

# Expansion of Hong Kong International Airport into a Three-Runway System

Coral Translocation Plan

May 2016

Airport Authority Hong Kong



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# 1 Introduction

## 1.1 Background

Under the Environmental Impact Assessment Ordinance, the Environmental Impact Assessment (EIA) Report and the Environmental Monitoring and Audit (EM&A) Manual (Register No.: AEIAR-185/2014) prepared for the “Expansion of Hong Kong International Airport into a Three-Runway System” (hereafter as the Project or the “3RS Project”) have been approved by the Environmental Protection Department (EPD), and an Environmental Permit (EP) (Permit No.: EP-489/2014) has been issued for the Project.

The project is proposed to be located on a new land formation area immediately north of the Hong Kong International Airport (HKIA) in North Lantau, covering a permanent footprint of approximately 650 ha. As stated in the approved EIA, the project primarily comprises:

- New third runway with associated taxiways, aprons and aircraft stands;
- New passenger concourse building;
- Expansion of the existing Terminal 2 (T2) building; and
- Related airside and landside works, and associated ancillary and supporting facilities.

Pursuant to Condition 2.12 of the Environmental Permit (EP), the Airport Authority Hong Kong (AAHK) should prepare a Coral Translocation Plan to specify the detailed baseline survey at areas with potential to affect coral colonies and translocation details including information of coral colonies to be translocated, recipient area, translocation methodology and monitoring of transplanted colonies.

Mott MacDonald Hong Kong Limited (MMHK) was appointed by AAHK as the Environmental Team (ET) for the Project to provide environmental team consultancy services including the preparation of a Coral Translocation Plan.

The EIA of the Project predicted that there will be direct impact on the coral communities along the northern seawall of the existing airport island. A pre-construction phase dive survey is recommended in the EIA to review the feasibility of coral translocation which is identified as a precautionary measure.

According to the Updated EM&A Manual, it is proposed to conduct a pre-construction phase dive survey for corals along the northern and northeastern seawall of the existing airport island and at the daylighting location on Sha Chau that may subject to direct habitat loss and disturbance as a precautionary measure prior to marine construction works to identify any coral colonies suitable for translocation.

The preliminary methodology for the pre-construction phase coral dive survey has been approved in Section 10.2.2 of the Updated EM&A Manual. A [Baseline Coral Survey Plan](#) was submitted to the Independent Environmental Checker (IEC) for the Project and the AAHK according to Section 10.6.1.4 of the Updated EM&A Manual to present the details of the baseline coral surveys recommended to be conducted six months prior to the commencement of construction at areas with potential to affect coral colonies. The Baseline Coral Survey Plan has been verified by the IEC and agreed by the AAHK in December 2015. Subsequently, the pre-construction phase dive survey for corals along the northern and northeastern seawall of the existing airport island and at the daylighting location on Sha Chau was conducted in January 2016.

## 1.2 Objectives of the Coral Translocation Plan

In accordance with Condition 2.12 of the EP, the Permit Holder shall submit a Coral Translocation Plan (The Plan) no later than 3 months before the commencement of construction works at areas with potential to affect coral colonies. The Plan shall include at least the following information/specifications:

- (i) a detailed baseline survey to be carried out before the commencement of the construction works at areas with potential to affect coral colonies to further confirm the exact number and locations of coral colonies; and
- (ii) translocation details including information of coral colonies to be translocated, recipient area, translocation methodology and monitoring of transplanted colonies.

This Plan has been prepared to present the findings of baseline coral dive survey and to detail the coral translocation proposal including translocation methodology and procedure, potential recipient area, translocation schedule and follow-up monitoring, to fulfil the EP requirement. The Agriculture, Fisheries and Conservation Department (AFCD) have been consulted in preparing this Plan.

## 2 Findings of Baseline Coral Dive Survey

### 2.1 Coral Survey at the Seawall of the existing Airport Island and the daylighting location on Sha Chau (Donor Site)

Spot dive survey was conducted on 29 January 2016 at the artificial seawall on the existing airport island and the daylighting location on Sha Chau where these areas are subject to potential direct loss of coral colonies. A total of 10 survey stations, labelled D1 to D9 and D16, were covered as shown in **Figure 2.1**. A distance of 100 m was surveyed at each station.

The survey stations D1 to D8 and D16 on the western, northern and northeastern side of the airport island were composed of artificial sloping seawall, large rocks and boulders with silty and muddy substrates. The survey site D9 on Sha Chau was composed of natural rocky shore, large and small boulders with silt and sand/rubble substrates. Water depth ranged from 1 m to 4.1 m. Visibility was low, range between 0.5 m and 1.2 m.

