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Gulhifalhu Coral Relocation – Intermediate update

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PROJECT NAME: Dredging, Reclamation and Revetment works at Gulhifalhu
PROJECT NUMBER: 462-10042

CLIENT NAME: Ministry of National Planning and Infrastructure
CLIENT REFERENCE: MNPI

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Rev. 0	All	New issue

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

The aim of the Project is to extend the land mass at Gulhifalhu, as part of the master plan for the international port development in Greater Malé Area. This will be achieved by reclaiming land and protecting the reclamation with revetment.

The total area of additional land to be reclaimed is approximately 192 ha at Gulhifalhu, using approximately 20 million m^3 of sand. The reclamation will be made to a height of +2.0 m MSL.

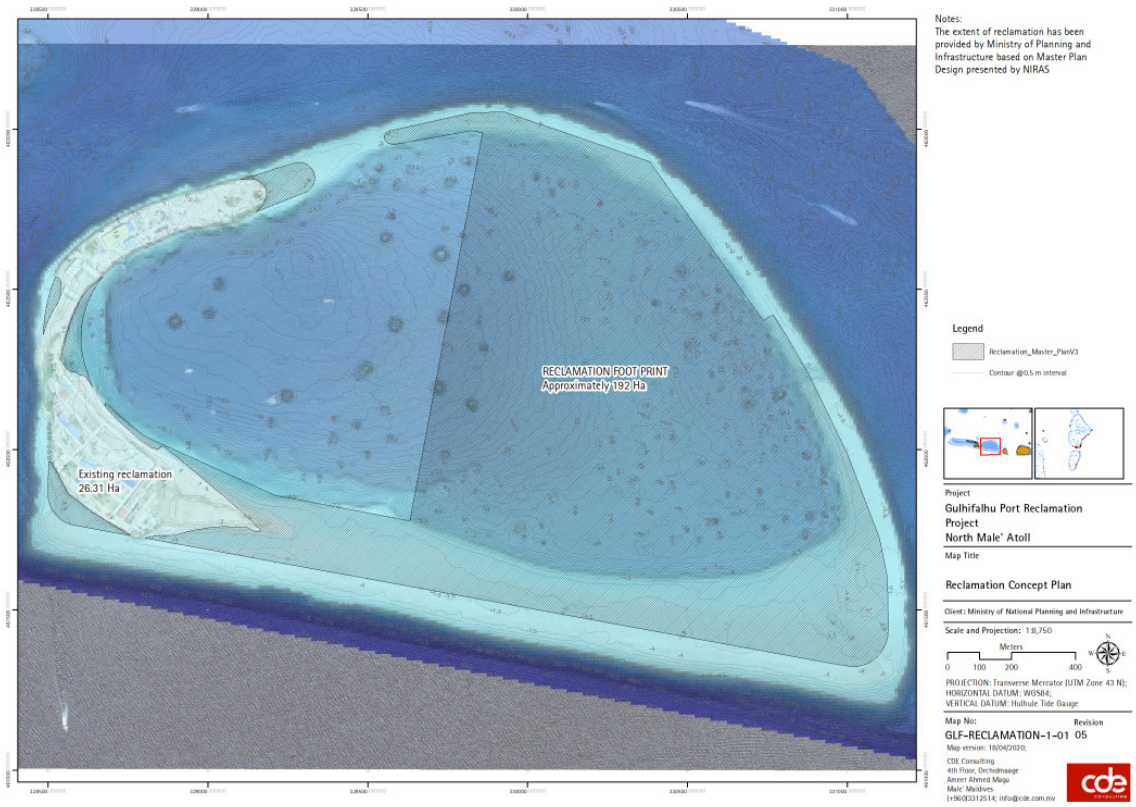


Figure 1.1 - Reclamation footprint

1.2 DOCUMENT SCOPE

Coral reef habitat within the direct footprint of the reclamation will inevitably be lost. The EIA describes mitigating measures for marine habitat loss and/or degradation in section 8.1.4. Item 3 describes a) relocation of smaller coral colonies, b) relocation of larger colonies and c) alternative mechanisms to offset the loss, such as funding conservation measures at other protected marine site(s) in Maldives [Ref. 1]. Client has chosen option c to mitigate for habitat loss and/or degradation and has indicated they will discuss an appropriate offsetting mechanism with the Ministry of Environment. Separately, Contractor has decided to perform partial coral relocation as a CSR initiative. This report is intended to describe the scope of Contractor's coral relocation efforts, the baseline at the receiving location and the progress so far, as the relocation is still ongoing.

