaiagorgia* sp. | 0 | 0 |
| **Hermatypic Scleractinia** | | |
| *Montipora peltiformis* | 1 | 0 |
| *Psammocora superficialis* | 2 | 0 |
| *Psammocora haimeana* | 0 | 1 |
| *Coscinaraean sp.* | 1 | 0 |
| *Pavona decussata* | 1 | 0 |

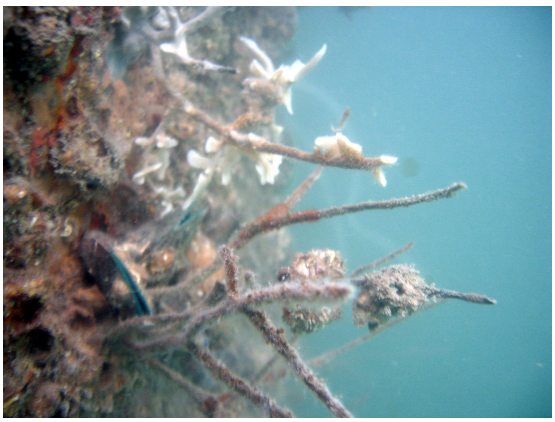
| Transect | REA 1 | REA 2 |
|---|---|---|
| *Favia speciosa* | 2 | 1 |
| *Favia rotumana* | 1 | 2 |
| *Favites pentagona* | 2 | 2 |
| *Favites chinensis* | 1 | 0 |
| *Favites abdita* | 2 | 1 |
| *Goniastrea aspera* | 1 | 0 |
| *Platygyra acuta* | 1 | 0 |
| *Plesiastrea versipora* | 2 | 0 |
| *Oulastrea crispata* | 1 | 1 |
| *Leptastrea purpurea* | 0 | 0 |
| *Leptastrea pruinosa* | 0 | 0 |
| *Cyphastrea serailia* | 3 | 0 |
| *Porites luta* | 2 | 0 |
| *Goniopora columna* | 1 | 0 |
| *Goniopora stutchburyi* | 1 | 1 |
| **Ahermatypic Scleractinia** | | |
| *Tubastraea faulkneri* | 0 | 0 |
| *Paracycyathus rotundatus* | 1 | 1 |
| **Mollusca** | | |
| *Phenacovolva brevitostris* | 0 | 0 |
| *Perna viridis* | 2 | 2 |
| Oysters small | 1 | 1 |
| Oysters large | 2 | 2 |
| **Porifere (sponge)** | | |
| With profile | 1 | 0 |
| Encrusting | 3 | 3 |
| Golf ball | 1 | 1 |
| **Crustacea** | | |
| Cirripedea | 0 | 0 |
| **Echinodermata** | | |
| *Diadema setosum* | 2 | 3 |
| *Parasalenia gratiosa* | 0 | 0 |
| *Echinothrix calamaris* | 2 | 2 |
| *Holothuria leucospilota* | 1 | 1 |
| **Misc.** | | |
| Coralline algae | 1 | 1 |
| Cyanobacteria l mats | 0 | 0 |
| *Zoanthid* spp. | 1 | 0 |
| Tunicate | 2 | 2 |

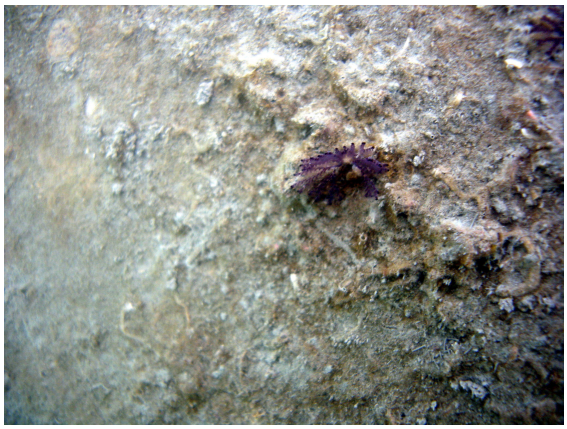
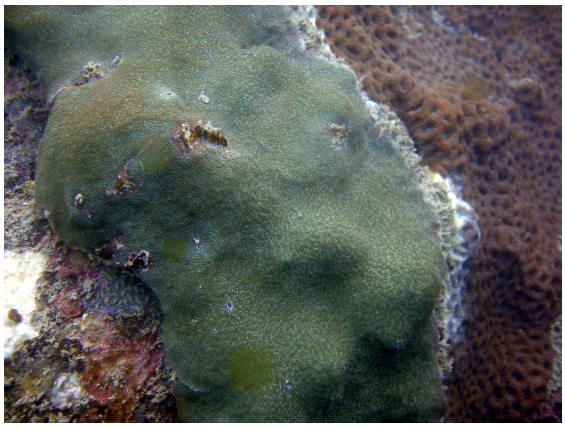
# Appendix F. Photographs