The survey stations were found with low occurrence of mobile and attached marine benthos on boulder surface. Species of soft coral *Guaiaigorgia* sp. was found at D2 to D9 and D16, with a total of 6,397 colonies of *Guaiaigorgia* sp. recorded and the percentage cover was low (~2%) to medium (~20%). Ahermatypic hard cup coral *Paracyathus rotundatus* was found at D2, D6 and D7 with very low coverage (<1%), as presented in **Table 2.1**.

Table 2.1: Species, Coverage and Size of Corals found at Spot Dive Survey Stations D2 to D9 and D16

Survey Station	Coral Species	Coverage (%)	Number of Coral Colonies	Size in Diameter (cm)
D2	<i>Guaiaigorgia</i> sp.	~2%	27	<5 – >20 cm
	<i>Paracyathus rotundatus</i>	<1%	--	--
D3	<i>Guaiaigorgia</i> sp.	~10%	126	<5 – <10 cm
D4	<i>Guaiaigorgia</i> sp.	~10%	231	<5 – >20 cm
D5	<i>Guaiaigorgia</i> sp.	~20%	1400	<5 – >20 cm
D6	<i>Guaiaigorgia</i> sp.	~20%	75	<5 – >20 cm
	<i>Paracyathus rotundatus</i>	<1%	--	--
D7	<i>Guaiaigorgia</i> sp.	~10%	455	<5 – >20 cm
	<i>Paracyathus rotundatus</i>	<1%	--	--
D8	<i>Guaiaigorgia</i> sp.	~20%	640	<5 – >20 cm
D9	<i>Guaiaigorgia</i> sp.	~20%	3300	<5 – >20 cm
D16	<i>Guaiaigorgia</i> sp.	~5%	143	<5 – <10 cm

The status and distribution of coral species recorded are provided in **Table 2.2** below.

Table 2.2: Status and Distribution of Coral Species Recorded

Species	Status in Hong Kong	Distribution
<i>Guaiaigorgia</i> sp.	Localized	North Lantau area
<i>Paracyathus rotundatus</i>	Common	Western waters in Hong Kong

All the coral species recorded are not listed in the CITES-listed endangered species database of Hong Kong. Hard corals (Order Scleratinia), of which the ahermatypic hard cup coral (*Paracyathus rotundatus*) belong to, are listed in Schedule 1 and 2 of the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586). Import, export and possession of those corals, no matter dead or living, are restricted.

Scattered and patchy hard coral individuals (*Paracyathus rotundatus*) with very low coverage (<1%) were recorded at three survey stations.

Detailed results of the dive survey are provided in **Appendix A**. Representative photographs of the habitats and species recorded are shown in **Appendix B**.

#### Suitability of Translocation of the Affected Corals

Only the coral colonies attached on movable boulders (less than 50 cm in diameter) are considered suitable for translocation. The gorgonian coral colonies in the areas D6, D7 and D8, i.e. northeastern side of the artificial seawall on the airport island, fit the criteria. About 300 gorgonian coral colonies at areas D6, D7 and D8 were found attached to movable boulders (i.e. less than 50 cm in diameter) in which they are feasible to be translocated with the substrate they attached, therefore translocation of these gorgonian coral colonies are recommended.

Prior to coral translocation, a more detailed pre-translocation survey is recommended to find out the actual number of gorgonian coral colonies within the northeastern side of the artificial seawall on the airport island that are suitable for translocation.

## 2.2 Consideration of Potential Recipient Site

The following characteristics are preferable in selecting the coral recipient site:

- In the vicinity of the original coral colony;
- Not impacted by the Project or other construction/marine activities;
- Presence of healthy coral community of the same species and similar hydrographical conditions as donor site; and
- Sufficient space to receive the translocated coral colonies.

Based on the above criteria, two locations are considered suitable for recipient site, i.e. Tai Mo To Island and Yam Tsai Wan, which are indicated in **Figure 2.1**.

The potential recipient site on Tai Mo To island is in the vicinity of the affected coral colonies at the northern artificial seawall of the airport island as well as outside the airport control zone where it will not be impacted by the Project, however, the site was found very exposed and its underwater visibility was very low according to the pre-construction coral surveys undertaken for Contract No. HY/2012/07 under the Tuen Mun – Chek Lap Kok Link project (Highways Department, 2013). The translocated corals may be

displaced easily at a very exposed site by strong wave action and also difficult to be found for post-translocation monitoring in very low underwater visibility. Therefore, it is recommended for an alternative recipient site where it is less exposed with better underwater visibility and presence of similar gorgonian coral community to the donor site.

