

Contract No. HY/2011/03

**Hong Kong-Zhuhai-Macao Bridge Hong Kong Link
Road**

**Section between Scenic Hill and Hong Kong
Boundary Crossing Facilities**

Coral Translocation Methodology Plan

Rev. 6

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Main Contractor



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1. Introduction

1.1 The Contract

- 1.1.1 This Coral Translocation Methodology is prepared for Contract HY/2011/03 Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road – Section between Scenic Hill and Hong Kong Boundary Facilities (“the Contract”) for the Highways Department of HKSAR. The Contract was awarded to China State Construction Engineering (Hong Kong) Limited (“the Contractor”) and BMT Asia Pacific was appointed as the Environmental Team by the Contractor.
- 1.1.2 The Contract is part of the Hong Kong – Zhuhai – Macao Bridge Hong Kong Link Road Project, the Project is considered to be a “Designated Project”, under Schedule 2 of the Environmental Impact Assessment (EIA) Ordinance (Cap 499) and an Environmental Impact Assessment (EIA) Report was prepared for the Project (Register No. AEIAR-144/2009). The current Environmental Permit (EP) EP-352/2009/A was issued on 31 October 2011. These documents are available through the EIA Ordinance Register.
- 1.1.3 Clause 2.7 of EP-352/2009/A states “*The Permit Holder shall submit to the Director for approval, at least one month before the commencement of construction of the Project, three hard copies and one electronic copy of a detailed coral translocation methodology, including pre-translocation survey, identification of receiving sites and post-translocation monitoring*”.

1.2 Purpose of this Plan

- 1.2.1 As part of the EIA, coral surveys were undertaken along the proposed reclamation site within an area immediately offshore and along the Southeast coastline of Airport Island. One of the surveys undertaken identified coral of very low coverage (<1%) comprising common gorgonian corals *Echinomuricea* sp. and hard coral *Balanophyllia* sp.. These were colonized in scattered locations and were only recorded in two of the eight dive survey locations.
- 1.2.2 The EIA findings state that ecological impacts to coral communities due to the HKLR reclamation works would be “minor” ranking (Section 10.6.3.37 of the EIA report). However, due to the conservation value of coral communities in Hong Kong, conditions have been included in the EP, the Environmental Monitoring and Audit Manual (EM&A) and the Employer’s Requirements (ER) to undertake a preconstruction survey to identify if there are coral present that are of conservation importance, and if so, determine if they are suitable for translocation, taking into account the value, health status and feasibility of translocation.
- 1.2.3 If such corals of conservation importance are identified, this information will then be incorporated into a detailed coral translocation proposal.
- 1.2.4 The following plan details the proposed procedures for the pre-translocation survey, coral translocation method and the post-translocation monitoring.



2. Environmental Requirements

2.1 Environmental Permit (EP-352/2009/A)

- 2.1.1 According to Condition 2.7 of the EP of the Hong Kong Link Road Project, the Permit Holder shall submit to the Director of Environmental Protection (DEP) for approval, at least one month before the commencement of construction of the Project, three hard copies and one electronic copy of a detailed coral translocation methodology, including pre-translocation survey, identification of receiving sites and post-translocation monitoring.

2.2 Environmental Monitoring & Audit Manual

- 2.2.1 According to the EM&A Manual, Section 10.2.25, a pre-construction dive survey for corals is required as a precautionary measure to identify any coral community suitable for translocation, taking into account the conservation value, the health status and the translocation feasibility.
- 2.2.2 Section 10.2.25 of the EM&A Manual states the following: “Pre-construction dive survey for corals – As a precautionary measure, a dive survey will be conducted at the marine pier sites nearest to intertidal zone (i.e. the pier sites to the west and to the east of the headland to be spanned over in Sha Lo Wan, and the pier site just offshore to the actual landing point on Airport Island) and along the shore of the HKLR reclamation site, prior to marine construction works in these three locations, to identify any coral colonies suitable for translocation, taking into account the conservation value, the health status and the translocation feasibility. A detailed translocation plan will be prepared if corals (including hard corals, soft corals and octocorals) of conservation importance, in good conditions, and feasible for translocation are identified during the survey.”
- 2.2.3 Of the three sites identified for the pre-construction dive survey for corals, only one of the locations is considered relevant under Contract HY/2011/03, which is the site “along the shore of the HKLR reclamation site”. The other two sites will be covered under Contract No. HY/2011/09.

