

## REQUEST FOR PROPOSALS – REEF-SCALE IMAGERY

### 1.0 Introduction & Summary of Solicitation

This Request for Proposals (RFP) details an invitation to submit a proposal for reef-scale imagery as part of the overarching monitoring of *Mission: Iconic Reefs* (M:IR) restoration work and associated reef sites.

This RFP plays a critical role in enabling the ability to track restoration progress on an ecosystem-wide scale; in so doing, this project directly contributes to the holistic approach of coral reef restoration activities, and is made possible through strong partnership between the National Marine Sanctuary Foundation (the Foundation) and the National Oceanic and Atmospheric Administration (NOAA) for work in the Florida Keys National Marine Sanctuary (Florida Keys NMS).

This project specifically seeks services to conduct reef-scale<sup>1</sup>, high-resolution imagery acquisition at one or more of the seven M:IR sites, primarily for immediate (2022) baseline imagery needs, as well as for potential continued imagery acquisition in future.

### 2.0 *Mission: Iconic Reefs* & RFP Objectives

*Mission: Iconic Reefs* (M:IR) – a coral reef restoration initiative within Florida Keys NMS – represents the application of current coral restoration techniques together with novel innovation and intervention activities. As such, M:IR requires both baseline and continued imaging in order to adequately evaluate and showcase restoration effects and progress.

M:IR has recently begun its 3rd year of a 20+ year-long restoration effort. Additionally, and to date, baseline imagery at the reef scale has been acquired in part for only two of the seven total M:IR sites. As such, current imagery needs represent a relative baseline, as restoration work is currently underway at all seven sites. Any and all imagery acquired in 2022 will thus serve as a relative baseline by which all future restoration work will be compared throughout the duration of M:IR. See the [M:IR Public Plan](#) for full restoration planning details.

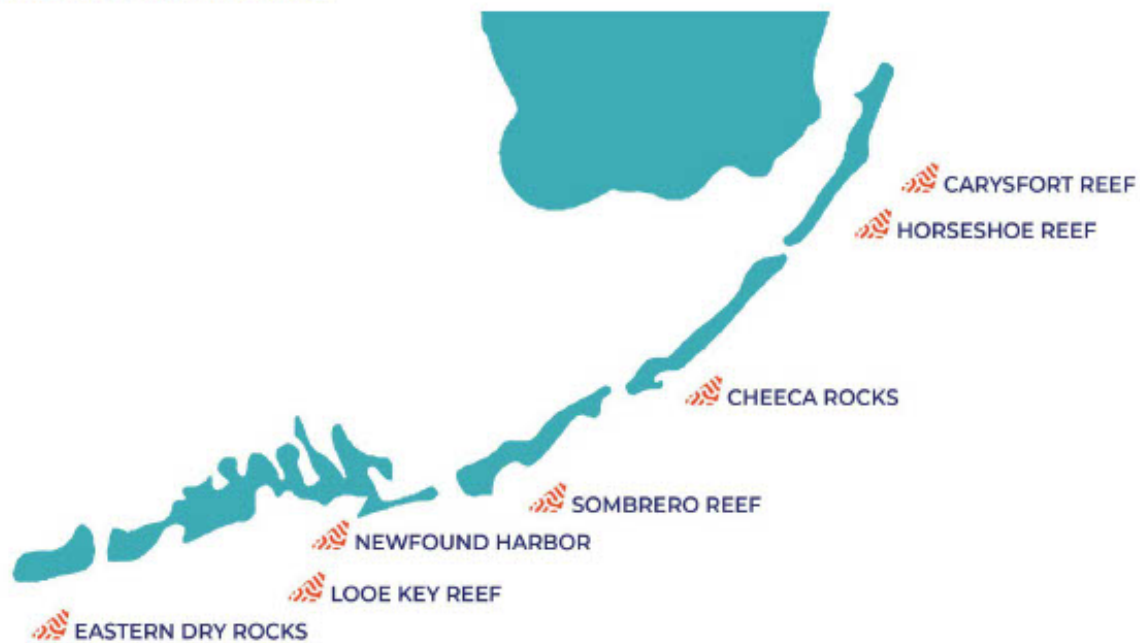
While restoration has started at all M:IR sites, dedicated Restoration Monitoring Areas (RMAs) and Control Areas (CAs) have been defined at all M:IR sites, as part of the recently-developed M:IR Monitoring and Research Plan (internal document; unpublished); restoration has not occurred at any of these RMAs or CAs, thus providing dedicated, unrestored reef area for more accurate baseline imaging. While CAs will stay unrestored

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<sup>1</sup> defined in section 3.0 below

throughout the duration of the mission, restoration activities will eventually be conducted in RMAs. These RMAs and CAs exist within segments, artificial delineations that divide the reef sites into manageable zones, as detailed in the reef site maps (see Appendix).

Contracted work under this agreement will be conducted exclusively within Florida Keys NMS, at one or more M:IR sites (Figure 1), which are spread throughout the Florida Keys reef tract. Contracted work will be coordinated in partnership with M:IR Florida Keys NMS staff, as well as M:IR coral restoration practitioners, as needed. Contracted work will adhere to details both within this RFP and within the final executed contract between the Foundation and contractor.



**Figure 1.** The seven M:IR sites throughout the Florida Keys NMS.

### 3.0 M:IR Baseline Imagery Needs

The seven M:IR sites are listed below to provide both the scale and scope of overall imagery acquisition priorities. There is a need to obtain high-resolution<sup>2</sup>, georeferenced imagery for these reef sites. **To fully meet M:IR needs, imagery acquisition would encompass the entirety of restorable habitat; at a minimum, however, imagery must include both the RMAs and CAs (as described in section 2.0) that are present at M:IR sites.** Any additional imaged reef area would add to the overall reef-scale understanding of the restoration work, and would be useful for monitoring as well as for communications

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<sup>2</sup>The resolution from GoPro-based systems is typically insufficient to meet the need for high-resolution imagery; GoPro-based systems are therefore not requested as part of this RFP. Centimeter-level resolution is the minimum resolution requested; greater resolution is preferred.



products. Depending on the methodology used, it may be possible to acquire imagery for additional reef area beyond the aforementioned minimum need, especially given the spatial orientation and delineation of the RMAs and CAs (see maps in the Appendix); more in-depth conversations may be requested with M:IR and Florida Keys NMS staff to discuss acquisition methodologies and potential ways to capitalize on certain methods to acquire additional imaged area. Additionally, proposals may include several acquisition methods to accomplish imagery needs.

Minimum imagery resolution should be at the centimeter level, with the overarching goal of deciphering the following metrics from processed imagery: coral cover; coral species abundance and density; coral size-frequency distribution; coral species diversity; coral condition/health; macroalgae cover; sessile invertebrate cover.

Shapefiles or KMLs of reef site locations and spatial extents (i.e., Segments, RMAs, CMAs, Habitat Types) may be provided upon request. See the Appendix for maps of all reef sites that detail the spatial orientation of RMAs and CAs.

Note that permanent markers/stakes for photomosaic acquisition may already be in place at M:IR sites and may provide sufficient target coverage for future/new acquisitions.