With reference to the pre-translocation surveys undertaken for Contract No. HY/2012/07 (Highways Department, 2014), the gorgonian coral community *Guaigorgia* sp. was found at Yam Tsai Wan near Sham Shui Kok of Northeast Lantau where it is relatively less exposed. Yam Tsai Wan was selected as the recipient site for the coral translocation exercises for Contract Nos. HY/2012/07 and HY/2012/08 under the Tuen Mun – Chek Lap Kok Link project as well as for Contract No. HY/2011/03 Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road- Section between Scenic Hill and Hong Kong Boundary Facilities. These three translocation exercises were considered to be undertaken successfully as the translocated corals did not show any signs of deterioration in conditions at the Yam Tsai Wan recipient site. In view of the above, it is recommended to select Yam Tsai Wan and vicinity as the recipient site upon a pre-translocation survey for confirming sufficient space to receive the translocated gorgonian coral colonies.



## 3 Methodology for the Translocation of Gorgonian Corals

### 3.1 General Information on the Translocation of Gorgonians

The translocation of soft corals and gorgonians in Hong Kong is more straightforward than that of hard corals. The gorgonian corals are soft, very hardy, not aggressive and have a wide tolerance to changes of conditions (Fabricius and Alderslade, 2000). Also, they do not possess some of the idiosyncrasies possessed by hard corals, such as orientation sensitivity. The constraint for hard coral translocation, such as avoiding direct exposure to ultra-violet (UV) light is not required for the translocation of gorgonians.

#### The Rules Established for Handling Corals of Hong Kong

There are certain procedures that need to be observed when handling soft, black and gorgonian corals. These are listed below for reference:

- Soft corals, black corals and gorgonians need to be relocated to areas that have very similar environmental conditions as the areas they originally came from, especially water flow and turbidity. Data needs to be collected for a specific time in both the donor and recipient areas to ensure the two areas are similar.
- Handling of soft corals, black corals and gorgonians needs to be kept to a minimum.
- It is highly preferable to move soft coral, black corals and gorgonians colonies with substratum.
- Sharp cutting tools are required if the corals have to be separated from their substratum. This also includes coral friendly gloves, long flat blades, small hammers and cutters. Removed corals should be kept as one piece wherever possible.
- The translocation process needs to be completed quickly in order to keep stress on the corals to a minimum.
- If colonies must be brought to the surface, this must be carried out at night or under a heavy covering. There should be absolutely no exposure to UV light.
- The corals have to be moved in small quantities in plastic containers. If the containers are transported in shallow water, covers must be used to reduce the exposure to UV light.
- Transplanted corals need to be stabilized or firmly attached to substratum in order to achieve a reasonable success rate.
- The placement of different species of the transplanted corals needs to be carefully supervised. There must be a reasonable vacant area maintained around each colony.

### 3.2 Timing of Translocation

There is no data available indicating the best time to translocate gorgonian corals. It seems that they reproduce during the same months as the hard corals in Hong Kong, however, this has never been confirmed. As such, there is no specific time constraint on the translocation of gorgonian corals.

### 3.3 Procedure of Coral Translocation

The following procedures will be performed during translocation of gorgonian corals to minimize stress and prevent damage to corals.

#### Initial works

- A pre-translocation survey will be carried out to determine the actual number of gorgonian coral colonies that are suitable to be transplanted. Criteria for suitable status are: accessibility, fragility, and healthiness.
- The pre-translocation survey will be conducted by swimming in a search pattern along pre-determined impact area or area previously identified with coral colonies. Number of colonies, species, coral cover partial mortality, GPS locations and substratum type will be recorded and the coral colonies identified as suitable for translocation will be located. Representative photographs of the habitat and coral species, and other ecological features will be taken.
- The key environmental parameters (including salinity, temperature, water current gradients and limits, and turbidity) of the donor area will be measured using fixed data loggers.
- A pre-translocation survey will be carried out at the selected recipient site at Yam Tsai Wan and vicinity. The information of data logger collected for the donor area will be matched with suitable data received from recipient areas.
- The species makeup of the donor area will be mapped.
- All selected recipient areas will be mapped.
- Upon commencement of initial works for translocation, a suitable area will be determined, within the recipient area, to receive the corals.

#### Translocation works

- Colonies that can be translocated with their substratum attached will be moved.
- Substratum sizes with the diameter (or longest lengths) <50cm will be considered practical for translocation.
- During the transportation process the corals must remain in water at an appropriate depth in suitable containers.
- Corals will be transported to the recipient site as soon as possible on the same day following the removal.
- At the recipient site, a suitable number of colonies will be tagged and all required particulars (refer to the Tagged Coral Colony Survey in section 3.5) will be collected for these coral colonies. Either a nail with tag or tag with the cable-tie imbedded into the Sea-C-Cement will be used to mark the selected colonies.

### Schedule of Translocation

Following approval of this Coral Translocation Plan, the translocation exercise including pre-translocation surveys and the translocation of gorgonian coral colonies from the northeastern side of the artificial seawall on the airport island to the selected recipient site will be undertaken. This translocation exercise will take about 20 days for completion of translocation of all the suitable gorgonian coral colonies. One extra day will be required to carry out the preliminary post-translocation surveys at both the donor and recipient sites.