2 CORAL RELOCATION

2.1 HARVESTING CORALS FROM GULHIFALHU LAGOON

Contractor has engaged a coral relocation expert, ReefScapers, to perform the relocation. The information in this chapter was supplied by ReefScapers to Contractor in their coral relocation proposal, and currently being executed.

An initial marine survey has been conducted by Reefscapers prior to the start of the project. During the survey, the coral reef health and biomass were assessed on the eastern side of the island (Figure 2.1). Both Reef Flat (in red) and Lagoon (in green) were surveyed to estimate the right amount of live corals to be relocated.

Figure 2.1 - Zones investigated for relocatable corals by ReefScapers

The most representative coral species in the Maldives are from the Acropora family. Acroporae can have different shapes including branches, digitates or tables. Those corals are fragile and when relocated, need to be attached to a hard substrate as for example Coral Frames. The Acropora species are being relocated into one of Reefscapers Coral Reef Restoration Project Sites (Section 2.2) and transplanted onto ReefScapers' Coral Frames.

The ReefScapers team is collecting the Acropora corals in buckets by diving/snorkelling and later placing them into a big tub on a dhoni. Sea water has to be constantly flowing within each tub to guarantee the best water quality and supply enough oxygen and to maintain a cool water temperature.

The corals are being transported to the recipient site and transplanted onto coral frames. The corals will to some extent be fragmented in the process.

Figure 2.2 - Sample images of coral relocation from ReefScapers' previous projects

Other reef building corals species are growing into a shape called “massive”. Those massive corals are heavy blocks of mineral reaching about 0,5m³ to 1m³ of more. Smaller colonies can be hauled on board the boat and carried in the tanks with water recirculation. The bigger ones will have to be floated and towed at the surface to another reef.

ReefScapers is determining on-site which and how many corals are feasible to be relocated within the available timeframe, which is approximately 2 weeks. Coral relocation was started on Friday 29-05-2020.

2.1.1 Progress to date

Reports of the type and amount of coral colonies harvested per day, received from ReefScapers to date, are included in Appendix 1. Below figures give an impression of the corals harvested to date.

Figure 2.3 - Branching corals carefully being separated from the substrate for relocation.

Figure 2.4 - Massives and submassives being gathered together for pick-up

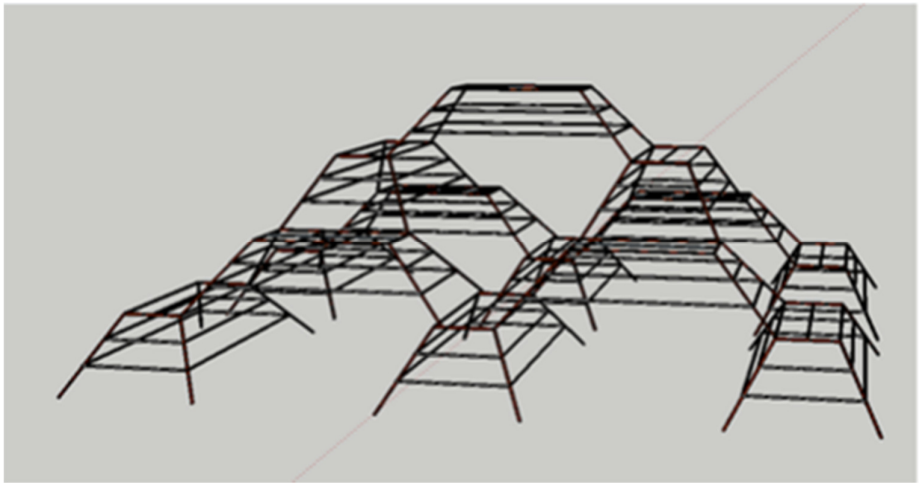
Figure 2.5 - Corals being transported on the dhoni in tubs with circulating water

2.2 RECIPIENT LOCATION FURANAFUSHI

As also indicated in the EIA Additional Information [Ref. 2], as shared with EPA on 06-05-2020, Coral relocation is planned to the lagoon on the western side of Furanafushi Island (Figure 2.6). This site is exclusively made up of a sandy bottom, and does not support naturally occurring coral colonies. The water depth at this site is between 5 m and 8 m.