Depth at M:IR sites varies by Habitat Type (Table 1) and also differs on a more nuanced level by individual site (available upon request). Approximate depth ranges by Habitat Type for all sites are shown in the table below.

<b>Table 1. Approximate Depth Ranges by Habitat Type</b>	
Shallow Reef Crest	0.05 - 1.3m
Reef Crest	0.7 - 1.8m
Spur and Groove - Top	1.6 - 2.5m
Spur and Groove - Sides	1.1 - 2.6m
Forereef Terrace	1.7 - 6.1m
Deep Reef	4.9 - 9.7m
Patch Reef	2.2 - 3.2m
Backreef	0.7 - 3.5m
Shallow Boulder Coral	0.7 - 6.1m
Deep Boulder Coral	4.9 - 9.7m

**M:IR sites listed below are in relative priority order, based on current M:IR imagery needs; however, these prioritizations may shift with time.**

Unless otherwise stated, planar areas to be imaged at each reef site are provided below and only reflect the combined total of RMAs and CAs present at that reef location, as this represents the minimum imagery need at each M:IR site.

<b>1. CARYSFORT REEF COMPLEX</b>	
Location	Upper Keys 25.2182996 N, 80.2139587 W
Reef Type	Offshore Spur & Groove with Patch Reef
Habitat Types Present	Patch Reef, Back Reef, Deep Reef, Forereef Terrace, Spur & Groove, Reef Crest, Shallow Reef Crest, Dense Palmata Framework
Total Planar Area <i>to be imaged</i>	256,235 m <sup>2</sup>

*Note that Carysfort Reef complex may be split into Carysfort North and Carysfort South, as is currently done for manageability of restoration work; see map images in the Appendix.*

<b>2. SOMBRERO</b>	
Location	Middle Keys 24.6258110 N, 81.1105002 W
Reef Type	Offshore Spur and Groove
Habitat Types Present	Deep Reef, Forereef Terrace, Spur & Groove, Reef Crest, Shallow Reef Crest
Total Planar Area <i>to be imaged</i>	23,250 m <sup>2</sup>

<b>3. HORSESHOE</b>	
Location	Upper Keys 25.1393255 N, 80.2951926 W
Reef Type	Nearshore Patch Reef
Habitat Types Present	Backreef, Forereef Terrace
Total Planar Area <i>to be imaged</i>	18,774 m <sup>2</sup>



<b>4. LOOE KEY - Eastern &amp; Western ends, Shallow &amp; Deep sections</b> <i>See the Appendix for reef site map delineating requested area to be imaged</i>	
Location	Lower Keys 24.5457287 N, 81.4058813 W
Reef Type	Offshore Spur and Groove
Habitat Types Present	Deep Reef, Forereef Terrace, Spur & Groove, Reef Crest, Shallow Reef Crest
Total Planar Area <i>to be imaged</i>	46,625 m <sup>2</sup>

*Looe Key reef received preliminary reef-scale imagery acquisition through the United States Geological Survey in 2021, covering the majority of the reef site, but leaving critical gaps at the eastern and western ends, as well as in the shallow and deep reef areas. To finalize relative baseline acquisition in 2022, imagery is needed within these remaining (western/eastern and shallow/deep) areas.*

<b>5. NEWFOUND HARBOR</b>	
Location	Lower Keys 24.6152986 N, 81.3886552 W
Reef Type	Nearshore Patch Reef
Habitat Types Present	Patch Reef, Shallow Boulder Coral, Deep Boulder Coral
Total Planar Area <i>to be imaged</i>	20,375 m <sup>2</sup>

*As a patch reef system, Newfound Harbor has discrete restoration locations distributed across the entire reef site location. As detailed in sections 2.0 and 3.0 above, total area to be imaged is reflective of RMAs and CMAs only. Any additional imagery acquired at this reef site should only be within M:IR segments. It is not a priority to acquire imagery from surrounding soft-bottom areas outside of M:IR segments.*

<b>6. EASTERN DRY ROCKS - Shallow &amp; Deep sections</b> <i>See the Appendix for reef site map delineating requested area to be imaged</i>	
Location	Lower Keys 24.4602265 N, 81.8425273 W
Reef Type	Offshore Spur and Groove
Habitat Types Present	Deep Reef, Forereef Terrace, Spur & Groove, Reef Crest, Shallow Reef Crest
Total Planar Area <i>to be imaged</i>	43,458 m <sup>2</sup>

*At Eastern Dry Rocks reef, reef-scale towed imagery was acquired by the United States Geological Survey in 2021 and covered the majority of the reef site. Critical habitat gaps remain in the shallow and deep reef areas. To finalize relative baseline acquisition in 2022, imagery is still needed within these shallower (Shallow Reef Crest to Spur & Groove) and deeper Habitat Types (Deep Reef).*

7. CHEECA ROCKS	
Location	Middle Keys 24.9005522 N, 80.6157492 W
Reef Type	Nearshore Patch Reef
Habitat Types Present	Patch Reef
Total Planar Area to be imaged	82,426 m2

*As a patch reef system, Cheeca Rocks has discrete restoration locations distributed across the entire reef site location. As detailed in sections 2.0 and 3.0 above, total area to be imaged is reflective of RMAs and CMAs only. Any additional imagery acquired at this reef site should only be within M:IR segments. It is not a priority to acquire imagery from surrounding soft-bottom areas outside of M:IR segments.*

## 4.0 Exclusions / Constraints

This RFP encompasses imagery acquisition, quality control, and Large Area Imagery model assemblage. All imagery collected will be **publicly accessible, open access, and will be utilized with additional partners for analyses.**

Florida Keys NMS *may* be able to provide logistical support by way of a) access to facilities and/or office space for temporary storing of equipment and/or for post-fieldwork imagery analyses, and/or b) Florida Keys NMS staff support for overall site logistics, and/or c) coordination of existing permanent markers at M:IR sites.

A Florida Keys NMS vessel will **not** be provided for fieldwork execution. Contractors should detail their own vessel arrangements within their submitted proposal.

Florida Keys NMS personnel will **not** be available to augment fieldwork personnel; however, Florida Keys NMS may be present in some oversight capacity depending on permit conditions, etc.

Florida Keys NMS computers and equipment will **not** be available to assist with any post-fieldwork imagery analyses; the contractor must provide all computers and equipment needed to execute the work.



As detailed in section 6.0 below, proposals should detail realistic budgets based on applicable project execution details (e.g., vessel chartering, travel, etc.). Proposals with detailed budgets that showcase cost efficiencies will be prioritized.

***Due to the popularity of M:IR sites for both recreational and commercial use, imagery acquisition may not occur on weekends, during other Federal or public holidays, or during scheduled local Florida Keys events (e.g., lobster mini-season).***

Note that permanent markers/stakes for photomosaic acquisition may already be in place at M:IR sites and may provide sufficient target coverage for future/new acquisitions.

