SEAGRASS SURVEYS

Post-Construction Benthic Resources Surveys for Maintenance Dredging of the Intracoastal Waterway in the Vicinity of Bakers Haulover Inlet

Submitted by Miami-Dade County Department of Economic and Regulatory Resources – Environmental Resources Management,
in accordance with Scope of work for FIND Agreement #ICW-DA-13-02 with Miami-Dade County

INTRODUCTION

This report is submitted as a final report for the fulfillment of Agreement #ICW-DA-13-02 by and between the Florida Inland Navigation District (FIND) Miami-Dade County, through its Department of Regulatory and Economic Resources - Environmental Resources Management (DERM) for services associated with identification, description and mapping of benthic resources inside Bakers Haulover Inlet, and specifically within the work area proposed for Inter Coastal Waterway (IWW) maintenance dredging. The Scope of Work (SOW) for the Agreement was developed to meet specific conditions of the State of Florida"s Department of Environmental Protection project related permit (No. 0173188-002-JC, with modifications). The SOW required identification and description of seagrasses and other benthic resources found within the defined work area (i.e., 150 meter turbidity mixing zone surrounding the area of the planned dredging area and the anticipated pipeline corridor. These resources included algae, sponges, soft corals, and hard corals.

Pre-construction biological assessments within the mixing zone and pipeline corridor were conducted from August 13th to September 6th, 2013. Methodologies utilized for seagrass surveys were consistent with NOAA"s National Marine Fisheries "Recommendations for Sampling *Halophila johnsonii* at a Project Site" guidance document (http://sero.nmfs.noaa.gov/pr/docs/JSG%20Survey%20Guidelines.pdf) as well as the survey methodology to define and quantify approximate seagrass and benthic resources abundance used by DERM during the 2010 surveys conducted for the prior IWW maintenance dredging. Seagrass areas were traced by a diver using a Garmin GPSMAP 76 device. The traces were downloaded using GPS Trackmaker® software, and subsequently imported into a GIS program (ArcGIS®) to produce the maps contained herein. All GIS shape files (NAD83) created during the mapping process and pre-construction survey information were provided to FIND prior to commencement of dredging on a CD submitted with the Pre-Construction Report in January 13th, 2014.

The maintenance dredging began in March of 2014 and concluded with the final bathymetric survey. The interim survey was conducted during dredging operations, on March 26, 2014. The methodology for this survey included vessel based inspections within the 150 m previously defined mixing zone and in-water survey inspections of the submerged pipeline with random checks within the immediate dredging and mixing-zone area. During this survey, there was no indication of damage to the benthic resources were observed.

METHODOLOGY

During Pre-construction monitoring, a total of 157 stations were assessed. Stations were located using randomly selected Latitude/Longitude coordinates within the region of the study area that contained seagrasses. Post-construction resource surveys to assess any changes in the benthic assemblages following construction activities, involved reassessment of the 157 stations evaluated for the preconstruction monitoring. The assessments were carried out from April 16th to April 23rd, 2014. The relative abundance and cover of sea grasses and benthic organisms were assessed using Braun-Blanquet Cover Abundance (BBCA) visual assessment methodology. On this methodology, each abundance value is tied to a range of coverage and/or abundance based on the scale shown on the Table 1.

Table 1. BBCA class scale of cover/abundance.

BBCA Value	Cover/Abundance
0	absent
0.1	<5% cover with a solitary individual/shoot
0.5	<5% cover with few individuals/shoots (sparse)
1	<5% cover with numerous individuals/shoots
2	≥5% cover and ≤25% cover
3	>25% cover and ≤50% cover
4	>50% cover and ≤75% cover
5	>75% cover

RESULTS & DISCUSSION

A total of 314 quadrats (2 per stations) were randomly distributed within those areas supporting benthic resources (Figure 1).

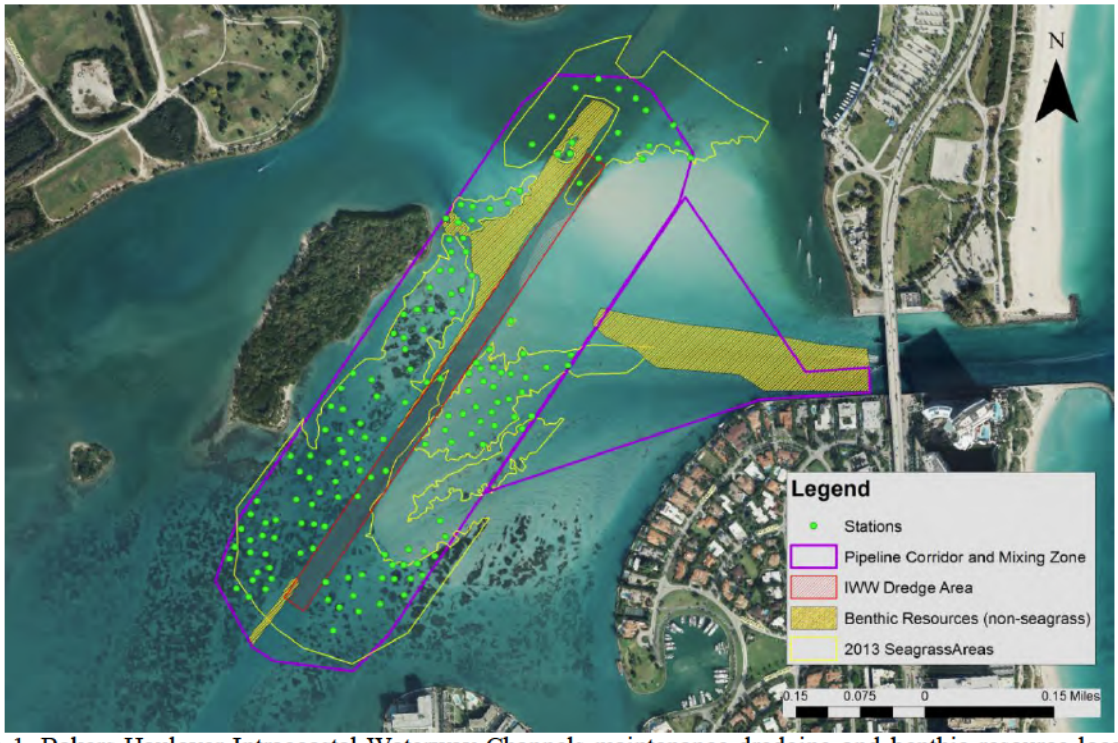

Figure 1. Bakers Haulover Intracoastal Waterway Channels maintenance dredging and benthic resource locations. Stations sampled during Post-Construction surveys.

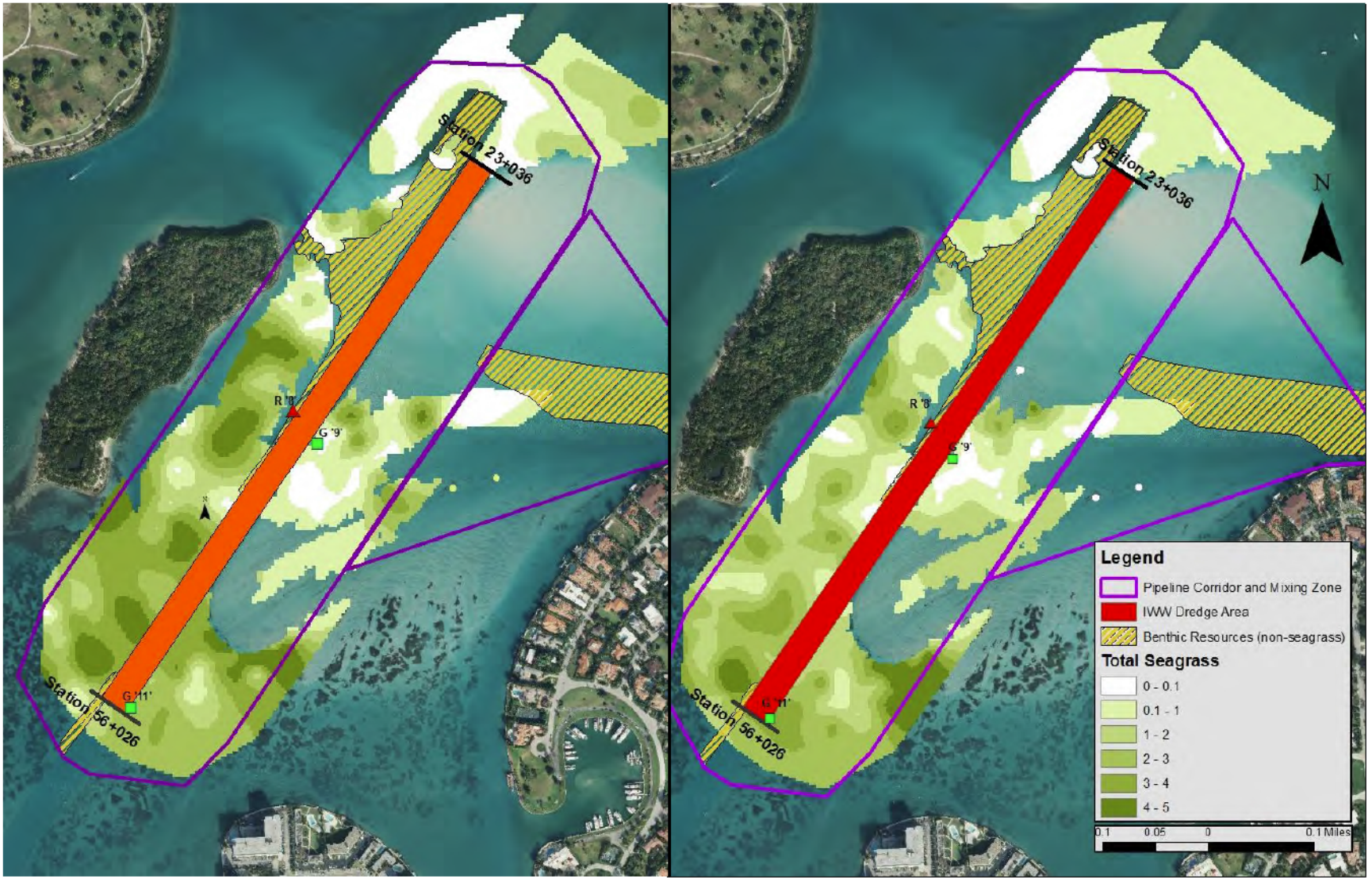

Figure 2. Total Seagrass relative densities (BBCA) for the Haulover dredge area and mixing zone observed during pre-construction (left) and post construction (right) dredging.

Seagrasses remain abundant and diverse, with the same five species as the pre-construction surveys distributed through the Mixing Zone. The frequency of seagrass observations was similar to the pre-construction sampling for the all seagrasses (Figure 3), with *Syringodium* being 8.4% higher. Using the Total Seagrass metric (TSG) for all seagrass species combined (McDonald, et. al 2008), cover/abundance showed a similar pattern to pre-construction with some lower BBCA values in the central-eastern area (Figure 2). TSG indicated there was a shift to lower percent cover compared to pre-construction, with 15.3% fewer observations having coverage greater than 25% (BBCA ≥3) (Figure 4). While, a similar percent increase was obtained for the lower BBCA class values less than 25% coverage (BBCA 2 - 0.1). Patchiness, as indicated by no seagrass (BBCA 0), was present at a similar percent of stations during the pre-construction and post construction, 28.7% versus 26%, respectively (Figure 4).

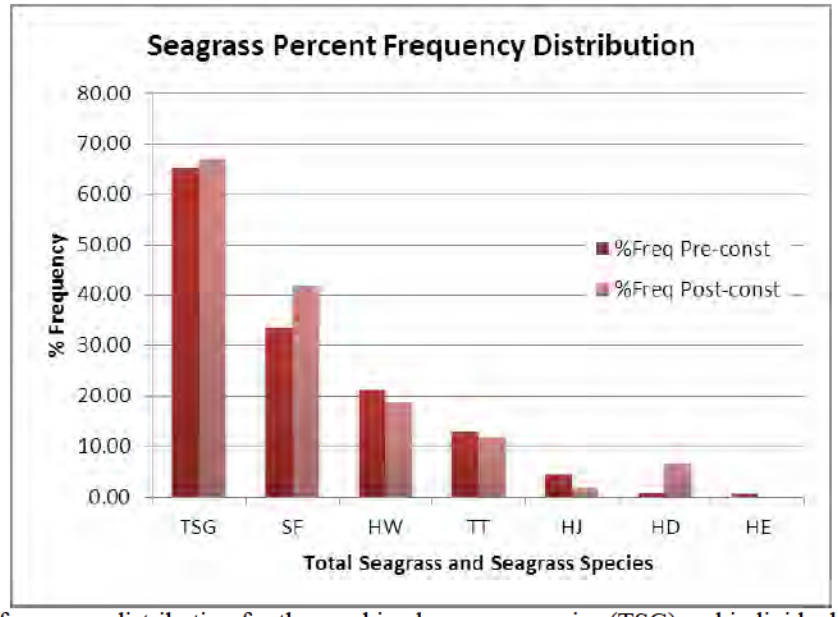

Figure 3. Seagrass frequency distribution for the combined seagrass species (TSG) and individual species.

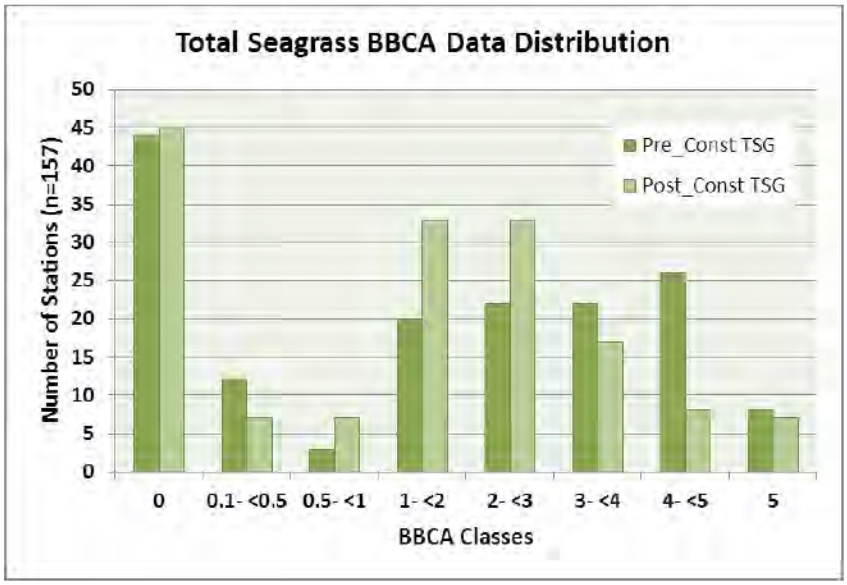

Figure 4. Total Seagrass abundance distribution for the area based on BBCA class data frequency.

The overall frequency of the species was consistent in the pre and post construction assessments. The differences in the pre/post Total Seagrass metric, is associated with the variations noted in the three most abundant seagrasses *Syringodium*, *Halodule* and *Thalassia*. Each had fewer observations in the higher BBCA classes during the post –construction sampling (Figure 5). For *Syringodium*, there was reduction primarily in the percentage of stations with coverage >75%, while for *Halodule* and *Thalassia* there were fewer stations observed in each of the coverage classes above 5% (BBCA >2). The increase in the amount of samples showing a lower BBCA group, can be attributed to two factors:

1. Small-scale patchiness and seasonal variations (Arrington, 2006; Fourqurean *et. al.,* 2001; Gilbert and Clark, 1981).
2. Seasonal variation in the density of seagrass shoots and leaves (and thereby „cover"). This variation has been well documented for subrripical and estuarine habitats. (Fourqurean *et. al.,* 2001; Fourqueran 1995; Milano 1991, Zieman 1982, 1975). For example, *Syringodium*, the most abundant seagrass in the project area, has been reported to reach a maximum abundance peak in September followed by a fairly rapid decline from October to February (Gilbert and Clark, 1981). Similarly, *Thalassia testudinum* has been documented to have minimal densities and leaf biomass in the fall and winter periods (Daramas et al. 2009)

For the *Halophila* species, *H. decipiens* was observed in 6.69% of the sampled area compared with 0.9 % observed during the preconstruction while the threatened seagrass *H. johnsonii* presence was confirmed at 1.9 % of the sites compared to 4.2 % observations during pre-construction. *Halophila englemanii* was not observed during the post-construction sampling. The absence of *H. englemanii* seems to be related to seasonal variations and typically occurs between February and June (Gilbert and Clark, 1981).

Specifically in regards to the threatened seagrass *H. johnsonii*, the west region of the Mixing Zone showed the highest concentration of *H. johnsonii* during pre and post construction sampling surveys. During post-construction, *H. johnsonii* was observed at a new set of stations and was absent from all stations where it had been recorded during pre-construction (Figure 6). This seagrass has shown itself to be variable at this location; in 2010 it seagrass was observed more on the east side of the IWW (Figure 6). Monitoring in other areas indicates that there is high spatial and temporal variation in the abundance of *H. johnsonii* (Virnstein *et. al.*, 1997) and can explain this pattern of alternated absence-presence observed in the Haulover IWW area.

