

## Appendix K Coral Translocation Plan




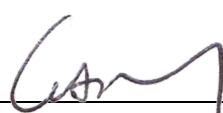

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KEPPEL SEGHERS - ZHEN HUA JOINT VENTURE

# CORAL TRANSLOCATION PLAN

(Clause 2.12, Further Environmental Permit FEP-01/429/2012/A)

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## 1. Introduction for Pre-Translocation Survey

### 1.1. Background

1.1.1. A marine ecological study was conducted in Shek Kwu Chau Island (SKC) and confirmed the presence of corals within the proposed reclamation boundary. A follow-up coral mapping survey recorded the number and locations of coral colonies to be affected by the reclamation project, with their species, sizes, and estimated translocatability. This coral translocation plan is to report the findings from the coral mapping survey and proposed translocation works.

### 1.2. Objective

1.2.1. The objectives of the survey are to record the species, number, locations, sizes and translocation feasibility of coral colonies within the boundary of the reclamation area and in the vicinity;

1.2.2. Potential recipient sites were also identified on the nearby coastline to facilitate a translocation programme, and to formulate a translocation plan with the recommended translocation site, the translocation method, and a monitoring plan.

## 2. Pre-Translocation Survey Methodology

### 2.1. Detailed Coral Survey at Shek Kwu Chau Direct Impact Site (Donor Site)

2.1.1. Since the visibility at SKC was very low (less than 0.5 m most of the time), an active search survey was conducted at the donor site at SKC as part of the detailed coral survey to locate all translocatable coral colonies. The pre-translocation survey areas were shown in **Figure 1**. The active search results of movable and non-movable coral colonies were shown in **Figure 2** and **Figure 3** respectively.

2.1.2. The location of any corals was identified to species level as far as practicable and their locations were recorded. A specific code was assigned to each recorded coral colony.

2.1.3. The results were presented as a map showing the estimated locations of all coral colonies within the survey areas. The total number of coral colonies, their sizes and species were provided. The health condition (including percentage cover of bleaching, mortality, the degree of sedimentation) of the corals was also recorded and the feasibility of translocation of corals of conservation importance was assessed.

2.1.4. Coral colonies (i.e. those attached to movable boulders with diameter <50 cm, in good health condition, and feasible for translocation) proposed to undertake translocation were identified and mapped during the survey.

2.1.5. Upon completion of the surveys, the requirement for translocation and the required dimensions of the recipient site were identified. Based on the results of the donor site, all corals attached to movable boulders with diameter <50 cm would be considered feasible for translocation.

### 2.2. Detailed Coral Survey at Shek Kwu Chau (Potential Recipient Sites)

### Spot-check Dive

- 2.2.1. Spot-check dive surveys covering the potential recipient sites were conducted. Three potential recipient sites (Sites R1, R2 and R3) were surveyed and the locations of the potential recipient sites are shown in **Figure 1**. The surveys were to check the presence of coral species similar to the donor site and the presence of suitable substratum to allow the translocated boulders/rocks to be permanently stabilized. The spot-check dive surveys required suitably trained and qualified SCUBA divers and marine ecologists swimming in a search pattern, at random water depths within the spot-check dive area (refer to **Figure 1**). Subtidal substrata (hard substratum seabed) within the proposed spot-check dive area was surveyed for the presence of coral communities. Target species parameters including estimated number of species, coral cover, partial mortality and the presence of any corals were also recorded during the spot-check dive. The divers also paid attention to the presence of non-typical reef structures, unusual coral species associations, unique or peculiar assemblages of the local reef formations, and reefs that are almost completely dominated by one particular species. Data were recorded during the dives on water proof paper in preparation for a later consolidation and analysis.
- 2.2.2. During the spot-check dive, the general environmental conditions of the potential recipient sites were also observed (e.g. presence of healthy coral community with similar coral species as the donor site, presence of suitable substratum to allow the translocated boulders/rocks to be permanently stabilized, sufficient space to receive the newly translocated coral colonies, etc.). If the preliminary survey findings reveal that the potential recipient site is not suitable, alternative recipient site(s) will be searched.

### Rapid Ecological Assessment (REA)

- 2.2.3. The REA survey was conducted along 100 m transect(s) parallel to the coastline (based on the preliminary results from the spot-check dives). The benthic cover, taxon abundance, and ecological attributes along the transects were recorded in a swath of 2 m wide, 1 m either side of the transect.
- 2.2.4. The locations of the REA transects were recorded on-site using a portable GPS unit. The number of colonies, sizes, and types of corals, their coverage, abundance, water depth, the health status of coral species will also be recorded. Photographs of representative taxa along the transects were also taken during the surveys.
- 2.2.5. Health status of coral was assessed by the following criteria:
- Gorgonian coral: Percentage of branches exhibiting partial mortality and secretion of mucus;
  - Coral: Percentage of the surface area exhibiting partial mortality and blanched/bleached area.
- 2.2.6. The benthic cover (Tier I) and taxon abundance (Tier II) of the transect will be assessed in a swath 2 m wide, 1 m either side of the transect. Two assessment categories (Tiers) will be used in the surveys, as follows:

Tier I – Categorization of Benthic Cover

2.2.7. Upon the completion of each transect, ecological and substratum attributes (refer to **Table 2.1**) were assigned to standard ranked ordinal categories (refer to **Table 2.2**).

**Table 2.1 Tier I Benthic Attribute Categories**

<b>Ecological Attributes</b>	<b>Substratum Attributes</b>
Coral	<u>Hard substrata</u>
Dead Coral	Bedrock / continuous pavement
Octocoral (Soft corals – black and Gorgonains)	Boulders blocks (diam. >50 cm)
Anemone beds	Cobble
Dead Standing corals	Rubble
Other benthos (sponges, zoanthids, ascidians and bryozoans)	Other
Macro-algae	<u>Soft substrata</u>
-	Sand
-	Mud / Silt
-	Mud

**Table 2.2 Tier II Ordinal Ranks of Percentage Cover of Benthic Attributes**

<b>Rank</b>	<b>Percentage Cover</b>
0	None Recorded
0.5	1-5 %
1	6-10 %
2	11-30 %
3	31-50 %
4	51-75 %
5	76-100 %

2.2.8. For substratum attributes, it is preferable to record actual estimates of coverage. 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%).

Tier II – Taxonomic Inventories to Define Types of Benthic Communities

2.2.9. An inventory of benthic taxa along each transect was compiled during the survey. Taxa was identified in situ to the following levels:

- Corals to species, where possible;
- Soft corals, anemones and conspicuous macroalgae to genus level, where possible;
- Other benthos (including sponges, zoanthids, ascidians ,and bryozoans) to genus level, where possible.

2.2.10. For each transect, each taxon in the inventory was ranked in terms of abundance in the community (refer to **Table 2.3**). 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 taken.

**Table 2.3 Ordinal Ranks of Taxon Abundance**

<b>Rank</b>	<b>Percentage Cover</b>
0	Absent
1	Rare
2	Uncommon
3	Common
4	Abundant
5	Dominant

2.2.11. To verify the suitability of the coral recipient site, data collected including environmental conditions, bathymetry, benthic composition at the coral recipient site was compared with the donor site. It is preferable to select the recipient site with the following characteristics:

- Presence of a healthy coral community of the similar coral species as the donor site;
- Similar environmental conditions, or better than the donor site, such as bathymetry, water depth, benthic composition, etc.;
- Presence of suitable substratum to allow the translocated boulders/rocks to be permanently stabilized;
- In the vicinity of the original coral colony; and
- Sufficient space to receive the newly translocated coral colonies.
- Presence of protection from storm/typhoon damage

2.2.12. In addition, the survey was confirmed if the proposed recipient site had the space requirements to accommodate the number of corals to be translocated, and the absence of identified constraints to their future growth and proliferation.

### **3. Pre-Translocation Survey Results**

#### **3.1. Detailed Coral Survey at SKC (Donor Site)**

3.1.1. According to the results of the coral REA surveys in the EIA report, all directly affected coral colonies were attached on movable boulders with diameter of <50 cm. In order to mitigate the direct impact to corals, translocation of directly affected coral colonies attached to movable rocks should be recommended. Therefore, active search coral surveys were conducted in January and February 2018 in order to confirm the presence of movable coral colonies under the requirements of EM&A manual. A serious increased sediment level on boulders and rocks were recorded during the mapping survey when compared to the baseline survey done in 2009 and the maximum water depth at the coral areas was reduced by 2m to 3m. Since it has been over 9 years after the baseline survey done in 2009, the increased sediment level and sediment deposit would probably be due to various factors e.g. series of typhoons over the past 9 years, especially the Super Typhoon Hato in 2017. Most of the soft corals/gorgonians recorded among the 198 coral colonies recommended for translocation in the approved EIA Report were not identified in this survey. Remaining soft coral/gorgonian found during the

active search survey were all attached to big boulder with size >50 cm in diameter and were considered to be not feasible for translocation. Thus, the following sections will focus on the results of hard corals and their translocatability.