3. Pre-Translocation Surveys

3.1 Pre-Translocation Survey for Donor Site

- 3.1.1 Due to the low underwater visibility at the Donor Site, relocation of tagged coral after coral mapping will be very difficult. In view of this, it is proposed to conduct the pre-translocation survey and translocate the movable coral colonies once identified.
- 3.1.2 If corals of conservation importance and in good conditions, in accordance with the approved EIA report, are identified but attached to large boulders (>50 cm in diameter) and considered not easy to translocate, they will be tagged and photographed, and information will be provided in the translocation proposal for further consideration of alternative translocation method (such as detachment technique for hard corals).

3.2 Selection Criteria for Recipient Site

- 3.2.1 It is preferable to select recipient with the following characteristics:
- In the vicinity of the original coral colony;
 - Not impacted by the Construction or other constructions/activities;
 - Presence of healthy coral community of the same species and similar hydrographical conditions; and
 - Sufficient space to receive the newly trans-located coral species
- 3.2.2 In view of the extent of the HKLR and HKBCF constructions, there are very limited sites suitable to act as recipient sites for the possible translocation of corals. This is coupled by the recent proposal of the Tung Chung Development and Reclamation, and the possible third runway at Hong Kong International Airport.
- 3.2.3 At least two sites (R1 and R2) along the coastline of Yam Tsai Wan and adjacent areas are proposed to be the optional coral recipient sites for translocation as indicated in **Figure 1**. These sites shared the similar habitat to the existing corals to be trans-located are about 8 to 10 km from the proposed reclamation site
- 3.2.4 A baseline survey will be conducted in these proposed recipient sites to ensure they are suitable to be the recipient sites. REA will be conducted at the proposed recipient site and its vicinity to check for the presence of healthy coral colonies such as soft coral *Echinomuricea* sp. and hard coral *Balanophyllia* sp., which had been observed in previous surveys.
- 3.2.5 If necessary, adjustment to the location of actual translocation sites for successful translocation should be considered. Once the exact location of the recipient site is marked, GPS coordinates will be recorded. After the baseline survey, one recipient site will be recommended for the coral translocation.



- 3.2.6 In order to distinguish the natural variation in health status of corals and the health variation due to coral translocation, certain number of natural coral colonies (e.g. 10 colonies) of same species as the donor sites within and adjacent to the recipient site will be randomly selected and tagged, if found. The same information will be recorded for these tagged coral colonies as those collected during survey at the donor site.

3.3 Pre-Translocation Survey at the Recipient Site

- 3.3.1 A semi-quantitative, Rapid Ecological Assessment (REA) method will be applied for the Pre-translocation Survey at the proposed recipient sites. The REA will assess the substrate type and taxonomic composition. All field data will be collected by marine ecologists using SCUBA dive equipment.
- 3.3.2 At each site, the REA survey will be performed along a **100m** transect parallel to the coastline. The substrate type along the length of the transects will be recorded at 1m intervals. The benthic cover, taxon abundance, and ecological attributes along the transects will also be recorded in a swathe of 2m wide, 1m either side of the transects.
- 3.3.3 The locations of the REA transects will be recorded on site using a handheld GPS unit (Garmin). Pictures of representative taxa along the transects will also be taken during the surveys. Photographic records of each coral colony tagged in the survey will be collected from an angle that best represents the entire colony. Samples of survey record forms are provided in **Appendix A**.