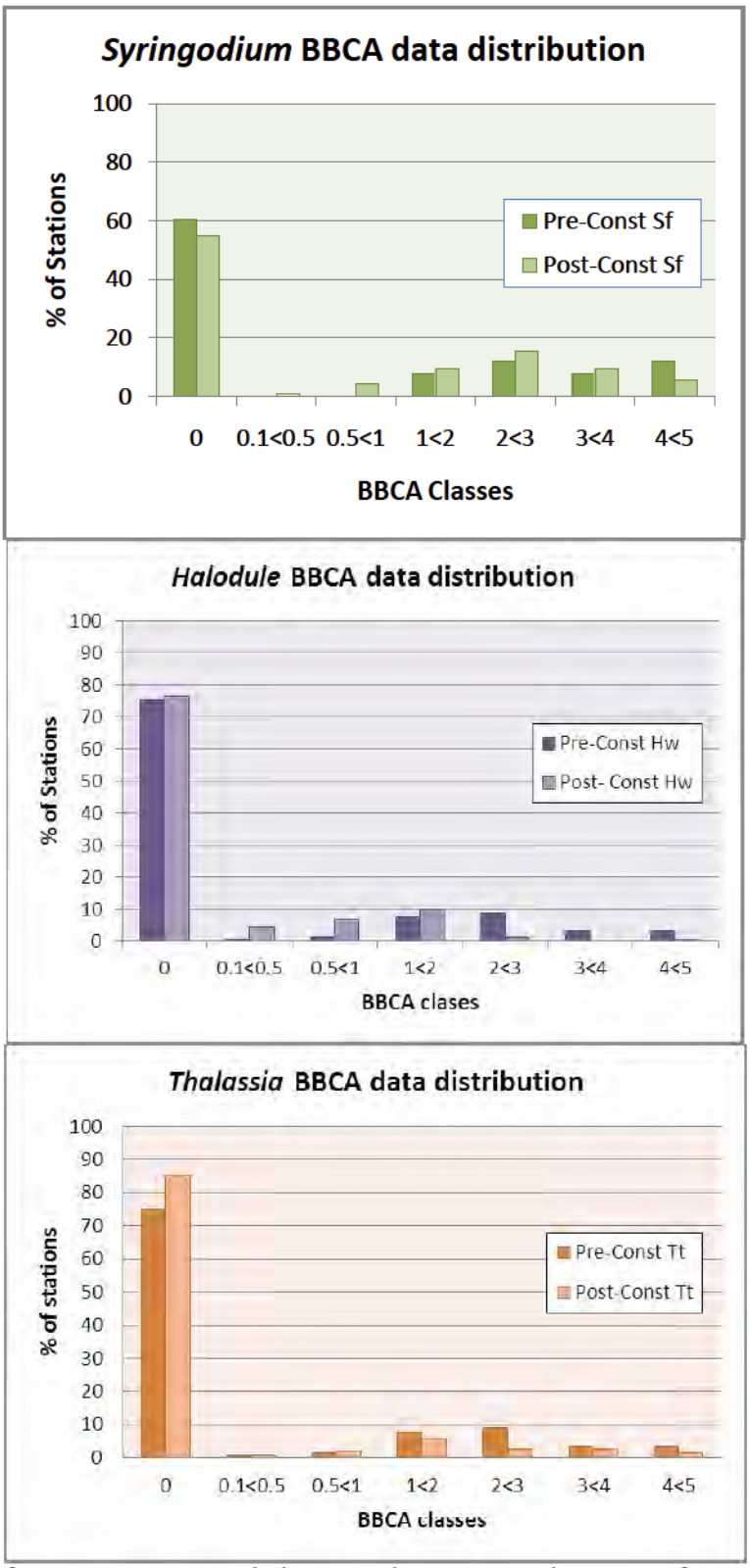

Figure 5. BBCA class frequency percentages during pre and post construction surveys for *Syringodium*, *Halodule*, and *Thalassia*. .

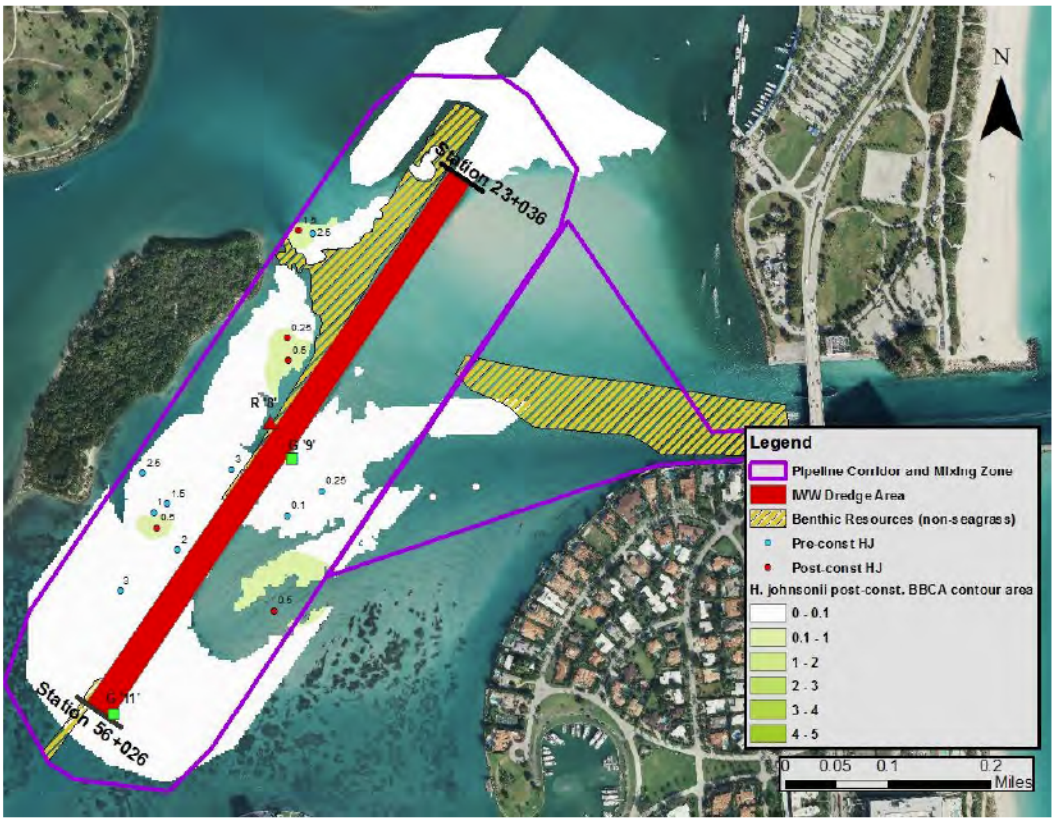

Figure 6.Pre and post BBCA scores, can post construction contour plots of for *H. johnsonii* within the project area.

Among the individual macroalgal components and sponges of the benthic community sampled during the post-construction surveys in the seagrass areas, red algae (TRO), sponges (SP), calcareous green algae (TCAL) and green algae other (TGO) were the most frequent (Figure 7). A general decrease in the frequency of observation in all of these non-seagrass benthic groups during the post-construction was observed in the area, with the exception of the red algae group.

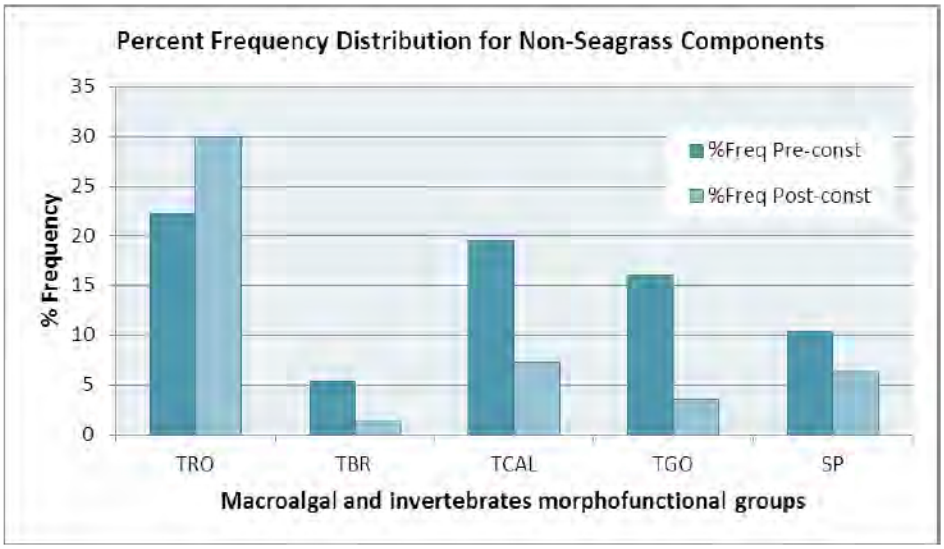

Figure 7. Macroalgae and sponge component frequency pre and post construction.

SUMMARY

Active dredging for this project was completed in less than two weeks. Surveys conducted approximately mid-way during the construction period documented low turbidity levels in the project area, and no discernible impacts to the seagrass community associated with the dredging activities. Differences in the relative abundance of seagrasses were noted between the pre and post construction surveys. However, the differences in the seagrass and algae community noted in the pre and post construction surveys were within the range of variation expected based on seasonal fluctuations. Data from on-going monitoring in the vicinity of the project area, have documented that the benthic community is diverse and dynamic as a result of the heterogeneous substrate and the high tidal energy (Milano 1991). Additionally, the timing of the pre and post sampling is a significant consideration, given that the pre-construction surveys were conducted in late summer/early fall during the peak shoot density and biomass period for seagrass (Fourqurean *et. al.,* 2001; Fourqueran 1995; Milano 1991, Zieman 1982, 1975). While the post construction surveys were carried out in late winter and early spring, when seagrasses have been documented to have their lowest shoot densities and biomass (Fourqurean *et. al.,* 2001; Forqueran 1995; Milano 1991; Gilbert and Clark, 1981; Zieman 1982, 1975). It was noted that the frequency of occurrence of the seagrasses was consistent during the pre and post construction surveys, indicates that the occurrence of the seagrass didn't change between the samplings, but the amount (density) did vary. This is also consistent with the consideration of seasonal variation of the densities and biomass. Therefore, the differences between the pre and post construction seagrass assessments are consistent with documented seasonal variations of shoot density and biomass (canopy). These variations resulted from the relative timing of the pre-construction (high density/biomass period) and post-construction (low density/biomass period) surveys, and no data (qualitative or quantitative) indicated impacts to the seagrass community associated with the dredging activities. .

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January 13, 2014

Mark Crosley
Executive Director
Florida Inland Navigation District
1314 Marcinski Road
Jupiter, FL 33477-9498

RE: Project # ICW-DA-13-02

Dear Mr. Crosley,

Attached please find the Pre-Construction Report and Invoice for ICW Maintenance Dredging Project in the vicinity of Baker's Haulover Inlet. A CD has been included with a PDF version of the report along with the associated seagrass shape files.

If you have any questions, please contact me at (305) 372-6861.

Christian Avila, Environmental Resources Project Supervisor
Restoration & Enhancement Section

August 2013 Pre-Construction Benthic Resources Surveys for Maintenance Dredging of the Intracoastal Waterway in the Vicinity of Bakers Haulover Inlet

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INTRODUCTION

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Surveys within the mixing zone and pipeline corridor were conducted August 13 - September 6, 2013. Methodologies utilized for seagrass surveys were consistent with NOAA's National Marine Fisheries "Recommendations for Sampling *Halophila johnsonii* at a Project Site" guidance document (http://sero.nmfs.noaa.gov/pr/docs/JSG%20Survey%20Guidelines.pdf) as well as the survey methodology used by DERM during the 2010 benthic resource surveys conducted for the prior IWW maintenance dredging in 2010. Seagrass areas were traced by a diver, towing a Garmin GPSMAP 76 on a surface float. The tether line between the diver and the foat was kept to a minimum to provide greatest accuracy of the positions recorded. The traces were downloaded using GPS Trackmaker® software, and subsequently imported into a GIS program (ArcGIS®) to produce the maps contained herein. All GIS shape files (NAD83) created during the mapping process are included on the CD submitted with this report.

The relative abundance and cover of seagrasses and benthic organisms were assessed using Braun-Blanquet Cover Abundance (BBCA) visual assessment methodology (Table 1). The BBCA scale was applied to all benthic components within two haphazardly placed 0.25m^2 quadrats at each station (two stations had 4 quadrats assessed). Preliminary assessments and seagrass areas mapped to identify areas of open sand that did not support any seagrass or other benthic resources. The BBCA assessments excluded those areas of sand. Within the traced seagrass areas a total of 165 stations (334 quadrats) were assessed. Stations were randomly distributed within those areas supporting benthic resources (Figure 1).

Table 1. Modified BBCA class scale of cover/abundance.

BBCA Value	Cover/Abundance
0	absent
0.1	<5% cover with a solitary individual/shoot
0.5	<5% cover with few individuals/shoots (sparse)
1	<5% cover with numerous individuals/shoots
2	≥5% cover and ≤25% cover
3	>25% cover and ≤50% cover
4	>50% cover and ≤75% cover
5	>75% cover

RESULTS & DISCUSSION

Seagrass Areas

Consistent with prior monitoring efforts of the Bakers Haulover Inlet flood shoal and IWW area, these surveys found a diverse seagrass, algal, and benthic invertebrate community with a high degree of heterogeneity. Six species of seagrass were identified in the study area; *Syringodium filiforme*, *Thalassia testudinum, Halodule wrightii,* and three species in the *Halophila* genus, *H. johnsonii, H. decipiens, and H. engelmannii*. Figure 2 shows a map of seagrass areas that were identified as well as relative densities of the BBCA scores for all species of seagrass, Total Seagrass, percent cover within the project area. In general, seagrass occurrence was highest in the western and southern portions of the surveyed area, and least in the eastern and northern portions of the area.

An indication of seagrasses patchiness is apparent in the BBCA data distribution; with 43 (26%) of the stations surveyed having no seagrass present in the quadrats (Figure 3). While, 36 (22%) stations had a Total Seagrass coverage of 50% or greater (i.e. BBCA score of 4 or higher). The most frequently encountered seagrass was *Syringodium*, which was found in 32.6% of the quadrats and 23.6% of those had coverage ≥50% (Table 2). *Halodule* was the second most frequently occurring seagrass, and was present in 24.9% of the quadrats, with 10.5% of the quadrats having coverage of ≥50%. *Thalassia* was infrequent, found in only 12.3% of the quadrats, and the majority of observations were <5% cover. Seagrasses in the *Halophila* genus make up the remaining 5.7% of the community; the endangered seagrass *H. johnsonii* was present in 2.7% of the quadrats, *H. dicipiens* in 0.9% and *H. englmanii* in 0.6%. The dominance of *Syringodium* and *Halodule* species, and limited presence of *Thalassia* in the area is an indication of generally good water quality, and dynamic salinity conditions in this area. Additional, details on the coverage/abundance and distribution of *H. johnsonii,* the endangered, seagrass are described in a dedicated section below.

The BBCA class data and abundance of algal and sponges associated with the seagrass community are listed by functional group in Table 3. Collectively algae and sponges within the Buffer Zone were frequent, with a total 73.7% of the quadrats surveyed (246 of 334) containing algae and sponges. However, percent cover of this group was generally low, >5% cover occurring in 57% of the samples.

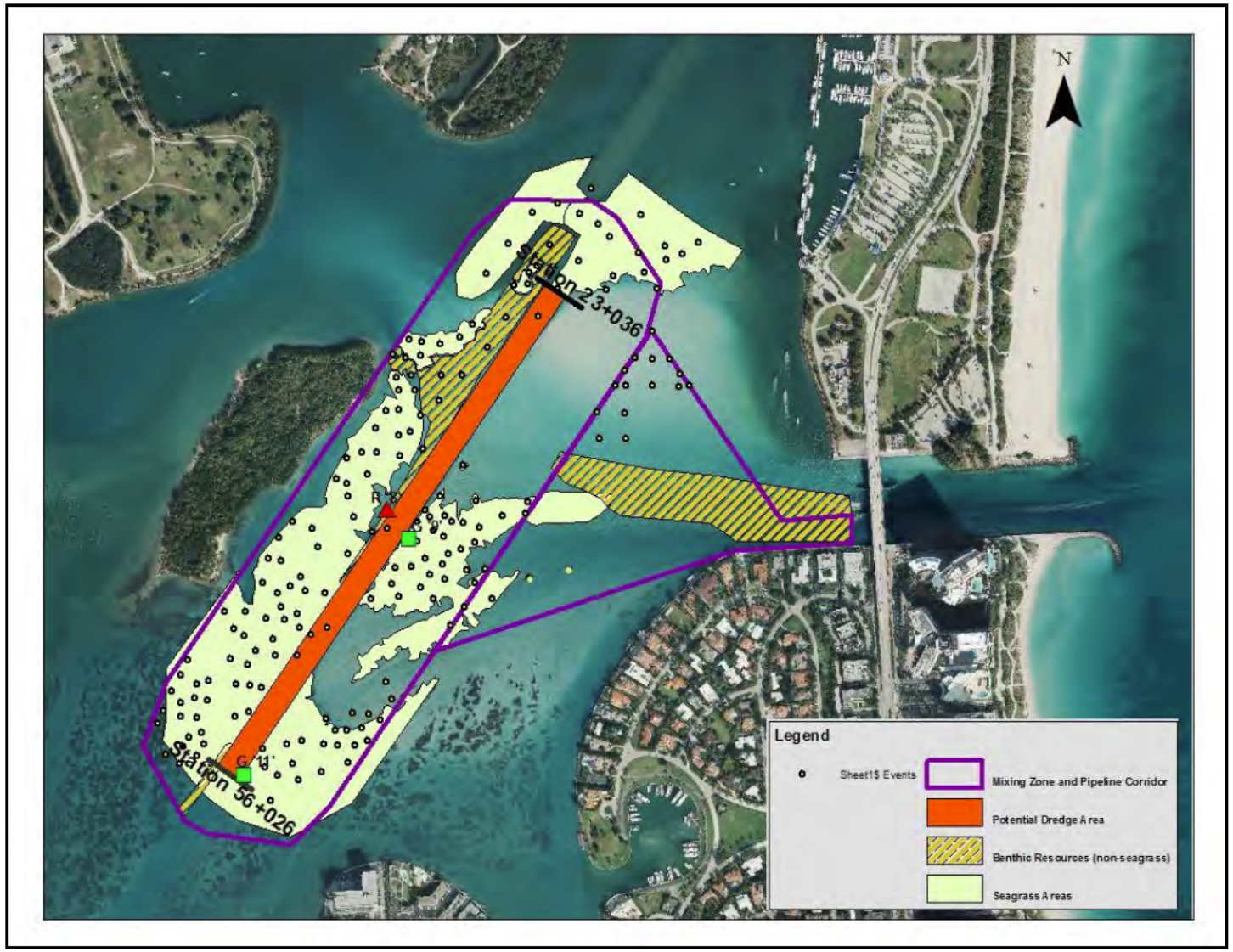

Figure 1.Bakers Haulover Inlet North Access and Intracoastal Waterway Channels proposed maintenance dredging location and all stations surveyed for quantifying seagrass and benthic resources.