Figure 2.6 - Coral relocation site at Furanafushi (Sheraton Full Moon Resort)

There are no hard substrates (e.g. rocks) on which corals can be transplanted at this site. Hence large pyramids (figure below) are planned to be used as a base for the relocated corals. A total of 10 pyramids, each consisting of 13 frames are planned to be deployed at this location. Each pyramid has the capacity to support approximately 400 coral colonies. Therefore, it is estimated around 4000 coral colonies of the 'branching' type can be relocated to this site. Additionally, approximately 1500 coral colonies of the 'massive' type are estimated to be relocated to this site. These numbers may still change, as the current lockdown situation is likely to cause unforeseen logistical challenges.



2.2.1 Environmental baseline at recipient site

As described above, the benthic substrate at the recipient site is 100% sand. Therefore, no Line Intercept Transects were performed, because it is known that percentage coral cover and colony size is currently 0.

As part of the EIA's baseline data collection, water quality testing at 1m depth has been performed at Furanafushi, at 15 January. Furanafushi is indicated with monitoring location 'W28' in the EIA [Ref. 1]. Another in-situ water quality test has been performed at 1m depth on 14 May. TSS could not be tested then as the MWSC laboratory was closed due to the COVID-19 lockdown. Water quality results are described in Table 2.1.

Table 2.1 - Water quality baseline results at Furanafushi, as described in the EIA [Ref. 1].

Parameter		15-01	14-05
Temperature	°C	28.85	30.47
pH		8.2	8.3
Conductivity	µS/cm	51330	51810
Salinity	‰	31.0	33.9
Turbidity	NTU	-0.11	0.00
Total Suspended Solids	mg/L	<5	N/A

2.2.2 Progress to date

The majority of the corals that have been harvested to date from Gulhifalhu lagoon have already been relocated to Furanafushi reef. Here, they still need to be definitively attached at an appropriate density on the coral frames. Below figures give an impression of the corals relocated to date. Visibility in the pictures is a bit lower than normal because of the coral placement activities in the water temporarily disturbing the sediment.

Figure 2.7 - Corals are brought to the frames in buckets and then placed onto the frames.

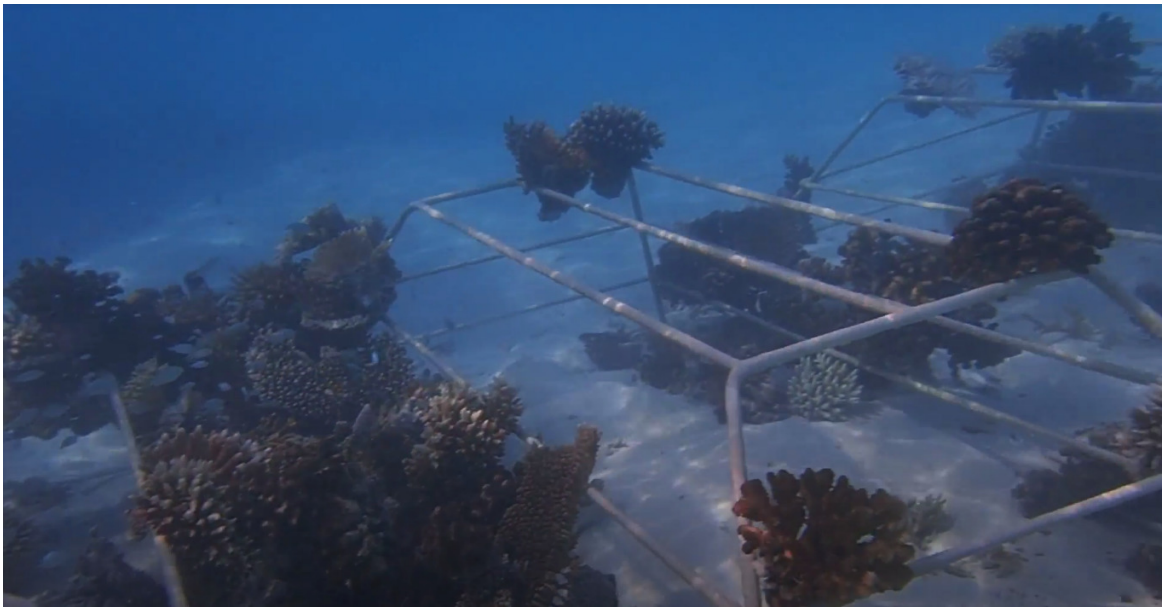


Figure 2.8 - Coral frames at Furanafushi. Collected corals still to be placed at an appropriate density on the frames. Fish already present, as seen on left side of the picture.