## 5.0 Deliverables

### Daily:

- **Brief daily report** detailing work accomplished, any issues encountered, and planned work for the upcoming working days (see section 6.0 below); template will be provided

### Within 7-14 days after acquisition:

- **Perimeter shapefiles or KML/KMZs** of specific image acquisition areas within each M:IR site worked
- **Written report detailing all in- or on-water activities** throughout the duration of the project, **including the collated daily reports for all working days** (see section 6.0 below)
- **Field photos of the acquisition process**
- **RAW image files** – high resolution (as defined above) and spatially referenced at multiple locations per reef site and per image (e.g., sufficient spatial references of high GPS accuracy for geo-referencing, co-registration with bathymetry, and aligning with maps and other imagery)
  - *JPG or other file types may be provided in addition to RAW files*
  - *See note above in 'Section 4.0 Exclusion / Constraints' regarding public image access*
  - *Exact method of transfer of these files will be discussed and decided upon prior to imagery acquisitions*

### Within 60 days after acquisition:

- **Detailed final report of the imagery acquisition methodologies** – inclusive of all technical details – designed and executed at the reef site(s) and including details of **confirmed and recorded imagery quality control checks** during the acquisition

process (e.g., at least daily) to ensure quality imagery deliverable (e.g., no gaps in coverage)

- *Templates/methods for quality control checks should be provided by contractor*
- **Georeferenced Large Area Imagery models** (i.e., photomosaics) created as part of the scope of work. Deliverables will include **all input imagery and georeferencing locations, the output photomosaic of the site and affiliated output files (e.g., .ply files), and report of parameters used to create the model** (e.g., Agisoft Metashape settings)

## 6.0 General Requirements & Instructions for Submission

### A) General Requirements

- a) **Coordination** with the Foundation and NOAA M:IR/Florida Keys NMS staff for Pre-Execution Planning and regular communications throughout the duration of the contracted work
- b) **Florida Keys NMS-approved permits** to execute fieldwork within Florida Keys NMS waters
  - *Note that permits may/not be needed, based on imagery acquisition methodology chosen*
  - *Note that Florida Keys NMS will work with the chosen contractor to obtain any necessary permits; all permits will need to be obtained before the chosen contractor may begin fieldwork*
- c) **Professional execution** of all in- and/or on-water activities
- d) **Written, daily report** for all working days that summarizes work accomplished, any issues encountered, and planned work for the upcoming working days; a template will be provided
  - *Note that this report must be submitted via email at the end of every working day as part of the contracted agreement*
- e) **Provision of all deliverables**, as required and detailed in Section 5.0 above

### B) Instructions for Proposal Submission

Applicants should provide the following details within their proposals, as applicable and relevant to the proposed methodologies for imagery acquisition:

- **Description of personnel** who will participate in the work;
  - Description of dive team to be utilized, if applicable, with certifications/credentials and dive CVs
- **Summary of organizational and/or personnel relevant work expertise**, with references as applicable;



- **Description of vessel(s)** (privately owned and/or contracted) that will participate in the work;
- **Description of how the above-referenced General Requirements will be supported;**
- **Description of how the above-mentioned (section 5.0) Deliverables will be supported;**
- **Detailed project budget**, including expenses summary, with cost breakdown
  - E.g., labor, supplies, tools, equipments, fuel, travel, etc.;
- **Proposed project timing and milestones;**
- **Any additional supporting materials, as applicable.**

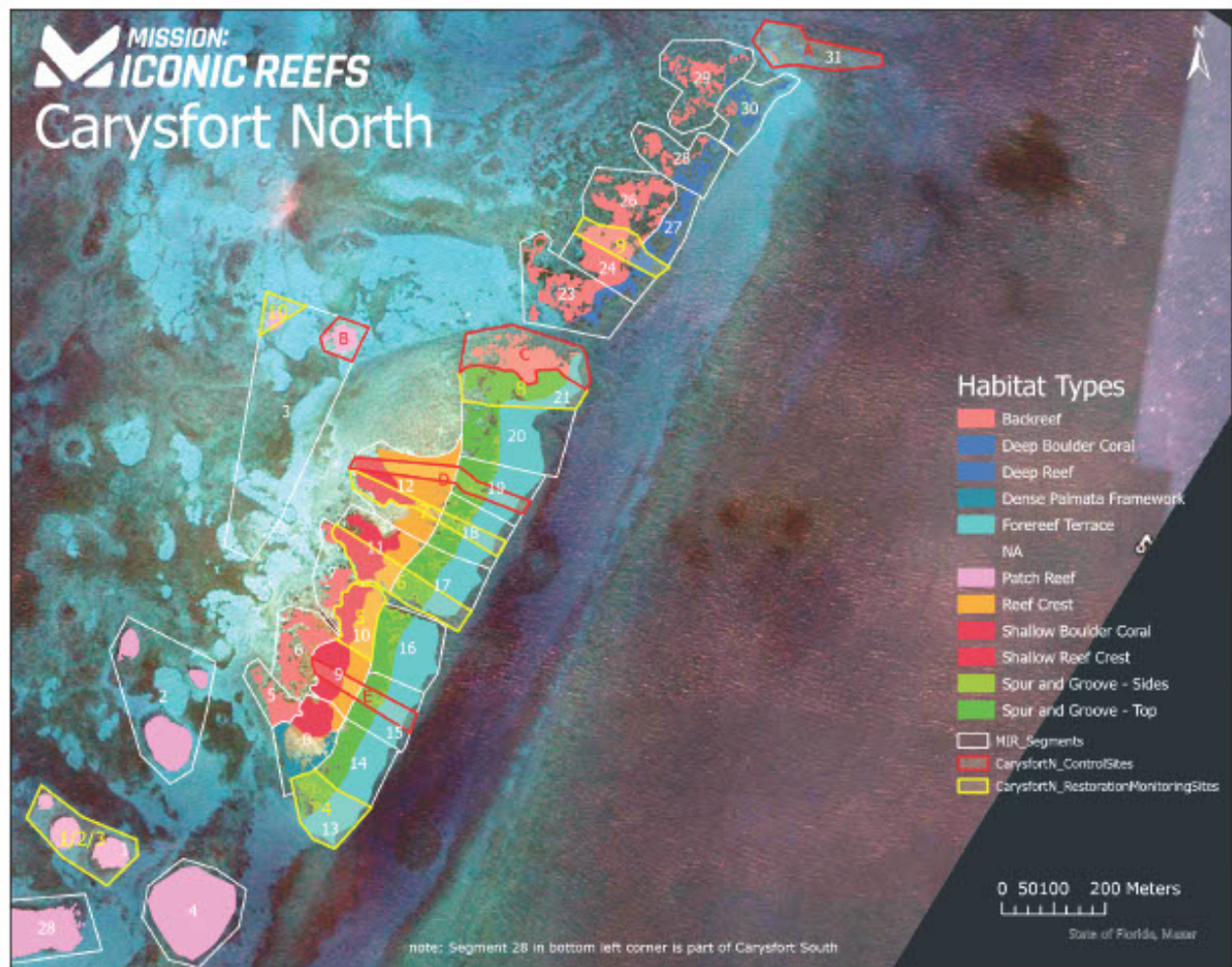
**Proposals should be in PDF form and sent to [RFP@marinesanctuary.org](mailto:RFP@marinesanctuary.org) with the subject line: 'Mission: Iconic Reefs Baseline Imagery Request for Proposals'.**

**Proposals will be reviewed on a rolling basis after the initial, priority review deadline of June 1<sup>st</sup> 2022 at 11:59 PM ET.** Any questions should be directed to Shannon Colbert, Vice President for External Affairs, at [shannon@marinesanctuary.org](mailto:shannon@marinesanctuary.org). We are happy to arrange conference calls to discuss this RFP, provide additional information, and/or address any questions.