### 3.4 Coral Colony Tagging

Ten percent (10%) of the translocated coral colonies will be tagged for post-translocation monitoring. These will be the “Translocated Corals”. Trained divers will also swim around the recipient area and locate ten numbers of indigenous colonies for tagging. These will be known as the “Control Corals”. Indigenous colonies of similar size, similar species to the colonies translocated will be preferred.

Steel rebars will be installed nearby the recorded coral colonies, with tags attached to allow the individual identification of the corals selected. Tags will consist of Perspex rectangles each with a unique identification number. These will be attached to the rebars with a cable tie.

### 3.5 Tagged Coral Colony Survey

Details of each tagged coral colony will be recorded. Typically the following data and parameters will be noted:

- Species.
- Size (cm<sup>2</sup>)
- Growth form
- Partial Mortality
- Sediment (thickness, type and colour)
- General health condition of the coral

Divers knowledgeable with Hong Kong corals and trained to carry out coral translocation and monitoring works will collect the survey data. Each tagged colony will be photographed and the location mapped.

### Data Presentation

A map showing the locations of the coral colonies tagged will be prepared with suitable scale. Data for each colony will be presented in table form as shown in the sample provided in **Appendix C**.

### 3.6 Reporting

A [Detailed Coral Translocation Report](#) will be submitted to EPD and AFCD upon the completion of the translocation works. The results of pre-translocation survey at the recipient site, pre-translocation survey and coral translocation at the donor site, preliminary post-translocation surveys and the tagged coral colony survey will be reported. The locations, conditions and photographic records of the translocated corals and the conditions of the recipient site will be detailed in the report.

## 4 Post-Translocation Coral Monitoring

### 4.1 Monitoring Methodology

In order to gauge the success of coral translocation, post-translocation monitoring surveys will be required. Typically the following information will be collected for each tagged coral:

- Species
- Size (cm<sup>2</sup>)
- Growth form
- Partial Mortality
- Sediment (thickness, type and colour)
- General health condition of the coral

The information collected will be the same as the Tagged Coral Colony Survey as mentioned in section 3.5. The general environmental conditions including weather, sea and tidal conditions of the coral recipient site will also be monitored. A sample of survey record form is provided in **Appendix C**.

Photographic records of the translocated and indigenous coral colonies will be taken as far as possible maintaining the same aspect and orientation as photographs taken for the pre-translocation surveys.

The results of the post-translocation monitoring should be reviewed with reference to findings of the pre-translocation survey and the data from original colonies at the recipient site.

If observations of any die-off / abnormal conditions of the translocated corals are made during the post-translocation monitoring, the ET shall inform the AAHK, Independent Environmental Checker (IEC), and AFCD, and liaise with AFCD to investigate any mitigation measures needed. The ET will identify the source of impact causing die-off / abnormal conditions of the translocated corals and if it is related to the 3RS Project, the ET will discuss with the relevant 3RS Contractor(s) that cause impacts to the translocated corals and the AAHK on any action to be taken by the Contractor(s).

Post-translocation monitoring results will be evaluated against Action and Limit Levels. Evaluation will be based on recorded changes in percentage of partial mortality of the corals. Action and Limit Levels are defined in **Table 4.1**.

**Table 4.1: Action and Limit Levels for Post-Translocation Coral Monitoring**

Parameter	Action Level Definition	Limit Level Definition
Mortality	If during Impact Monitoring a 15% increase in the percentage of partial mortality on the corals occurs at more than 20% of the translocated coral colonies that is not recorded on the original corals at the recipient site, then the Action Level is exceeded.	If during the Impact Monitoring a 25% increase in the percentage of partial mortality at more than 20% of the translocated coral colonies occurs that is not recorded at the original corals at the recipient site, then the Limit Level is exceeded.

If the defined Action Level or Limit Level for coral monitoring is exceeded, the actions as set out in **Table 4.2** will be implemented.