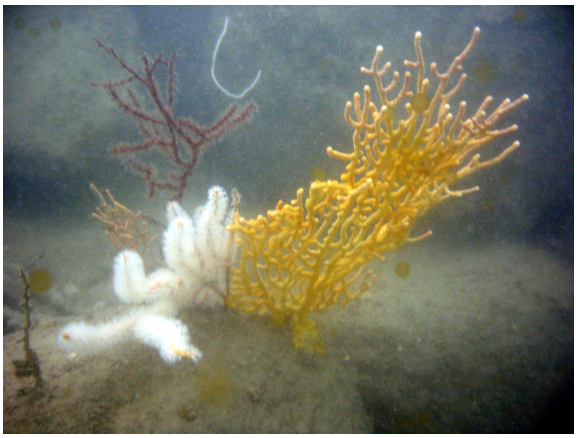
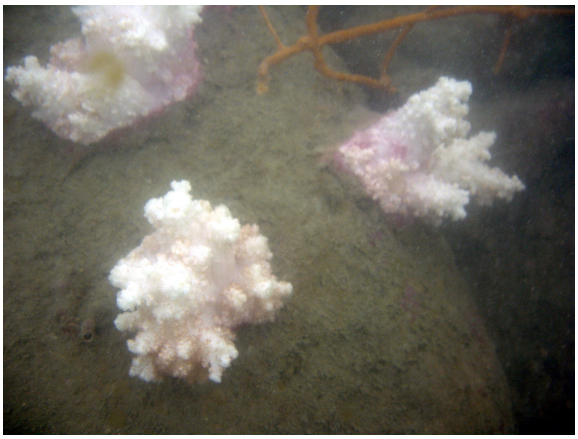
| | |
|---|---|
|  | Plate 1. The seawall at T2. |
|  | Plate 2. The quarry rock protection mound immediately out from T2. |
|  | Plate 3. A colony of *Echinogorgia* sp. on the quarry rock protection mound at T2. |

| | |
|---|---|
|  | Plate 4. The ahermatypic hard coral *Paracycyathus rotundatus* |
|  | Plate 5. The ahermatypic hard coral *Tubastraea faulkneri* |
|  | Plate 6. The gorgonian *Guaiagorgia* sp. |

| | |
|---|---|
|  | Plate 7. Many of the dives involved working around ships. Special diving procedures were required. |
|  | Plate 8. Some of the transect stations were part of the shipping pier. In such cases, the survey was carried out down the pillars. |
|  | Plate 9. The start of the sub-tidal area of the pillars had a lot of marine life attached. This changed further on down the pillar. |

| | |
|---|---|
|  | Plate 10. Some of the colonies of gorgonians on the pillars were dead. |
|  | Plate 11. A section of the container terminal that was surveyed as part of this project. |
|  | Plate 12. A dolos seawall. This wall seemed new in that there was very little settled on it. |

| | |
|---|---|
|  | Plate 13. The dolosse had very little marine life on them. |
|  | Plate 14. Some of the natural coastline surveyed at Kau Yi Chau. |
|  | Plate 14. A cluster of hard corals at Kau Yi Chau. |

| | |
|---|---|
|  | Plate 15. A cluster of gorgonians at Kau Yi Chau.. |
|  | Plate 16. A section of the natural coastline at Green Island. |
|  | Plate 17. Soft coral and a gorgonian at Green Island. |