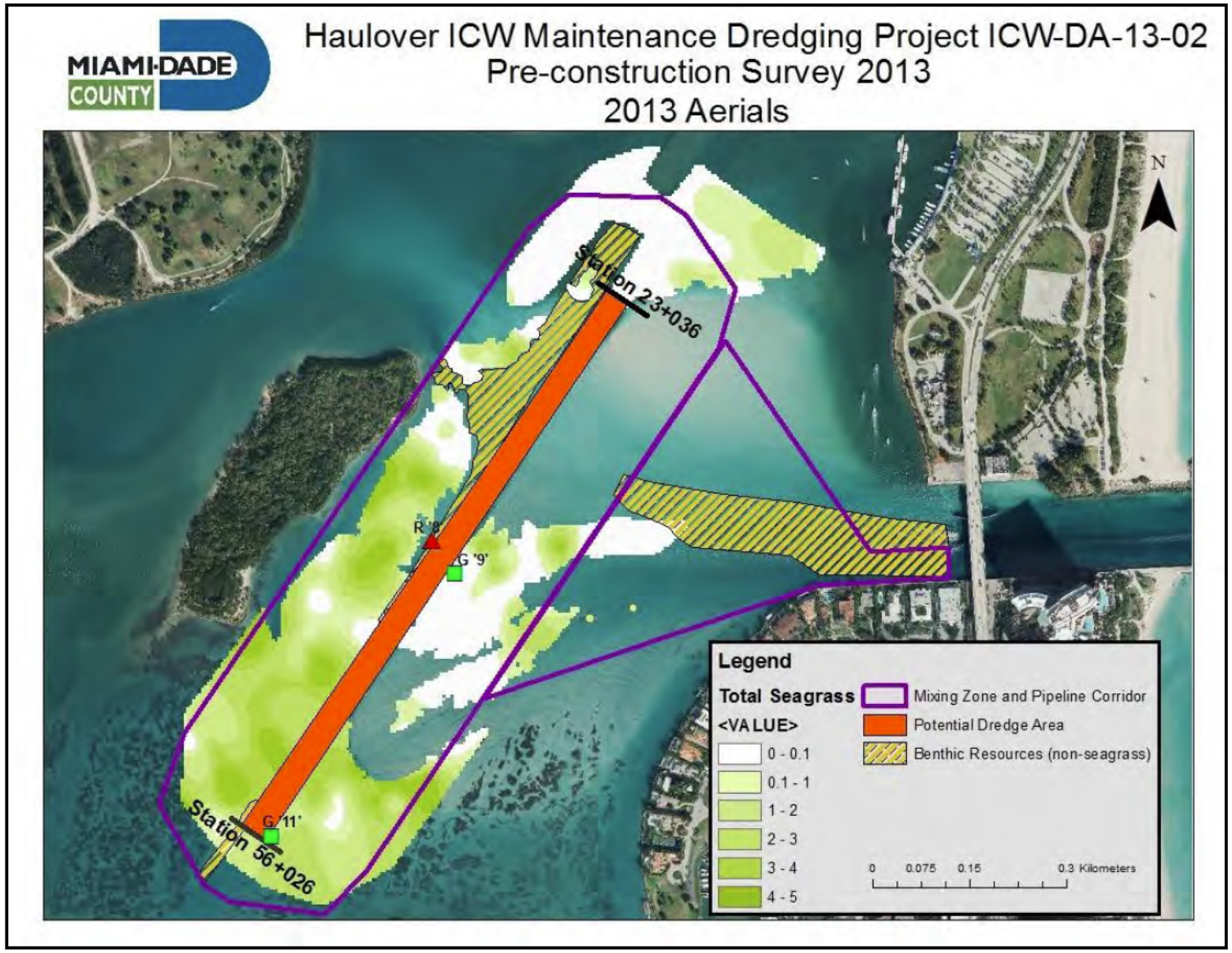

Figure 2.Countour plots of BBCA for Total Seagrass cover within the project area.

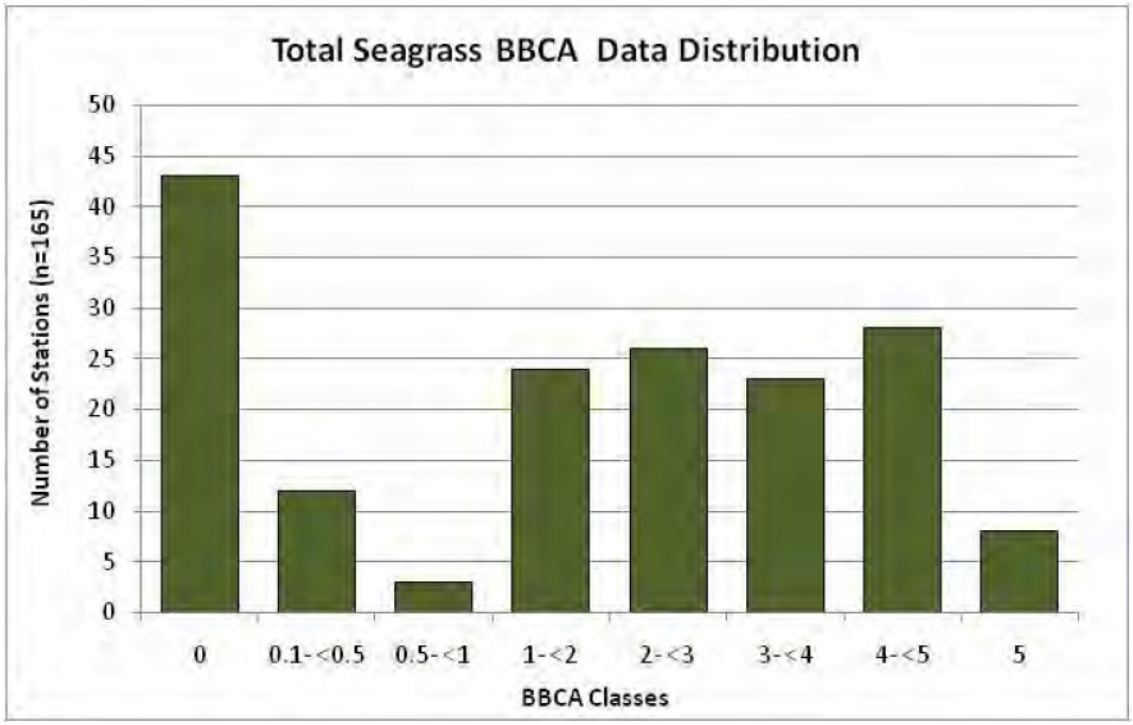

Figure 3. Seagrass Area station BBCA class data frequency for the combined Total Seagrass metric.

Table 2. Seagrass BBCA class data distribution for all quadrats in the Seagrass Area.

	BBCA Class									
Seagrass	**0**	**0.1**	**0.5**	**1**	**2**	**3**	**4**	**5**	**Total Freq**	**% Freq**
Total Seagrass	109	12	8	25	51	46	45	38	225	67.4%
Syringodium	225	0	0	7	24	21	27	30	109	32.6%
Halodule	251	1	1	16	30	19	10	6	83	24.9%
Thalassia	293	10	5	8	8	6	4	0	41	12.3%
H.johnsonii	320	2	1	0	4	5	2	0	14	4.2%
H.dicipiens	331	0	2	0	0	1	0	0	3	0.9%
H.englmanii	332	0	1	1	0	0	0	0	2	0.6%

Table 3. Benthic functional groups BBCA class data distribution and frequency for all quadrats within the Seagrass Area.

	BBCA Class									
Benthic Category	**0**	**0.1**	**0.5**	**1**	**2**	**3**	**4**	**5**	**Total Freq**	**% Freq**
Red Algae - Non-Drift	260	3	20	22	26	2	1	0	74	22.2%
Green Algae - Calcareous	267	14	28	13	8	4	0	0	67	20.1%
Green Algae - Fleshy	278	5	16	26	5	3	1	0	56	16.8%
Sponge	300	28	6	0	0	0	0	0	34	10.2%
Brown Algae	319	1	6	2	6	0	0	0	15	4.5%

Halophila johnsonii abundance and distribution

The south-west region of the dredge buffer zone area showed the highest concentration of *H. johnsonii,* with some areas having between 25-75% cover by seagrass and benthic organisms (Figure 3). This is slightly different from the previous sampling in 2010, where the seagrass was observed more in the regions east of the dredge (Figure 3). . Even though the majority of sites where the *H. johnsonii* found had between 25-75% cover of all benthic organisms (including seagrass), it should be noted that *H. johnsonii* was only found in less than 5% of all sites sampled during this period.

Pipeline Corridor

The benthic resources found within the designated pipeline corridor are shown in Figure 4. The northern portion of the pipeline corridor is a sand shoal. The central region is characterized by rubble substrate with algal cover and isolated sponge, which extends through the most of eastern most portion of the Corridor. The southwestern portion does contain seagrass that extends from the Buffer Zone. **Note**: It would appear that pipeline placement will need to be on the southern side of the eastern pipeline corridor to avoid impact to benthic resources.

Benthic Resources – Non Seagrass

During the 2010 pre-construction surveys three areas were identified with significant benthic communities but entirely devoid of seagrasses (Figure 1). Those areas were confirmed in the same locations during this sampling series. This community is a mix of benthic invertebrates and algae among a carbonate rock and rubble or hard bottom substrate. Red algae, sponges, soft corals, and Green Algae (Fleshy) were the most frequent, although not found to have coverage greater than 20% (Table 4). The additional benthic components, of Hard Corals and Brown algae were found in 16.7% and 11.1% of the samples respectively.

Table 4. Benthic functional groups BBCA class data distribution and frequency within the Benthic Resources – Non Seagrass defined areas.

	BBCA Class									
Benthic Category	**0**	**0.1**	**0.5**	**1**	**2**	**3**	**4**	**5**	**Total Freq**	**% Freq**
Red Algae - Non-Drift	8	0	0	6	4	0	0	0	10	55.6%
Sponge	11	0	1	3	3	0	0	0	7	38.9%
Soft Coral	12	1	0	1	4	0	0	0	6	33.3%
Green Algae - Fleshy	14	0	0	2	2	0	0	0	4	22.2%
Hard Coral	15	2	1	0	0	0	0	0	3	16.7%
Brown Algae	16	0	0	0	2	0	0	0	2	11.1%
Green Algae - Calcareous	18	0	0	0	0	0	0	0	0	0.0%

Summary

- Seagrass Areas
  - A diverse and frequent but generally low percent cover seagrass community was documented throughout the majority of the project's buffer zone.
  - The endangered seagrass *Halophila johnsonii* was documented at similar frequency and percent cover, as the 2010 IWW dredging project in this location in, but has changed in spatial distribution.
  - Functional algal groups and sponges were also documented in low-moderate frequencies and low percent cover within the Seagrass Area.

- Benthic Resources – Non Seagrass Areas
  - Within the Buffer Zone were areas defined as Benthic Resources – Non Seagrass Areas, and are characterized by moderate-low frequency, low percent cover algae and benthic invertebrates.

- Pipeline Corridor
  - A large seagrass bed extends from the buffer zone into the pipeline corridor.
  - The central part of the pipeline corridor has a large area of Benthic Resources – Non Seagrass, predominantly algae and sponges.
  - It would appear that pipeline placement will need to be on the southern side of the eastern pipeline corridor to avoid impact to benthic resources.

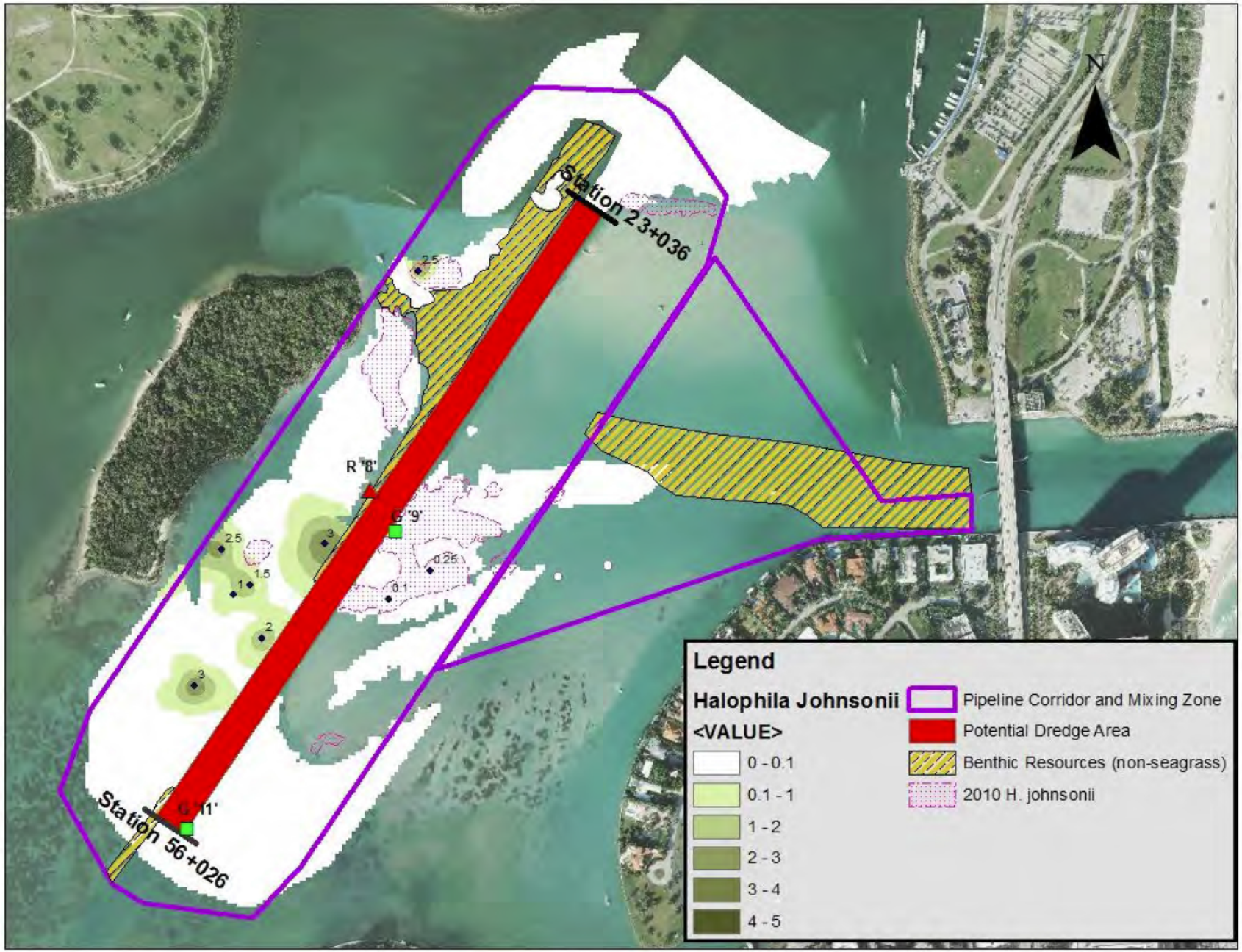

Figure 4. Contour plots for the endangered seagrass *Halophila johnsonii* based on August 2013 BBCA cover/abundance values and the 2010 *H.johnsonii* area.

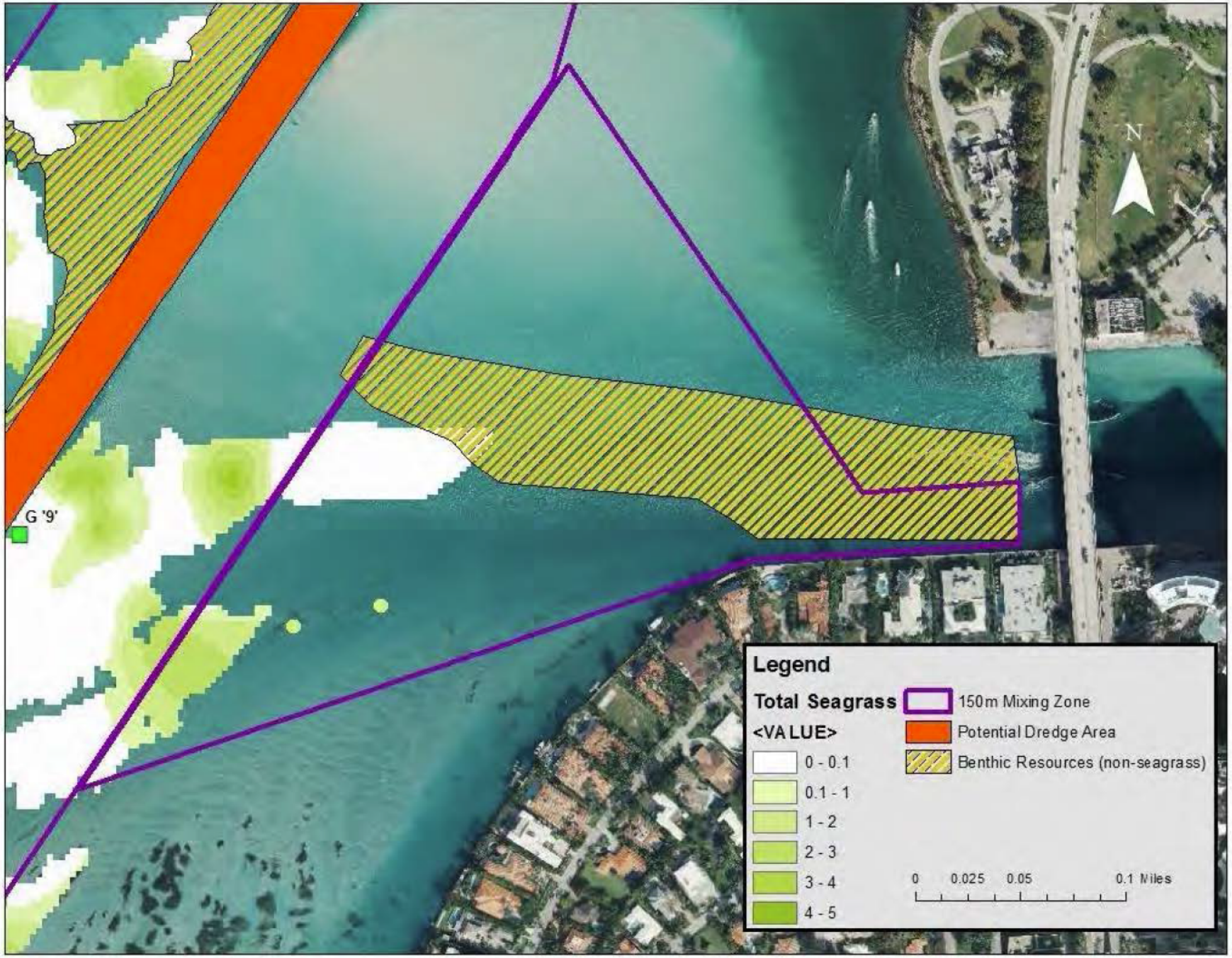

Figure 5. Seagrass and benthic resources within the designated pipeline corridor.