**Table 4.2: Event and Action Plan for Post-Translocation Coral Monitoring**

Event	ET Leader	IEC	AAHK	Relevant Contractor for the 3RS Project*
Action Level Exceedance	<ol style="list-style-type: none"> <li>1. Check monitoring data;</li> <li>2. Identify the source(s) of impact and investigate if the exceedance is project-related;</li> <li>3. Inform the IEC, AAHK and Contractor* of the findings;</li> <li>4. Increase the monitoring to at least once a month to confirm findings;</li> <li>5. Liaise with AFCD to investigate any mitigation measures needed, and propose mitigation measures for consideration.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss monitoring with the ET and the Contractor*;</li> <li>2. Review proposals for additional monitoring and any other measures submitted by the Contractor* and advise the AAHK accordingly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with the IEC additional monitoring requirements and any other measures proposed by the ET;</li> <li>2. Make agreement on the measures to be implemented.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inform the AAHK and ET and confirm notification of the non-compliance in writing;</li> <li>2. Discuss with the ET and the IEC and propose measures to the IEC and the AAHK;</li> <li>3. Implement the agreed measures.</li> </ol>
Limit Level Exceedance	<p>Undertake Steps 1-5 as in the Action Level Exceedance. If further exceedance of Limit Level is found project-related, suspend relevant construction works until an effective solution is identified.</p>	<ol style="list-style-type: none"> <li>1. Discuss monitoring with the ET and the Contractor*;</li> <li>2. Review proposals for additional monitoring and any other measures submitted by the Contractor* and advise the AAHK accordingly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with the IEC additional monitoring requirements and any other measures proposed by the ET;</li> <li>2. Make agreement on the measures to be implemented.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inform the AAHK and ETL and confirm notification of the non-compliance in writing;</li> <li>2. Discuss with the ET and the IEC and propose measures to the IEC and the AAHK;</li> <li>3. Implement the agreed measures.</li> </ol>

\*Note: "Contractor" in the table shall refer to relevant 3RS Contractor(s) that cause impacts to the translocated corals.

## 4.2 Tentative Monitoring Programme

The programme for the post-translocation monitoring surveys will follow a typical monitoring schedule. Monitoring frequency is proposed to be twice in the first month, then once a month for two months, and subsequently two surveys carried out at six-month intervals. A total of six surveys for post-translocation monitoring will be carried out as shown in **Table 4.3**.

All the tags for marking the translocated and indigenous coral colonies will be removed / retrieved once the monitoring programme is completed.

Table 4.3: Tentative Schedule of Post-Translocation Coral Monitoring

Post-Translocation Monitoring Survey	Timing
1 <sup>st</sup> Monitoring Survey	15 days after the translocation works
2 <sup>nd</sup> Monitoring Survey	30 days after the translocation works
3 <sup>rd</sup> Monitoring Survey	2 months after the translocation works
4 <sup>th</sup> Monitoring Survey	3 months after the translocation works
5 <sup>th</sup> Monitoring Survey	9 months after the translocation works
6 <sup>th</sup> Monitoring Survey	15 months after the translocation works

#### 4.3 Reporting for Post-translocation Monitoring

[Post-translocation Coral Monitoring Reports](#) will be submitted to EPD and AFCD after the completion of monitoring works. The results of the post-translocation monitoring surveys will be reviewed with reference to the pre-translocation survey results and findings.