Figure 2.9 - Coral frames at Furanafushi as seen from the surface

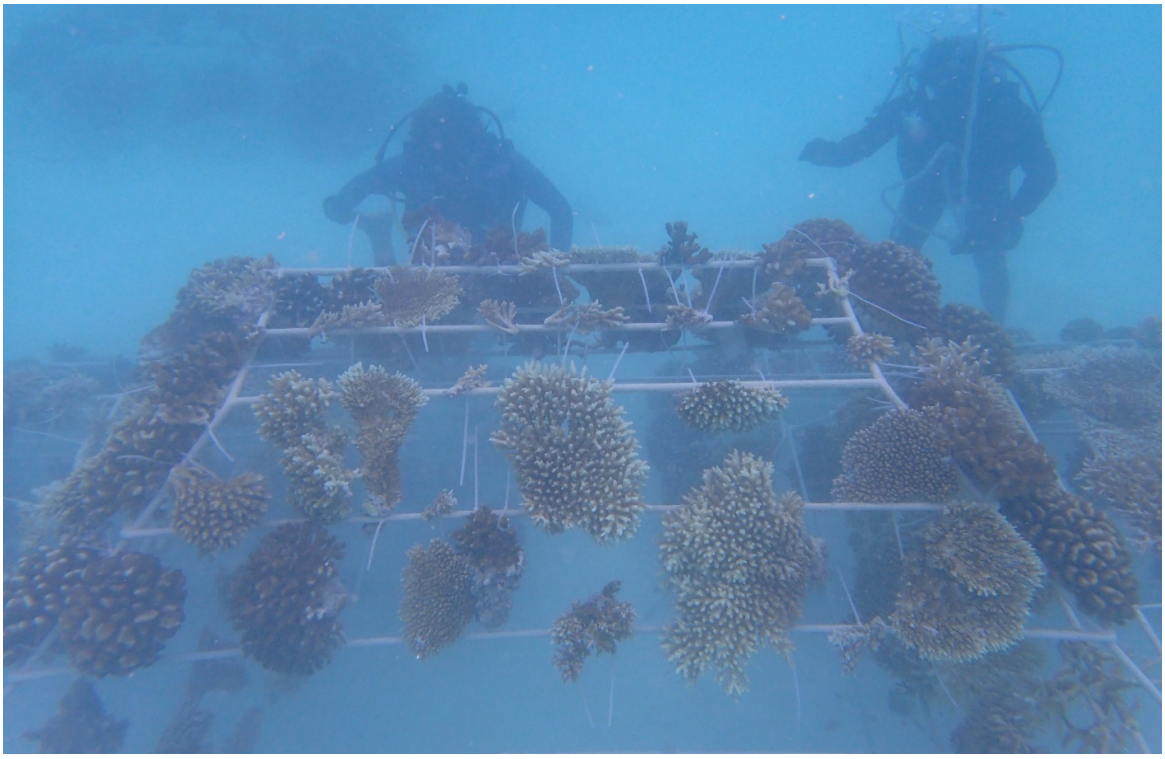


Figure 2.10 - Coral frames stacked in a 'pyramid' shape.

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3 REFERENCES, ABBREVIATIONS, DEFINITIONS

3.1 REFERENCES

Documents	
No.	**Document**
[Ref. 1]	CDE Consulting (2020). EIA for the proposed Gulhifalhu Port Development Project Phase 1: Dredging, Reclamation and Shore Protection
[Ref. 2]	CDE Consulting (2020). EIA Additional Information for the proposed Gulhifalhu Port Development Project Phase 1: Dredging, Reclamation and Shore Protection

3.2 ABBREVIATIONS

Abbreviation	Full meaning
BWC	Boskalis Westminster Contracting Ltd
CSR	Corporate Social Responsibility
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
MSL	Mean Sea Level
MWSC	Malé Water and Sewerage Company
TSS	Total Suspended Solids