- 3.1.2. Sixty five (65) coral colonies (**Appendix 1**) were mapped during the survey. All corals recorded during the survey colonized on hard substrates, and Forty-nine were attached to non-movable boulders. Locations of movable and non-movable coral colonies found during the active search surveys are shown in **Figure 2** and **Figure 3** respectively.
- 3.1.3. The mapped corals comprised 6 species, besides the uncommon *Coscinaraea* sp., all common to dominant in Hong Kong (see **Table 3.1** below). All corals were recorded at the water depth range of 2.5 m to 4.5 m. Photos of the site and representative corals are shown in **Photo Plate 1**.

**Table 3.1 List of coral species and no. of individuals recorded during the mapping survey**

Scientific name	No. of individuals	Status in Hong Kong
<b>Coral</b>		
<i>Psammocora superficialis</i>	35	Abundant
<i>Oulastrea crispata</i>	3	Common
<i>Goniopora stutchburyi</i>	10	Common
<i>Turbinaria peltata</i>	1	Common
<i>Coscinaraea n</i> sp.	1	Uncommon
<i>Tubastrea</i> sp.	15	Common
6 species	65 individuals	

- 3.1.4. Sixteen (16) coral colonies (**Appendix 1**) are attached to rock less than 50 cm in diameter in which they are feasible to be removed with the rock they attached. Though they are belonged to species common and abundant (except one *Coscinaraea n* sp. colony) in Hong Kong, mitigation measures would still be adopted for these corals. These colonies would need special attention during the translocation process.

3.2. Detailed Coral Survey at SKC (Potential Recipient Sites)

Spot-Check

- 3.2.1. The Spot-Check and REA surveys were performed in January and February 2018 for potential Recipient Site R1, R2 and R3 (**Figure 1**); and the weather conditions were summarized in **Table 3.2**. Spot-Check surveys were conducted along the hard substrate of the three proposed recipient sites at the south-eastern and eastern coast of SKC. 4 species to 7 species of coral were recorded during the spot-check surveys in the three potential recipient sites (**Table 3.3**). Following the spot-check survey, REA survey was conducted at the same date.

**Table 3.2 Weather Condition for the Spot-Check and REA Surveys**

Date	Condition	Average Underwater Visibility
30 January 2018	- East force 4 to 5, - Sunny period	Less than 0.5m
9 February 2018	- Northeast force 4, Sunny period	Less than 1m
22 February 2018	- East force 4 to 5 - Sunny period	Less than 1m

**Table 3.3 Coral Species Recorded in Sites R1, R2 and R3 during Spot Checks**

Coral Species	Site R1	Site R2	Site R3	Status in Hong Kong
<b>Coral</b>				
<i>Cyphastrea serailia</i>			x	Dominant
<i>Favites chinensis</i>			x	Dominant
<i>Coscinaraea</i> sp.			x	Uncommon
<i>Goniopora stutchburyi</i>	x	x	x	Common
<i>Oulastrea crispata</i>	x	x	x	Abundant
<i>Porites lutea</i>		x		Dominant
<i>Psammocora superficialis</i>	x	x	x	Dominant
<i>Tubastrea</i> sp.	x	x	x	Common
Total No. of Species	4	5	7	

**Table 3.4 GPS Coordinates of REA Transects Starting and Ending Points, Maximum Depth and Bottom Substrate of Recipient Sites R1, R2 and R3**

Site	GPS Location at Starting Point	GPS Location at Ending Point	Max. Depth	Bottom Substrate
R1	E 113°59'27.91"	E 113°59'30.91"	4.5 m	Natural Bedrock and Boulders
	N 22°11'19.71"	N 22°11'21.19"		
R2	E 113°59'40.69"	E 113°59'40.99"	4.5 m	Natural Bedrock and Boulders
	N 22°11'31.45"	N 22°11'34.115"		
R3	E 113°59'29.00"	E 113°59'30.09"	4.5 m	Natural Bedrock and Boulders
	N 22°11'43.71"	N 22°11'46.75"		

Site R1 REA Transect

3.2.2. A 100m transect was laid at proposed recipient Site R1 (**Figure 4**). GPS coordinates of REA Transect Starting and Ending, Maximum Depth and Bottom Substrate of the site were summarized in **Table 3.4**. The average water depth of the transect was about 2.5 to 4.5 m.

3.2.3. This site is mainly composed of natural bedrock and boulders down to 4.5 meters water depth along the surveyed route (**Table 3.5**). Patches of hard coral colonies were recorded along the REA transect and 4 species of hard coral were recorded. The abundance of hard coral species recorded along the transect was shown in **Table 3.6**. Besides, some invertebrates such as common sea snail: *Thais luteostoma*, Sea urchins: *Anthocidaris crassispina* and common green mussel: *Septifer virgatus* were found at the surface of the boulders.

**Table 3.5 Ecological and Substratum Attributes of Recipient Site R1**

<b>Ecological Attributes</b>	<b>Rank</b>
Hard Corals	0.5
Dead Coral	0
Octocoral	0
Sea anemone beds	0
Dead Standing Corals	0
Other Benthos	1
Macroalgae	0
<b>Substratum Attributes</b>	<b>Rank</b>
Bedrock	5
Boulders (diameter >50cm)	4
Cobbles (diameter <50cm)	1
Rubble (dead corals)	0
Sand with gravel	1
Mud & Silt	0

**Table 3.6 Taxon Abundance of Recipient Site R1**

<b>Benthic Communities</b>	<b>Abundance in the Site</b>
<b>Corals</b>	
<i>Goniopora stutchburyi</i>	1
<i>Oulastrea crispata</i>	1
<i>Psammocora superficialis</i>	1
<i>Tubastrea sp.</i>	1
<b>Other Benthos</b>	
<i>Thais luteostoma</i>	1
<i>Septifer virgatus</i>	1
<i>Anthocidaris crassispina</i>	1

3.2.4. This site supported a sparse and patchy cover (~5%) of hard corals. All the recorded coral colonies grow on the boulders and rocks surfaces. All hard

coral colonies recorded along the transect are common hard coral species in Hong Kong water and in fair health condition.

Site R2 REA Transect

3.2.5. A 100m transect was laid at proposed recipient Site R2 (**Figure 4**). GPS coordinates of REA Transects Starting and Ending, Maximum Depth and Bottom Substrate of the site were summarized in **Table 3.4**. The average water depth of the transect was about 3 to 4 m.

3.2.6. This site is mainly composed of natural bedrock and boulders down to 4.5 meters water depth along the surveyed route (**Table 3.7**). Patches of hard coral colonies were recorded along the REA transect and 5 species of hard coral were recorded. The abundance of coral species recorded along the transect was shown in **Table 3.8**. Besides, some invertebrates such as common sea snail: *Thais luteostoma*, Sea urchins: *Anthocidaris crassispina* and common green mussel: *Septifer virgatus* were found at the surface of the boulders.

**Table 3.7 Ecological and Substratum Attributes of Recipient Site R2**

Ecological Attributes	Rank
Hard Corals	0.5
Dead Coral	0
Octocoral	0
Sea anemone beds	0
Dead Standing Corals	0
Other Benthos	1
Macroalgae	0
Substratum Attributes	Rank
Bedrock	5
Boulders (diameter >50cm)	4
Cobbles (diameter <50cm)	1
Rubble (dead corals)	0
Sand with gravel	1
Mud & Silt	0

**Table 3.8 Taxon Abundance of Recipient Site R2**

Benthic Communities	Abundance in the Site
<b>Corals</b>	
<i>Goniopora stutchburyi</i>	1
<i>Oulastrea crispata</i>	1
<i>Porites lutea</i>	1
<i>Psammocora superficialis</i>	1
<i>Tubastrea sp.</i>	1
<b>Other Benthos</b>	
<i>Thais luteostoma</i>	1
<i>Septifer virgatus</i>	1
<i>Anthocidaris crassispina</i>	1



3.2.7. This site supported a sparse and patchy cover (~5%) of hard corals. In general, the health conditions of hard corals are in fair condition. All the recorded hard coral colonies grow on the boulders and rocks surfaces. All hard coral colonies recorded along the transect are common coral species in Hong Kong water.

Site R3 REA Transect

3.2.8. A 100m transect was laid at proposed recipient Site R3 (**Figure 4**). GPS coordinates of REA Transect Starting and Ending, Maximum Depth and Bottom Substrate of the site were summarized in **Table 3.4**. The average water depth of the transect was about 2.5 to 4 m.