## 5 Reference

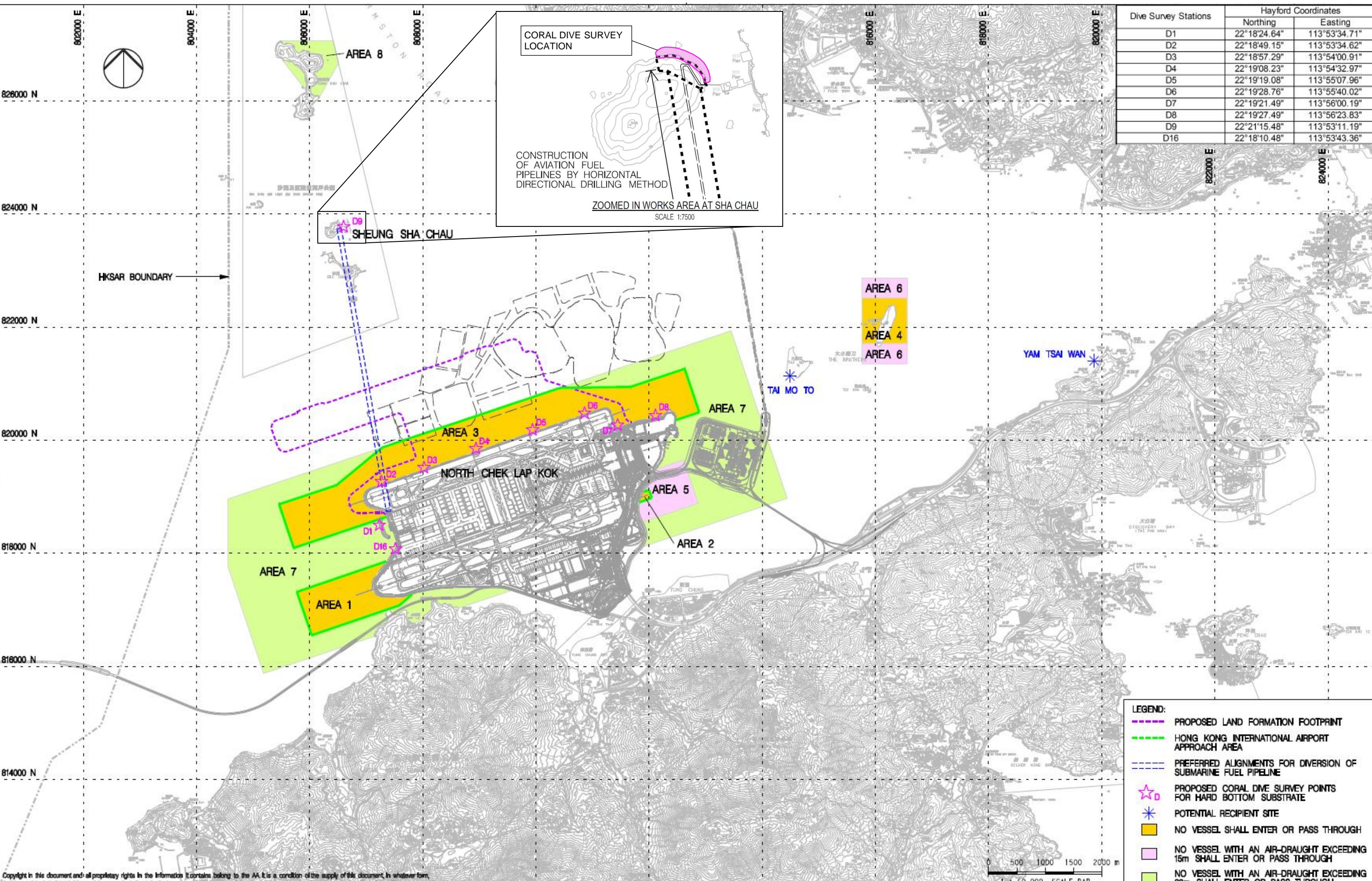
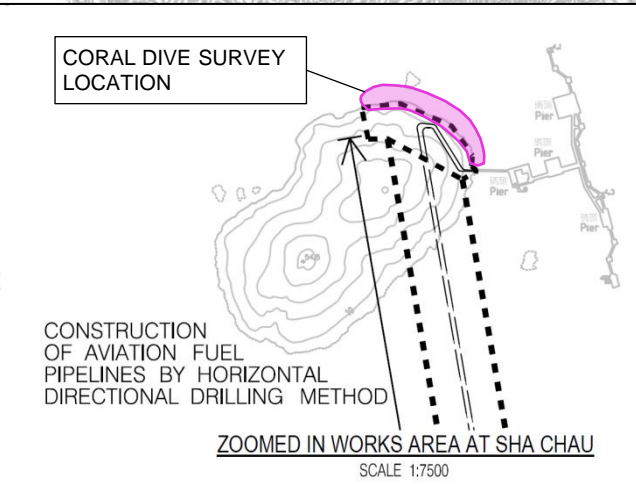
Fabricius, K. and P. Alderslade. 2000. *Soft Corals and Sea Fans A comprehensive guide to the tropical shallow-water genera of the Central-West Pacific, the Indian Ocean and the Red Sea*. Australian Institute of Marine Science, Townsville, Australia, 264pp.

Highways Department, 2013. *Contract No. HY/2012/07 Tuen Mun – Chek Lap Kok Link – Southern Connection Viaduct Section: Detailed Coral Translocation Methodology*. Prepared by Environmental Resources Management, for Highways Department, the Government of Hong Kong Special Administrative Region.

Highways Department, 2014. *Contract No. HY/2012/07 Tuen Mun – Chek Lap Kok Link – Southern Connection Viaduct Section: Detailed Coral Translocation Report*. Prepared by Environmental Resources Management, for Highways Department, the Government of Hong Kong Special Administrative Region.



Dive Survey Stations	Hayford Coordinates	
	Northing	Easting
D1	22°18'24.64"	113°53'34.71"
D2	22°18'49.15"	113°53'34.62"
D3	22°18'57.29"	113°54'00.91"
D4	22°19'08.23"	113°54'32.97"
D5	22°19'19.08"	113°55'07.96"
D6	22°19'28.76"	113°55'40.02"
D7	22°19'21.49"	113°56'00.19"
D8	22°19'27.49"	113°56'23.83"
D9	22°21'15.48"	113°53'11.19"
D16	22°18'10.48"	113°53'43.36"



**LEGEND:**

- PROPOSED LAND FORMATION FOOTPRINT
- HONG KONG INTERNATIONAL AIRPORT APPROACH AREA
- PREFERRED ALIGNMENTS FOR DIVERSION OF SUBMARINE FUEL PIPELINE
- ☆ D PROPOSED CORAL DIVE SURVEY POINTS FOR HARD BOTTOM SUBSTRATE
- ☆ POTENTIAL RECIPIENT SITE
- NO VESSEL SHALL ENTER OR PASS THROUGH
- NO VESSEL WITH AN AIR-DRAUGHT EXCEEDING 15m SHALL ENTER OR PASS THROUGH
- NO VESSEL WITH AN AIR-DRAUGHT EXCEEDING 30m SHALL ENTER OR PASS THROUGH

