

Appendix 4.4

Consultancy Agreement No. NEX/2301

South Island Line (East) – Ecological Impact Assessment

Marine Ecological Survey (Dive Survey)



Report for Dive Survey

at Aberdeen Channel (February 2009)

and

Telegraph Bay (November 2009)



miniprojects co. Ltd.

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and
Telegraph Bay

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Prepared by:
miniprojects co. Ltd.

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1. Introduction

1.1 Project Background

Mott MacDonald Hong Kong Limited has been appointed to formulate a survey team to conduct a marine ecology survey for the project South Island Line (East) – Ecological Impact Assessment.

miniprojects Company Limited (miniprojects co. Ltd.) have been commissioned by Mott MacDonald Hong Kong Limited to undertake Marine Ecological Survey (Dive Surveys) at Aberdeen Channel (Wong Chuk Hang) and Cyberport (Telegraph Bay).

The Dive Surveys aim to record the physical (substrate types) and ecological (marine benthic organisms and corals) benthic components at selected locations that will be potentially affected by the construction of the proposed South Island Line (East).

This report presents the results of dive surveys at two locations (Wong Chuk Hang and Telegraph bay). As background to the dive surveys, a brief review of previous subtidal survey findings at surrounding areas is presented in Section 2 of this report. The survey methodology is described in Section 3, the results and summary of the survey findings are presented in Sections 4 and 5, respectively.

2. Previous Survey Findings

2.1 Survey Areas near Wong Chuk Hang, Aberdeen Channel

2.1.1 Ocean Park Master Redevelopment Project Contract C105 – Baseline Coral Survey Report

No previous subtidal survey has been conducted along the coast of Wong Chuk Hang in the Aberdeen Channel. The nearest area, which has been subjected to coral survey, was at the artificial shore at the east side beyond the typhoon shelter, at where a detail baseline coral survey has been conducted for the OPMR project in 2007 (Maunsell 2007). The coral survey site, known as Site 5 in the report, is ~1 km away from the proposed construction site at Wong Chuk Hang.

Assessment of substrate and ecological attributes were performed by semi-quantitative, Rapid Ecological Assessment (REA) surveys. In the survey, a total seven hard (*Pasmocora superficialis*, *Montipora cf. turgescens*, *Plesiastrea versipora*, *Cyphastrea serailia*, *Leptastrea pruinosa*, *Goniopora stutchburyi* and *Porites* sp.) and two soft coral (*Lobophytum depressum* and *Euplexaura* sp.) species were found on boulders at shallow water.

2.2 Survey Areas near Telegraph Bay, Cyperport

In studies conducted for the Civil Engineering Department (Binnie Consultants Limited 1995, 1997) and Environmental Protection Department (CDT 2004), low abundance and diversity of hard and soft corals have also been recorded at Magazine Island and Ap Lei Chau, which are approx. 4 - 5 km away from the coast of Cyperport.

The latest, previous information on coral community around the construction area at Telegraph Bay is from the dive surveys conducted in 1990s (Binnie Consultants Limited 1995) and 2005 (Black and Veatch 2006) at the same location and nearby areas. In the surveys, no hard coral species, soft coral species or other species of conservation interest was recorded. The conservation value of the survey areas was, therefore, identified as low.

3. Methodology

3.1 Dive Surveys – Spot Dive and Rapid Ecological Assessment Surveys

Along the coasts of Wong Chuk Hang in the Aberdeen Channel and Telegraph Bay at Cyberport, assessment of substrate and ecological attributes was firstly performed by spot dives at selected locations (Fig. 3.1), followed by semi-quantitative, Rapid Ecological Assessment (REA) surveys if any taxa of conservative interest were present. All field data were collected by marine ecologists using SCUBA dive.

REA surveys provide information on the relative cover of coral and other major benthic groups, as well as inventory of sessile benthic taxa used to define community types. REA has been adopted in many regions to examine baseline information on coral reefs, such as the Great Barrier Reef (DeVantier et al. 1998). This method can be applied to a wide range of coral reef and community types and were also used in a coral community study in Hong Kong with some modification (OCL 2003).

On 21-22 February 2009, spot dive surveys were conducted at six sites at Wong Chuk as shown in Fig. 3.1. At site with the presence corals or other taxa of conservation interest, REA surveys were conducted to obtain more detail data on substrate and ecological attributes. In this study, REA surveys were conducted at two dive survey sites as shown in Fig. 3.2.

On 29 November 2009, spot dive surveys were conducted at six sites at Telegraph Bay as shown in Fig. 3.3. REA surveys were conducted at three sites (Fig. 3.4) to obtain detail data on substrate and ecological attributes.

At each site, the REA survey was performed along a 50m transect laid parallel to the shore. The benthic cover, taxon abundance, and ecological attributes of the transects were recorded in a swathe of 2m wide, 1m either side of the transect.

The locations and routes (starting and end points) of the REA transects were recorded on site using GPS (Garmin GPS 60CS). Pictures of representative taxa and video footages along the transects were taken during the surveys.

Two types of information were recorded:

1. Cover of the major benthic groups;
2. Inventory of sessile benthic taxa.

These were performed according to Tier I and Tier II levels of information.

Tier I: Categorization of ecological (benthic cover) and environmental variables.

To describe the benthic cover, six substrate and seven ecological attributes (Table 3.1a) were assigned. Each attribute was given a rank, from 0 to 6 (Table 3.1b) based on the overall cover along the survey area.

Tier II: Taxonomic inventories to define types of benthic communities.

An inventory of benthic taxa was compiled during each swim. Taxa were identified either *in situ* or with the aid of photos to confirm identification afterward.