3.2.9. This site is mainly composed of natural bedrock and boulders down to 4.5 meters water depth along the surveyed route (**Table 3.9**). Patches of hard coral colonies were recorded along the REA transect and 7 species of coral were recorded. The abundance of coral species recorded along the transect was shown in **Table 3.10**. Besides, some invertebrates such as common sea snail: *Thais luteostoma*, Sea urchins: *Anthocidaris crassispina* and common green mussel: *Septifer virgatus* were found at the surface of the boulders.

**Table 3.9 Ecological and Substratum Attributes of Recipient Site R3**

Ecological Attributes	Rank
Hard Corals	0.5
Dead Coral	0
Octocoral	0
Sea anemone beds	0
Dead Standing Corals	0
Other Benthos	1
Macroalgae	0
Substratum Attributes	Rank
Bedrock	5
Boulders (diameter >50cm)	4
Cobbles (diameter <50cm)	1
Rubble (dead corals)	0
Sand with gravel	1
Mud & Silt	0

**Table 3.10 Taxon Abundance of Recipient Site R3**

Benthic Communities	Abundance in the Site
<b>Corals</b>	
<i>Cyphastrea serailia</i>	1
<i>Favites chinensis</i>	1
<i>Coscinaraea sp.</i>	1
<i>Goniopora stutchburyi</i>	1
<i>Oulastrea crispata</i>	1
<i>Psammocora superficialis</i>	1
<i>Tubastrea sp.</i>	1

<b>Benthic Communities</b>	<b>Abundance in the Site</b>
<b>Other Benthos</b>	
<i>Thais luteostoma</i>	1
<i>Septifer virgatus</i>	1
<i>Anthocidaris crassispina</i>	1

3.2.10. This site supported a sparse and patchy cover (~5%) of hard corals. In general, the health conditions of corals are in fair condition. Except for the uncommon coral *Coscinaraea sp.*, all the recorded coral colonies grow on the boulders and rocks surfaces. All the recorded coral colonies grow on the boulders and rocks surfaces. Except for the uncommon coral *Coscinaraea sp.*, all coral colonies recorded along the transect are common coral species in Hong Kong water. Photos of the site and representative corals are shown in **Photo Plates 2**.

#### 4. Discussion

##### 4.1. Detailed Coral Survey at SKC (Donor Site)

- 4.1.1. A total of 65 coral colonies were mapped during the mapping survey and 16 were identified to be feasible of translocating to the recipient site. A detailed translocation programme should be prepared for coral colonies within the reclamation site and the works area. Except for coral *Coscinaraea sp.*, all other corals subject to translocation are all considered, common, abundant, and dominant species in Hong Kong (Chan, et al. 2005). These species have been recorded extensively in Hong Kong and are not considered to be rare or of special conservation values in Hong Kong waters.
- 4.1.2. The extent of direct impact areas (i.e. areas to be affected by the proposed seawall and maritime structure) is shown in **Figure 5**. Translocatable corals identified in these areas will be translocated to recipient site during the coral translocation work.
- 4.1.3. Prior to commencement of construction of the Project, coral colonies attached on small rocks and boulders that are manually movable by a diver underwater and are directly affected by the Project shall be translocated as far as practical to the nearby recipient site with suitable habitats and healthy community of the same coral species. Three coral recipient sites in the south-east and east coast of SKC were identified in the site search survey.
- 4.1.4. All translocation activities shall be carried out by experienced marine ecologist(s) to be agreed by AFCD. Before the coral translocation, a Coral Translocation Plan should be submitted to AFCD for consultation.

##### 4.2. Detailed Coral Survey at SKC (Potential Recipient Sites)

- 4.2.1. REA surveys were conducted at the proposed coral translocation recipient sites R1, R2, and R3. The hard substrates in this site are mainly composed of bedrock and boulders. The average water depth among the three proposed recipient sites is around 4.5 m.
  - 4.2.2. Scattered patches of hard coral colonies were recorded at these three sites. Except for the uncommon coral *Coscinaraea sp.*, all the corals recorded during the survey are common species in Hong Kong water. All three sites exhibit similar coral composition in which targeted species of corals were recorded in the recipient sites in which their health conditions are similar to the donor site. However, Site R3 showed a relatively higher number of coral colonies and species composition than other two sites during the REA survey. When compared to Site R1 and Site R2, Site R3 got the similar water depth as the donor site (4 m) and corals were found at the similar water depth (2 m to 4 m). Also, R3 is located in the inner bay of Southeast SKC in which it can be protected from storm/typhoon damage during the summer time. Besides, there is enough sufficient space at the Site R3 to receive all translocated corals from the affected areas. Therefore, Site R3 will be a suitable recipient site for the coral translocation work.
- 4.3. Referring to EIA study, the proposed implementation schedule for coral translocation is summarised in Appendix 3. All implementation measures shall be implemented according to the location and time specified in the implementation schedule.

## **5. Method Statement for Coral Translocation**

### **5.1. Coral Translocation Procedure**

- 5.1.1. The 16 translocatable coral colonies identified during the Pre-translocation Survey will be translocated before any construction works.
- 5.1.2. During the coral translocation, divers will search any coral colonies which are attached to boulder size of less than 50 cm in diameter within the direct impact areas. Corals which attached to movable boulders (less than 50 cm in diameter) will be marked and photographs of each colony will be taken and additional information for each of the coral colonies will also be collected (water depth, orientation, attached boulders size, general conditions immediately surrounding of the coral colonies).
- 5.1.3. 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.
- 5.1.4. 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.
- 5.1.5. 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.
- 5.1.6. Corals will be transported to the recipient site R3 as soon as possible following the removal. The vessel will progress at a slow and steady speed (<5 knots) to the recipient site.
- 5.1.7. When arriving at the coral recipient site R3, 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 water depths with orientations as their previous location at the donor site as far as possible.
- 5.1.8. Divers will tag trans-located colonies at the recipient site by using plastic tags with colony number (~3.5 cm diameter), which will be glued onto boulders by just adjacent to the coral colonies. All tags will be anchored in the 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. Ten natural coral colonies at the recipient site R3 will also be tagged for post-monitoring and their size, health conditions (percentage of mortality and bleaching), the percentage of sediment cover will be monitored.
- 5.1.9. Divers will keep records of size, location, health conditions (percentage of mortality and bleaching), the percentage of sediment cover of each translocated coral colony after the completion of translocation works. Photographs of each translocated coral upon completion of translocation will be taken and used as a baseline for future monitoring.
- 5.1.10. Tentative schedule of translocation: 20, 23, 24, 25, 28 and 29 March 2018

## 5.2. Post-translocation Monitoring

- 5.2.1. According to the Clause 6b.4.3 of the EM&A manual, the post-translocation monitoring will be proposed to AFCD for agreement. Following coral translocation in the recipient site R3, the trans-located coral colonies as well as the tagged natural coral colonies at the recipient site will be monitored quarterly for one year (i.e. a total of four post-translocation monitoring). Monitoring will record the following parameters; the size, presence, survival, health conditions (percentage of mortality/bleaching) and percentage of sediment of each trans-located coral colony and each tagged natural colony. The general environmental conditions including weather, sea, and tidal conditions of the coral recipient site will also be monitored.
- 5.2.2. 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.
- 5.2.3. 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.
- 5.2.4. If observations of any die-off / abnormal conditions of the translocated corals are made during the post-translocation monitoring, the ET should inform the Contractor, Independent Environmental Checker (IEC) and AFCD, and liaise with AFCD to investigate any mitigation measures needed.
- 5.2.5. 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 5.1**.
- 5.2.6. Translocated coral colonies and the tagged natural coral colonies at the recipient site will be monitored quarterly for one year. The 1st to 4th post-translocation monitoring will be conducted in June 2018, September 2018, December 2018 and March 2019.
- 5.2.7. Since Site R3 is located at the opposite side of the works area at about 2 km away, it is considered that indirect impact to the recipient site R3 due to the construction of the Project will be negligible. Therefore, the one year quarterly post translocation monitoring at the recipient site R3 is considered adequate. Further monitoring of the translocated coral colonies during Construction Phase is not proposed.

**Table 5.1 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 are not recorded on the original corals at the receptor site, then the Action Level is exceeded.	If during Impact Monitoring a 25% increase in the percentage of partial mortality on the corals occurs at more than 20% of the translocated coral colonies that are not recorded on the original corals at the receptor site, then the Limit Level is exceeded.