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Rev.	Date	Description	Checked
A	18APR16	FIRST ISSUE	HY



INDICATIVE BASELINE CORAL SURVEY LOCATIONS

Consultant's Signatures for Approval		Date
Design	JT	18APR16
Checkers	GC / TK	18APR16
Approver	EC	18APR16

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM	
Drawing No.	Scale at A3 1 : 60000
FIGURE 2.1	Rev. A

# Appendix A Raw Data of Baseline Coral Dive Survey

Table 1: Weather Condition during the Spot Check Dive Survey

Location (Survey Station)	Date	Weather	Air Temperature (°C)	Water Temperature (°C at 1m depth)	Salinity (ppt)
Western side of the airport island (D1 and D16)	29 January 2016	Cloudy	15 – 17 °C	16 °C	28 - 31
Northern and northeastern side of the airport island (D2 to D8)	29 January 2016	Cloudy	16 – 17 °C	17 – 18 °C	23 - 31
Sha Chau (D9)	29 January 2016	Cloudy	16 °C	17 °C	22

Table 2: GPS Location, Distance Surveyed, Maximum Depth, Minimum Depth and Visibility at the Dive Survey Stations

Survey Station	GPS Location (Starting Point)	Distance surveyed (m)	Maximum Depth (m)	Minimum Depth (m)	Visibility (m)
D1	22°18.343' N 113°53.725' E	100	2.5	1.5	0.5
D16	22°18.133' N 113°53.859' E	100	4.1	1.2	0.5
D2	22°18.727' N 113°53.746' E	100	2.9	1.1	0.75
D3	22°18.858' N 113°54.136' E	100	2.7	1.8	0.5
D4	22°19.043' N 113°54.716' E	100	3.1	1.1	0.5
D5	22°19.221' N 113°55.303' E	100	3.0	1.1	0.5
D6	22°19.434' N 113°55.808' E	100	3.0	1.2	1.0
D7	22°19.348' N 113°56.144' E	100	3.1	1.1	0.5
D8	22°19.454' N 113°56.695' E	100	2.9	1.0	0.5
D9	22°21.209' N 113°53.148' E	100	3.6	1.1	1.2

Table 3: Raw Data at the Dive Survey Stations

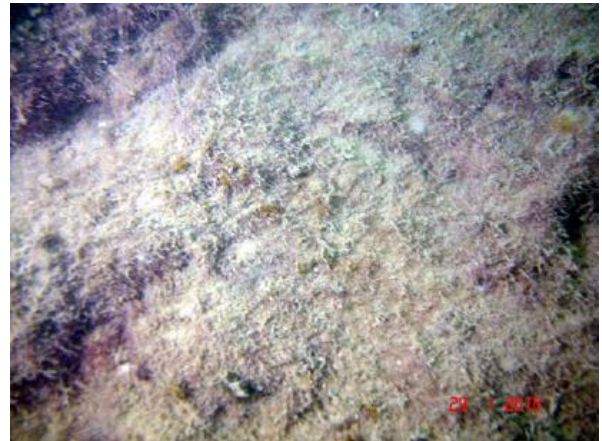
Parameter	D1	D16	D2	D3	D4
Substratum Type	Artificial sloping seawall; Large rocks & boulders; Silt	Artificial sloping seawall; Large rocks & boulders	Artificial sloping seawall; Large rocks & boulders	Artificial sloping seawall; Large rocks & boulders; Silt	Artificial sloping seawall; Large rocks & boulders
Occurrence of hard coral	Nil	Nil	<i>Paracyathus rotundatus</i> <1%	Nil	Nil
Occurrence of Gorgonian and details	Nil	<i>Guaiaigorgia</i> sp. (1/10m <sup>2</sup> on hard substratum) <5cm - 50% <10cm - 50% >20cm - 0% Partial Mortality = 10% Depth band: 1.2~3.1m	<i>Guaiaigorgia</i> sp. (1/10m <sup>2</sup> under rocks) <5cm - 50% <10cm - 35% >20cm - 15% Partial Mortality = 40% Depth band: 1.8~2.1m	<i>Guaiaigorgia</i> sp. (1/5m <sup>2</sup> under rocks) <5cm - 90% <10cm - 10% >20cm - 0% Partial Mortality = 10% Most new recruits In groups/patches of ~10m <sup>2</sup> Depth band: 1.8~2.5m	<i>Guaiaigorgia</i> sp. (1/3m <sup>2</sup> under rocks & crevices) <5cm - 50% <10cm - 40% >20cm - 10% Partial Mortality = 30% Depth band: 1.8~2.5m
Occurrence of other soft coral	Nil	Nil	Nil	Nil	Nil
Occurrence of other invertebrates and algae	Nil	<i>Thais</i> sp.; <i>Ergalatax contractus</i> ; Rock oysters <i>Saccostrea cucullata</i> ; other gastropod	<i>Perna viridis</i> ; Coralline algae; <i>Ergalatax contractus</i>	<i>Ergalatax contractus</i>	<i>Ergalatax contractus</i> ; other gastropod, algae
Remarks	Ghosted net fragment; Ghosted fishing line; Silt average ~0.5cm; Silt is ~ 2cm deep in places on rocks	-	Ghosted net fragments; Plastic rubbish	Plastic rubbish	-