3.4 Assessment Criteria

- 3.4.1 The ecological value of each transect at the proposed recipient sites will be assessed following the Technical Memorandum of the Environmental Impact Assessment Ordinance (TM-EIAO) guidance tables (Annex 8 Tables 1 and 2). Within these tables, two types of information are recorded:
- Cover of the major benthic groups; and
 - Inventory of sessile benthic taxa.
- These will be performed according to Tier I and Tier II levels, described below:
- 3.4.2 Tier I: Categorization of ecological (benthic cover) and environmental variables - To describe the benthic cover, six substrate and seven ecological attributes (Table 1a) will be assigned. Each attribute will be given a rank, from 0 to 6 (Table 1b) based on the overall cover along **the survey** area.
- 3.4.3 Tier II: Taxonomic inventories to define types of benthic communities - An inventory of benthic taxa will be compiled during each swim. The taxa will be 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 (such as sponges zoanths, 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 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 1 : Categories of Benthic Attributes, Ordinal Ranks of Percentage Cover of Substrate, and 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%		

3.5 Assessment Locations

- 3.5.1 The proposed locations for the dive survey sites are shown in **Figure 1**. These include sites which are “along the shore of the HKLR reclamation site” as required in the EM&A Manual, and the proposed recipient sites.

3.6 Reporting

- 3.6.1 A detailed translocation proposal will be prepared to present the results of the pre-translocation surveys and suitability of the recipient sites. This Proposal will also include information on corals of conservation importance and in good conditions but attached on non-movable boulders and subjected to further consideration of alternative translocation method.



4. Coral Translocation Method

4.1 Coral Translocation Procedures

- 4.1.1 Since the underwater visibility at the surveyed area is very low (usually less than 20cm). Relocating all the tagged coral after coral mapping is very difficult and almost impossible. Therefore, coral translocation will be followed immediately after locating the movable coral colonies.
- 4.1.2 During the coral translocation, divers will search any translocatable coral colonies (coral attached to boulder size less than 50 cm in diameter) in the whole affected area. Corals which attached to movable boulders (less than 50 cm in diameter) will be marked and photograph of each colony will be taken and additional information for each of the coral colonies will also be collected (depth, orientation, attached boulders size, general conditions immediately surrounding of the coral colonies).
- 4.1.3 The movable boulders will be moved entirely as a whole object and lifted from the sea bottom and loaded to ship/boat with lifting bag immediately.
- 4.1.4 The trans-located coral colonies transferred onto the vessel will be submerged in seawater tanks (e.g. 80 cm x 100 cm x 40 cm in dimension and 32 liters in volume each) with continuous aeration onboard. Each seawater tank will hold no more than 4 boulders to avoid overcrowding.
- 4.1.5 Ambient water quality parameters of sea surface temperature and dissolved oxygen will be measured once (with at least triplicate sampling) at the coral donor site on the day of coral translocation. The seawater quality in the tank will be checked every ten minutes to ensure no fluctuation above 10% ambient occurs to the seawater in which the coral are submerged.
- 4.1.6 Corals will be transported to the recipient site as soon as possible following the removal. The vessel will progress in a slow and steady speed (<5 knots) to the recipient site.
- 4.1.7 When arriving at the coral recipient site, SCUBA divers, with the supervision of the marine ecologist, will carefully place the boulders with coral colonies one by one to the seabed in order to minimize disturbance to the seabed and/or sediment. The coral colonies will be positioned to similar depths with orientations as their previous location at the donor site as far as possible.
- 4.1.8 Divers will tag trans-located colonies at the recipient site with laminated, waterproof labels with colony number (~10 x 6 cm), which will be tied onto boulders just adjacent to the coral colonies. Photograph of a sample tag is showed in Appendix B. All tags will be anchored in vicinity of the coral colonies but no so near as to interfere with potential growth. This would allow the revisit of the coral colonies during the post-translocation monitoring.
- 4.1.9 Divers will keep records of size, location, health conditions (percentage of mortality), percentage of sediment cover of each translocated coral colony after the completion of translocation works using



the same methodologies adopted in the baseline pre-translocation survey. Photographs of each translocated coral upon completion of translocation will be taken and used as a baseline for future monitoring.

4.2 Coral Translocation Precautionary Measures

- 4.2.1 Every effort will be made to minimize the amount of contact by the diver and the length of time the boulders/rocks are handled. All the coral colonies attached on the boulders will be kept submerged at all time with a brief exposure unavoidable when transferred onto the vessel.
- 4.2.2 The placement of boulders in tanks will ensure that the coral colonies are fully covered by seawater. Coral exposure to air should be avoided as far as possible during transport from the donor site to the recipient site. Shading will also be provided by placing the seawater under shell roof of the vessel to avoid exposure to direct sunlight.
- 4.2.3 During the course of transportation, all the coral colonies on the boulders will be submerged at all times. Constant supervision of the boulders and the correct orientation of boulder in the seawater holding tanks will be carried out to ensure coral colonies are not damaged on the way to the recipient site.
- 4.2.4 The pre-translocation surveys and coral translocation shall be conducted by qualified marine ecologist(s) approved by AFCD, who has knowledge and sound experience in coral identification and translocation works.