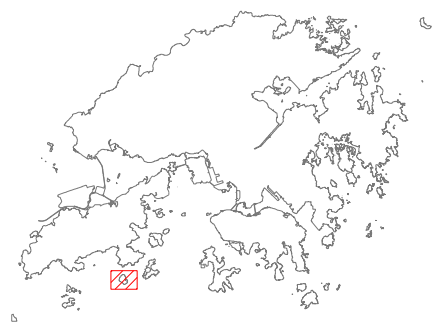
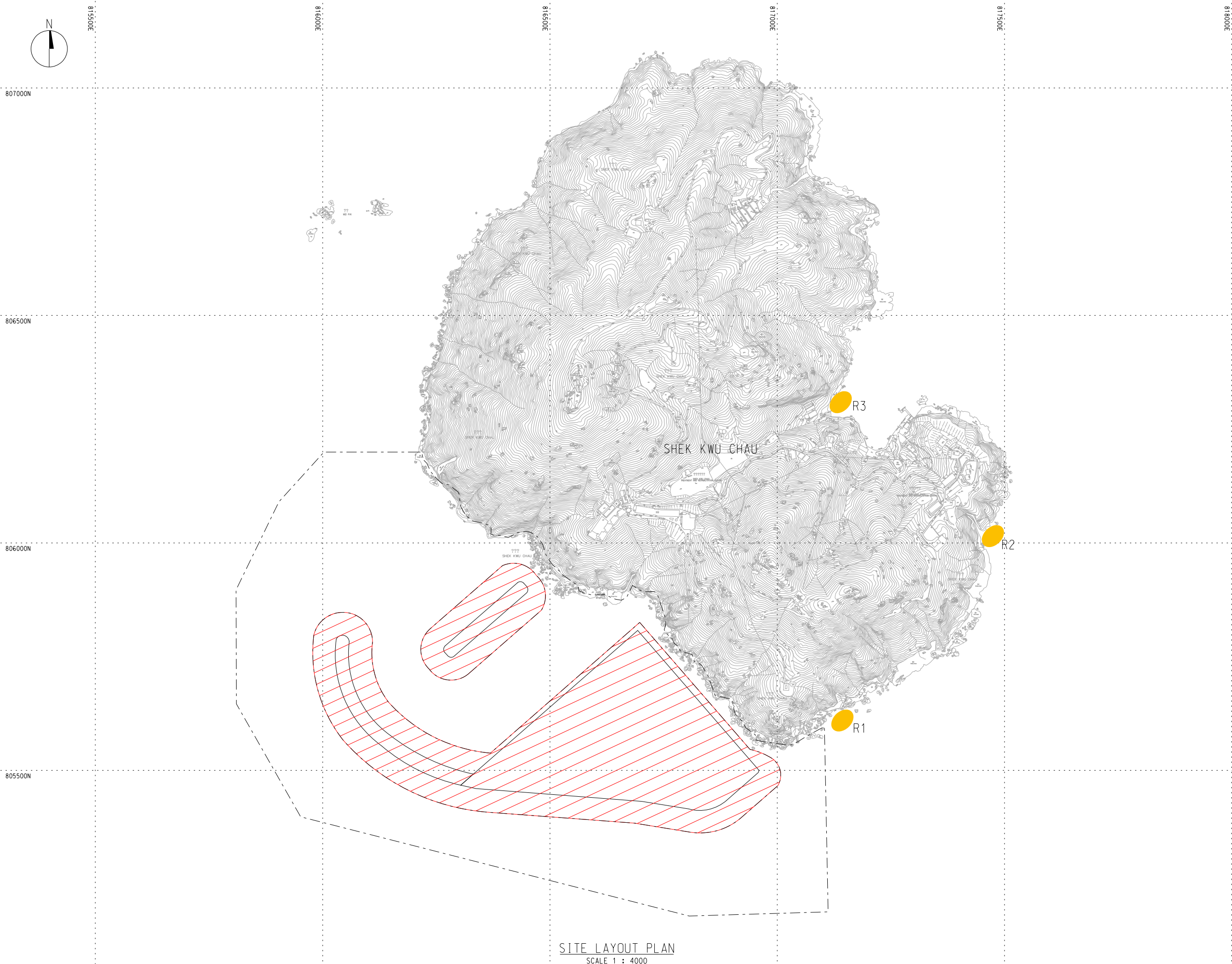
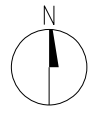
\*If the defined Action Level or Limit Level for coral monitoring as listed in **Table 5.1** is exceeded, the actions as set out in **Appendix 2** will be implemented.

## **6. Reporting**

- 6.1. A Translocation Report will be submitted to EPD and AFCD two weeks after completion of the coral translocation.
- 6.2. Findings from Post-Translocation Monitoring will be presented in the Monitoring Results Section under monthly EM&A Report of the respective reporting month and submitted to EPD and AFCD after completion of each quarterly survey. The results of the post-translocation monitoring surveys should be reviewed with reference to the pre-translocation survey results and findings.

**Figure 1 Pre-Translocation Survey Area and Proposed Recipient Sites R1, R2 and R3**





LOCATION KEY PLAN

- LEGEND:
- SITE BOUNDARY
  - ARTIFICIAL ISLAND AND MARITIME STRUCTURES OF IMM
  - PROPOSED RECIPIENT SITE
  - PRE-TRANSLOCATION SURVEY AREA

SITE LAYOUT PLAN  
SCALE 1 : 4000

STATUS		<b>FOR DESIGN</b>	
DESIGNED	---	CHECKED	---
DRAWN	---	DATED	MAR/16/2018
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DESIGN CHECKER



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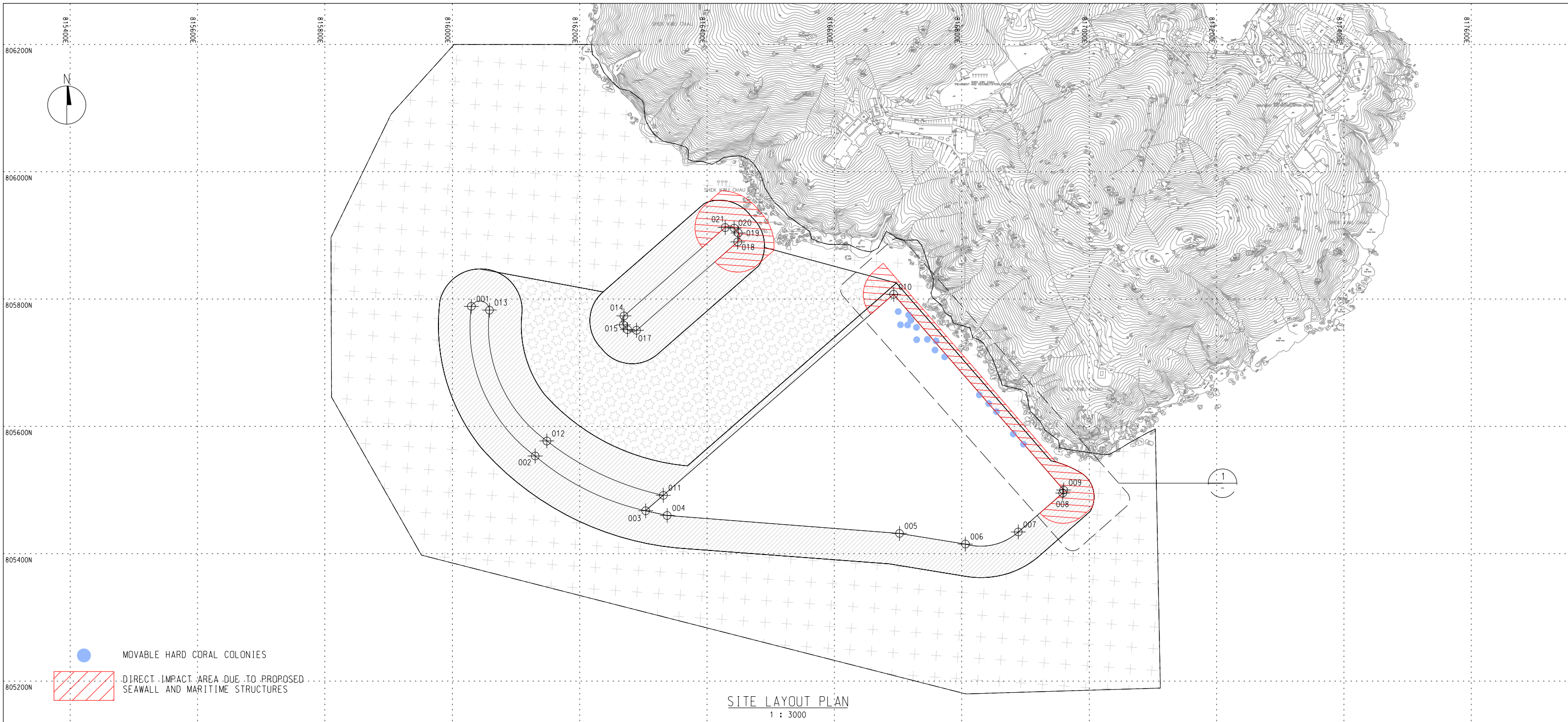
PROJECT