## Appendix - M:IR Site Maps

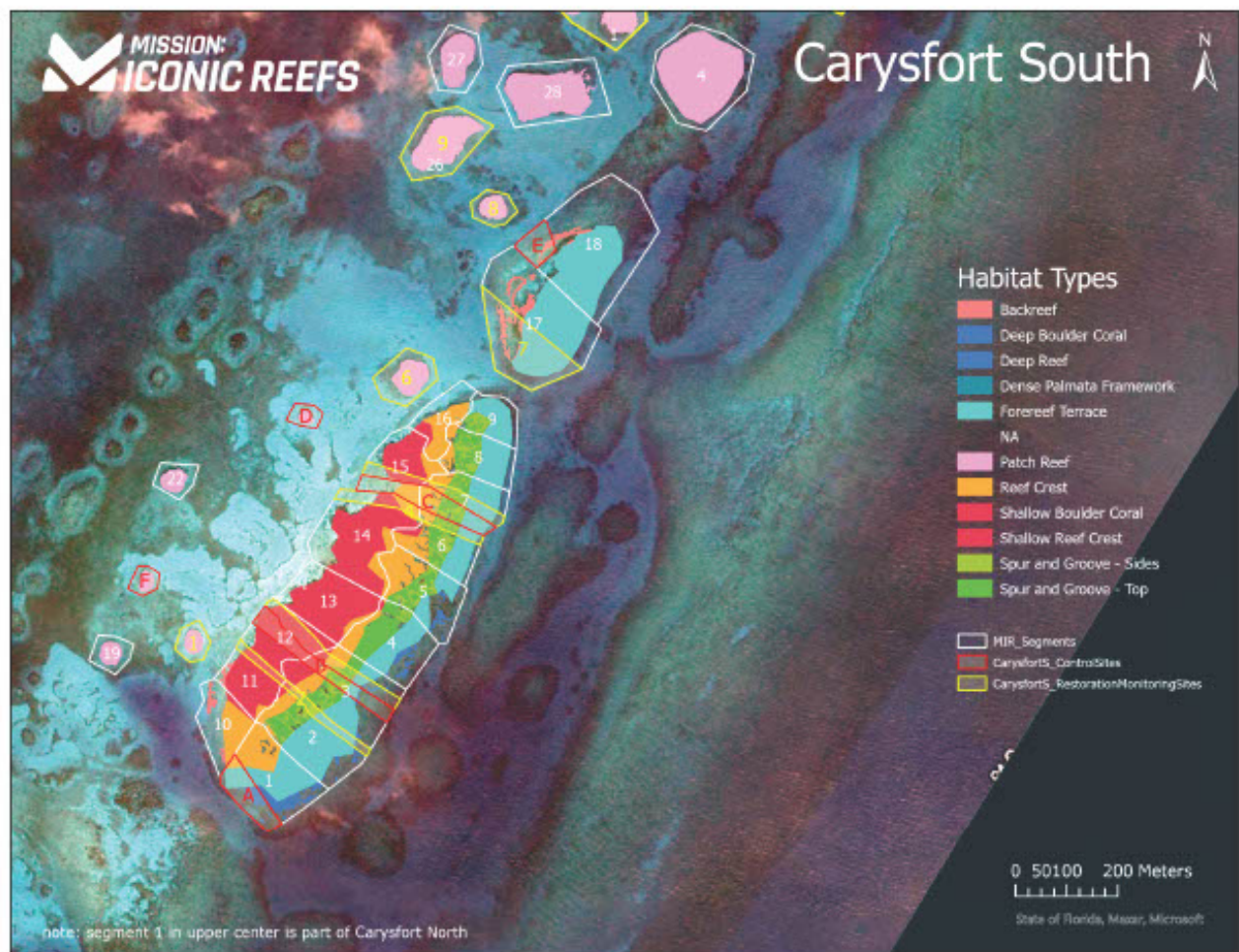
Habitat Type Abbreviations	
SRC	Shallow Reef Crest
RC	Reef Crest
S&G	Spur & Groove
FT	Forereef Terrace
DR	Deep Reef
BR	Back Reef
PR	Patch Reef
SBC	Shallow Boulder Coral
DBC	Deep Boulder Coral
DPF	Dense Palmata Framework