POST-CONSTRUCTION SURVEYS FOR MAINTENANCE DREDGING OF THE INTRACOASTAL WATERWAY IN THE VICINITY OF BAKERS HAULOVER INLET PROJECT #: ICW-DA-10-03

INTRODUCTION:

On August 30th the Florida Inland Navigation District (FIND) and Miami-Dade County's Department of Environmental Resources Management (DERM) entered in to a "Project Agreement" to conduct biological monitoring activities to meet regulatory requirements for the maintenance dredging of the Intracoastal Waterway in the vicinity of Bakers Haulover Inlet, Miami-Dade County (US Army Corp of Engineers [USACE] Project ICW-DA-10-03). The Scope of Work of the FIND-DERM agreement provided for pre-construction, "interim' and post-construction biological assessments of biological resources within the "variance zone' (e.g., 150m meter area surrounding the active dredging area). The following maps and information are submitted as partial fulfillment of an FIND-DERM Project Agreement associated with the post-construction biological monitoring inside Bakers Haulover Inlet, and specifically within the area proposed for maintenance dredging.

Pre-construction biological assessments were conducted from August 30th to October 8th, 2010. Seagrass areas were defined and approximate abundance quantified throughout the area. Seagrass areas were traced using a Garmin GPSMAP 76 device. The traces were downloaded using, and subsequently incorporated into a GIS program (ArcGIS®) to produce the maps contained herein. All GIS shape files (NAD83) created during the mapping process were provided to FIND prior to commencement of dredging. All pre-construction survey information was submitted to FIND in the Pre-Construction Survey Report in October 2010.

The maintenance dredging began in November of 2010 and concluded with the final bathymetric surveys on February 4, 2011. Three interim surveys were completed immediately before commencement of dredging, approximately midway through construction, and again after dredging was completed. During these vessel based surveys, no indication of damage to the benthic resources in the area were observed.

METHODOLOGY:

Post-construction resource surveys were carried out from February 10th to February 28th, 2011. The seagrass beds and other areas with benthic resources identified through the pre-construction monitoring efforts were surveyed again to assess any changes in the benthic assemblages post construction. The relative abundance and cover of sea grasses and benthic organisms were assessed using Braun-Blanquet Cover Abundance (BBCA) methodology. This methodology utilizes visual observations of the habitats to estimate the abundance and benthic cover of the components of the benthic community. Cover of benthic components within 0.16 m^2 quadrats (4

quadrats per assessment site) was rated on a scale of 0-5. Each value is tied to a range of coverage and/or abundance based on the following scale:

Table 1: Braun-Blanquet Abundance Scale

Scale	% Cover	Abundance Description
5	> 75%	High
4	50-75%	Moderate
3	25-50%	Low to Moderate
2	5-25%	Low
1	<5%	Sparse
0.5		Few individuals with small cover
0.1		Solitary

The dredging operation utilized spuds within the channel and authorized dredging footprint to remain stationary during construction activities instead of anchoring outside of the channel. Therefore, the post construction assessment did not involve surveying any anchor drop locations.

RESULTS:

Figure 1 shows the overall project area including the 150m turbidity mixing zone, the dredged area of the navigation channel, the pipeline corridor, and the perimeter of the seagrass areas as defined in the pre-construction survey completed in October of 2010. The mixing zone was broken down into geographic regions (North, East, Southeast, Southwest, and West) to allow for descriptions of the benthic resources on a smaller scale.

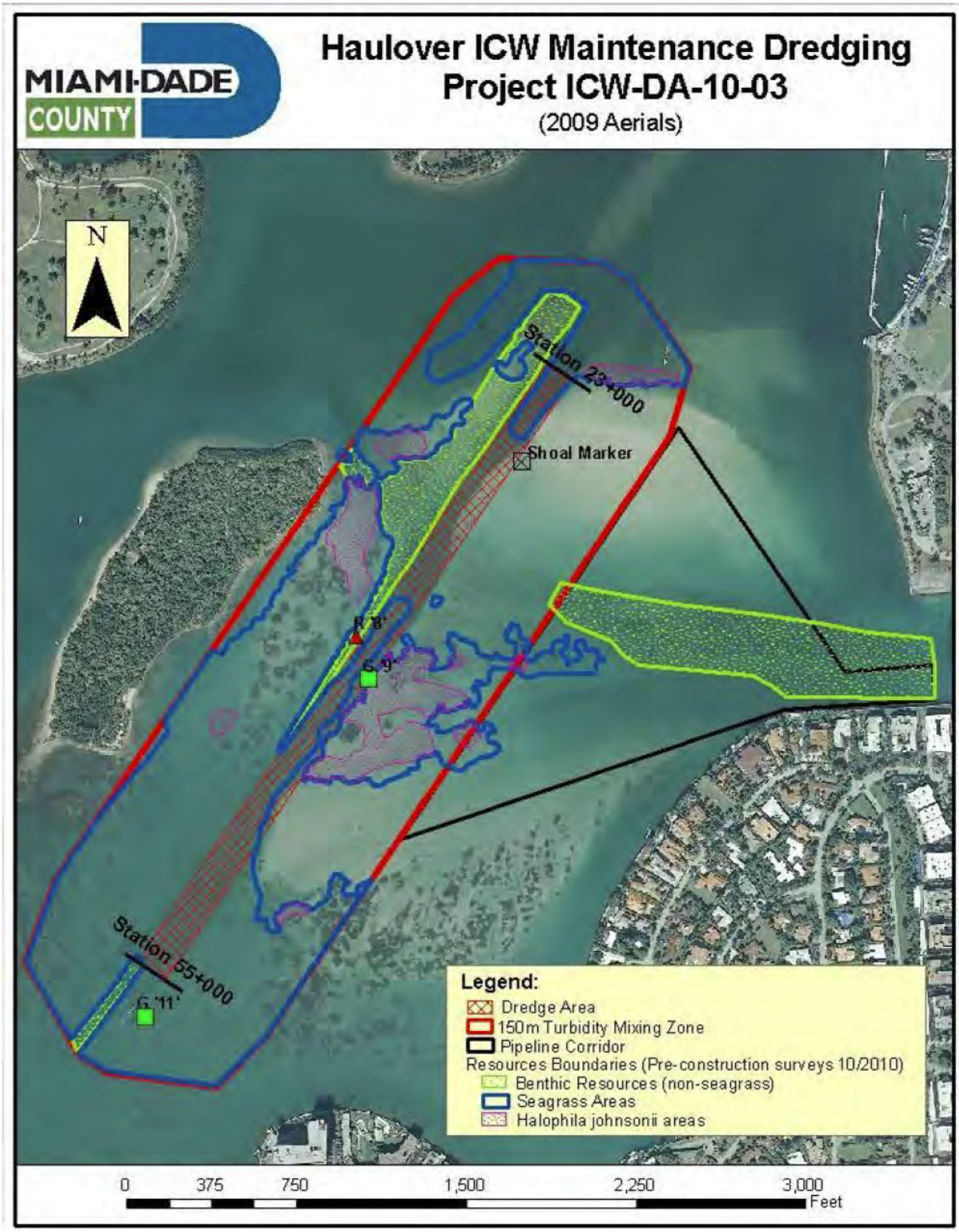

Figure 1. Bakers Haulover Intracoastal Waterway Channels maintenance dredging and benthic resource locations.

NORTH REGION

Prior to construction, the north region of the mixing zone consisted of a large seagrass area that spanned from west to east across the channel, an area with benthic resources other than seagrass just west of the channel, and another small seagrass area west of the channel (Figure 2). Drift red algal species and macro-algae species (*Halimeda* spp., *Penicillus* spp., *Udotea* spp., and *Caulerpa* spp.) were common throughout the areas in the pre and post construction assessments.

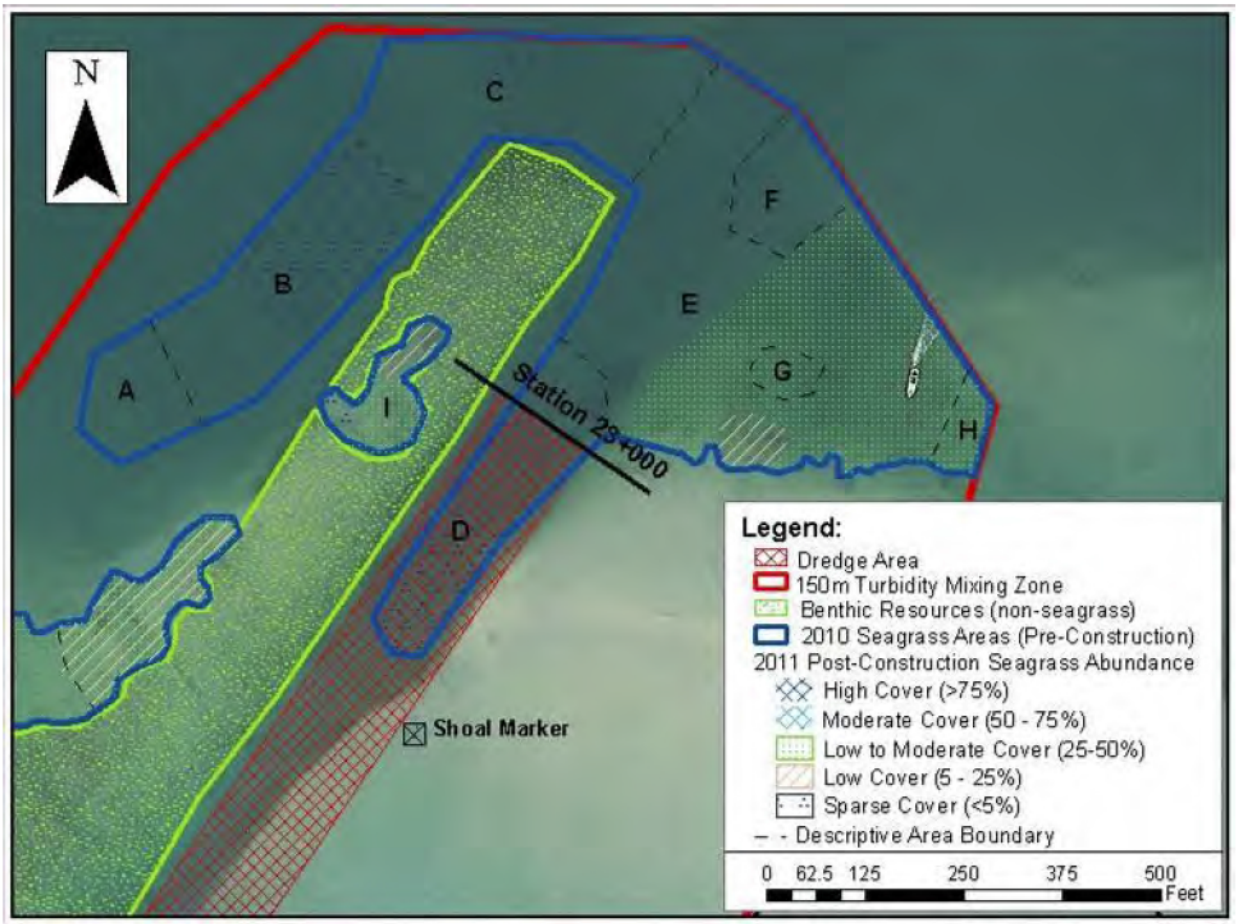

Figure 2. Seagrass areas in the north region of the mixing zone (2009 aerials) based on post construction surveys. Lettered areas are described further in text.

The large seagrass area was divided into similar areas based on species composition and abundance, A through H as shown in Figure 2. The seagrass areas west of the channel, Areas A, B, and C, were comprised of sparse (<5%) to low (5 - 25%) seagrass cover of *Halophila decipiens* prior to construction. In the post construction assessment, these areas were void of seagrass or only contained sparse *H. decipiens.*

Moderate (50 - 75%) seagrass cover consisting again of *H. decipiens* only was observed in Area D in the channel prior to construction. However, after construction, Area D only contained a small area of sparse *H. decipiens*.

Area E was a large low to moderate (25 - 50%) seagrass cover area in the pre-construction assessment. The portion of Area E falling within the channel was dominated by *H. decipiens* prior to construction, but was void of seagrass in the post construction assessment. Prior to construction, the northeastern portion of Area E was also dominated by *H. decipiens,* but also contained a low cover of *Halodule wrightii.* *Halophila decipiens* was absent in the post construction assessment in this area, but the low cover of *H. wrightii* remained. Just north of the shoal in the southern part of Area E, the –threatened" (as per the Endangered Species Act) seagrass species, *Halophila johnsonii*, was observed in addition to *H. wrightii* and *H. decipiens* in the pre-construction assessment. However, in the post construction assessment only *H. wrightii* was observed resulting in a lower overall seagrass abundance.

Area F was a high (>75%) seagrass cover areas dominated by *H. decipiens* with sparse *H. wrightii* before construction. No seagrass was observed in this area during the post construction assessment.

In the pre-construction surveys, Area G was a low seagrass cover area comprised of a mix of *Syringodium filiforme*, *H. wrightii*, and *H. decipiens*. The post construction assessment documented a slightly higher abundance, low to moderate cover, but only of *S. filiforme* and *H. wrightii—H. decipiens* was not observed.

In the extreme eastern portion, Area H, *H. wrightii*, *S. filiforme,* and *Thalassia testudinum* were all observed in mixed species seagrass beds with a combined moderate percent cover. The abundance of *T. testudinum* was lower in the post construction assessment resulting in a low to moderate overall seagrass cover for this area (Figure 3).

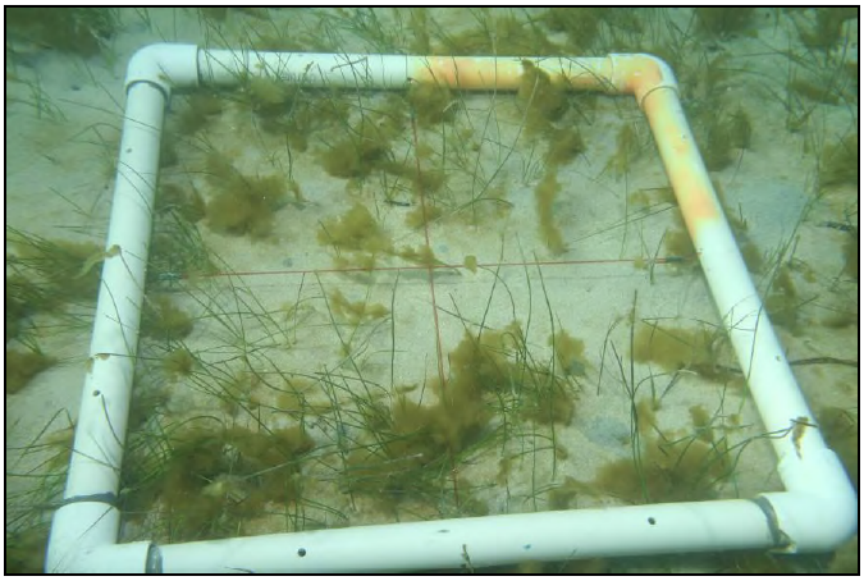

Figure 3. Post construction survey quadrat with *Syringodium filiforme* and *Halodule wrightii* in the North Region—Area H.

Just west of the channel, a smaller seagrass area (Area I) was observed surrounded by an area with non-seagrass benthic resources. In both the pre and post construction surveys, sparse *T.*

testudinum with low percent cover was observed in the western portion of this seagrass area (Figure 4) while low to moderate percent cover of *H. wrightii* was observed in the east.

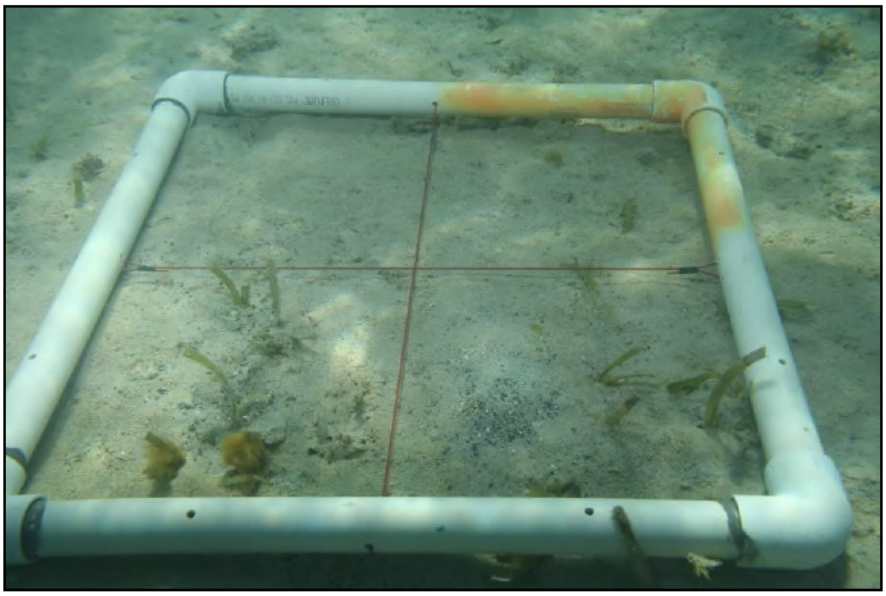

Figure 4. Post construction survey quadrat with sparse *Thalassia testudinum* cover (North Region—Area I_.