Hard corals (Order Scleractinia) – to genus and species level where possible;

Soft corals (Subclass Octocorallia) – to genus level where possible;

Other benthos (sponges, zoanthids, bryozoans, macroalgae, etc) – to genus level where possible or phylum with growth form;

Each taxon in the inventory will be given a rank (0 to 5) on the basis of its abundance in the community at the site (Table 3.1c). These broad categories rank the taxa in terms of the relative abundance of individuals, rather than the contribution to benthic cover, at each site.

Table 3.1: Categories of a) benthic attributes, b) ordinal ranks of percentage cover of substrate, and (c) ordinal ranks of taxa abundance.

a) Benthic attributes		b) Percentage Cover		c) Taxon abundance	
Substrate	Ecological	Rank	Percentage Cover	Rank	Abundance
Bedrock	Hard Corals	0	Not recorded	0	Absent
Boulders (diameter >50cm)	Dead Coral Skeleton	1	1-5%	1	Sparse
Cobbles (diameter < 50cm)	Soft Corals	2	6-10%	2	Uncommon
Rubble (dead corals)	Sea anemone beds	3	11-30%	3	Common
Sand with gravel	Encrusting Algae	4	31-50%	4	Abundant
Mud & Silt	Coralline Algae	5	51-75%	5	Dominant
	Erect Macroalgae	6	76-100%		

Fig. 3.1 Map showing Locations of the Spot Dive Survey Sites at Aberdeen Channel.



Fig. 3.2 Map showing Locations of the REA Survey Sites at Aberdeen Channel.



Fig. 3.3 Map showing Locations of the Spot Dive Survey Sites at Telegraph Bay (Cyberport).

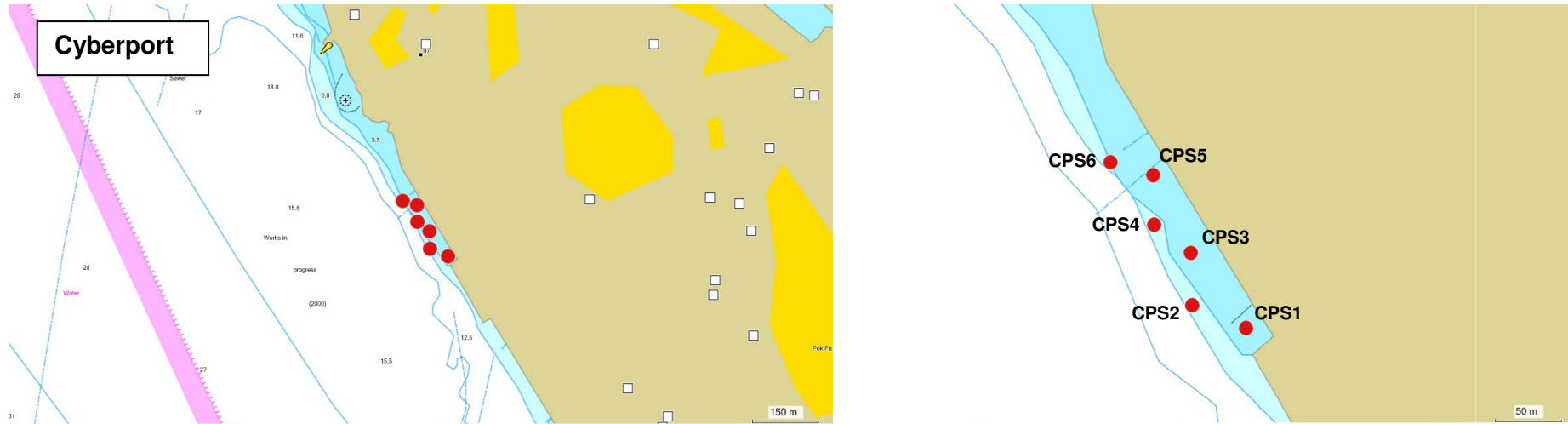
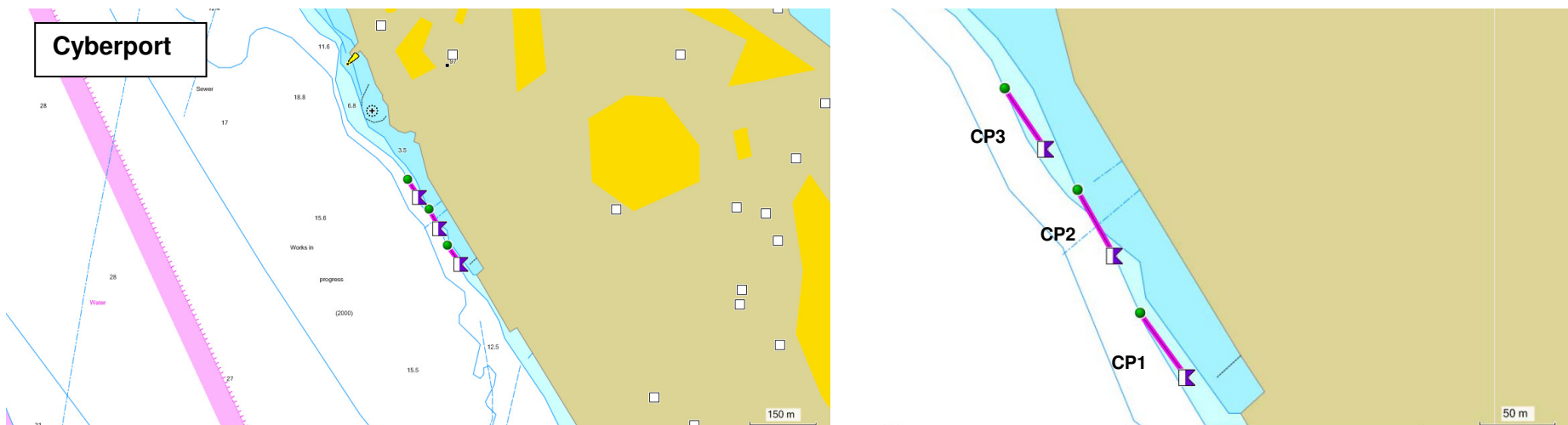


Fig. 3.4 Map showing Locations of the REA Survey Sites at Telegraph Bay (Cyberport)



4. Results

4.1 Dive Surveys – Spot Dive and Rapid Ecological Assessment Surveys

The dive surveys along the coast of Wong Chuk Hang in the Aberdeen Channel, and Telegraph Bay at Cyberport were conducted on 21, 22 February and 29 November 2009, respectively.