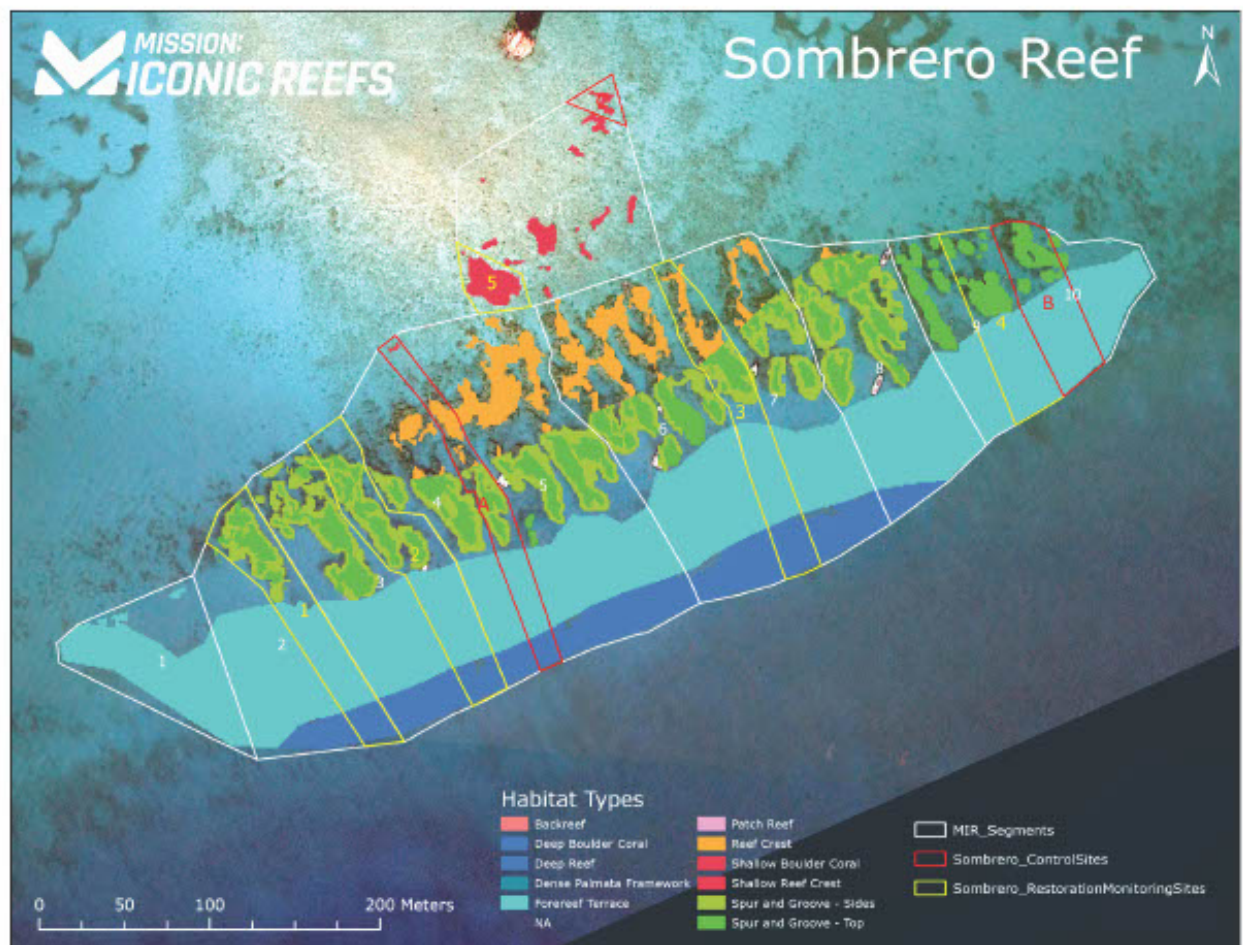
Carysfort North Approx. Total 145,765 m <sup>2</sup>							
Carysfort North RMA Approx. Total 90,665 m <sup>2</sup>				Carysfort North CA Approx. Total 55,100m <sup>2</sup>			
RMA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>	CA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>
1/2/3	PR	200 × 80	16,000	A	BR; DR	220 × 80	17,600
4	S&G; FT	130 × 90	11,700	B	PR	70 × 60	4,200
5	SRC; RC	112 × 70	7,840	C	BR; FT	220 × 90	19,800
6	SRC; RC; S&G; FT	280 × 60	16,800	D	SRC; RC; S&G; FT	320 × 25	8,000
7	SRC; RC; S&G; FT	315 × 35	11,025	E	SRC; RC; S&G; FT	220 × 25	5,500
8	S&G; FT	220 × 65	14,300	-	-	-	-
9	BR; DR	170 × 50	8,500	-	-	-	-
10	PR	90 × 50	4,500	-	-	-	-



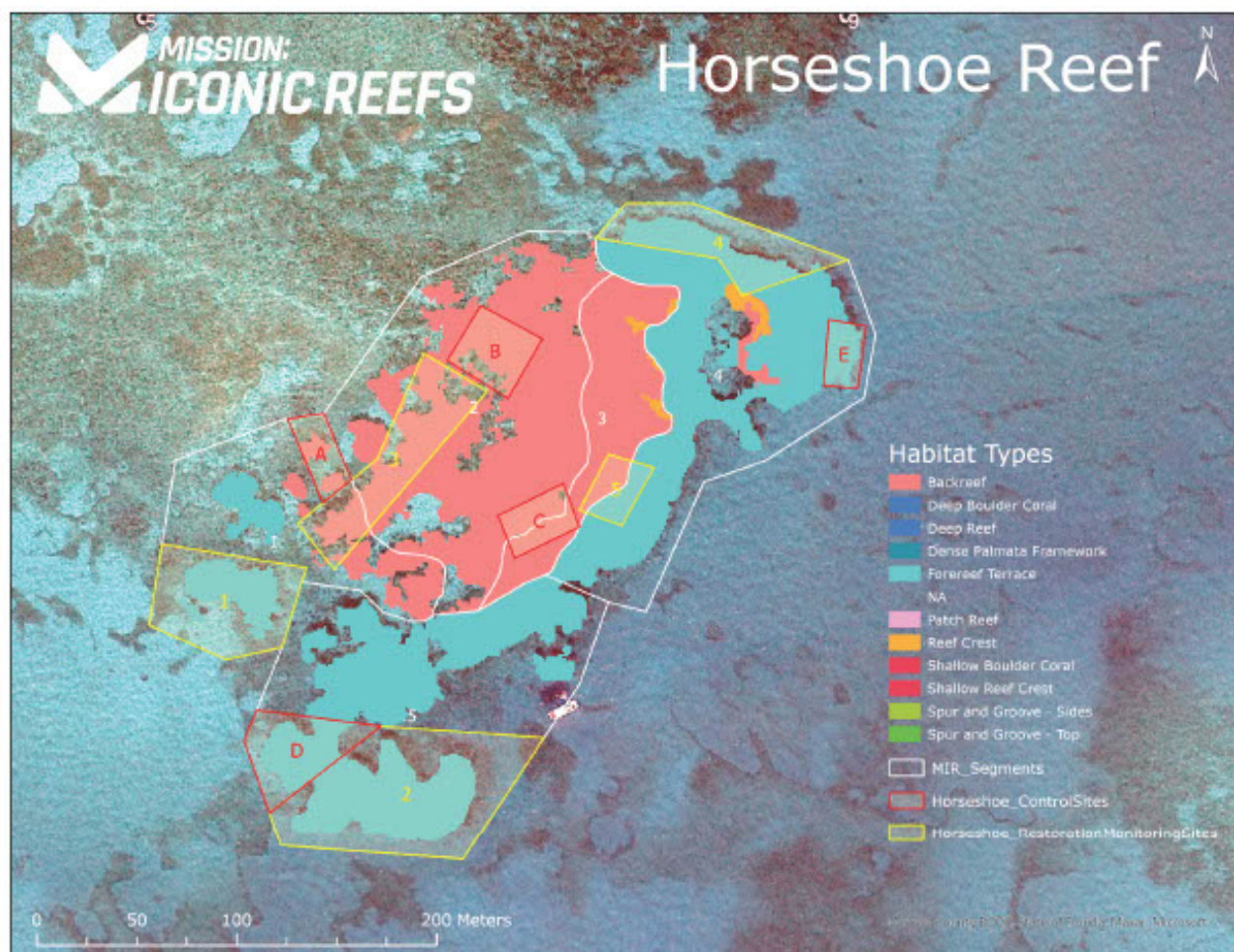


Carysfort South Approx. Total 110,470 m <sup>2</sup>							
Carysfort South RMA Approx. Total 77,790 m <sup>2</sup>				Carysfort South CA Approx. Total 32,680 m <sup>2</sup>			
RMA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>	CA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>
1	PR	70 × 50	3,500	A	RC; FT; DR	144 × 55	7,920
2	SRC; RC; S&G; FT; DR	300 × 15	4,500	B	SRC; RC; S&G; FT	325 × 21	6,825
3	SRC; RC; S&G; FT; DR	290 × 30	8,700	C	RC; S&G; FT	260 × 40	10,400
4	SRC; RC; S&G; FT	280 × 25	7,000	D	PR	50 × 40	2,000
5	SRC; RC; S&G; FT	270 × 17	4,590	E	BR	55 × 65	3,575
6	PR	110 × 80	8,800	F	PR	40 × 49	1,960
7	FT; BR	220 × 95	20,900	-	-	-	-
8	PR	80 × 60	4,800	-	-	-	-
9	PR	150 × 100	15,000	-	-	-	-