3.3 DEFINITIONS

Definition	Full meaning
Project	Dredging, Reclamation and Revetment Works at Gulhifalhu
Client	Ministry of National Planning and Infrastructure
Contractor	Boskalis Westminster Contracting Ltd

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APPENDIX 1 – CORAL RELOCATION – DAILY PROGRESS REPORTS

Daily Coral Relocation Report	
Name	Thomas Le Berre
Date	29th May 2020
Type of coral harvested *(e.g. branching, massive, etc.)*	Tabular, digitate, branching and submassives
Coral family *(e.g. Acropora, Porites, etc.)*	Acropora, Pocillopora
Number of coral colonies or fragments harvested	200 colonies, large number of fragments
Average size of coral colonies or fragments harvested	40 cm
Approximate location within Gulhifalhu lagoon	Coral heads on south eastern part of the lagoon
Type of artificial structure corals will be attached to *(e.g. frame, table, plugs, etc.)*	colonies to be attached on frames
Location corals will be relocated to *(e.g. N/W/S/E side of resort/reef, average depth, etc.)*	resort lagoon area, 5 m depth

Daily Coral Relocation Report	
Name	Thomas Le Berre
Date	30th May 2020
Type of coral harvested *(e.g. branching, massive, etc.)*	Tabular, digitate, branching and submassives
Coral family *(e.g. Acropora, Porites, etc.)*	Acropora, Pocillopora
Number of coral colonies or fragments harvested	350 colonies, large number of fragments
Average size of coral colonies or fragments harvested	40 cm
Approximate location within Gulhifalhu lagoon	Coral heads on south eastern part of the lagoon
Type of artificial structure corals will be attached to *(e.g. frame, table, plugs, etc.)*	colonies to be attached on frames
Location corals will be relocated to *(e.g. N/W/S/E side of resort/reef, average depth, etc.)*	resort lagoon area, south, 5 m depth

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Daily Coral Relocation Report	
Name	Thomas Le Berre
Date	31st May 2020
Type of coral harvested *(e.g. branching, massive, etc.)*	Tabular, digitate, branching and submassives
Coral family *(e.g. Acropora, Porites, etc.)*	Acropora, Pocillopora
Number of coral colonies or fragments harvested	400 colonies, large number of fragments
Average size of coral colonies or fragments harvested	40 cm
Approximate location within Gulhifalhu lagoon	Coral heads on south eastern part of the lagoon
Type of artificial structure corals will be attached to *(e.g. frame, table, plugs, etc.)*	colonies to be attached on frames
Location corals will be relocated to *(e.g. N/W/S/E side of resort/reef, average depth, etc.)*	resort lagoon area, south, 5 m depth

Daily Coral Relocation Report	
Name	Thomas Le Berre
Date	1st June 2020
Type of coral harvested *(e.g. branching, massive, etc.)*	massives and submassives
Coral family *(e.g. Acropora, Porites, etc.)*	Porites, Psammocora
Number of coral colonies or fragments harvested	397 colonies
Average size of coral colonies or fragments harvested	30 cm
Approximate location within Gulhifalhu lagoon	Southern reef flat
Type of artificial structure corals will be attached to *(e.g. frame, table, plugs, etc.)*	colonies to be installed on northern reef flat and existing reef structure
Location corals will be relocated to *(e.g. N/W/S/E side of resort/reef, average depth, etc.)*	Furanafushi northern reef flat, depth 1 to 3 m

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Daily Coral Relocation Report	
Name	Thomas Le Berre
Date	2nd June 2020
Type of coral harvested *(e.g. branching, massive, etc.)*	Tabular, digitate, branching and submassives
Coral family *(e.g. Acropora, Porites, etc.)*	Acropora, Pocillopora
Number of coral colonies or fragments harvested	400 colonies, large number of fragments
Average size of coral colonies or fragments harvested	40 cm
Approximate location within Gulhifalhu lagoon	Coral heads on south eastern part of the lagoon
Type of artificial structure corals will be attached to *(e.g. frame, table, plugs, etc.)*	colonies to be attached on frames
Location corals will be relocated to *(e.g. N/W/S/E side of resort/reef, average depth, etc.)*	resort lagoon area, south, 5 m depth