The locations of the spot dives and the transects for REA surveys are shown in Figs. 3.1, 3.2 and 3.3, and survey conditions in Tables 4.1 and 4.2. Records of ecological and substrate attributes, as well as the taxonomic inventories are presented in Tables 4.3 and 4.4. Photos of physical characteristics of the survey sites and substrate characteristics are shown in Appendices I to III.

Table 4.1: Location and Physical attributes of Spot Dive Sites

Location	Spot Dive Site	GPS Coordinates	Depth (m)	Visibility (m)	Substrate type	Presence of Hard Corals?	Presence of Soft Corals?
Wong Chuk Hang	ES1	N 22°14'43.9" E 114°09'37.3"	5 - 8	1	Muddy bottom	NO	NO
	ES2	N 22°14'44.5" E 114°09'37.1"	2 - 4	0.5	Muddy bottom with waste wood	YES	NO
	ES3	N 22°14'44.8" E 114°09'35.9"	5 - 8	1	Muddy bottom	NO	NO
	ES4	N 22°14'45.0" E 114°09'36.5"	2 - 4	0.5	Muddy bottom with waste wood and tyres	YES	YES
	ES5	N 22°14'45.7" E 114°09'35.7"	5 - 8	1	Muddy bottom	NO	NO
	ES6	N 22°14'46.4" E 114°09'36.3"	2 - 4	0.5	Muddy bottom with small boulders	YES	NO

Location	Spot Dive Site	GPS Coordinates	Depth (m)	Visibility (m)	Substrate type	Presence of Hard Corals?	Presence of Soft Corals?
Telegraph Bay	CPS1	N 22°15'34.6" E 114°07'43.5"	2-4	1	Artificial boulders	YES	NO
	CPS2	N 22°15'35.2" E 114°07'41.9"	5 - 8	0.5	Muddy bottom	NO	NO
	CPS3	N 22°15'36.3" E 114°07'41.8"	2-4	1	Artificial boulders	YES	NO
	CPS4	N 22°15'37.0" E 114°07'40.8"	5 - 8	0.5	Muddy bottom	NO	NO
	CPS5	N 22°15'38.3" E 114°07'40.9"	2-4	1	Artificial boulders	YES	NO
	CPS6	N 22°15'38.6" E 114°07'39.5"	5 - 8	0.5	Muddy bottom	NO	NO

Table 4.2: Location of REA Survey Sites and Physical Condition during Each Survey.

Location	REA Dive Site	GPS Coordinates	Depth (m)	Visibility (m)	Weather	Tide	Current (knot)
Wong Chuk Hang	ET1	Start N 22°14'45.1" E 114°09'36.5"	2 - 4	1	Calm Sunny	Flood	0.5 – 1
		End N 22°14'44.0" E 114°09'37.7"					
	ET2	Start N 22°14'46.8" E 114°09'36.6"	2 - 4	1			
		End N 22°14'45.3" E 114°09'36.3"					
Telegraph Bay	CP1	Start N 22°15'34.6" E 114°07'43.5"	3 - 5	1-2	Calm Sunny	Flood	0.5 – 1
		End N 22°15'36.0" E 114°07'42.2"					

Location	REA Dive Site	GPS Coordinates	Depth (m)	Visibility (m)	Weather	Tide	Current (knot)
	CP2	Start N 22°15'36.3" E 114°07'41.9"	3 - 5	1-2			
		End N 22°15'37.9" E 114°07'40.9"					
	CP3	Start N 22°15'38.2" E 114°07'40.8"	3 - 5	1-2			
		End N 22°15'39.6" E 114°07'39.9"					

4.1.1 Wong Chuk Hang - Spot Dive Survey

Survey sites at Wong Chuk Hang (Fig. 3.1) were composed of vertical sea walls under the Ap Lei Chau Bridge while the sea bottom mainly was dominated by cobbles and sand at shallow area and mud and silt towards the center of the channel. The bottom substrate was, however, mainly covered by anthropogenic wastes (Appendix Ia).

The spot dives revealed the vertical sea wall at ES4 was generally covered by tunicates, barnacles, mussels, tube worms, and bryozoans (Table 4.3). Spots ES1, ES3 and ES5 were muddy bottom. Spots ES2, ES4 ES6 were general cobbles and sand bottom covered by waste materials such as tyres and wood pieces. Scattered colonies of hard corals *Oulastrea crispata* were observed on these wastes especially on the tyres (Appendix Ia).

4.1.2 Wong Chuk Hang - REA Survey

REA surveys were performed at 2 locations at Wong Chuk Hang on the shallow hard substrate where hard and soft coral were observed in the spot dive survey (Fig. 3.2, Appendix II).

Along transect ET1, the substrate was dominated by anthropogenic wastes such as wood pieces and tyres. The other hard substrates are either vertical seawall or scattered natural boulders and cobbles (Table 4.4). The common epibenthos on the hard surface included bryozoans, tunicates, sponges and barnacles (Appendix IV). 10 small colonies of hard coral, *Oulastrea crispata*, were found on both boulder and tyre surface. A species of octocoral, *Echinomuricea* sp., was recorded with 2 colonies growing on the vertical seawall (Appendix II).