5. Post-translocation Monitoring

5.1 Post-translocation Monitoring Method

- 5.1.1 Following coral translocation, the trans-located coral colonies as well as the tagged natural coral colonies at the recipient site will be monitored biweekly for the first month and then quarterly for one year (i.e. a total of six post-translocation monitoring). Monitoring will record the following parameters (using the same methodology adopted during the pre-translocation survey); the size, presence, survival, health conditions (percentage of mortality) and percentage of sediment of each trans-located coral colonies. The general environmental conditions including weather, sea, and tidal conditions of the coral recipient site will also be monitored. Samples of survey record forms are provided in **Appendix A**.
- 5.1.2 Photographic records of the trans-located and natural coral colonies will be taken as far as possible maintaining the same aspect and orientation as photographs taken for the pre-translocation surveys. All the tags for marking the trans-located and natural coral colonies will be removed / retrieved once the monitoring programme is completed.
- 5.1.3 The results of the post-translocation monitoring surveys should be reviewed with reference to findings of the baseline survey and the data from original colonies at the recipient site..
- 5.1.4 If, during the post-translocation monitoring, observations of any die-off / abnormal conditions of the trans-located corals are made, the ET will inform the Contractor, Independent Environmental Checker (IEC)/ Environmental Project Office (ENPO), Agriculture, Fisheries and Conservation Department (AFCD) and in liaison with AFCD investigate any measures needed.

5.2 Compliance / Action Event Action Plan

- 5.2.1 Post-translocation monitoring results should be evaluated against Action and Limit Levels. Evaluation should be based on recorded changes in percentage of partial mortality of the gorgonian corals. Action and Limit Levels are defined in **Table 2**.

Table 2. Action and Limit Levels for Coral Monitoring During Construction

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.

- 5.2.2 If the defined Action Level or Limit Levels for coral monitoring are exceeded, the stepwise procedures set out in **Table 3** should be implemented.



Table 3. Action and Limit Level Exceedance Procedure for Coral Monitoring

Event		Action			
		ET Leader	IEC	ER	Contractor
Action Exceedance	Level	<ol style="list-style-type: none"> 1. Check monitoring data; 2. Inform the IEC, ER and Contractor of the findings; 3. Increase the monitoring to at least once a month to confirm findings; 4. Propose mitigation measures for consideration 	<ol style="list-style-type: none"> 1. Discuss monitoring with the ET and the Contractor; 2. Review proposals for additional monitoring and any other measures submitted by the Contractor and advise the ER accordingly. 	<ol style="list-style-type: none"> 1. Discuss with the IEC additional monitoring requirements and any other measures proposed by the ET; 2. Make agreement on the measures to be implemented. 	<ol style="list-style-type: none"> 1. Inform the ER and confirm notification of the non-compliance in writing; 2. Discuss with the ET and the IEC and propose measures to the IEC and the ER; 3. Implement the agreed measures.
Limit Exceedance	Level	Undertake Steps 1-4 as in the Action Level Exceedance. If further exceedance of Limit Level, suspend construction works until an effective solution is identified.	<ol style="list-style-type: none"> 1. Discuss monitoring with the ET and the Contractor; 2. Review proposals for additional monitoring and any other measures submitted by the Contractor and advise the ER accordingly. 	<ol style="list-style-type: none"> 1. Discuss with the IEC additional monitoring requirements and any other measures proposed by the ET; 2. Make agreement on the measures to be implemented. 	<ol style="list-style-type: none"> 1. Inform the ER and confirm notification of the non-compliance in writing; 2. Discuss with the ET and the IEC and propose measures to the IEC and the ER; 3. Implement the agreed measures.