Contract EP/SP/66/12  
Integrated Waste Management Facilities  
Phase 1

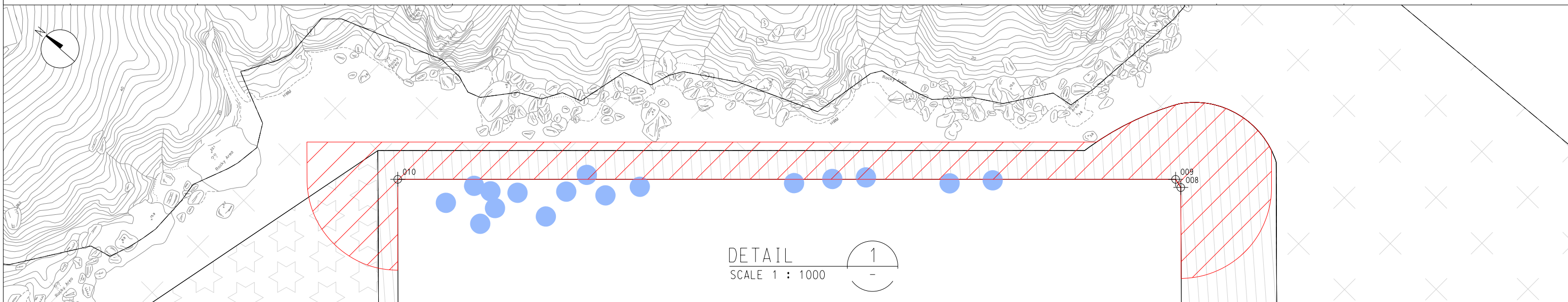
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SCALE @ A1	DRAWING NO.	REV.	1 : 4000	EP/SP/66/12/COR/004	A

**Figure 2 Locations of Movable Coral Colonies**





SITE LAYOUT PLAN  
1 : 3000

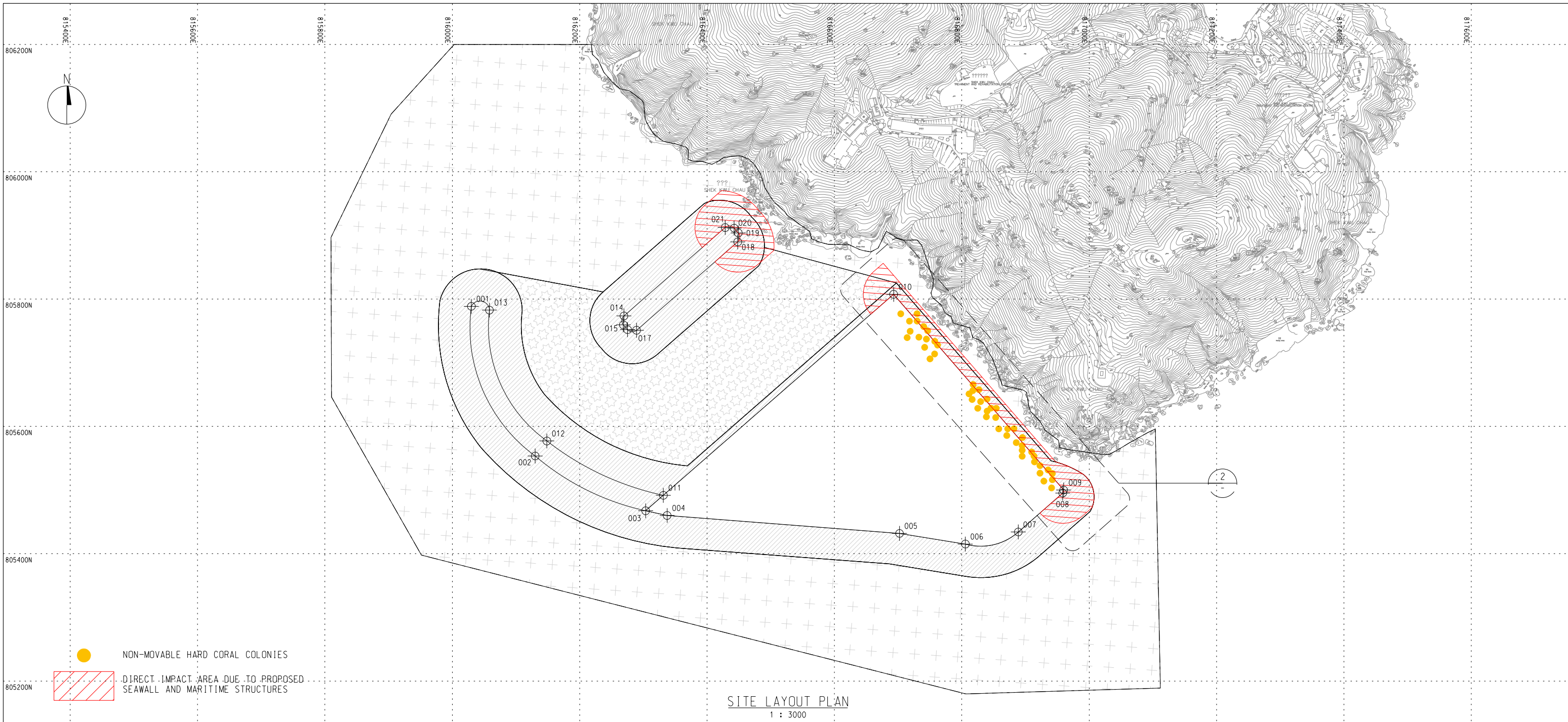


DETAIL  
SCALE 1 : 1000

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DESIGNED	CHECKED	 環境保護署 Environmental Protection Department	 Keppel Seghers – Zhen Hua Joint Venture	 ARCADIS Design & Consultancy for natural and built assets	 SMC Member of the Surlana Jurong Group	Contract EP/SP/66/12 Integrated Waste Management Facilities Phase 1	TITLE		
DRAWN	DATED						SCALE @ A1	DRAWING NO.	REV.
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**Figure 3 Locations of Non-Movable Coral Colonies**