Surrounding Area I was sand and rubble area with algae, sponges, soft coral, and occasional stony corals. This area extends to the south through the west and southwest regions. These benthic resources were also found on the west wall of the channel, but not on the floor of the channel considered part of the dredging footprint. No changes were noted in this area post construction.

EAST REGION

Two different seagrass areas were found within the eastern region of the mixing zone during the pre-construction surveys (Figure 5). Drift red algal species and macro-algae species (*Halimeda* spp., *Penicillus* spp., *Udotea* spp., and *Caulerpa* spp.) were common throughout the seagrass areas. To the north of the seagrass areas, a sand and rubble area was noted with drift red algae, blue-green algal turf, and hydroids before and after construction.

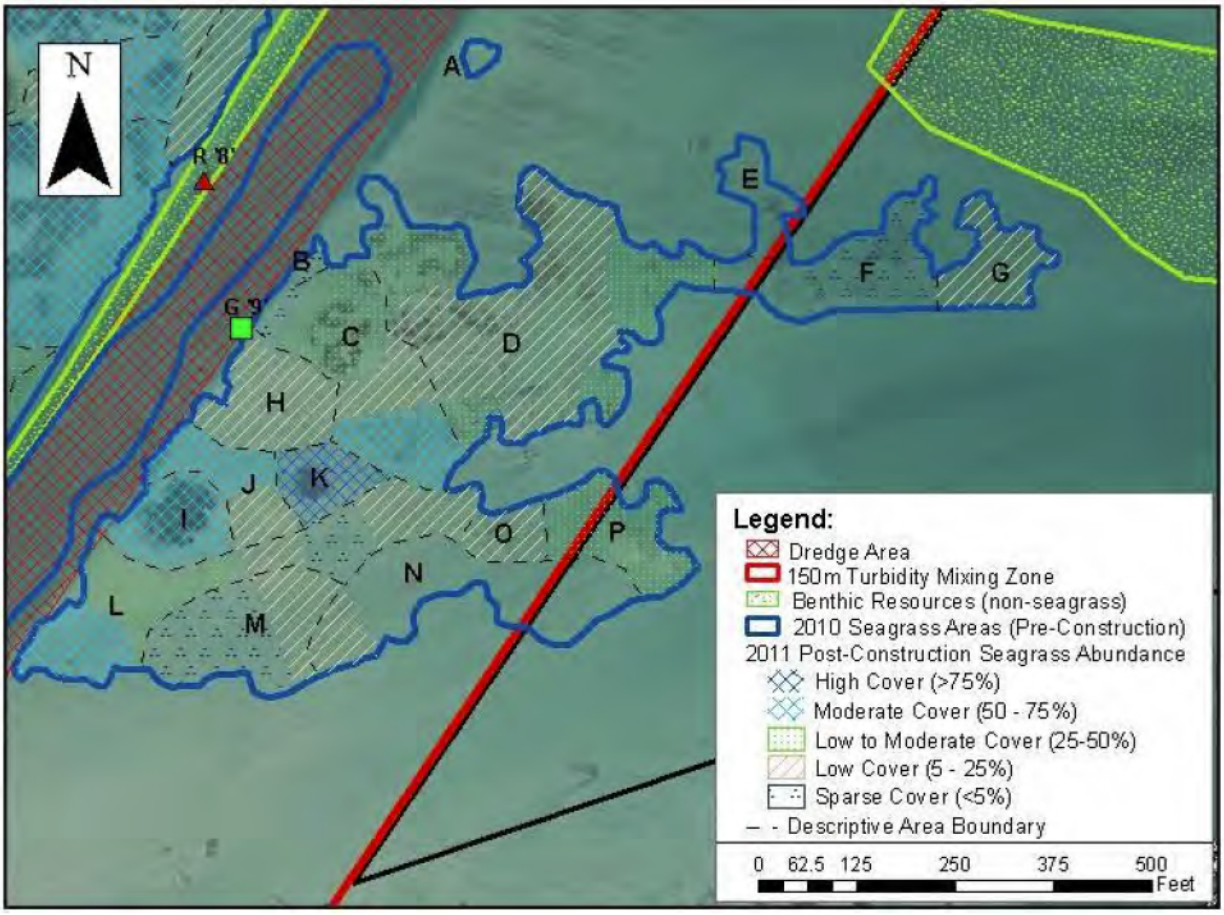

Figure 5. Seagrass areas in the eastern region of the mixing zone (2009 Aerials) based on post construction surveys. Lettered areas are described further in text.

Prior to construction, The small northern seagrass area, A, was comprised of low to moderate (25- 50%) cover of *H. wrightii* cover. However, during the post construction assessment seagrass was not observed.

The large seagrass area was comprised of several seagrass and algal species with a wide range of abundance (Areas B through P; Figure 5). In the late summer/early fall pre-construction surveys, the threatened species, *H. johnsonii,* was observed throughout the area along the ICW channel east toward the edge of the survey area (except Areas G, I, K, O, and P). The observed range of *H. johnsonii* in the east region is shown in Figure 1. During the winter post construction surveys, *H. johnsonii* was not observed.

The small seagrass area in the northwest, Area B, was a low to moderate mix of *H. wrightii*, *H. johnsonii*, and *T. testudinum* prior to construction. With the absence of *H. johnsonii*, only a sparse abundance of *H. wrightii* and *T. testudinum* were observed post construction.

In the pre-construction surveys, Area C, consisted mainly of *H. wrightii* and *H. johnsonii* near the channel with a moderate density of *S. filiforme* just to the east. Area C was mainly *H. wrig*htii and *H. johnsonii* in the central portion with a high abundance of *S. filiforme* in the

southern portion. Lower seagrass abundance was found in eastern and central portions of Area C during the post constructions surveys due to the absence of *H. johnsonii*. The southern portion of Area C maintained a moderate cover of *S. filiforme* in the post construction assessment.

Area D was a low to moderate percent cover seagrass area in the pre-construction surveys with *T. testudinum* dominating the cover followed by *S. filiforme*, *H. wrightii,* and *H. johnsonii* in the northwest portion, *H. wrightii* dominating followed by *S. filiforme* and *H. johnsonii* in the center, and *S. filiforme* dominating followed by *H. wrightii* in the east (Figure 6). The northwest and eastern portion of Area D maintained low to moderate seagrass cover in the post construction assessment while the cover decreased in the central region due to the absence of *H. johnsonii* and lower cover of *S. filiforme*.

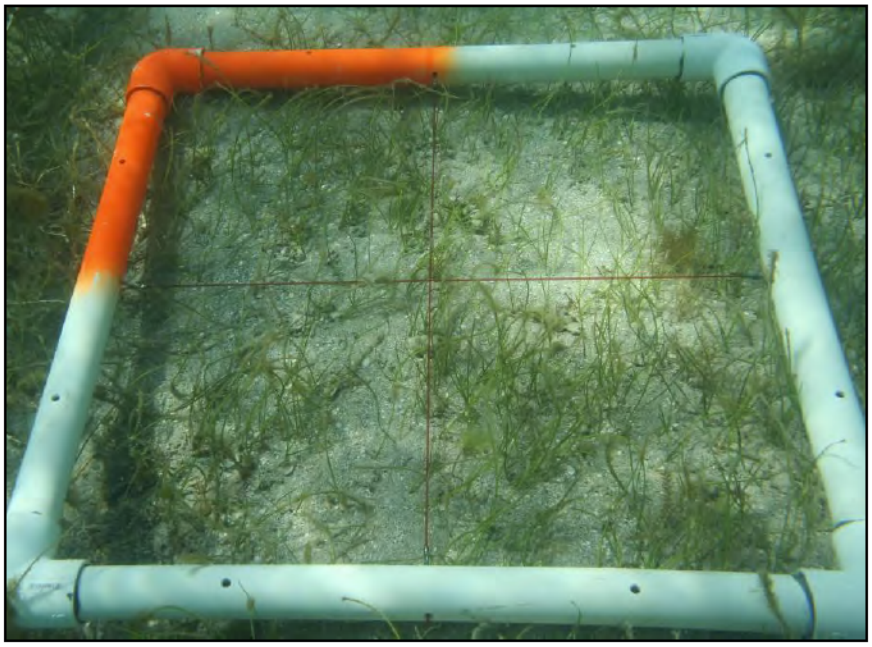

Figure 6. Post construction survey quadrat with *Syringodium filiforme* (East Region—east portion of Area D).

The north area, E, had a low to moderate cover of *S. filiforme* in the pre-construction surveys. However, during the post construction assessment seagrass was not observed.

Area F was a low (5-25%) seagrass cover area in the pre construction surveys and dominated by *H. wrightii* and *H. johnsonii* in the west and *H. decipiens* and *H. wrightii* in the east. The seagrass cover decreased to sparse in the post construction survey due to the absence of *H. johnsonii* and *H. decipiens*.

The far eastern area, G, was a moderate percent cover area of *H. decipiens* in the pre-construction surveys. In the post construction surveys, H. decipiens was not observed, but H. wrightii was found with low cover.

Area H along the channel consisted of low to moderate percent cover of *H. wrightii* and *H. johnsonii* and to a much lesser extent *S. filiforme* during the pre-construction surveys. The post construction surveys documented a low percent seagrass cover for the area with no observation of *H. johnsonii*.

Halophila johnsonii was found throughout Area J with *Syringodium filiforme* dominating the western portion and *H. wrightii* dominating the cover in the eastern portions resulting in an overall moderate seagrass cover during the pre-construction surveys. *Halophila johnsonii* was not observed during the post construction surveys. *Halodule wrightii* cover was also slightly lower in the eastern portions during post construction surveys resulting in a low to moderate seagrass cover in the eastern part of Area J.

In the pre-construction surveys, Areas I and K had a high (>75%) percent seagrass cover were dominated by dense *S. filiforme.* Area I also had a low abundance of *T. testudinum* and *H. wrightii* around the edges of the *S. filiforme* bed in the pre-construction surveys. As a result of the random quadrat placement, *T. testudinum* and *H. wrightii* cover was not observed in the post construction survey in Area I resulting in a moderate percent seagrass cover instead of high.

Prior to construction, Area L was a low to moderate percent cover area in the southwest dominated by *H. wrightii* through out except in the southwest portion where *S. filiforme* was more abundant. *Halophila johnsonii* was also present in the western and eastern portions in the pre-construction surveys. The post construction surveys documented the absence of *H. johnsonii* throughout the area as well as a decline in *H. wrightii* cover toward the central and eastern portions of Area L.

Area O was a moderate seagrass cover area dominated by *S. filiforme* followed by *H. wrightii*. The cover of *S. filiforme* was lower post construction which reduced the overall seagrass cover to low.

The southern sparse, low, and low to moderate percent cover areas, M, N, and P respectively, observed in the pre-construction surveys were dominated by *H. wrightii.* The northern portions of Areas M and N areas also contained *H. johnsonii* in the pre-construction surveys. *Halophila johnsonii* was not observed in the post construction surveys. The low cover of *H. wrightii* was also not observed in the central and eastern portions of Area N during post construction surveys. Area P maintained a low to moderate percent cover of *H. wrightii* in the post-construction surveys.

SOUTHEAST REGION

The southeast region is comprised of one large seagrass area that continues to the west into the southwest and western regions (Figure 7). Several seagrass species were observed with a wide range of abundance in both the pre and post construction surveys. Drift red algae and macro green algae were also found through the seagrass areas in the southeast region. North of the seagrass area barren sand now covers what appears to be seagrass in the 2009 Aerials.

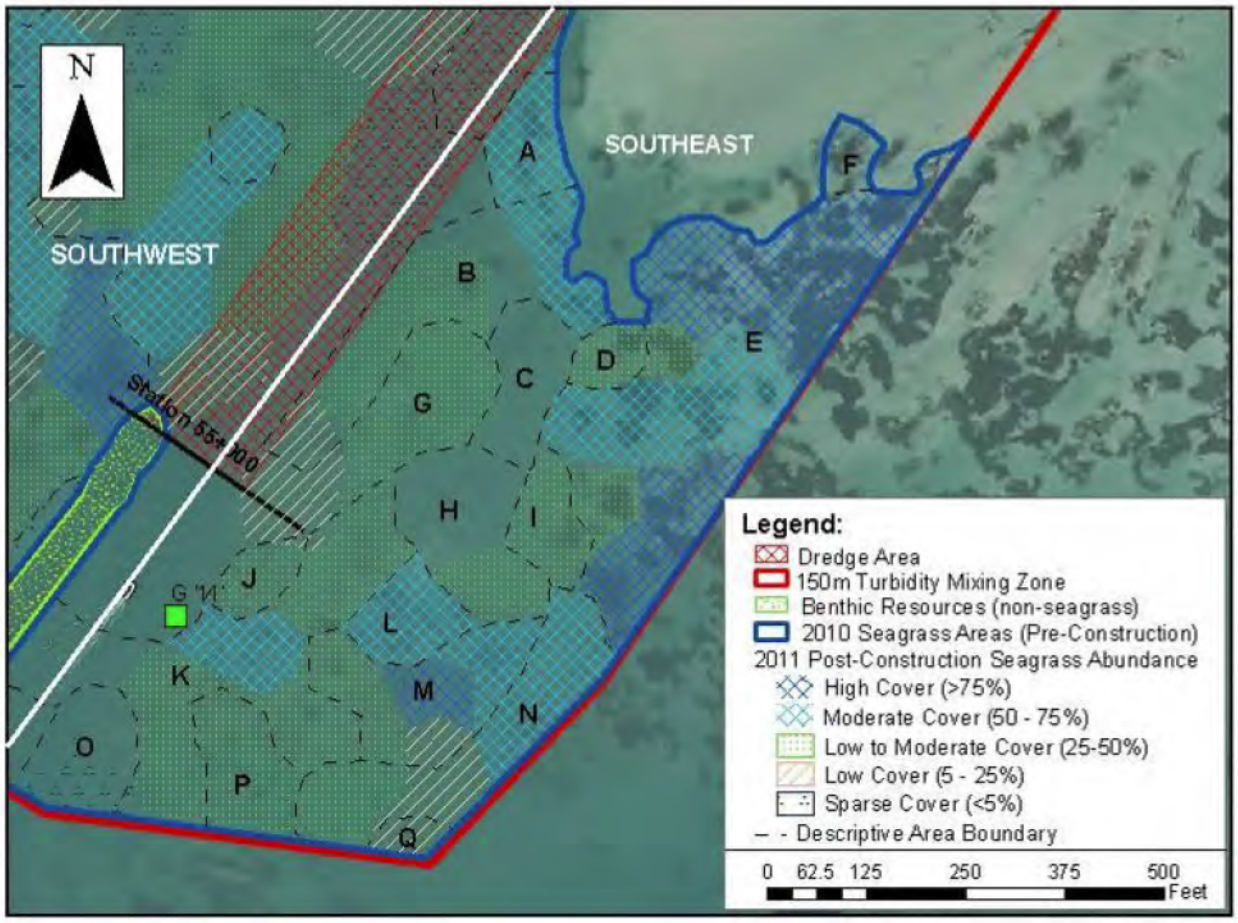

Figure 7. Seagrass areas in the southeastern region of the mixing zone (2009 Aerials) based on post construction surveys. Lettered areas are described further in text. Note that the southwestern region includes the areas in the channel and to the west (see Figure 7).

In the pre-construction surveys, Areas A, E, and L had high (>75%) percent seagrass cover dominated by dense *S. filiforme* beds (visible on aerials, Figure 6). The threatened species *H. johnsonii* was also observed in the pre-construction surveys in the north portion of Area E adjacent to the dense *S. filiforme* beds. In the eastern portion of Area E, the *S. filiforme* beds also had a low cover of *T. testudinum* around the edges in the pre-construction surveys. A lower abundance of *S. filiforme* was observed in Area A, the central portion of Area E, and Area L during the post construction surveys. However, the majority of Area E maintained high seagrass cover (Figure 8). *Halophila johnsonii* was not observed in the north portions of Area E during the winter post construction surveys. During the post construction surveys, the northeastern portion of Area E was found void of seagrass due to the shoal migrating farther south.

Figure 8. Post construction survey quadrat with high *Syringodium filiforme* cover Southeast Region—Area E.

Areas F and I were also dominated by dense *S. filiforme* beds with a moderate percent cover in the pre-construction surveys. During the post construction surveys, Area F was void of seagrass due to the shoal migrating farther south. Area I had a lower cover of *S. filiforme* during the post construction surveys.

In the preconstruction surveys, Area B was dominated by *S. filiforme* in the north, both *H. decipiens* and *H. wrightii* in the center, and *H. wrightii* in the south. During the post construction surveys, the northern portion of Area B maintained the moderate percent cover of *S. filiforme*. However, in the central portion, *H. decipiens* was absent resulting in no seagrass coverage. The seagrass cover was lower in the southern portion of Area B in the post construction surveys as a result of the absence of *H. decipiens* and lower *S. filiforme* coverage.

Syringodium filiforme was also the most abundant species in areas D, G, M, P and Q which all had an overall low to moderate seagrass cover in the pre-construction surveys. In Area D, *H. wrightii*, *T. testudinum*, and *H. decipiens* were also present with a lower abundance. In the post construction survey, *H. decipiens* was not present in Area D. *Halodule wrightii* was present with a low abundance in Area P and Q in the pre-construction surveys. However, in the post construction surveys, *H. wrightii* was not observed in Area Q accounting for the low seagrass cover. In the southern portion of Area P, *T. testudinum* was observed prior to construction, but not in the post construction surveys. The northern portion of Area G and all of Area M maintained a low to moderate cover of seagrass in both the pre and post construction surveys. The southwestern portion of Area G had a lower percent cover of *H. wrightii* in the post construction survey compared to the pre-construction survey which lowered the overall seagrass coverage in that portion.