Parameter	D5	D6	D7	D8	D9
Substratum Type	Artificial sloping seawall; Large rocks & boulders	Artificial sloping seawall; Large rocks & boulders	Artificial sloping seawall; Large rocks & boulders	Rocky coastline; Vertical seawall section; Small boulders; Sand seabed	Rocky coastline; Large and small boulders; Sand / rubble seabed; Silt; Exposed shore
Occurrence of hard coral	Nil	<i>Paracyathus rotundatus</i> <1%	<i>Paracyathus rotundatus</i> <1%	Nil	Nil
Occurrence of Gorgonian and details	<i>Guaiaigorgia</i> sp. (2m <sup>2</sup> under rocks & crevices) <5cm - 30% <10cm - 50% >20cm - 20% Partial Mortality = 20% In groups/patches of ~10m <sup>2</sup> Depth band: 1.8~2.5m	<i>Guaiaigorgia</i> sp. (1/10m <sup>2</sup> under rocks & crevices) <5cm - 80% <10cm - 10% >20cm - 10% Partial Mortality = 30% Depth band: 1.8~2.8m	<i>Guaiaigorgia</i> sp. (1m <sup>2</sup> under rocks & crevices) <5cm - 20% <10cm - 50% >20cm - 30% Partial Mortality = 30% Depth band: 2.0~2.7m	<i>Guaiaigorgia</i> sp. (2m <sup>2</sup> on hard substratum) <5cm - 50% <10cm - 30% >20cm - 20% Partial Mortality = 10% Depth band: 2.3~2.7m	<i>Guaiaigorgia</i> sp. (3m <sup>2</sup> on hard substratum) <5cm - 40% <10cm - 40% >20cm - 20% Partial Mortality = 10% Depth band: 1.4~2.5m
Occurrence of other soft coral	Nil	Nil	Nil	Nil	Nil
Occurrence of other invertebrates and algae	<i>Phenacovolva brevis</i> ; Coralline algae; other gastropod, algae	<i>Ergalatax contractus</i>	<i>Thais</i> sp.; <i>Ergalatax contractus</i>	<i>Thais</i> sp.; <i>Ergalatax contractus</i> ; <i>Temnopleurus</i> sp.	Algae; Rock oysters <i>Saccostrea cucullata</i> ; other gastropod
Remarks	-	-	-	Construction rubbish	Plastic rubbish

## Appendix B Representative Photographs taken during the Dive Survey



Artificial Sloping Seawall with Boulders



Typical Substratum Surface



*Guaiaogorgia* sp. at Survey Station D5



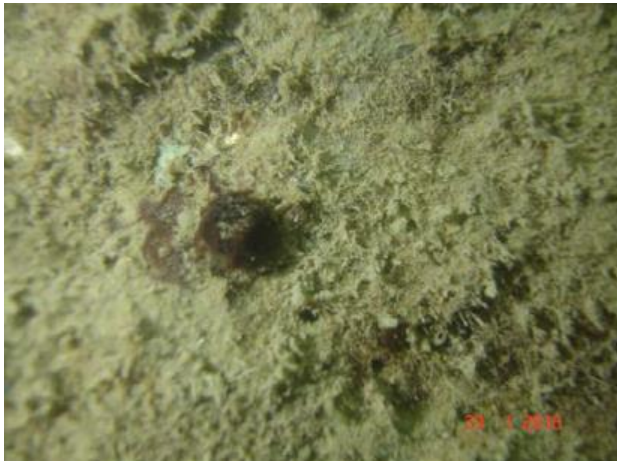
Soft coral at Survey Station D6



Soft coral at Survey Station D7



Soft coral at Survey Station D8



*Paracyathus rotundatus* at Survey Station D6



*Paracyathus rotundatus* at Survey Station D7



Rocky coastline at Sha Chau (Survey Station D9)



*Guaiaigorgia* sp. with partial mortality at Survey Station D9