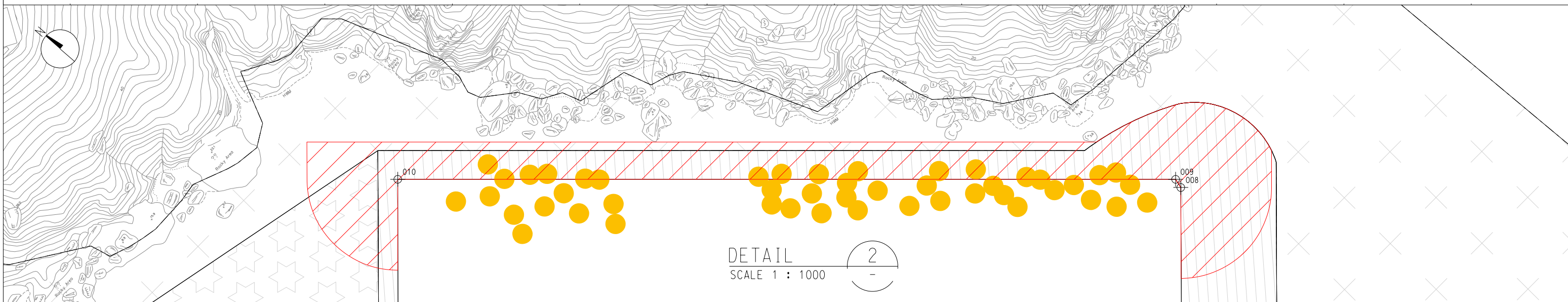




● NON-MOVABLE HARD CORAL COLONIES

▨ DIRECT IMPACT AREA DUE TO PROPOSED SEAWALL AND MARITIME STRUCTURES

SITE LAYOUT PLAN  
1 : 3000



DETAIL  
SCALE 1 : 1000

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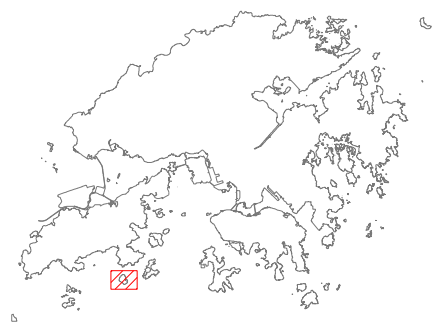
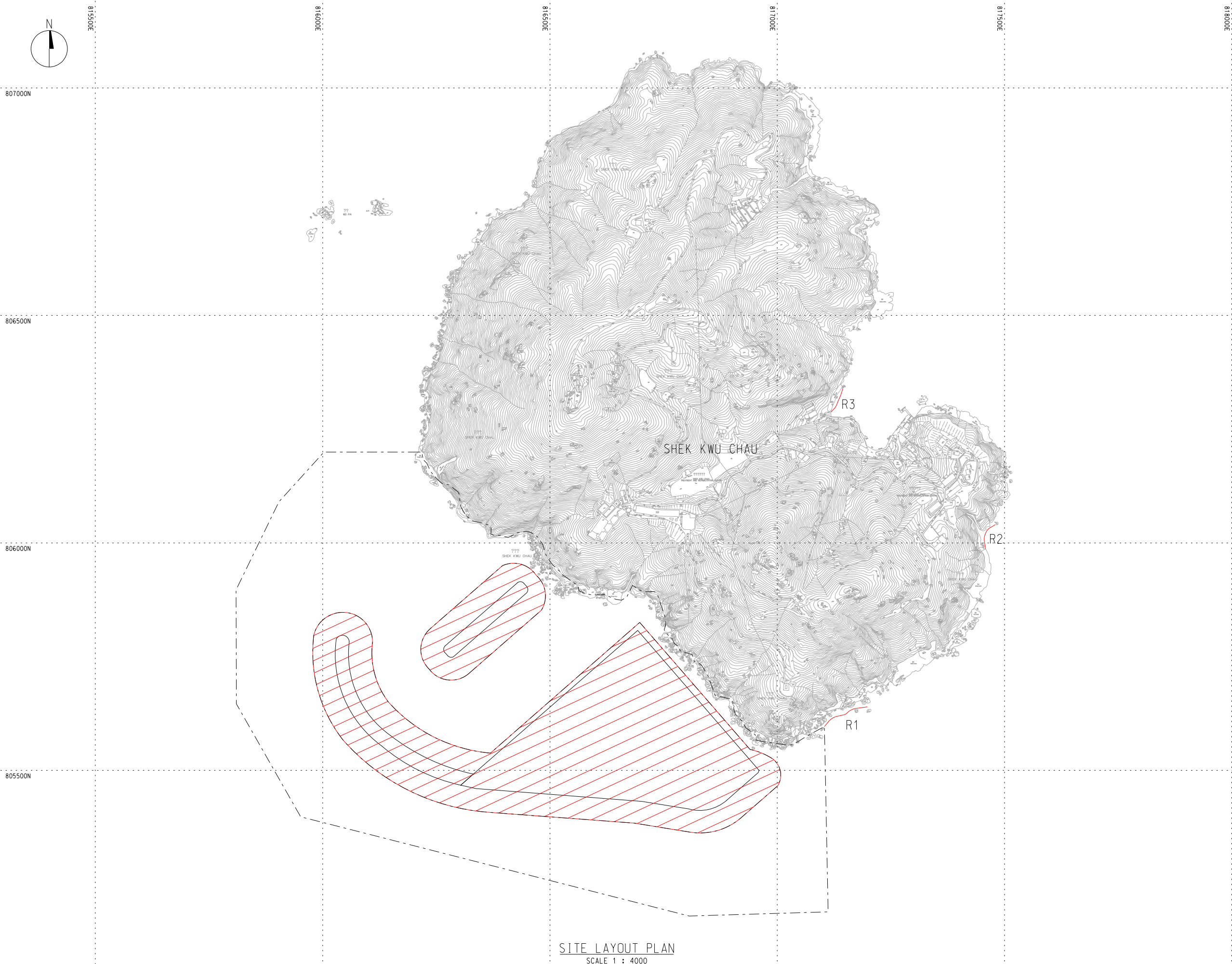
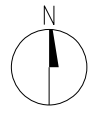
PROJECT

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Integrated Waste Management Facilities  
Phase 1


TITLE	
SCALE @ A1	DRAWING NO.
REV.	

**Figure 4** Locations of REA Transects at Proposed Recipient Sites R1, R2 and R3





LOCATION KEY PLAN

- LEGEND:
- SITE BOUNDARY
  - ARTIFICIAL ISLAND AND MARITIME STRUCTURES OF IMM
  - REA TRANSECTS
  -  PRE-TRANSLOCATION SURVEY AREA

SITE LAYOUT PLAN  
SCALE 1 : 4000

STATUS		<b>FOR DESIGN</b>	
DESIGNED	---	CHECKED	---
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Environmental Protection Department

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DESIGNER



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DESIGN CHECKER



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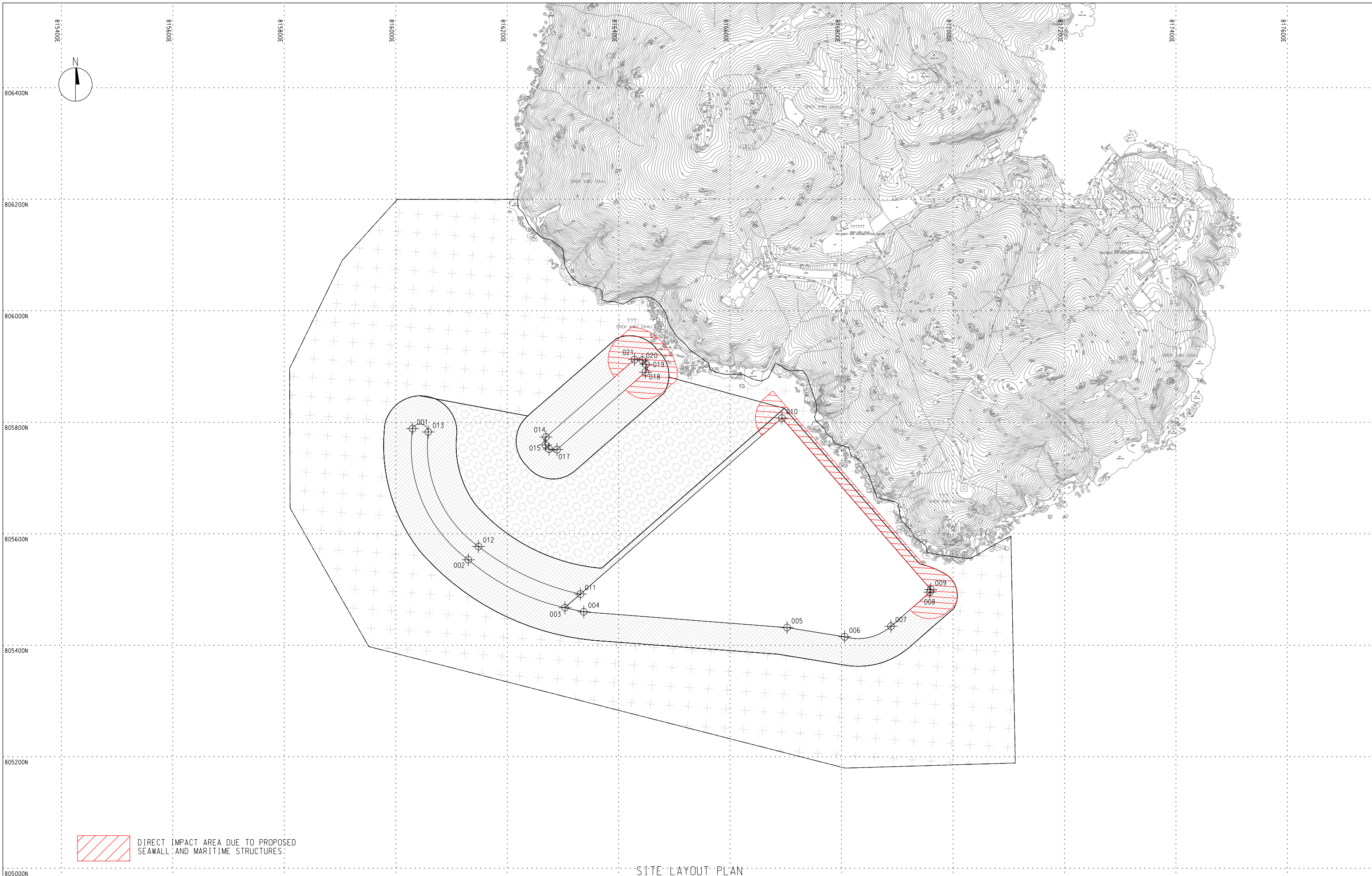
PROJECT


Contract EP/SP/66/12  
Integrated Waste Management Facilities  
Phase 1

TITLE			INTEGRATED WASTE MANAGEMENT FACILITIES PHASE 1 REA TRANSECTS AT SITE R1, R2 AND R3		
SCALE @ A1	DRAWING NO.	REV.			
1 : 4000	EP/SP/66/12/COR/003	A			

**Figure 5 Direct Impact Area**






 DIRECT IMPACT AREA DUE TO PROPOSED SEAWALL AND MARITIME STRUCTURES

SITE LAYOUT PLAN  
 1 : 3000

STATUS		CLIENT	ORIGINATOR	DESIGNER	DESIGN CHECKER	PROJECT	TITLE
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DRAWN	DATED						DRAWING NO.
APPROVED	© COPYRIGHT RESERVED						REV.