Transect ET2 was dominated by cobbles, covered with anthropogenic wastes near the seawall. The dominant sessile animals on hard substrates included bryozoans, sponges and tunicates (Table 4.4). Only one colony of hard coral, *Oulastrea crispate*, was observed on boulder surface. No octocoral or other taxa of conservation interest was recorded along ET2 (Appendix II).

Table 4.3: Presence/ Absence of Taxa at each Spot Dive Site

Spot dive site	Hard coral	<i>Oulastrea crispata</i>	Soft coral	<i>Echinomericea sp.</i>	Other epenthos	Sponges	Bryozoans	Tunicates	Rock Oyster	Barnacles	Mussels	Tube worms
Wong Chuk Hang												
ES1		0		0		0	0	0	0	0	0	0
ES2		1		0		0	0	0	0	0	0	0
ES3		0		0		0	0	0	0	0	0	0
ES4		1		1		1	1	1	0	1	0	0
ES5		0		0		0	1	0	1	1	0	1
ES6		1		0		1	1	0	1	1	0	0
Telegraph Bay												
CPS1		1		0		1	1	0	0	1	1	1
CPS2		0		0		0	0	0	0	0	0	0
CPS3		1		0		1	1	0	0	1	1	1
CPS4		0		0		0	0	0	0	0	0	0
CPS5		1		0		1	1	0	0	1	1	1
CPS6		0		0		0	0	0	0	0	0	0

(1 = presence, 0 = absence)

4.1.3 Telegraph Bay - Spot Dive Survey

Survey sites at Telegraph Bay (Fig. 3.3) were mainly composed of artificial boulders at shallow water while the deeper sea bottom was muddy substrate. (Appendix Ib).

The spot dives revealed the artificial boulders at CPS1, CPS3 and CPS5 were generally covered by barnacles, mussels, tube worms, sponges and bryozoans (Table 4.3). Scattered colonies of hard corals *Oulastrea crispata* were observed on these boulder substrates. Spots CPS2, CPS4 and CPS6 were, however, muddy bottom (Appendix Ib).

4.1.4 Telegraph Bay – REA Survey

REA survey was performed at 3 locations at Telegraph Bay, Cyberport on the shallow hard substrate (Fig. 3.4, Appendix III).

Along the three transects (CP1, CP2 and CP3), artificial boulders were the dominant substrates. The major inhabitants include sponges (4 to 10%), mussels (0 - 5%), tube worms (0 - 5%), bryozoans (6 to 20%) and barnacles (0 to 10%) (Table 4.4, Appendix IV). Some trash materials (wood and tyres, Appendix IV) were observed along the transect CP3.

Low abundance of a hard coral species, *Oulastrea crispata*, was found along all three transects, with overall coverage < 5%. A total of 35 small colonies were observed along these transects. No octocoral was observed in the swath of the transect (Appendix IV).

4.2 Coral community

The coral community in the three survey sites was typical community type of shallow rocky bottom at west to southwest Hong Kong waters. The species diversity was low, colonies were usually small in size, with encrusting growth form, and patchily distributed. At all three sites, only one species of hard coral *Oulastrea crispata* (Family Faviidae) was observed. This species is characterized by the encrusting growth form and small size of only a few centimeters across. These coral species mainly inhabit subtidal turbid water, attached to wave washed rock; and the abundance is generally not high within its distribution range (Veron 2000).

A total of 48 colonies was found over the 5 REA transects along the coasts of Wong Chuk Hang and Telegraph Bay (11 and 37 colonies, respectively). The colony size, percentage cover of sedimentation, area bleaching and partial mortality of each coral are summarized in Table 4.5. Size of the colonies was generally small, ranged from 4 to 130 cm². At Wong Chuk Hang, the colonies were generally suffered from higher level of sedimentation, with bleaching and sedimentation occurred in selected colonies. The hard corals at Telegraph Bay mainly scattered on surface of artificial boulders, with generally low level of sedimentation and mortality.

One species of octocoral, the sea whip *Echinomuricea* sp., was found at transect ET1 in Wong Chuk Hang. The species is locally common in the deeper water or shaded shallow water with high turbidity. Two colonies were observed and both showed no sign of suffering from sedimentation.

Table 4.4: REA Survey - Ecological and Substrate Attributes, and Taxonomic Inventories

Locations	Wong Chuk Hang		Telegraph Bay		
	ET1	ET2	CP1	CP2	CP3
Substrate attributes (0 – 6)					
Bedrock	0	0	0	0	0
Boulder (diameter >50cm)	2	0	6	6	6
Cobble (diameter<50cm)	1	5	1	1	1
Rubble (dead corals)	0	0	0	0	0
Sand with gravel	0	2	1	1	1
Mud & Silt	2	0	1	1	2
Wastes (wood, tyre or metal)	5	2	0	0	1

	Wong Chuk Hang		Telegraph Bay		
	ET1	ET2	CP1	CP2	CP3
Ecological attributes (0 – 6)					
Hard corals	1	1	1	1	1
Dead coral skeleton	0	0	0	0	0
Soft corals (Gorgonian Octocoral)	1	0	0	0	0
Sea anemones	0	0	0	0	0
Macroalgae	0	0	0	0	0
Encrusting algae	0	0	0	0	0
Coralline algae	0	0	0	0	0

	Wong Chuk Hang		Telegraph Bay		
	ET1	ET2	CP1	CP2	CP3
Taxonomic inventories (0 – 5)					
Hard Coral					
Faviidae	<i>Oulastrea crispata</i>	1	1	1	1