6. Programme and Reporting of the Dive Survey and Translocation

6.1 Programme

- 6.1.1 It is anticipated to conduct the dive surveys in September 2012, depending upon the approval of the methodology and personnel from Environmental Protection Department (EPD) and AFCD and weather conditions. The survey report and translocation plan can be submitted within two weeks following the survey.
- 6.1.2 The translocation of corals will be commenced upon the approval of the translocation plan from EPD and AFCD. The time required for translocation depends upon the number of coral colonies to be trans-located and the weather conditions. It is anticipated the translocation will be commenced in September 2012. The detail translocation report is anticipated to be submitted in September to October 2012.
- 6.1.3 The tentative program for the quarterly post-translocation monitoring detailed below:

Post-translocation Monitoring	Tentative Date
1) First Quarterly Monitoring	Within one week after the completion of the translocation, then once every two weeks for the first following month.
2) Second Quarterly Monitoring	3 months after the translocation
3) Third Quarterly Monitoring	6 months after the translocation
4) Fourth Quarterly Monitoring	9 months after the translocation

6.2 Reports to be Submitted to EPD and AFCD

- 6.2.1 A Detailed Coral Translocation Proposal will be submitted to EPD and AFCD including pre-translocation survey results, identification of receiving sites and proposed post-translocation monitoring schedule. This Proposal will also include information on corals of conservation importance and in good conditions but attached on non-movable boulders and subjected to further consideration of alternative translocation method. This proposal is anticipated to be submitted in September 2012.
- 6.2.2 A Detailed Translocation Report will be submitted to EPD and AFCD upon the completion of the translocation activities. The locations, conditions and photographic records of the trans-located corals and the conditions of the recipient site will be detailed in the report. This report will be completed two weeks after the translocation activities and is anticipated to be in September to October 2012.



- 6.2.3 Post-Translocation Monitoring Reports will be submitted to EPD and AFCD two weeks after the completion of monitoring work. The results of the post-translocation monitoring surveys shall be reviewed with reference to the pre-translocation survey results and findings.