**Photo Plate 1 - Photos Taken at Shek Kwu Chau (Donor Site)**



**Photo 1. Bedrock at Shek Kwu Chau**



**Photo 2. Boulders at Shek Kwu Chau**

**Photo Plate 1 - Photos Taken at Shek Kwu Chau (Donor Site)**



**Photo 3. Sandy Bottom at Shek Kwu Chau**



**Photo 4. *Tubastrea* sp. at Shek Kwu Chau**

**Photo Plate 1 - Photos Taken at Shek Kwu Chau (Donor Site)**



**Photo 5. *Turbinaria peltata* at Shek Kwu Chau**



**Photo 6. Movable *Psammocora superficialis* at Shek Kwu Chau**



**Photo Plate 1 - Photos Taken at Shek Kwu Chau (Donor Site)**

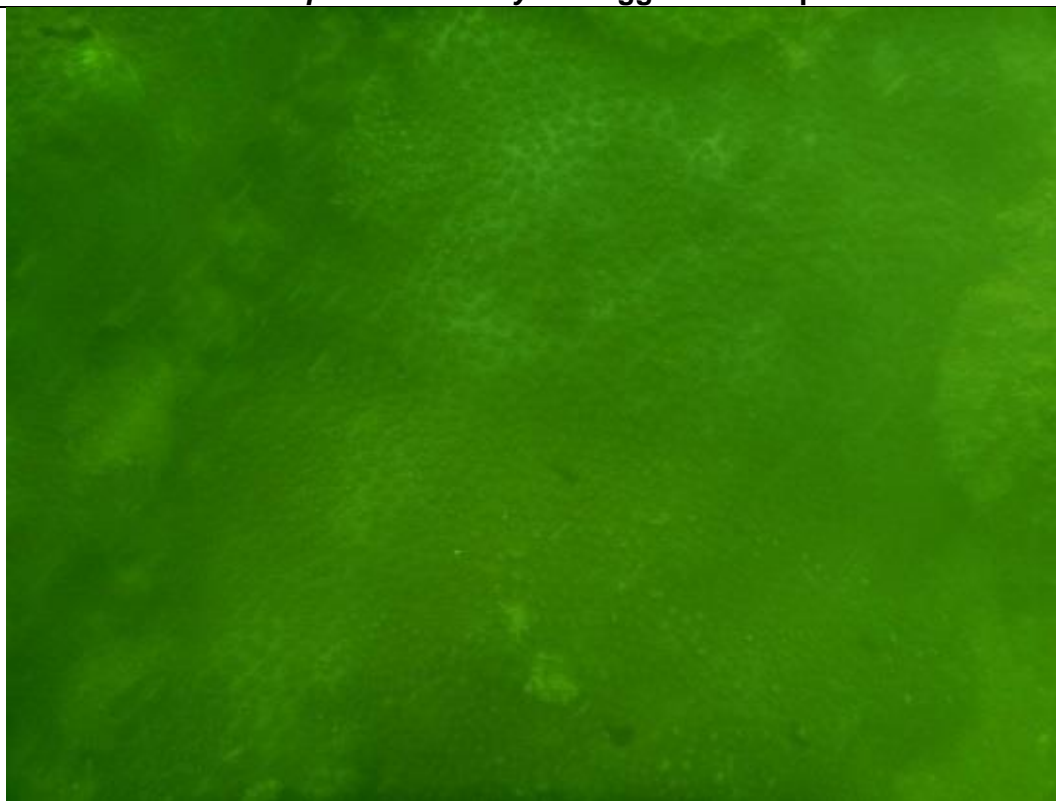


**Photo 7. Movable *Coscinaraea n* sp. at Shek Kwu Chau**

**Photo Plate 2 - Photos Taken at  
Suggested Recipient Site R3**



**Photo 8. *Goniopora stutchburyi* at Suggested Recipient Site R3**

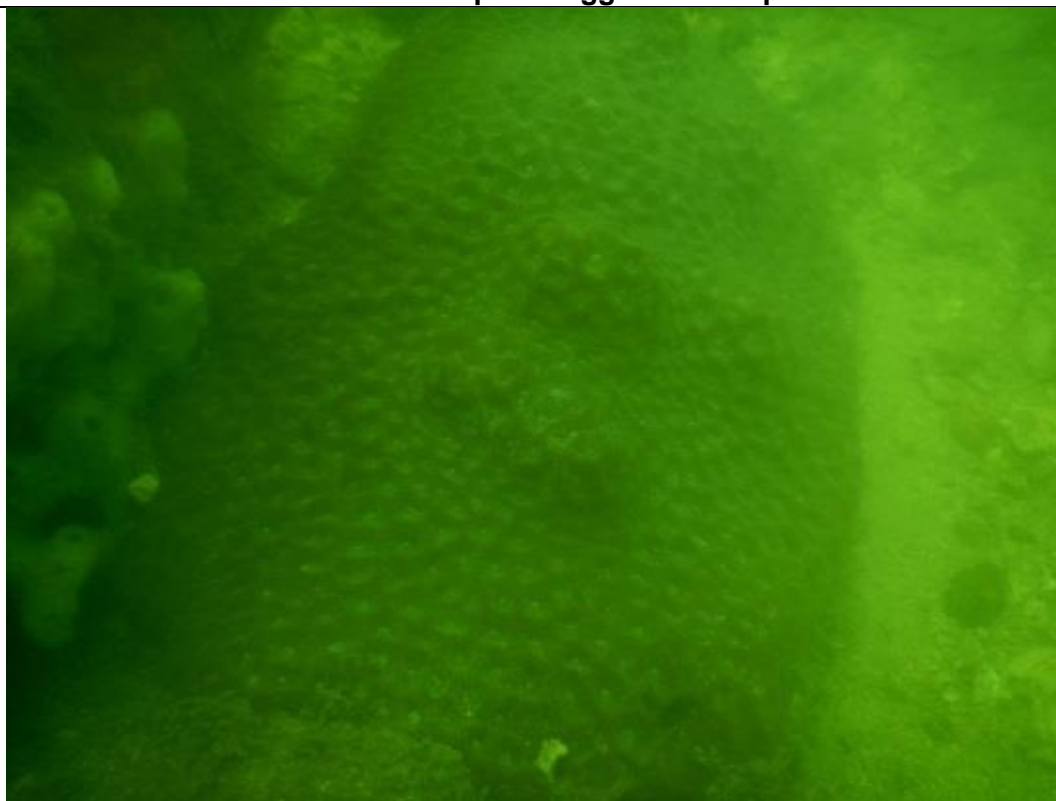


**Photo 9. *Cyphastrea serailia* at Suggested Recipient Site R3**

**Photo Plate 2 - Photos Taken at  
Suggested Recipient Site R3**



**Photo 10. *Coscinarea* sp. at Suggested Recipient Site R3**



**Photo 11. *Favites chinensis* at Suggested Recipient Site R3**

**Photo Plate 2 - Photos Taken at  
Suggested Recipient Site R3**



**Photo 12. *Psammocora superficialis* at Suggested Recipient Site R3**



**Photo 13. *Turbinaria peltata* at Suggested Recipient Site R3**



**Appendix 1 Mapping Survey Findings of Coral Colonies at SKC (Donor Site)**

<b>Coral Code</b>	<b>Coral Species</b>	<b>Size (cm)</b>	<b>% Bleaching</b>	<b>% Mortality</b>	<b>% Sediment</b>	<b>Translocation Feasibility</b>
1	<i>Psammocora superficialis</i>	23	0	0	2	NO
2	<i>Psammocora superficialis</i>	25	0	0	0	NO
3	<i>Psammocora superficialis</i>	13	0	0	0	YES
4	<i>Psammocora superficialis</i>	26	0	0	5	YES
5	<i>Psammocora superficialis</i>	35	0	0	0	NO
6	<i>Psammocora superficialis</i>	12	0	0	0	YES
7	<i>Psammocora superficialis</i>	36	0	0	7	NO
8	<i>Psammocora superficialis</i>	25	0	0	0	NO
9	<i>Psammocora superficialis</i>	16	0	0	0	NO
10	<i>Psammocora superficialis</i>	26	0	0	3	YES
11	<i>Psammocora superficialis</i>	24	0	0	0	NO
12	<i>Psammocora superficialis</i>	27	0	0	0	NO
13	<i>Psammocora superficialis</i>	35	0	0	0	YES
14	<i>Psammocora superficialis</i>	24	0	0	0	NO
15	<i>Psammocora superficialis</i>	25	0	0	6	NO
16	<i>Psammocora superficialis</i>	16	0	0	0	YES
17	<i>Psammocora superficialis</i>	13	0	0	0	YES
18	<i>Psammocora superficialis</i>	16	0	0	0	NO
19	<i>Psammocora superficialis</i>	25	0	0	10	NO
20	<i>Psammocora superficialis</i>	14	0	0	0	NO
21	<i>Psammocora superficialis</i>	35	0	0	10	YES
22	<i>Psammocora superficialis</i>	25	0	0	0	NO
23	<i>Psammocora superficialis</i>	12	0	0	0	NO
24	<i>Psammocora superficialis</i>	25	0	0	0	NO
25	<i>Psammocora superficialis</i>	26	0	0	0	YES
26	<i>Psammocora superficialis</i>	23	0	0	0	NO
27	<i>Psammocora superficialis</i>	25	0	0	0	NO
28	<i>Psammocora superficialis</i>	16	0	0	0	YES
29	<i>Psammocora superficialis</i>	28	0	0	6	NO
30	<i>Psammocora superficialis</i>	25	0	0	0	NO
31	<i>Psammocora superficialis</i>	16	0	0	0	NO
32	<i>Psammocora superficialis</i>	23	0	0	0	YES
33	<i>Psammocora superficialis</i>	30	0	0	5	NO
34	<i>Psammocora superficialis</i>	18	0	0	0	NO
35	<i>Psammocora superficialis</i>	14	0	0	0	NO
36	<i>Tubastrea sp.</i>	8	0	0	0	NO
37	<i>Tubastrea sp.</i>	5	0	0	0	NO
38	<i>Tubastrea sp.</i>	7	0	0	0	NO
39	<i>Tubastrea sp.</i>	10	0	0	0	NO
40	<i>Tubastrea sp.</i>	6	0	0	0	NO
41	<i>Tubastrea sp.</i>	12	0	0	0	NO
42	<i>Tubastrea sp.</i>	6	0	0	0	NO
43	<i>Tubastrea sp.</i>	7	0	0	0	NO
44	<i>Tubastrea sp.</i>	7	0	0	0	NO

<b>Coral Code</b>	<b>Coral Species</b>	<b>Size (cm)</b>	<b>% Bleaching</b>	<b>% Mortality</b>	<b>% Sediment</b>	<b>Translocation Feasibility</b>
45	<i>Tubastrea sp.</i>	9	0	0	0	NO
46	<i>Tubastrea sp.</i>	4	0	0	0	NO
47	<i>Tubastrea sp.</i>	7	0	0	0	NO
48	<i>Tubastrea sp.</i>	8	0	0	0	NO
49	<i>Tubastrea sp.</i>	9	0	0	0	NO
50	<i>Tubastrea sp.</i>	6	0	0	0	NO
51	<i>Goniopora stutchburyi</i>	26	0	0	0	NO
52	<i>Goniopora stutchburyi</i>	15	0	0	0	NO
53	<i>Goniopora stutchburyi</i>	14	0	0	0	NO
54	<i>Goniopora stutchburyi</i>	21	0	0	0	NO
55	<i>Goniopora stutchburyi</i>	27	0	0	5	YES
56	<i>Goniopora stutchburyi</i>	14	0	0	0	YES
57	<i>Goniopora stutchburyi</i>	23	0	0	0	YES
58	<i>Goniopora stutchburyi</i>	19	0	0	0	NO
59	<i>Goniopora stutchburyi</i>	21	0	0	0	NO
60	<i>Goniopora stutchburyi</i>	16	0	0	0	NO
61	<i>Coscinaraea n sp.</i>	21	0	0	0	YES
62	<i>Oulastrea crispata</i>	5	0	0	0	NO
63	<i>Oulastrea crispata</i>	6	0	0	0	NO
64	<i>Oulastrea crispata</i>	4	0	0	0	NO
65	<i>Turbinaria peltata</i>	9	0	0	0	YES

**Appendix 2 Event and Action Plan for Post-Translocation Monitoring**

Event	Action			
	ET Leader	IEC	SO	Contractor