Locations		Wong Chuk Hang			Telegraph Bay	
Soft Coral (Gorgonian Octocoral)						
	<i>Echinomuricea sp.</i>	1	0	0	0	0
Other benthos						
	Sponges	2	3	2	2	2
	Bryozoans	4	4	2	2	2
	Tunicates	2	2	0	0	0
	Hydroids	2	2	0	0	0
	Rock Oysters	1	1	0	0	0
	Mussels	0	0	1	1	0
	Barnacles	1	2	2	2	2
	Tube worms	0	0	0	0	0
	Gastropods	1	1	1	2	1
	Sea Urchins	0	0	1	1	1

		Wong Chuk Hang		Telegraph Bay		
		ET1	ET2	CP1	CP2	CP3
No. Hard Coral Species		1	1	1	1	1
No. Octocoral Species		1	0	0	0	0

Table 4.5: Hard Coral and Octocoral Colonies, Size, Percentage Area of Sedimentation, Bleaching and Partial Mortality in the Survey Sites

No.	Species	Site	Transect	Area (cm ²)	% Sedimentation	% Bleaching	% Mortality
Hard Coral							
1	<i>Oulastrea crispata</i>	WCH	ET1	4	3	0	0
2	<i>Oulastrea crispata</i>	WCH	ET1	130	40	0	0
3	<i>Oulastrea crispata</i>	WCH	ET1	50	45	0	0
4	<i>Oulastrea crispata</i>	WCH	ET1	110	50	0	0
5	<i>Oulastrea crispata</i>	WCH	ET1	10	10	0	0
6	<i>Oulastrea crispata</i>	WCH	ET1	70	30	0	0
7	<i>Oulastrea crispata</i>	WCH	ET1	20	10	0	0
8	<i>Oulastrea crispata</i>	WCH	ET1	90	8	0	0
9	<i>Oulastrea crispata</i>	WCH	ET1	60	70	0	10
10	<i>Oulastrea crispata</i>	WCH	ET1	60	50	20	5
11	<i>Oulastrea crispata</i>	WCH	ET2	60	4	0	0
12	<i>Oulastrea crispata</i>	TB	CP1	14	4	0	0
13	<i>Oulastrea crispata</i>	TB	CP1	25	8	0	0
14	<i>Oulastrea crispata</i>	TB	CP1	20	10	0	5
15	<i>Oulastrea crispata</i>	TB	CP1	25	5	0	0
16	<i>Oulastrea crispata</i>	TB	CP1	30	2	0	0
17	<i>Oulastrea crispata</i>	TB	CP1	30	5	0	10
18	<i>Oulastrea crispata</i>	TB	CP1	6	5	0	0

No.	Species	Site	Transect	Area (cm ²)	% Sedimentation	% Bleaching	% Mortality
19	<i>Oulastrea crispata</i>	TB	CP1	6	8	0	0
20	<i>Oulastrea crispata</i>	TB	CP2	4	1	0	0
21	<i>Oulastrea crispata</i>	TB	CP2	18	4	0	0
22	<i>Oulastrea crispata</i>	TB	CP2	25	5	0	0
23	<i>Oulastrea crispata</i>	TB	CP2	5	0	0	0
24	<i>Oulastrea crispata</i>	TB	CP2	30	8	0	5
25	<i>Oulastrea crispata</i>	TB	CP2	10	1	0	0
26	<i>Oulastrea crispata</i>	TB	CP2	15	8	0	10
27	<i>Oulastrea crispata</i>	TB	CP2	15	6	0	0
28	<i>Oulastrea crispata</i>	TB	CP2	4	1	0	0
29	<i>Oulastrea crispata</i>	TB	CP2	10	3	0	0
30	<i>Oulastrea crispata</i>	TB	CP2	8	0	0	0
31	<i>Oulastrea crispata</i>	TB	CP2	12	2	0	0
32	<i>Oulastrea crispata</i>	TB	CP2	12	3	0	0
33	<i>Oulastrea crispata</i>	TB	CP2	15	2	0	0
34	<i>Oulastrea crispata</i>	TB	CP2	70	4	0	5
35	<i>Oulastrea crispata</i>	TB	CP2	20	5	0	0
36	<i>Oulastrea crispata</i>	TB	CP2	40	5	0	5
37	<i>Oulastrea crispata</i>	TB	CP2	100	2	0	0
38	<i>Oulastrea crispata</i>	TB	CP2	8	0	0	0
39	<i>Oulastrea crispata</i>	TB	CP2	6	1	0	0
40	<i>Oulastrea crispata</i>	TB	CP2	4	0	0	0
41	<i>Oulastrea crispata</i>	TB	CP2	10	0	0	0
42	<i>Oulastrea crispata</i>	TB	CP2	40	5	0	0
43	<i>Oulastrea crispata</i>	TB	CP2	18	2	0	0
44	<i>Oulastrea crispata</i>	TB	CP2	50	1	0	0
45	<i>Oulastrea crispata</i>	TB	CP2	5	0	0	0
46	<i>Oulastrea crispata</i>	TB	CP2	8	0	0	0
47	<i>Oulastrea crispata</i>	TB	CP2	40	2	0	0
48	<i>Oulastrea crispata</i>	TB	CP3	4	5	0	0

(WCH = Wong Chuk Hang; TB = Telegraph Bay)

5. Summary

Spot and REA dive surveys conducted at Wong Chuk Hang and Telegraph Bay revealed that the diversity and abundance of hard and soft corals were low in the proposed impact sites. Most hard substrates were dominated by barnacles, tube worms, mussels and sponges, and generally covered by a thin layer of sediments.

Along the coasts of both locations, the distribution of both the hard and soft corals were limited to shallow water with hard, artificial substrates but absent at deeper water with muddy bottom.

Only one hard coral species, *Oulastrea crispata* (Faviidae), was recorded at all survey sites along the coast of both Wong Chuk Hang and Telegraph Bay at shallow water, with a total of 48 (11 and 37, respectively) colonies was found.