Halophila decipiens was responsible for the low (5-25%) percent seagrass cover in Area C, the northern portion of Area H, and the northern portion of Area O in the pre-construction surveys. *Halophila decipiens* was not observed in the post construction survey; therefore, all of these areas were void of seagrass cover. The southern portion of Area H was comprised of mix of *S. filiforme* and *H. wrightii* in both the pre and post construction surveys with an increase in abundance in the post construction survey. The southern portion Area O was comprised of *H. wrightii* with a low and then sparse cover in the pre and post construction survey respectively.

Area J had a high percent seagrass cover with a high abundance of *H. wrightii* and sparse *S. filiforme* in the pre-construction surveys while in the post construction survey the abundance in of *H. wrightii* was lower resulting in a lower overall seagrass cover.

In both the pre and post construction surveys, the southern seagrass area, K, was dominated by *S. filiforme* to the east and *H. wrightii* in the central portion. The overall seagrass percent cover was lower in the southern and eastern portions of Area K in the post construction surveys. In the pre construction survey, *H. decipiens* was abundant in the Area K in and adjacent to the channel, but was absent in the post construction surveys.

The southern portion of Area N was a mix of *H. wrightii* and *S. filiforme* and the northern portion of Area O is comprised of *H. wrightii* in both the pre and post construction surveys. The cover of S. filiforme was lower in the post construction survey resulting in a lower overall seagrass cover in the central portion of Area N while the cover of H. wrightii was higher resulting in higher overall seagrass abundance in the northern and southern portions.

SOUTHWEST REGION

During the pre and post construction surveys, one large seagrass area was found within the southwest region of the 150m mixing zone (Areas A through N; Figure 9). This seagrass area extended through the ICW channel and into the previously described southeastern region as well as north into the western region. Throughout the seagrass area, drift red algae and macro green algae including *Halimeda* spp., *Udotea* spp., and *Caulerpa* spp. were observed.

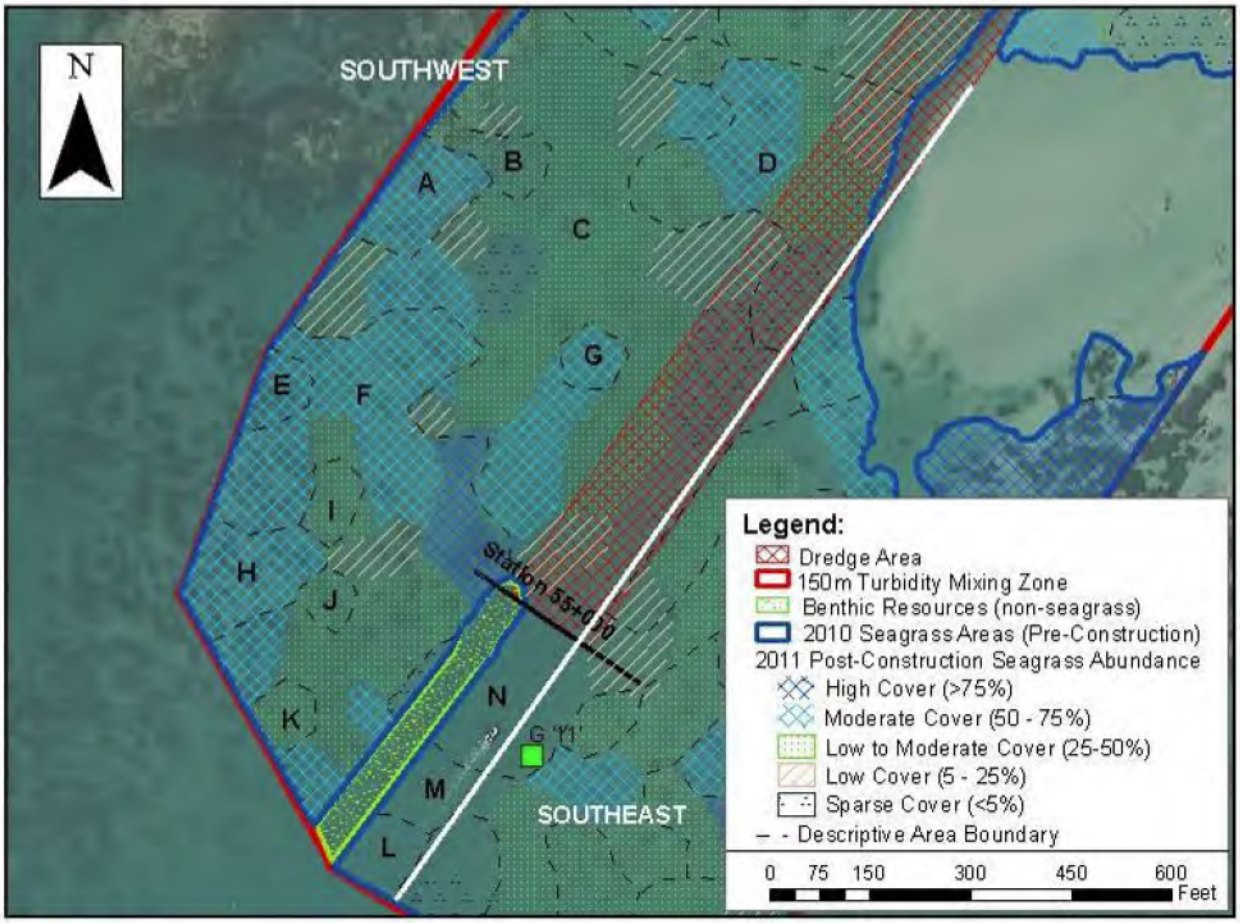

Figure 9. Seagrass areas in the southwestern region of the mixing zone (2009 Aerials) based on post construction surveys. Lettered areas are described further in text. Note that the southeastern region includes the areas east of the channel (see Figure 6).

Throughout both the pre and post construction surveys, *S. filiforme* was the prevailing seagrass species in the Southwest Region. In the pre-construction surveys, Areas E and H located in the western portion of this region had high (75%) seagrass cover dominated by *S. filiforme.* Area H also had sparse *T. testudinum* and *H. wrightii* in both the pre and post construction surveys. *Syringodium filiforme* cover was lower in the post construction surveys resulting in an overall moderate seagrass cover for these two areas.

The other moderate seagrass cover areas in the post construction assessment were dominated by *S. filiforme* and included Area A, portions of Area C, D, and F, and Area G. In both the pre and post construction surveys, *Thalassia testudinum* was also observed in the western portions of Areas A and F, mainly with low abundance on the edge of the *S. filiforme* beds. *Halodule wrightii* was observed with low abundance in central and south portions of Area F and eastern portions D (located within the channel) in both the pre and post construction surveys. The extreme southern portion of Area F and again the eastern portions of Area D (within channel) contained *H. decipiens* in the pre-construction surveys, but not the post construction surveys. Lower seagrass abundance in the post construction surveys in the central and southern portions of Area F and the eastern portions of Area D resulted in an overall low to moderate seagrass

coverage. An increase in overall seagrass abundance was also observed in the eastern portion of Area F due to an increase in *S. filiforme* cover.

Area C was a large section with low to moderate (25-50%) seagrass cover in the pre-construction survey and varying seagrass cover in the post construction assessment. In the western and southern portions of Area C, *S. filiforme* was the most common species followed by *H. wrightii* and *T. testudinum* in both the pre and post construction surveys. In the pre-construction surveys, the central and eastern portion also had *H. decipiens* which was not observed in any portion of Area C in the post construction surveys. The absence of H. decipiens and the lower abundance of S. filiforme and H. wrightii in the post construction surveys resulted in lower overall seagrass abundance than the pre-construction surveys in the western, eastern, and channel areas of Area C.

In both the pre and post construction surveys, Area G was a moderate cover seagrass area with a combination of *S. filiforme* and *H. wrightii*.

Area B in the north was dominated by *S. filiforme* in both pre and post construction surveys. In the post construction survey *T. testudinum* was also observed in the western portion. This observation and a slightly higher abundance of *S. filiforme* resulted in a low to moderate seagrass cover in the post construction assessment opposed to the low cover observed in the pre-construction surveys.

Halodule wrightii and S. filiforme were common species in the central seagrass areas I and J. The overall seagrass cover in Area I was low in the pre-construction surveys and low to moderate in the post construction survey while J maintained a low to moderate seagrass cover area through both survey periods.

In Area K, *H. decipiens* was the most abundant species in the pre-construction surveys with a lower abundance of *S. filiforme*. In the post construction survey, H. decipiens was absent while the abundance of S. filiforme was higher resulting in an overall low to moderate abundance of seagrass.

In the pre-construction surveys, Areas L, M, and N in the south and within the channel were low to moderate and moderate seagrass cover areas are dominated by *H. decipiens*. Again, *H. decipiens* was absent in the post construction surveys.

A small area with non-seagrass benthic resources was also observed in the southern part of this region on the western side of the channel wall. Numerous sponges and hard corals were noted in this area. These benthic resources were also found on the west wall of the channel, but not on the floor of the channel considered part of the dredging footprint. No changes were noted in this area post construction.

WEST REGION

Two large and one small seagrass areas were found within the west region of the 150m mixing zone (Figure 10). The largest area extends north from the southwestern region and two more areas are to the north. In both the pre and post construction surveys, drift red algae and macro green algae including *Halimeda* spp., *Udotea* spp., *Penicillus* sp., and *Caulerpa* spp. were observed throughout the seagrass areas. Outside of the largest seagrass area to the west is sand with sparse green algal coverage. To the north and east is an area with non-seagrass benthic resources including sponges, soft coral, algae, and sparse hard coral colonies. The benthic resources were also found on the west wall of the channel, but not on the floor of the channel considered part of the dredging footprint.

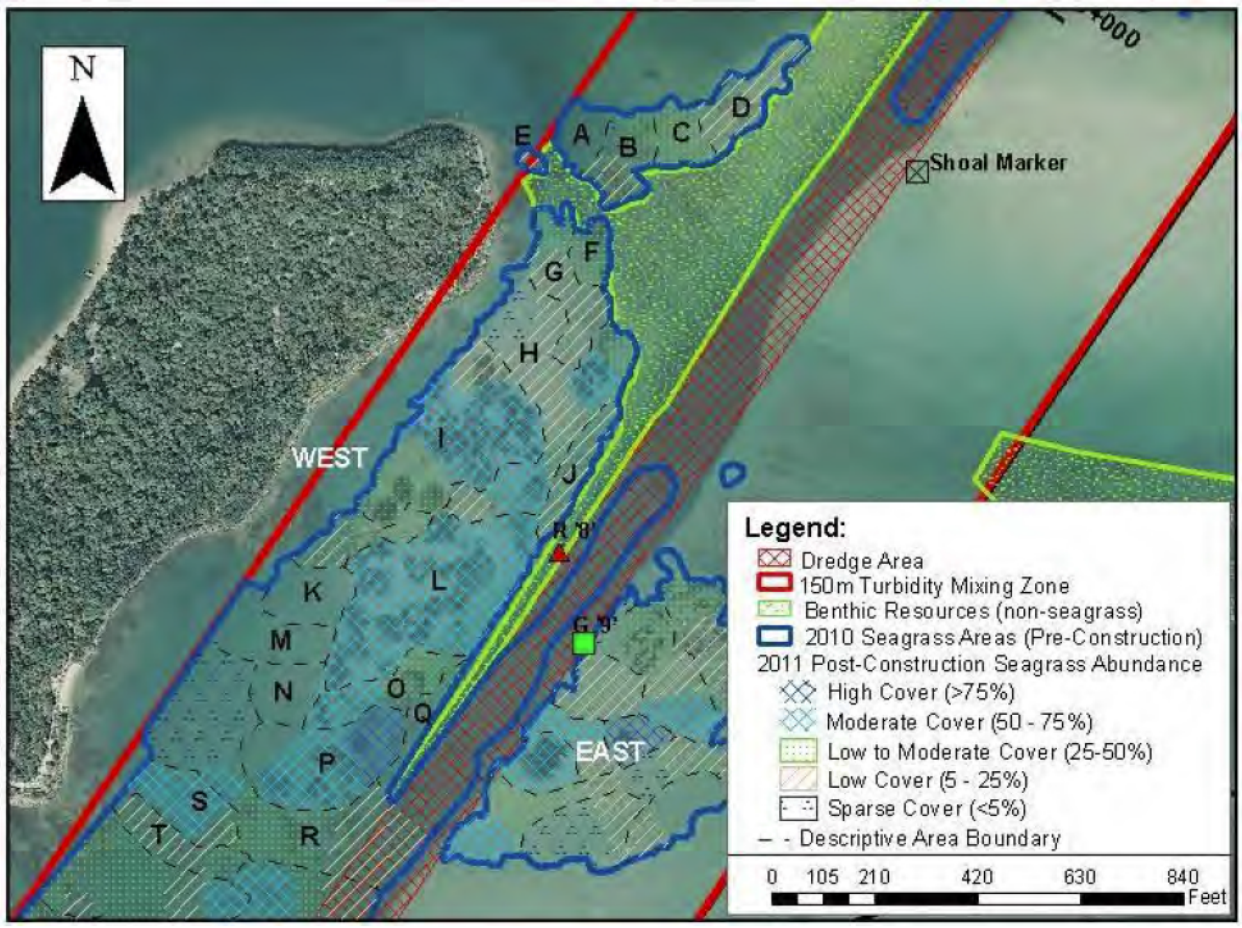

Figure 10. Seagrass areas in the west region of the mixing zone (2009 Aerials) based on post construction surveys.

In the northern most seagrass area in the west region, Area A was dominated by *H. decipiens* with low to moderate (25-50%) percent cover area in the pre-construction survey while in the post construction survey *H. decipiens* was absent. In the pre-construction survey, Area B was comprised of *S. filiforme* in the south and *H. wrightii*, *H. johnsonii*, and *H. decipiens* to the north. Both *H. johnsonii* and *H. decipiens* were absent from the post construction survey resulting in a

lower overall seagrass cover than prior to construction. *Syringodium filiforme* and *H. wrightii* were found in Area C and D in the pre and post construction surveys, but with lower abundance in post construction surveys. *Halophila johnsonii* was also present in Area C in the pre-construction surveys, but not in the post construction surveys. The absence of *H. johnsonii* and *H. decipiens* and lower abundance of *S. filiforme* and *H. wrightii* in the post construction survey resulted in lower overall seagrass abundance in Areas C and D.

The small seagrass patch in the northwest portion of the west region, Area E, consisted of *T. testudinum* with moderate (50-75%) cover in the pre-construction survey and low (5-25%) cover in the post construction survey.

In the large seagrass area in the western region, Areas F and G were dominated by S. filiforme followed by *H. wrightii* in both pre and post construction surveys. *Halophila johnsonii* was also present in these two areas prior to construction, but not in the post construction surveys. Area F had an overall low to moderate seagrass cover in the pre and post construction surveys. The seagrass cover in the majority of Area G was low in both survey periods except for the northern portion which showed a higher abundance of *S. filiforme* in the post construction assessment.

In pre-construction surveys, Area H had low to moderate (25 – 50%) seagrass cover with *H. wrightii* and *H. johnsonii* common in the north and central portions while *S. filiforme* and *T. testudinum* were more common in the eastern and southwestern portions. *Halophila johnsonii* was absent in post construction surveys reducing the overall seagrass abundance in the north and central portions to low. The northeastern and south central portion of Area H remained at low to moderate or moderate seagrass cover where *S. filiforme* abundance was higher in post construction surveys. The seagrass cover in the southwestern portion of Area H was lower due to the absence of *H. decipiens* in the post construction survey.

Areas I, L, and P were dominated by *Syringodium filiforme* and the majority of these areas maintained moderate seagrass cover in both the pre and post construction surveys. In Area L, *Halodule wrightii* was also present in the southern and east portions in both survey periods. In the northern and south portions of Area I, *S. filiforme* cover was lower in the post construction survey reducing the overall seagrass cover to low and low to moderate respectively. In the western portion of Area P, *H. decipiens* was present in the pre construction surveys, but not the post resulting in an area void of seagrass cover. The seagrass cover in eastern portion of Area P was higher in post construction surveys as a result of higher *S. filiforme* abundance.

Syringodium filiforme was the most abundant species in Area O with a lower abundance of *H. wrightii* in the eastern portion in both the pre and post construction surveys. Prior to construction, Area O had an overall low to moderate seagrass cover. The cover was higher in the western portion of this area in the post construction surveys due to a higher *S. filiforme* abundance.

In Area R, *S. filiforme* was the most abundant species in the central portion during both survey periods. *Halodule wrightii* was also present with a low abundance in the eastern portion of R during both surveys. *Halophila decipiens* was also abundant in the western areas and in the eastern areas located in the channel in the pre-construction surveys, but was absent in post

construction surveys. In the pre-construction surveys, Area R had low to moderate seagrass cover, but due to the absence of *H. decipiens* in the post construction survey the overall seagrass cover was reduced to sparse in the western portion and low in the eastern portion.

Area J maintained a low cover of seagrass in both the pre and post construction surveys. Halodule wrightii was common in both survey periods, but *H. decipiens* was only present in the pre-construction surveys.

Areas K, M, and N were dominated by *H. decipiens* in the pre-construction surveys with a low abundance of *S. filiforme* in the eastern portion of area K. In the post construction assessment, all three areas were void of seagrass resources.

In pre-construction surveys, Areas S and T had an overall moderate and low seagrass cover respectively. Area T and the eastern portion of Area S were dominated by *S. filiforme* while the western portion of Area S was dominated by *H. wrightii* in both survey periods. The western portion of Area S maintained the moderate seagrass cover in the post construction survey, but the seagrass cover was lower in the eastern portion due to a lower abundance of *S. filiforme*. The seagrass abundance remained the same in the western portion of Area T over the two survey periods, but was higher in the eastern portion due to high S. filiforme abundance in the post construction survey.