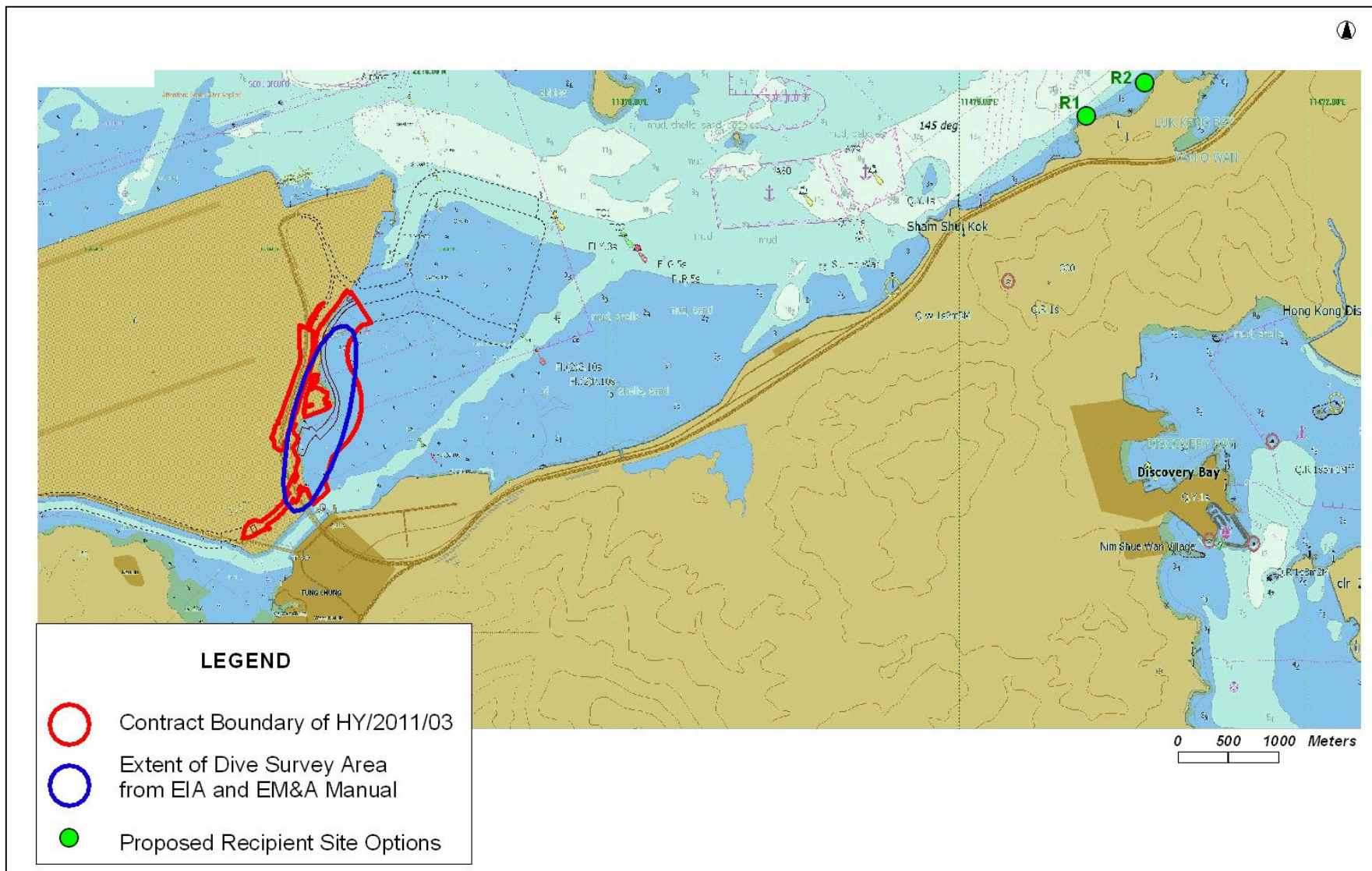


Figure 1 : Proposed Survey Location and Recipient Sites

**APPENDIX A – SAMPLE DATA RECORD
SHEETS**

Sample of data sheet for REA transect surveys: Physical and Biological Attributes

Site	Physical conditions:						
Transect No.	Water depth:						
Meter	Phy	Biol	Remark	Meter	Phy	Biol	Remark
1				51			
2				52			
3				53			
4				54			
5				55			
6				56			
7				57			
8				58			
9				59			
10				60			
11				61			
12				62			
13				63			
14				64			
15				65			
16				66			
17				67			
18				68			
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21				71			
22				72			
23				73			
24				74			
25				75			
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32				82			
33				83			
34				84			
35				85			
36				86			
37				87			
38				88			
39				89			
40				90			
41				91			
42				92			
43				93			
44				94			
45				95			
46				96			
47				97			
48				98			
49				99			
50				100			

Legend (Physical)

- BR = Bedrock
- BD = Boulder
- CB = Cobble
- RB = Rubble
- SD = Sand
- ST = Silt and Mud

Legend (Biological)

- BA = Bare
- SP = Sponge
- MA = Macroalgae
- EA = Encrusting algae
- CA = Coralline algae
- BY = Brvozoan
- BN = Barnacles
- HC = Hard coral
- SC = Soft coral
- SA = Sea anemone

Other mobile species:

Sample of data sheet for REA transect surveys: Hard Coral Colonies

No.	Species	Transect No.	Position on transect (m)	Size (Length x Width, cm)	Sedimentation (%)	Mortality (%)	Type and size (diameter, cm) of associated substrate
H1							
H2							
H3							
H4							
H5							
H6							
H7							
H8							
H9							
H10							
H11							
H12							
H13							
H14							
H15							
H16							
H17							
H18							
H19							
H20							

Sample of data sheet for REA transect surveys: Soft Coral Colonies

No.	Species	Transect No.	Position on transect (m)	Size (Height x Width, cm)	Sedimentation (%)	Mortality (%)	Type and size (diameter, cm) of associated substrate
S1							
S2							
S3							
S4							
S5							
S6							
S7							
S8							
S9							
S10							
S11							
S12							
S13							
S14							
S15							
S16							
S17							
S18							
S19							
S20							

**APPENDIX B – PHOTOGRAPH OF A SAMPLE
TAG**



Photograph of a sample tag.