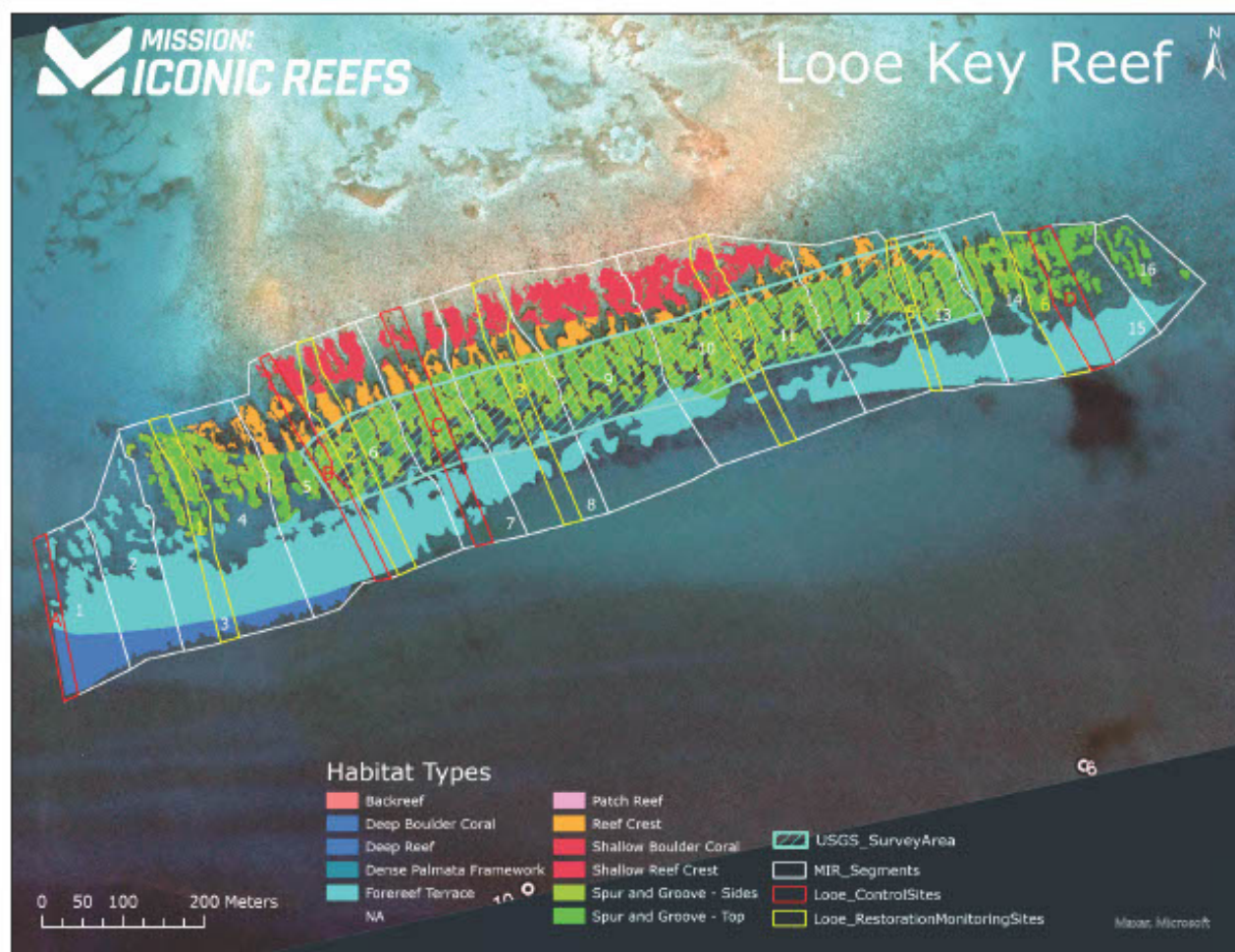


Sombrero Approx. Total 23,250 m <sup>2</sup>							
Sombrero RMA Approx. Total 17,700 m <sup>2</sup>				Sombrero CA Approx. Total 5,550 m <sup>2</sup>			
RMA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>	CA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>
1	S&G; FT; DR	160 × 30	3,180	A	RC; S&G; FT; DR	190 × 20	2,600
2	S&G; FT; DR	170 × 30	3,140	B	S&G; FT	90 × 30	2,600
3	RC; S&G; FT; DR	180 × 20	3,400	C	SRC	30 × 20	360
4	S&G; FT	100 × 25	2,800	-	-	-	-
5	SRC	40 × 30	900				



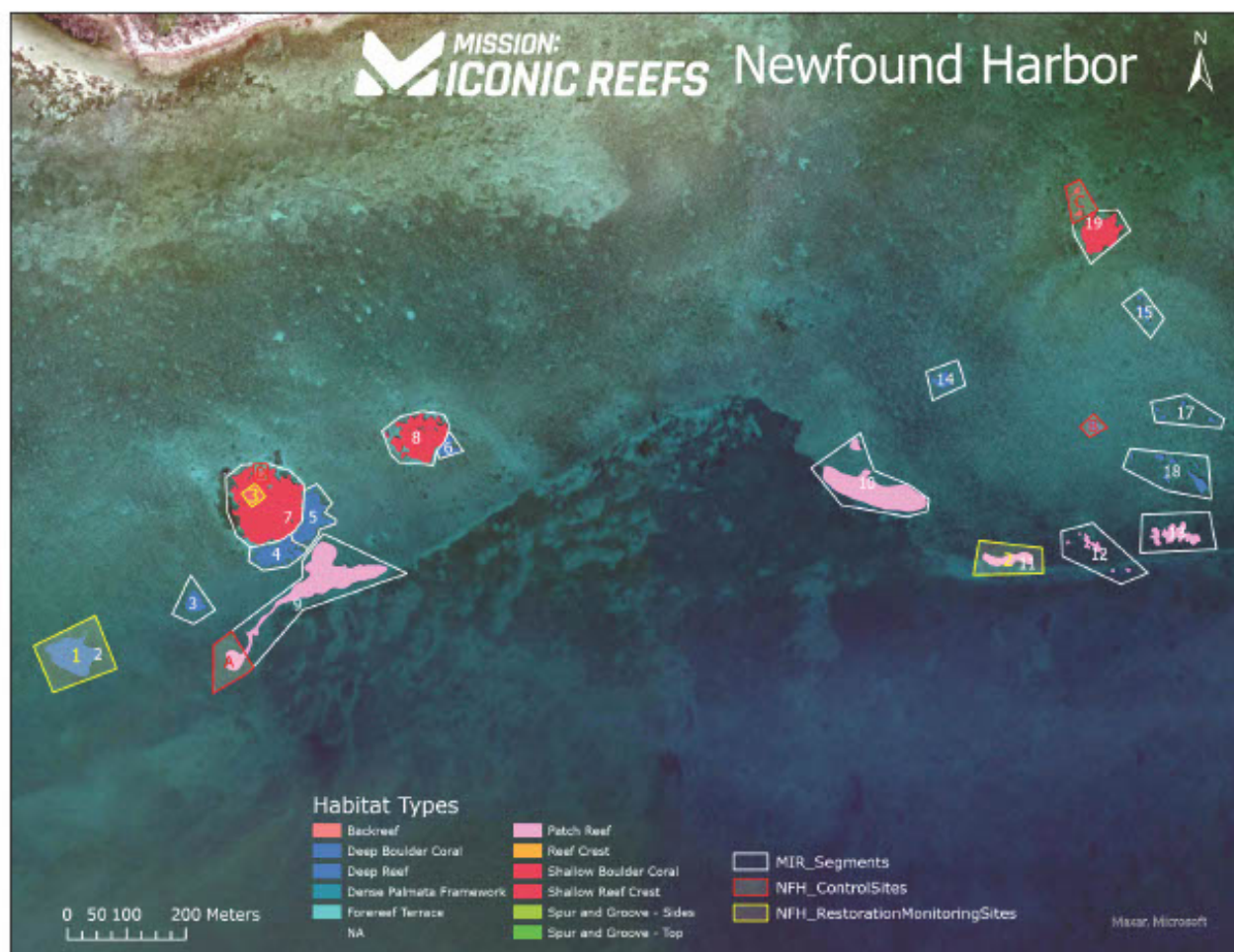
Horseshoe Approx. Total 18,774 m <sup>2</sup>							
Horseshoe RMA APPROX TOTAL 13,711 m <sup>2</sup>				Horseshoe CA APPROX TOTAL 5,063 m <sup>2</sup>			
RMA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>	CA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>
1	FT	60 × 45	2,700	A	BR	35 × 15	525
2	FT	90 × 60	5,400	B	BR	34 × 32	1,088
3	BR	110 × 20	2,200	C	BR	30 × 20	600
4	FT	95 × 30	2,850	D	FT	60 × 40	2,400
5	BR; FT	33 × 17	561	E	FT	30 × 15	450