The benthic resources area identified in the north region extends to the south into the western region. The west wall of the channel falls into this area and is a small ledge with 1-3‘ relief. Along the entire length of this ledge and to the west of the channel, numerous sponge, soft coral, and stony coral species were observed. Some of the stony coral species observed include *Oculina diffusa*, *Stephanocoenia intersepta*, *Siderastrea* spp., *Solenastrea hyades*, *Porities* spp., *Madracis decactis*, *Meandrina meandrites*, and *Colpophyllia natans*. Larger stony coral colonies were mainly found on or close to the ledge. Smaller colonies (< 10cm diameter), mainly *Siderastera* spp., *Porites* spp., and *S. intersepta,* were observed farther to the west. Soft coral species, *Pseudopterogorgia* spp. and *Gorgonia ventalina*, were occasionally observed through out the area. Sponge species observed included *Desmapsamma anchorata, Dysidea* spp., *Cliona varians*, *Spheciospongia vesparium*, *Cliona* spp., *Chondrilla* spp., *Ircinia* spp., and *Niphates digitalis*. The benthic resources were not on the floor of the channel that was part dredging footprint. No changes to these resources were observed in the post construction survey.

SUMMARY

During the post construction surveys, excessive sedimentation or physical injury to the seagrass beds as a result of dredging activities was not observed. Although not attributable to dredging activity, sand burial of seagrass was observed at the northern part of the Southeast Region as a result of the migrating sand shoal.

Overall, the seagrass cover in the vicinity of Haulover ICW Maintenance Dredging was lower in post construction surveys than in the pre-construction surveys. Within the channel, the decline in

seagrass cover could be partially attributed to authorized dredging activity. However, outside of the channel, the lower seagrass abundance is most likely attributed to normal seasonal declines as the pre-construction survey efforts were conducted in late summer/early fall during the peak growing season while the post construction surveys were carried out in colder, winter months. The seasonal variation is especially true for both *H. decipiens* and *H. johnsonii* species which were generally absent in the post construction surveys. Other fluctuations in the seagrass cover before and after construction may be attributed to the random quadrat placement methodology utilized for these surveys.

Based on the post construction survey efforts, the changes observed in the seagrass cover in the vicinity of the Haulover ICW do not appear to be a result of dredging activities, but as a result of seasonal changes and random survey methodology.

PRE-APPLICATION SURVEYS
FOR
MAINTENANCE DREDGING OF THE
BAKERS HAULOVER INLET NORTH ACCESS CHANNEL
AND THE INTRACOASTAL WATERWAY
IN THE VICINITY OF VICINITY OF BAKERS HAULOVER INLET
PROJECT #: ICW-DA-08-04

INTRODUCTION:

The following maps and information are submitted as partial fulfillment of an interlocal agreement by and between Miami-Dade County's Department of Environmental Resources Management and the Florida Inland Navigation District for project ICW-DA-08-04 for services associated with demarcation and description of benthic resources inside Bakers Haulover Inlet, and specifically within the area being considered for maintenance dredging. The agreement called for identification and description of seagrass and other benthic resources in two areas: a 150 meter turbidity mixing zone surrounding the area of the planned dredging area and the anticipated dredge pipeline corridor. Other benthic resources include areas where algae, sponges, soft corals, and sparse hard corals were observed.

From June 11th to July 21st, 2008, the 150m turbidity mixing zone surrounding the proposed maintenance dredge area and the proposed pipeline corridor in the vicinity of Bakers Haulover Inlet were surveyed to assess and identify benthic resources including seagrass beds. Seagrass areas were defined and approximate abundance quantified throughout the area. Seagrass areas were traced using Garmin GPS 76, the traces were downloaded using Trackmaker software, and subsequently incorporated into a GIS program (ArcView®) to produce the maps contained herein. All GIS shape files (NAD83) created during the mapping process are provided.

Approximate abundance or cover values of sea grasses and benthic organisms were assessed using Braun-Blanquet Cover Abundance (BBCA) methodology. This methodology utilizes visual observations of the habitats to estimate the abundance and benthic cover of the components of the benthic community. Estimates, provided in the subsequent text, are based on the following abundance scale:

Table 1: Braun-Blanquet Abundance Scale

Scale	% Cover	Description
5	> 75%	High
4	50-75%	Moderate
3	25-50%	Low to Moderate
2	5-25%	Low
1	<5%	Sparse
0.5		Few individuals with small cover
0.1		Solitary

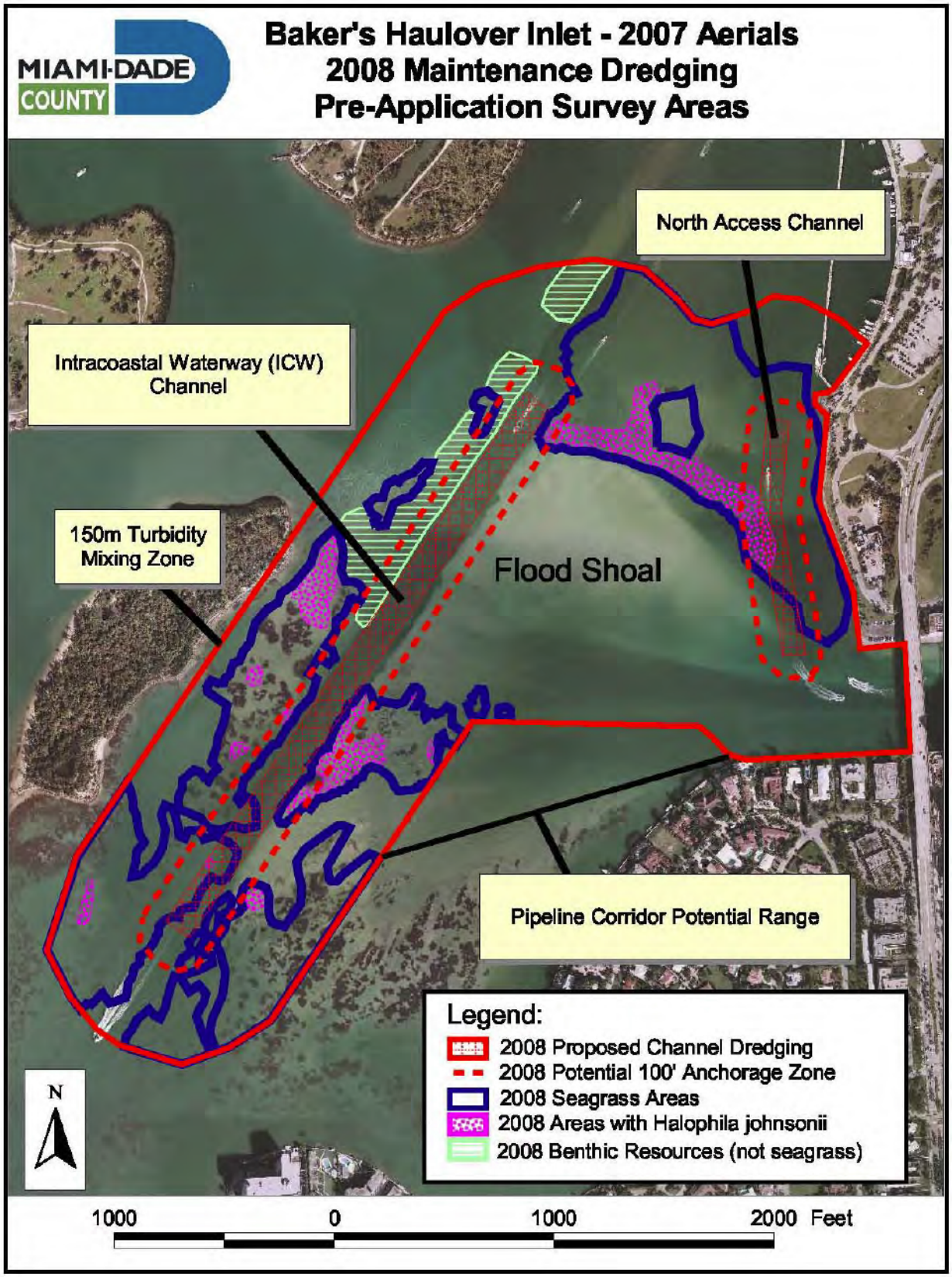

Figure 1. Bakers Haulover Inlet North Access and Intracoastal Waterway Channels proposed maintenance dredging locations.

RESULTS:

Figure 1 shows the overall project area including the 150m turbidity mixing zone, the navigation channels to be dredged, and the proposed pipeline corridor. The mixing zone was broken down into geographic regions (Northeast, East, Southeast, Southwest, West, and Northwest) to allow for descriptions of the benthic resources on a smaller scale.

NORTHEAST REGION

The northeast region of the mixing zone is mainly characterized by sparse to low seagrass coverage that begins north of the shoal and extends through the edge of the mixing zone (Figure 2). This area begins in the ICW channel to the west, extends to the seawall of Haulover Park to the east, and includes the Bakers Haulover Inlet north access channel. The area northeast of the seagrass was barren sand with a few isolated sponges. A barren sandy area was also observed in the center of the larger seagrass area. Throughout the northeast region, drift red algae and macro-green algae (*Halimeda* spp. and *Caulerpa* spp.) were also observed.

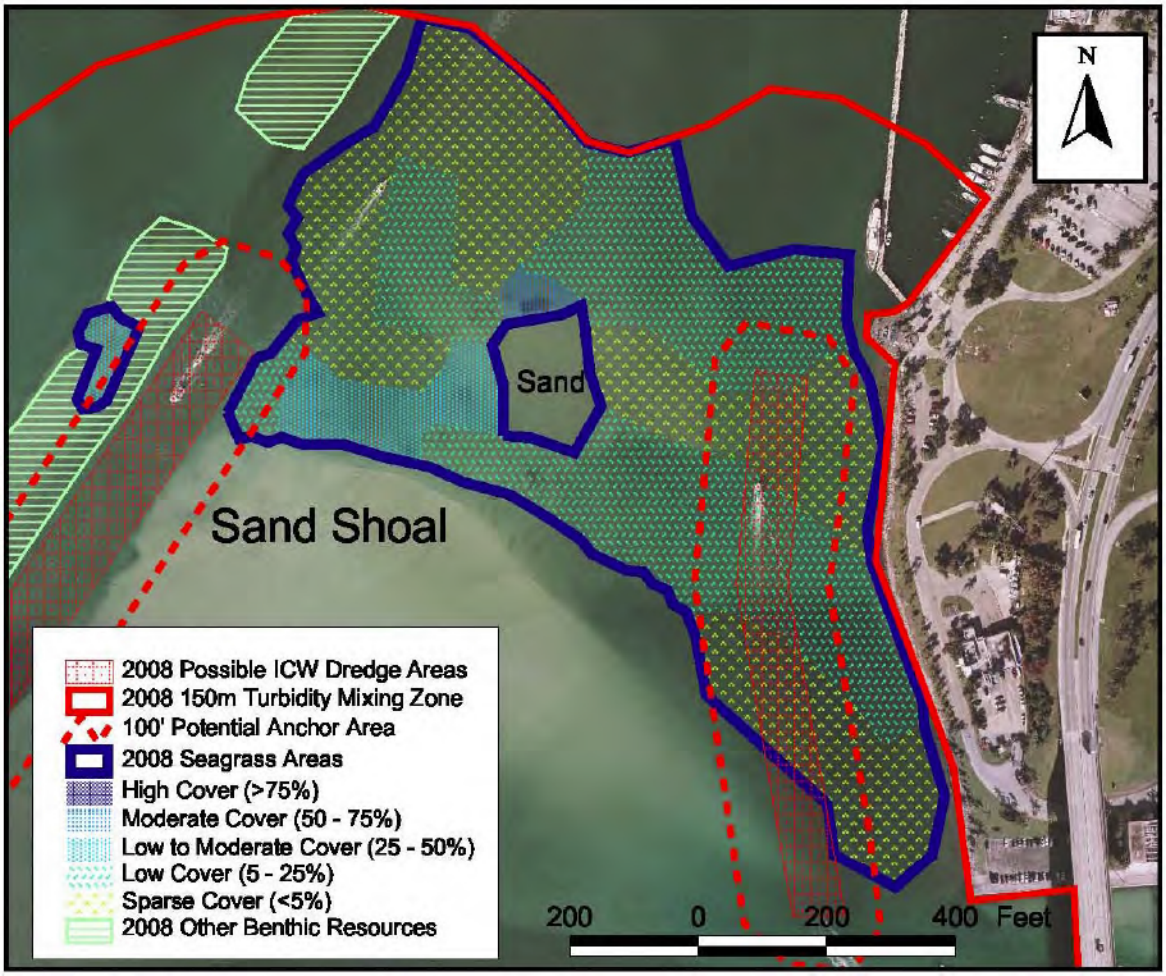

Figure 2. Seagrass areas in the northeast region of the mixing zone (2007 aerials).

The north, east, and southeast portions of this area are dominated by sparse (<5% cover) to low (up to 25% cover) of *Halophila decipiens*. Just north of the central sand area, a patch of *Syringodium filiforme* with moderate cover (50-75%) was observed. Along the southern edge of the seagrass area (just north of the sand shoal), a variety of seagrass species were observed including *Halodule wrightii*, *S. filiforme*, *H. decipiens*, and the threatened species *Halophila johnsonii* with low to low to moderate densities, 5-50% cover (Figure 3). The observed range of *H. johnsonii* in the northwest region is shown in Figure 1.

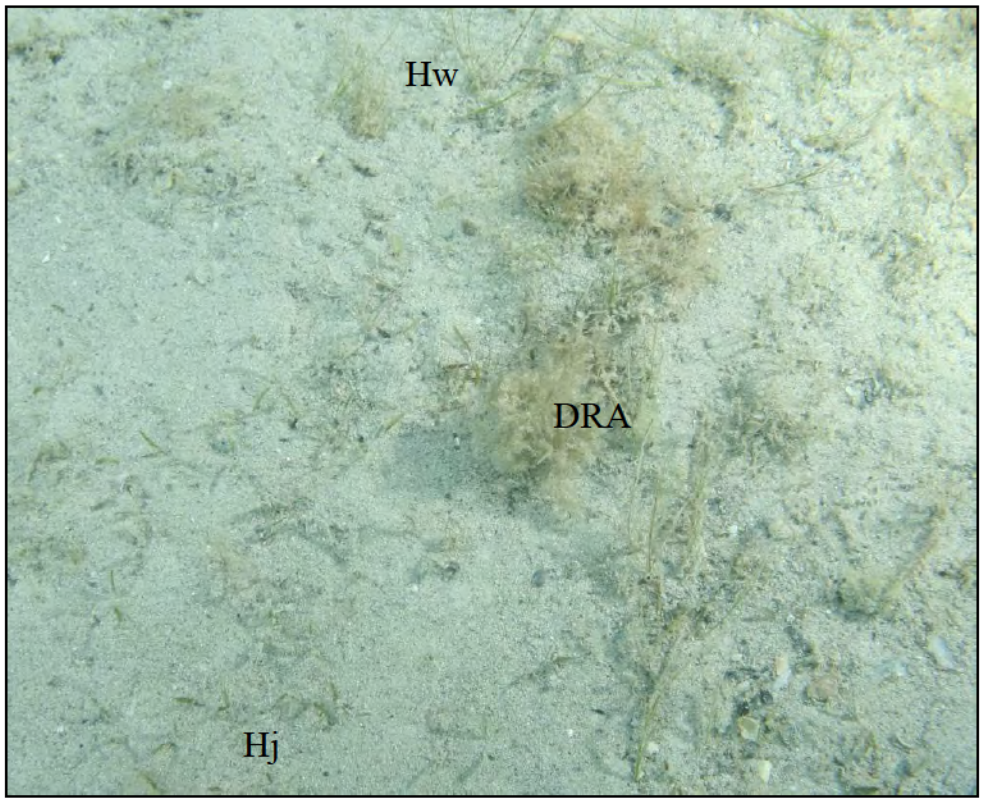

Figure 3. *Halodule wrightii* (Hw), *Halophila johnsonii* (Hj), and drift red algae (DRA) in seagrass area north of shoal.

EAST REGION

Three different seagrass areas, **E-1, E-2**, and **E-3**, were found within the eastern region of the mixing zone (Fig. 4). Drift red algal species and macro-algae species (*Halimeda* spp., *Batophora* spp., *Penicillus* spp., *Udotea* spp., and *Caulerpa* spp.) were common throughout the seagrass areas. To the north of the seagrass areas was sand with a blue-green algal turf.