Two colonies of one species of octocoral, *Echinomuricea* sp. (Plexauridae), was recorded at one of the survey sites at Wong Chuk Hang (ET1).

No other taxon of high conservation interest was recorded in the survey sites.

In Hong Kong waters, the low salinity and murky water at the western Hong Kong limit the development of few thriving hard coral species such as *Oulastrea crispata*, *Plesiastrea versipora* and several *Favia* species, and soft coral such as *Echinomuricea* sp. and . Only *Oulastrea crispata* and *Echinomuricea* sp. were recorded in the study areas. The low diversity and abundance of corals in the present study is a typical finding in the western Hong Kong waters.

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APPENDIX

Appendix Ia Photos of the Dive Survey Sites at Wong Chuk Hang.



Wong Chuk Hang – Artificial habitat



Wong Chuk Hang – Artificial habitat



Spot 1 (ES1) – Muddy bottom



Spot 2 (ES2) – Muddy bottom with waste wood



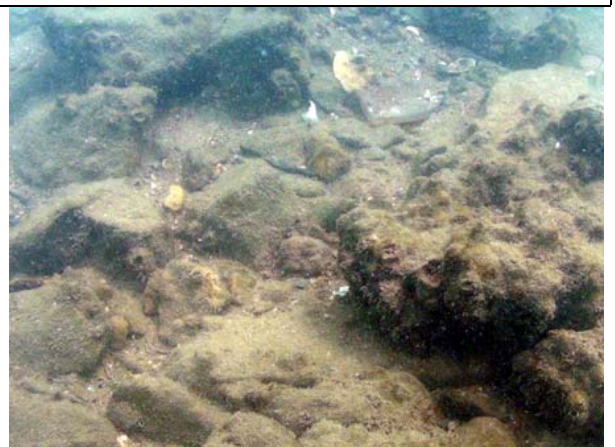
Spot 3 (ES3) – Muddy bottom



Spot 4 (ES4) – Vertical sea wall with waste tyres and wood at bottom



Spot 5 (ES5) – Sandy bottom



Spot 6 (ES6) – Muddy bottom with small boulders

Appendix Ib Photos of the Dive Survey Sites at Telegraph Bay.



Telegraph Bay – Artificial habitat



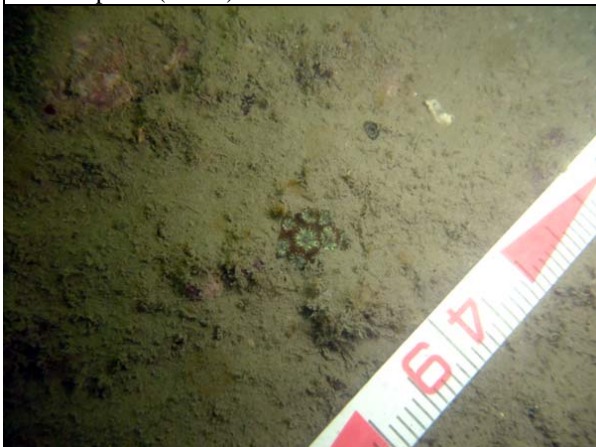
Telegraph Bay – Artificial habitat



Spot 1 (CPS1) – Artificial hard substrates



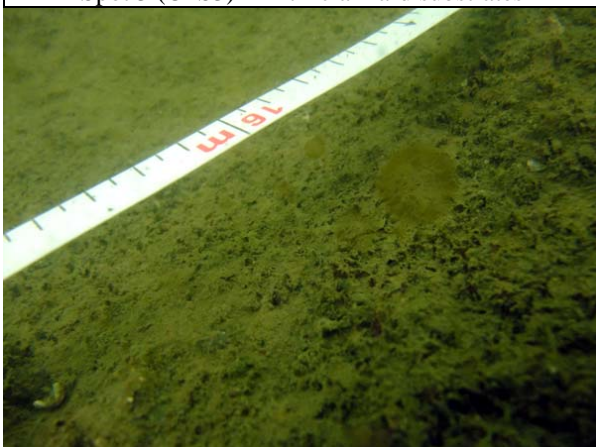
Spot 2 (CPS2) – Muddy bottom



Spot 3 (CPS3) – Artificial hard substrates



Spot 4 (CPS4) – Muddy bottom

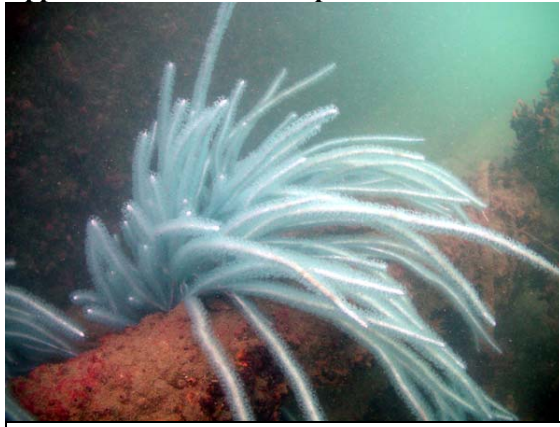


Spot 5 (CPS5) – Artificial hard substrates



Spot 6 (CPS6) – Muddy bottom

Appendix II Photos of Representative Taxa at Wong Chuk Hang.



ET1: Octocoral - *Echinomuricea* sp.