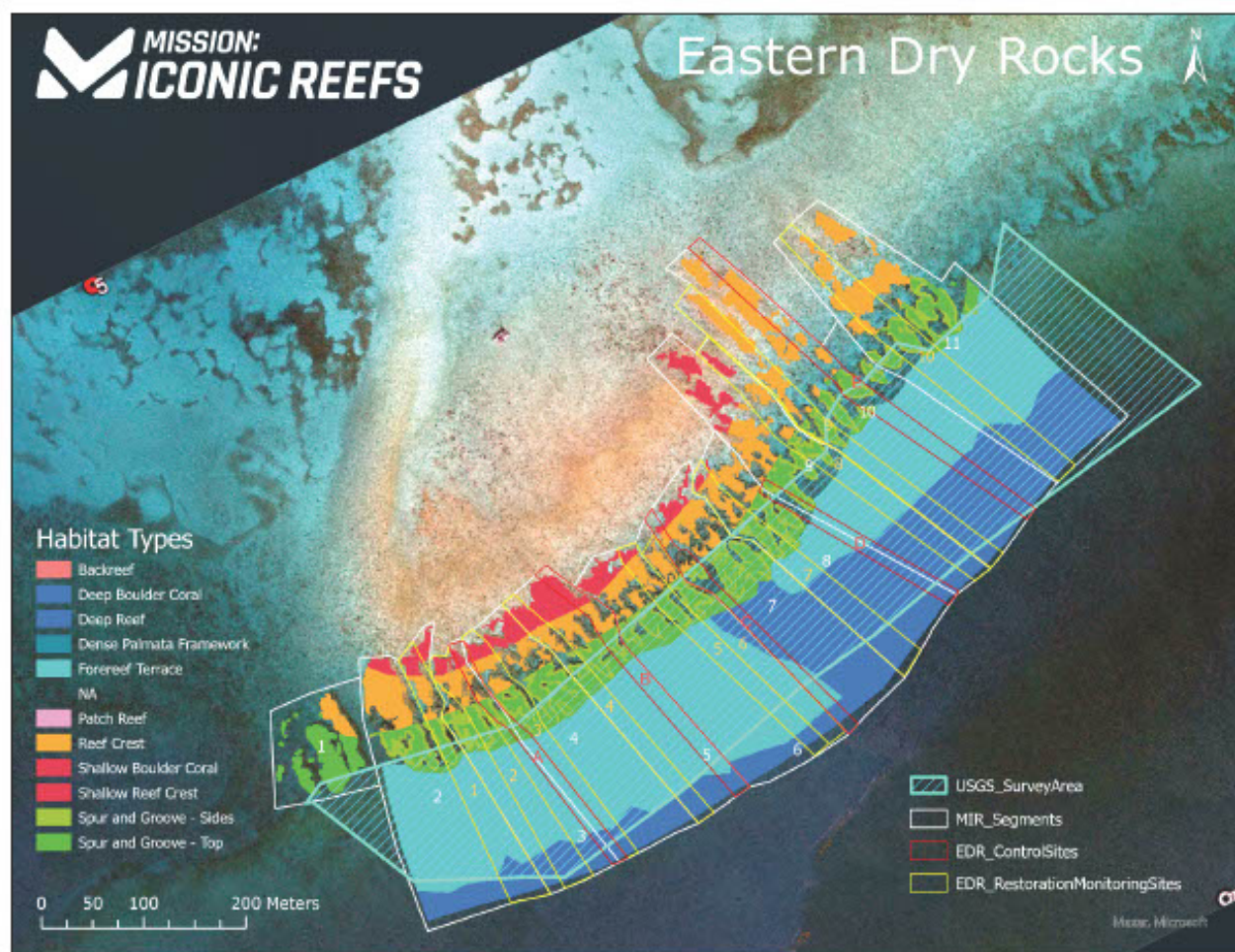
Looe (Remaining) Approx. Total 46,625 m <sup>2</sup>							
Looe (Remaining) RMA APPROX TOTAL 28,368 m <sup>2</sup>				Looe (Remaining) CA APPROX TOTAL 18,257 m <sup>2</sup>			
RMA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>	CA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>
1	S&G; FT; DR	250 × 25	6,250	A	FT; DR	194 × 18	3,492
2	SRC; RC; FT	107 × 34 102 × 25	6,188	B	SRC; RC; FT	117 × 21 104 × 16	4,121
3	SRC; RC; FT	108 × 30 101 × 22	5,462	C	SRC; RC; FT	104 × 22 97 × 22	4,422
4	SRC; RC; FT	85 × 26 93 × 21	4,163	D	S&G; FT	183 × 34	6,222
5	RC; FT	10 × 11 73 × 15	1,205	-	-	-	-
6	S&G; FT	170 × 30	5,100	-	-	-	-

Lengths, widths, and areas within the table above for RMAs and CAs to be imaged reflect areas outside of the Looe USGS survey area (portrayed in blue hatch on the map). Lengths and widths for shallow areas outside of the survey area are listed directly above lengths and widths for deeper areas outside of the survey area within the above table. Note that deep areas are not present within RMA 5.