Daily Coral Relocation Report	
Name	Thomas Le Berre
Date	3rd June 2020
Type of coral harvested *(e.g. branching, massive, etc.)*	Tabular, digitate, branching and submassives
Coral family *(e.g. Acropora, Porites, etc.)*	Acropora, Pocillopora
Number of coral colonies or fragments harvested	450 colonies, large number of fragments
Average size of coral colonies or fragments harvested	35 cm
Approximate location within Gulhifalhu lagoon	Coral heads on northern part of the lagoon
Type of artificial structure corals will be attached to *(e.g. frame, table, plugs, etc.)*	colonies to be attached on frames
Location corals will be relocated to *(e.g. N/W/S/E side of resort/reef, average depth, etc.)*	resort channel area, 5 m depth

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Daily Coral Relocation Report	
Name	Thomas Le Berre
Date	4th June 2020
Type of coral harvested *(e.g. branching, massive, etc.)*	Submassives, digitate and tabular
Coral family *(e.g. Acropora, Porites, etc.)*	Pocillopora and Acropora
Number of coral colonies or fragments harvested	550 colonies, large number of fragments
Average size of coral colonies or fragments harvested	30 cm
Approximate location within Gulhifalhu lagoon	Coral heads on northern part of the lagoon
Type of artificial structure corals will be attached to *(e.g. frame, table, plugs, etc.)*	colonies to be attached on frames
Location corals will be relocated to *(e.g. N/W/S/E side of resort/reef, average depth, etc.)*	resort lagoon area, 5 m depth

Daily Coral Relocation Report	
Name	Thomas Le Berre
Date	5th June 2020
Type of coral harvested *(e.g. branching, massive, etc.)*	Tabular, digitate and submassive
Coral family *(e.g. Acropora, Porites, etc.)*	Acropora and Pocillopora
Number of coral colonies or fragments harvested	480 colonies, large number of fragments
Average size of coral colonies or fragments harvested	40 cm
Approximate location within Gulhifalhu lagoon	Coral heads on northern part of the lagoon
Type of artificial structure corals will be attached to *(e.g. frame, table, plugs, etc.)*	colonies to be attached on frames
Location corals will be relocated to *(e.g. N/W/S/E side of resort/reef, average depth, etc.)*	resort lagoon area, 5 m depth

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Daily Coral Relocation Report	
Name	Thomas Le Berre
Date	6th June 2020
Type of coral harvested *(e.g. branching, massive, etc.)*	massives and submassives
Coral family *(e.g. Acropora, Porites, etc.)*	Porites, Psammocora, Hydnophora
Number of coral colonies or fragments harvested	544 colonies
Average size of coral colonies or fragments harvested	30 cm
Approximate location within Gulhifalhu lagoon	Southern reef flat
Type of artificial structure corals will be attached to *(e.g. frame, table, plugs, etc.)*	colonies to be installed on northern reef flat and existing reef structure
Location corals will be relocated to *(e.g. N/W/S/E side of resort/reef, average depth, etc.)*	Furanafushi northern reef flat, depth 1 to 3 m

Daily Coral Relocation Report	
Name	Thomas Le Berre
Date	7th June 2020
Type of coral harvested *(e.g. branching, massive, etc.)*	Tabular, digitate and submassive
Coral family *(e.g. Acropora, Porites, etc.)*	Acropora and Pocillopora
Number of coral colonies or fragments harvested	420 colonies, large number of fragments
Average size of coral colonies or fragments harvested	45 cm
Approximate location within Gulhifalhu lagoon	Coral heads on northern part of the lagoon
Type of artificial structure corals will be attached to *(e.g. frame, table, plugs, etc.)*	colonies to be attached on frames
Location corals will be relocated to *(e.g. N/W/S/E side of resort/reef, average depth, etc.)*	resort dive site area, 5 m depth

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Daily Coral Relocation Report	
Name	Thomas Le Berre
Date	8th June 2020
Type of coral harvested *(e.g. branching, massive, etc.)*	Tabular, digitate and submassive
Coral family *(e.g. Acropora, Porites, etc.)*	Acropora and Pocillopora
Number of coral colonies or fragments harvested	400 colonies, large number of fragments
Average size of coral colonies or fragments harvested	35 cm
Approximate location within Gulhifalhu lagoon	Coral heads on northern part of the lagoon
Type of artificial structure corals will be attached to *(e.g. frame, table, plugs, etc.)*	colonies to be attached on frames
Location corals will be relocated to *(e.g. N/W/S/E side of resort/reef, average depth, etc.)*	resort dive site area, 5 m depth