Action Level Exceedance	<ol style="list-style-type: none"> <li>1. Check monitoring data</li> <li>2. Inform the IEC, SO ,and Contractor of the findings;</li> <li>3. Increase the monitoring to at least once a month to confirm findings;</li> <li>4. 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 SO 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 the agreement on the measures to be implemented.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inform the SO 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 SO;</li> <li>3. Implement the agreed measures.</li> </ol>
Limit Level Exceedance	<ol style="list-style-type: none"> <li>1. Undertake Steps 1-4 as in the Action Level Exceedance. If further exceedance of Limit Level, propose enhancement 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 SO 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 the agreement on the measures to be implemented.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inform the SO 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 SO;</li> <li>3. Implement the agreed measures.</li> </ol>

**Appendix 3 Implementation Schedule for Coral Translocation of IWMF**

EIA Ref.	Current Plan Ref.	Environmental Protection Measures / Mitigation Measures	Location / Timing	Implementation Agent	Implementation Stages*			
					Des	C	O	Dec
7b.6.2.6 – 7b.6.2.15	3.1	<p><u>Measures to avoid direct impact of movable coral colonies at donor site</u></p> <ul style="list-style-type: none"> <li>● Mapping of all movable (those attached to movable boulders with diameter &lt;50cm) coral colonies at direct impact site</li> </ul>	IWMF Site	Environmental Team	✓			
7b.6.2.6 – 7b.6.2.15	3.2	<p><u>Measures to choose suitable recipient site</u></p> <ul style="list-style-type: none"> <li>● Recipient site should have the same species of coral as the donor at similar depth.</li> <li>● The recipient site should locate at area that will be protected from typhoon action.</li> <li>● The recipient site should have sufficient space to receive all translocated corals from the affected areas</li> </ul>	IWMF Site	Environmental Team	✓			
7b.6.2.6 – 7b.6.2.15	5.1.1 – 5.1.5	<p><u>Measures during translocation of movable coral colonies from donor site</u></p> <ul style="list-style-type: none"> <li>● 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</li> <li>● 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</li> <li>● 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</li> </ul>	IWMF Site	Environmental Team	✓			

<p>7b.6.2.6 – 7b.6.2.15</p>	<p>5.1.6 &amp; 5.1.7</p>	<p>Measures when putting the translocated corals at the recipient site</p> <ul style="list-style-type: none"> <li>● Corals will be transported to the recipient site R3 as soon as possible following the removal. The vessel will progress at a slow and steady speed (&lt;5 knots) to the recipient site</li> <li>● When arriving at the coral recipient site R3, 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 water depths with orientations as their previous location at the donor site as far as possible</li> </ul>	<p>Recipient R3</p>	<p>Environmental Team</p>	<p>✓</p>			
<p>7b.6.2.6 – 7b.6.2.15</p>	<p>5.1.8 &amp; 5.1.9 &amp; 5.2.6</p>	<p><u>Measures during post-translocation monitoring</u></p> <ul style="list-style-type: none"> <li>● Divers will tag trans-located colonies at the recipient site by using plastic tags with colony number (~3.5 cm diameter), which will be glued onto boulders by just adjacent to the coral colonies. All tags will be anchored in the 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</li> <li>● Ten natural coral colonies at the recipient site R3 will also be tagged for post-monitoring and their size, health conditions (percentage of mortality and bleaching), the percentage of sediment cover will be monitored</li> <li>● Divers will keep records of size, location, health conditions (percentage of mortality and bleaching), the percentage of sediment cover of each translocated coral colony after the completion of translocation works. Photographs of each translocated coral upon completion of translocation</li> </ul>	<p>Recipient R3</p>	<p>Environmental Team</p>	<p>✓</p>			

		<p>will be taken and used as a baseline for future monitoring</p> <ul style="list-style-type: none"> <li>● Translocated coral colonies and the tagged natural coral colonies at the recipient site will be monitored quarterly for one year. The 1st to 4th post-translocation monitoring will be conducted in June 2018, September 2018, December 2018 and March 2019. Monitoring will record the following parameters; the size, presence, survival, health conditions (percentage of mortality/bleaching) and percentage of sediment of each trans-located coral colony and each tagged natural colony.</li> </ul>						
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\*Des – Design, C-Construction, O-Operation, and Dec - Decommissioning