Newfound Harbor Approx. Total 20,375 m <sup>2</sup>							
Newfound Harbor RMA APPROX TOTAL 13,125 m <sup>2</sup>				Newfound Harbor CA APPROX TOTAL 7,250 m <sup>2</sup>			
RMA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>	CA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>
1	DBC	100 × 80	8,000	A	PR	60 × 65	3,900
2	PR	100 × 45	4,500	B	DBC	30 × 25	750
3	SBC	25 × 25	625	C	SBC	50 × 40	2,000
-	-	-	-	D	SBC	30 × 20	600



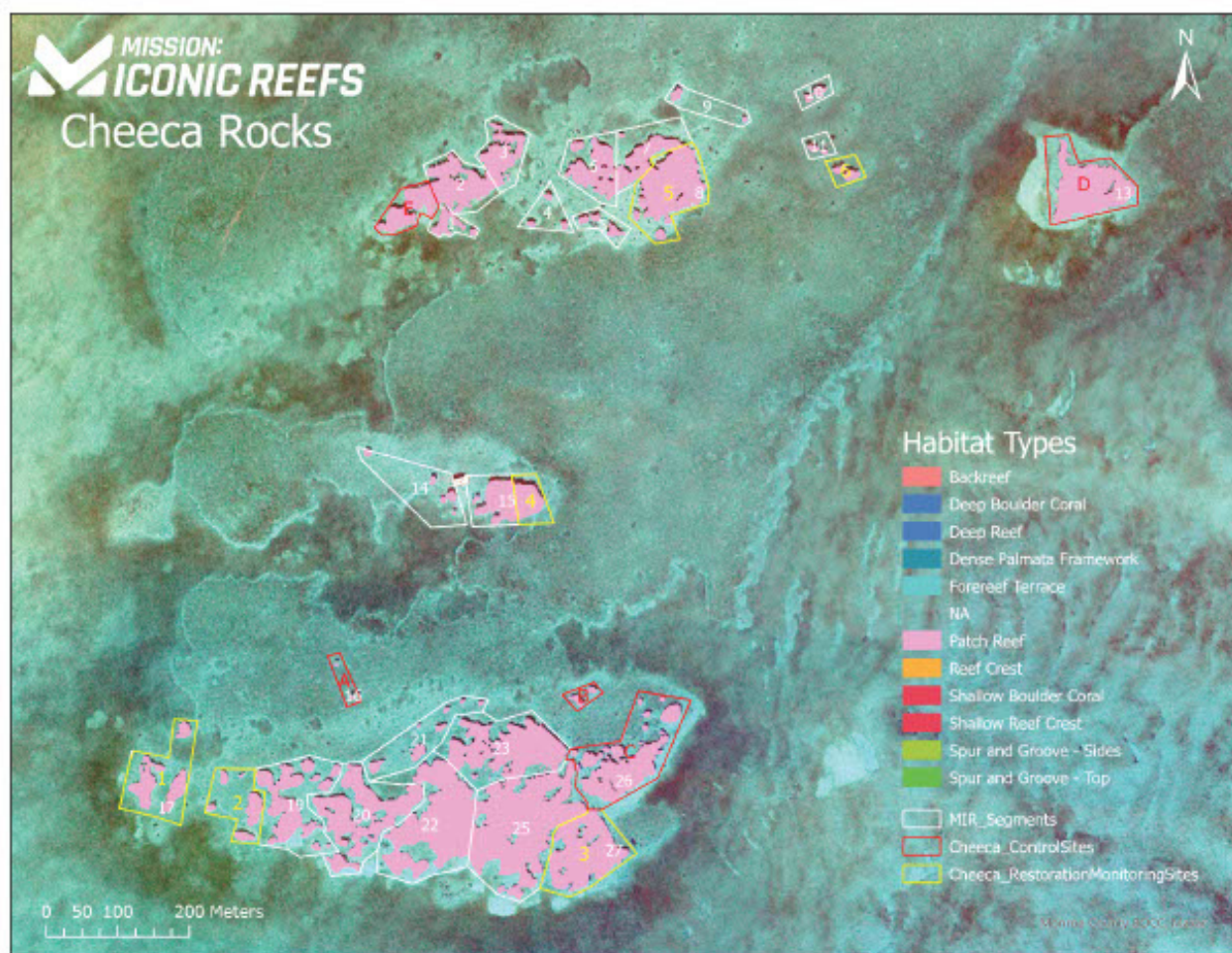


EDR Remaining Approx. Total 43,458 m <sup>2</sup>							
EDR Remaining RMA Approx. Total 32,582 m <sup>2</sup>				EDR Remaining CA Approx. Total 10,876 m <sup>2</sup>			
RMA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>	CA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>
1	SRC; RC; S&G; DR	99 × 28 20 × 41	3,592	A	SRC; RC; S&G; DR	96 × 15 19 × 16	1,744
2	SRC; RC; S&G; DR	88 × 24 10 × 30	2,412	B	SRC; RC; S&G; FT; DR	98 × 22 39 × 15	2,741
3	SRC; RC; S&G; DR	98 × 29 19 × 12	3,070	C	SRC; RC; FT; DR	69 × 11 60 × 11	1,419
4	SRC; RC; S&G; DR	97 × 20 34 × 17	2,518	D	S&G; DR	18 × 17 20 × 17	646
5	SRC; RC; FT; DR	60 × 21 60 × 18	2,340	E	RC; S&G	206 × 21	4,326
6	SRC; RC; FT; DR	47 × 13 61 × 20	1,831	-	-	-	-

7	SRC; RC; DR	71 × 28 46 × 29	3,322	-	-	-	-
8	SRC; RC; S&G; DR	158 × 24 23 × 17	4,183	-	-	-	-
9	SRC; RC; S&G; DR	187 × 20 16 × 19	4,044	-	-	-	-
10	SRC; RC; S&G	170 × 31	5,270	-	-	-	-

Lengths, widths, and areas within the table above for RMAs and CAs to be imaged reflect areas outside of the EDR USGS survey area (portrayed in blue hatch on the map). Lengths and widths for shallow areas outside of the survey area are listed directly above lengths and widths for deeper areas outside of the survey area within the above table. Note that deep areas are not present within RMA 10 and CA E.





Cheeca Rocks Approx. Total 82,426 m <sup>2</sup>							
Cheeca Rocks RMA Approx. Total 45,169 m <sup>2</sup>				Cheeca Rocks CA Approx. Total 37,257 m <sup>2</sup>			
RMA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>	CA	Habitat Types	Approx. LxW (m)	Approx. Area m <sup>2</sup>
1	PR	88 × 135	11,880	A	PR	15 × 69	1,035
2	PR	79 × 95	7,505	B	PR	49 × 38	1,862
3	PR	81 × 125	10,125	C	PR	196 × 70	13,720
4	PR	34 × 65	2,210	D	PR	136 × 120	16,320
5	PR	96 × 119	11,424	E	PR	90 × 48	4,320
6	PR	45 × 45	2,025	-	-	-	-