ET1: Tunicates & Bryozoans



ET1: Sponges & Bryozoans



ET1: Predatory gastropods – *Thais leutostoma*



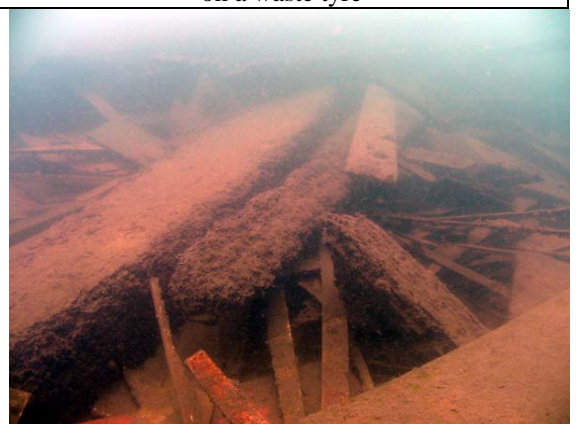
ET1: Hard Coral – *Oulastrea crispata*



ET1: Patches of Hard Coral (*Oulastrea crispata*) on a waste tyre



ET1: Pink Sponges & Barnacles



ET1: Barnacles on waste wood

Appendix II..... Continued.



ET2: Common sessile animals on sea wall



ET2: Tunicates & Bryozoans



ET2: Sponges on a iron rod



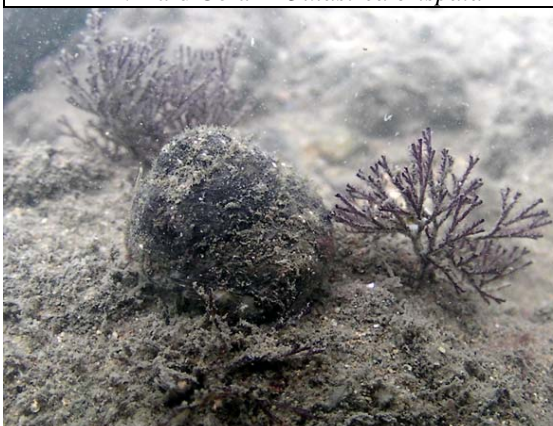
ET2: Hydroids



ET2: Hard Coral – *Oulastrea crispata*



ET2: Rock Oysters and Barnacles



ET2: Herbivory Gastropod – *Chlorostoma* sp.

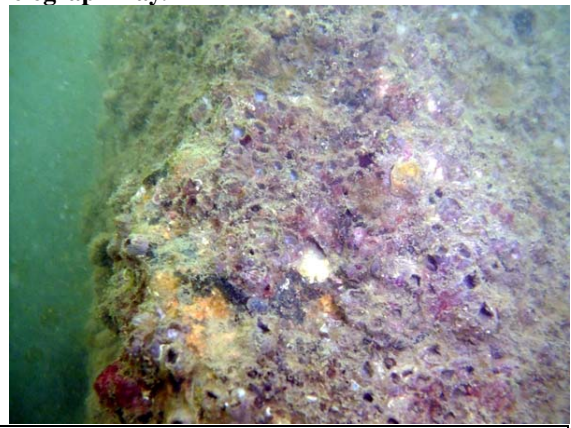


ET2: Barnacles on a boulder

Appendix III Photos of Representative Taxa at Telegraph Bay.



CP1 & 2: Sponges



CP1 & 2: Barnacles



CP1 & 2: Small Mussels - *Brachidontes*



CP1 & 2: Bryozoans



CP1: Hard Coral – *Oulastrea crispata*



CP1: Hard Coral – *Oulastrea crispata*



CP1 & 2: Sea Urchin – *Anthocidaris crassispina*

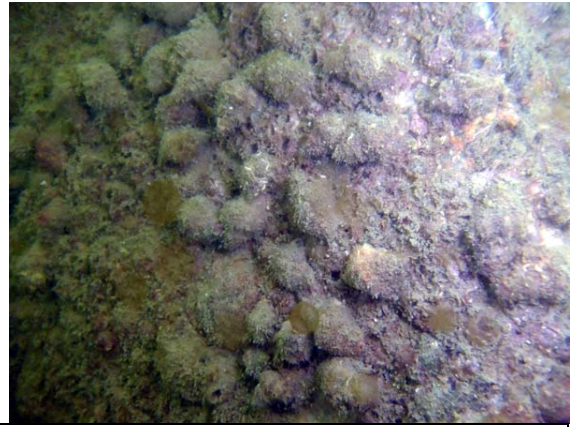


CP1 & 2: Sea Urchin – *Temnopleurus toreumaticus*

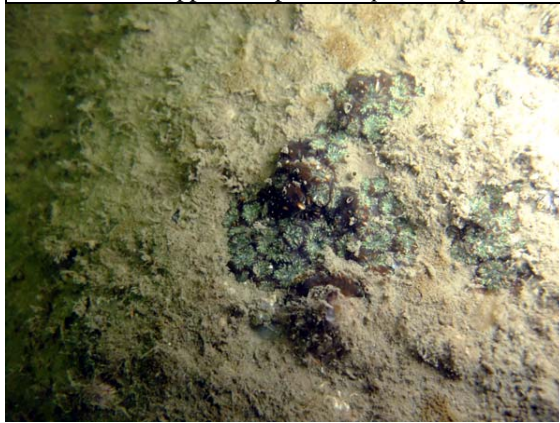
Appendix III.....Continued.



CP1: Slipper Limpet – *Crepidula* sp.



CP1: Predatory gastropods – *Thais leutostoma*



CP2: Hard Coral – *Oulastrea crispata*



CP2: Hard Coral – *Oulastrea crispata*



CP2: Hard Coral – *Oulastrea crispata*

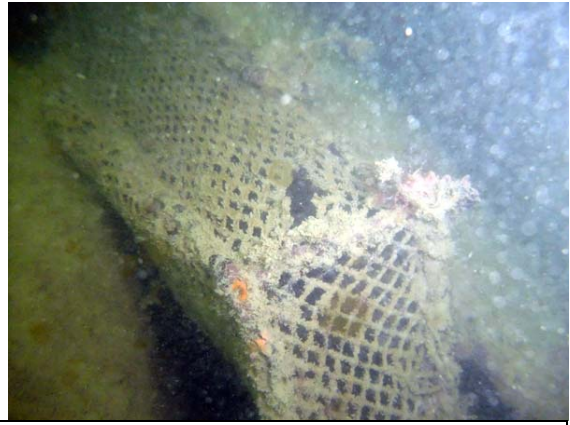


CP2: Hard Coral – *Oulastrea crispata*

Appendix III Continued.



CP3: Trash wood



CP3: Trash wood



CP3: Trash tyre



CP3: Sponges & Bryozoans



CP3: Hard Coral – *Oulastrea crispata*



CP3: Hard Coral – *Oulastrea crispata*

Appendix IV Substrate Type (Physical and Biological) along each REA Transect.

Meter	Wong Chuk Hang				Meter	Telegraph Bay					
	ET1		ET2			CP1		CP2		CP3	
	Phy	Biol	Phy	Biol		Phy	Biol	Phy	Biol	Phy	Biol
1	BD	BA	CB	BA	1	BD	SP	BD	HC	BD	SP
2	SD	BA	CB	BA	2	BD	SD	BD	BY	WT	BA
3	WT	BA	CB	BN	3	BD	SD	BD	MS	WT	BA
4	ST	BA	CB	BA	4	BD	BY	BD	TW	WT	BA
5	WT	BA	CB	BA	5	BD	BY	BD	MS	WT	BA
6	ST	BA	CB	BA	6	BD	BY	BD	HC	BD	BY
7	WT	BA	CB	BA	7	ST	BA	BD	MS	BD	BA
8	ST	BA	CB	BN	8	BD	BY	BD	BN	BD	BA
9	CB	BA	CB	BA	9	ST	BA	BD	HC	BD	BA
10	ST	BA	CB	BA	10	ST	BA	BD	MS	BD	BA
11	WT	BA	CB	BA	11	ST	BA	BD	MS	BD	BA
12	WT	BA	SD	BA	12	BD	BY	BD	MS	BD	BA
13	WT	BA	CB	BY	13	BD	BN	BD	BA	BD	BA
14	WT	BA	CB	BA	14	BD	BN	BD	BY	BD	BA
15	WT	BA	CB	BN	15	BD	BN	BD	BN	BD	BA
16	WT	BA	CB	BA	16	BD	MS	BD	BN	BD	BA
17	WT	BA	CB	BA	17	BD	MS	BD	BY	ST	BA
18	WT	BA	CB	BA	18	BD	BA	BD	BA	ST	BA
19	WT	HC	CB	BA	19	BD	MA	BD	BY	ST	BA
20	BD	BA	CB	BN	20	SD	BY	BD	BA	ST	BA
21	WT	BA	CB	BA	21	ST	BA	RU	BA	ST	BA
22	WT	BA	CB	BA	22	BD	BA	RU	BA	ST	BA
23	WT	BA	SD	BA	23	BD	MS	RU	BA	ST	BA
24	WT	BA	CB	BA	24	BD	TW	RU	BY	ST	BA
25	WT	BA	CB	BA	25	BD	BA	BD	BA	ST	BA
26	WT	BA	CB	BA	26	BD	MS	BD	BY	ST	BA
27	WT	BA	CB	BY	27	BD	MS	BD	BA	ST	BA
28	WT	BA	CB	BY	28	ST	BA	BD	BA	BD	BY
29	WT	BY	CB	BA	29	BD	TW	BD	BA	BD	BA
30	WT	BA	CB	BA	30	ST	BA	BD	BA	BD	BA
31	WT	BA	SD	BA	31	SD	BA	ST	BA	BD	BA
32	WT	BA	SD	BA	32	SD	BA	BD	BA	BD	BN
33	WT	BA	SD	BA	33	BD	BY	BD	BA	BD	SP
34	WT	BA	CB	BA	34	BD	BY	BD	BA	BD	BY
35	WT	BA	SD	BA	35	ST	BA	ST	BA	BD	BA
36	WT	BA	SD	BA	36	SD	BA	BD	BA	BD	BA
37	WT	BN	CB	BA	37	ST	BA	BD	BA	BD	BA
38	WT	BA	CB	BA	38	BD	BN	BD	BA	BD	BA
39	WT	BA	CB	BY	39	BD	HC	BD	BA	BD	BA
40	WT	BA	CB	BA	40	BD	BA	BD	BA	BD	BA
41	WT	BA	CB	BA	41	ST	BA	BD	BA	BD	BA
42	WT	BA	SD	BA	42	ST	BA	BD	BA	BD	BA
43	WT	BA	SD	BA	43	ST	BA	BD	HC	BD	BA
44	WT	BA	SD	BA	44	ST	BA	BD	BA	BD	BA
45	WT	BA	WT	SP	45	BD	CA	BD	TW	BD	BA
46	WT	BY	WT	BA	46	BD	BA	BD	BY	BD	BY
47	WT	BA	SD	BA	47	ST	BA	BD	BY	BD	BA
48	WT	BA	SD	BA	48	ST	BA	BD	BA	BD	BY
49	WT	BA	WT	BA	49	BD	HC	BD	BA	BD	BA
50	WT	BA	WT	BA	50	BD	BY	BD	BN	BD	BA

Legend (Physical)	Legend (Biological)
BR = Bedrock	BA = Bare
BD = Boulder	SP = Sponge
CB = Cobble	MA = Macroalgae
RB = Rubble	EA = Encrusting algae
SD = Sand	CA = Coralline algae
ST = Silt and Mud	BY = Bryozoan
WT = Waste (wood, tyre, etc.)	BN = Barnacles
	HC = Hard coral
	SC = Soft coral
	SA = Sea anemone
	MS = Mussel
	TW = Tube worm