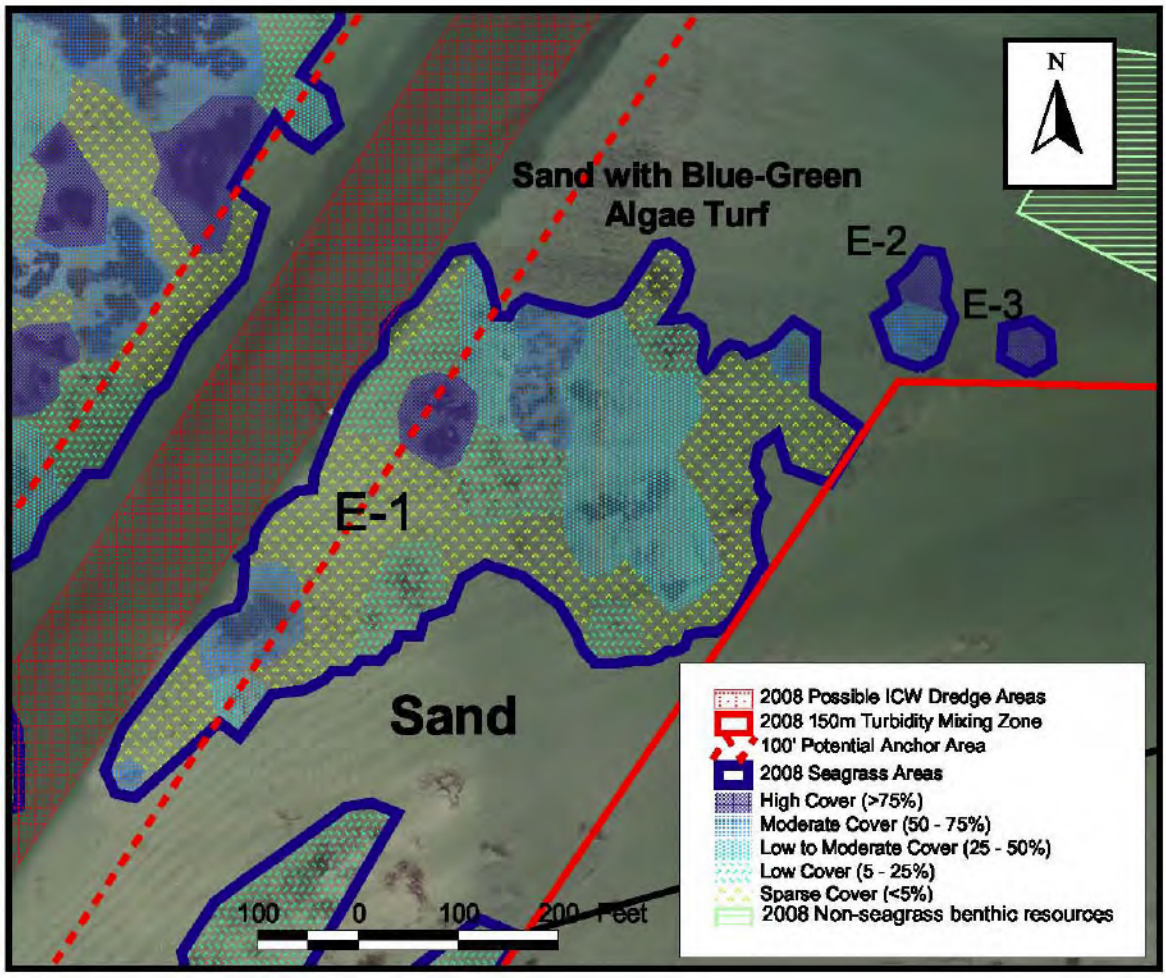

Figure 4. Seagrass areas in the eastern region of the mixing zone (2007 Aerials).

The largest seagrass area, **E-1**, was comprised of several seagrass and algal species with a wide range of abundance. The areas with high (>75%) and moderate (50-75%) percent seagrass cover were dominated by dense *Syringodium filiforme* beds. The north moderate cover area in the center of E-1 also had *Thalassia testudinum* around the edges of the *S. filiforme* beds. *Halodule wrightii* and *H. decipiens* were also observed in the moderate percent cover area in the northeast. The low to moderate seagrass cover areas (25-50% cover) were comprised of *H. wrightii* in the south, *S. filiforme, T. testudinum* and *H. wrightii* in the northwest, *S. filiforme* and *H. wrightii* in the center, and *S. filiforme* in the Northeast. The sparse (<5%) and low (5-25%) cover areas throughout E-1 were comprised of *H. wrightii* and *H. johnsonii*. The threatened seagrass *H. johnsonii* was observed throughout the western area of E-1 along the ICW channel and in a

smaller area on the west and north edge. The observed range of *H. johnsonii* in the east region is shown in Figure 1.

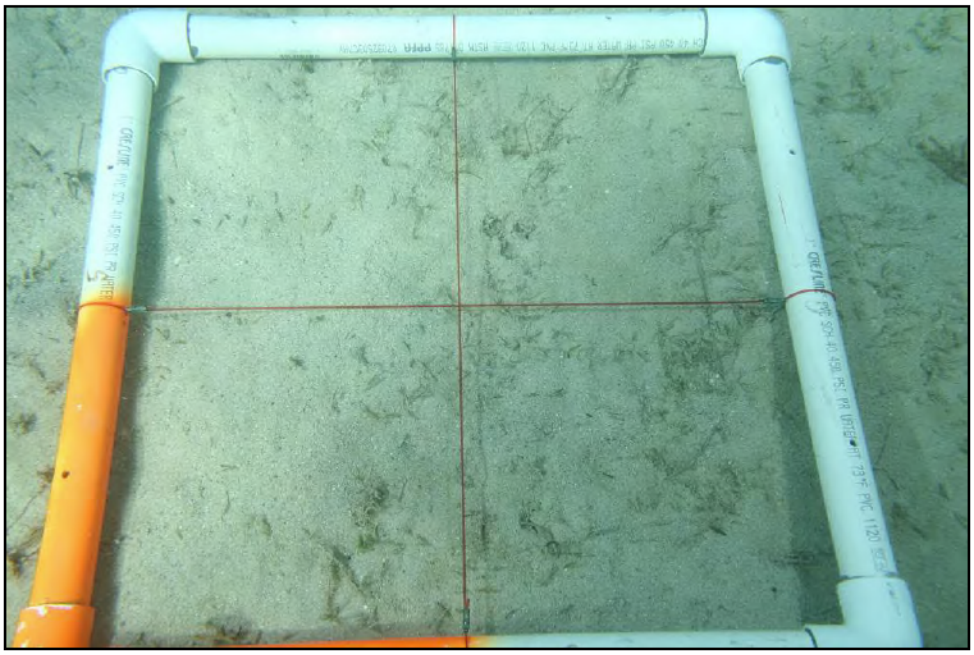

Figure 5. *Halophila johnsonii* in the western portion of E1.

Seagrass Area E2 and E3 were comprised of two seagrass species—*Halodule wrightii* and *Syringodium filiforme* (Fig. 4). Both areas were dominated by *S. filiforme* with a lower percent cover of *H. wrightii*.

Figure 6. *Syringodium filiforme* bed in E-2.

SOUTHEAST REGION

Four well-defined seagrass areas, **SE-1, SE-2, SE-3**, and **SE-4** were found within the southeastern region of the mixing zone (Figure 7). Drift red algae and macro green algae were also found through the seagrass areas in the southeast region. North of SE-4, barren sand now covers what appears to be seagrass in the 2007 Aerials.

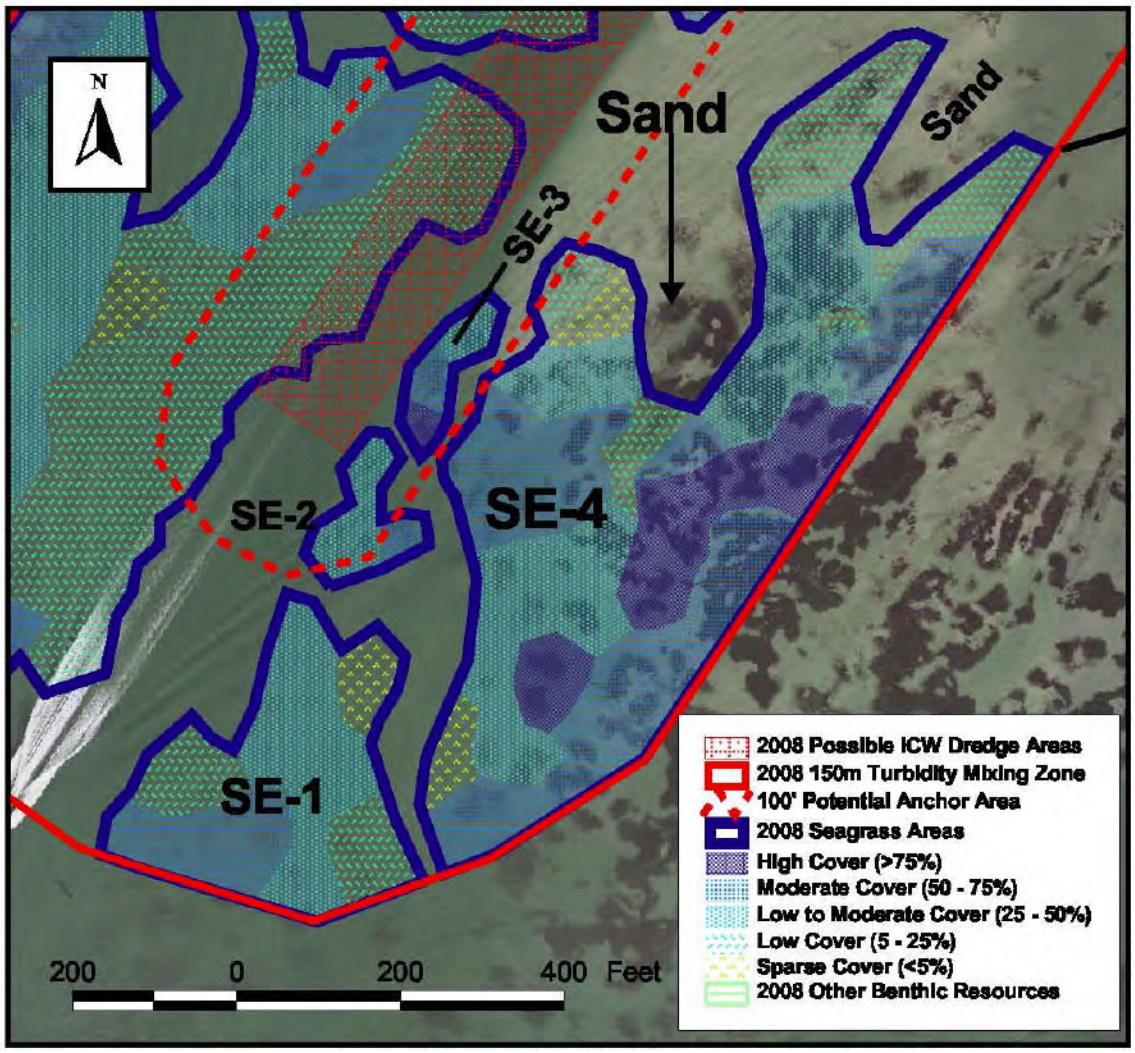

Figure 7. Seagrass areas in the southeastern region of the mixing zone (2007 Aerials).

The southern most seagrass area **SE-1** was comprised of varying abundances of *Halodule wrightii*, *Syringodium filiforme,* and *Halophila decipiens*. The moderate (50-75%) percent cover area in the south contained *H. wrightii*. The low to moderate (25-50%) percent cover area contained *S. filiforme* in the south, *H. decipiens* in the center, and *S. filiforme* and *H. wrightii* in the north. *Syringodium filiforme, H. wrightii*, and *H. decipiens* were observed in the low (5-25%) percent cover seagrass areas. *Halophila decipiens* was observed with sparse coverage (<5%) in the northeastern portion of SE-1.

The seagrass areas **SE-2 and SE-3** were dominated by varying percent cover of *S. filiforme* (Figure 8). In the eastern portion of SE-2, a low abundance of *T. testudinum* also surrounded the dense beds of *S. filiforme* (Figure 8A).

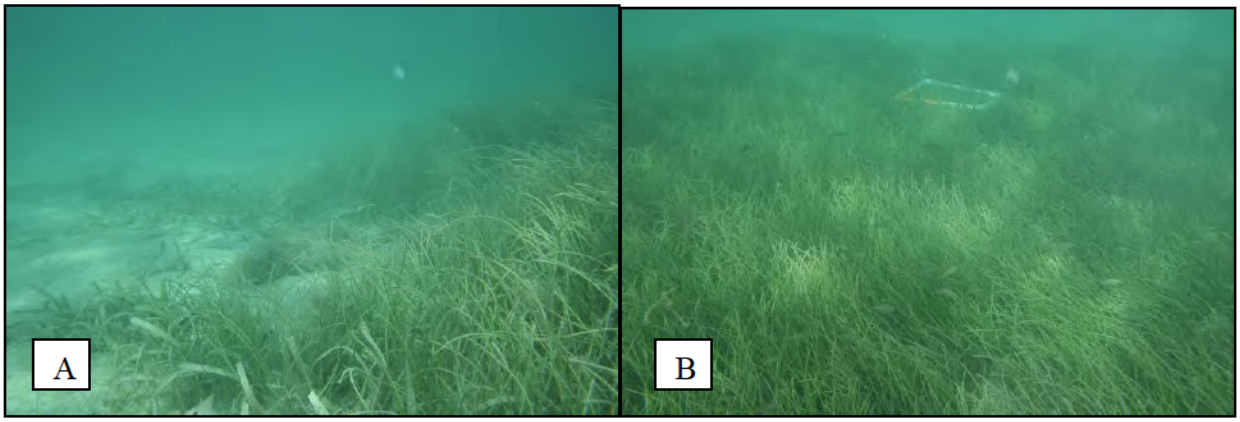

Figure 8. A) *Syringodium filiforme* bed with *Thalassia testudinum* around the edges in SE-2; B) Dense *S. filiforme* bed in SE-3.

The large seagrass area **SE-4** was comprised of varying abundances of *H. wrightii*, *S. filiforme, H. decipiens*, and *H. johnsonii*. Dense *S. filiforme* beds were responsible for the areas with high percent seagrass cover. Occasionally, these *S. filiforme* beds had *T. testudinum* around the edges. The moderate percent cover areas of SE-4 were also dominated by dense *S. filiforme* beds with occasional dense *H. wrightii* beds. Again, several of *S. filiforme* beds had *T. testudinum* around the edges. The central low to moderate percent cover areas were comprised of *S. filiforme* and to a lesser extent *H. wrightii*. The only seagrass observed in the low to moderate coverage area in the northwest and the low coverage areas in the center and north was *H. wrightii*. A sparse coverage of *H. wrightii* was observed in the south and in the northwest portions of SE-4. The threatened species *H. johnsonii* was also observed in the sparse coverage area in the northwest. The observed range of *H. johnsonii* in the southeastern region is shown in Figure 1.

SOUTHWEST REGION

One large seagrass area is found within the southwest region of the 150m mixing zone (Figure 9). This seagrass area does extend beyond the mixing zone to the west and into the ICW channel to the east. Through out the seagrass area drift red algae and macro green algae including *Halimeda* spp., *Udotea* spp., and *Caulerpa* spp. were observed. Outside of the seagrass area is sand with sparse green algal coverage.

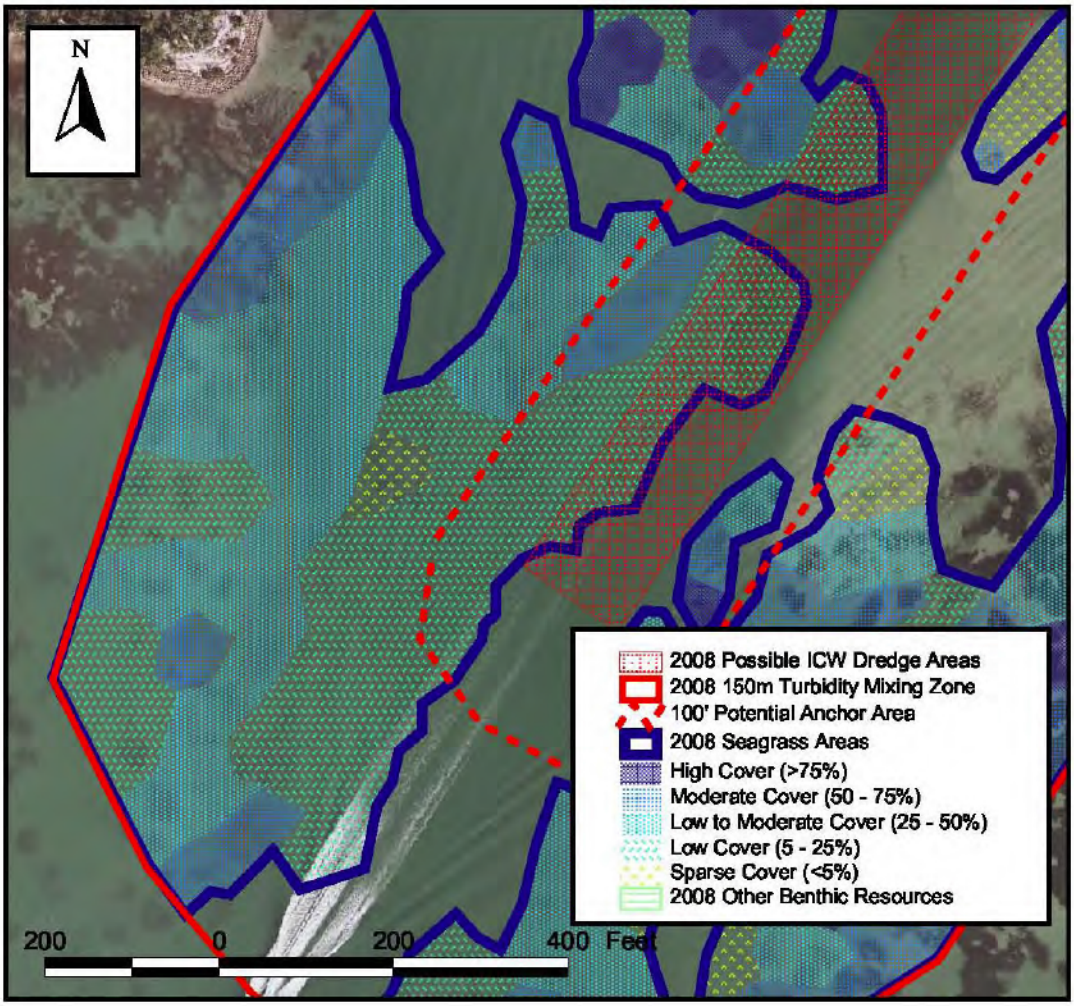

Figure 9. Seagrass areas in the southwestern region of the mixing zone (2007 Aerials).

Syringodium filiforme was the dominant seagrass species in the moderate coverage (50-75%) coverage areas through out this region. In the south and west moderate coverage areas, *Thalassia testudinum* was also observed, mainly with low abundance on the edge of the *S. filiforme* beds. *Halodule wrightii* was also observed with low abundance in the western moderate coverage areas. The low to moderate coverage (25-50%) areas contained both *S. filiforme* and *H. wrightii* and to a lesser extent *Halophila decipiens*. *Halodule wrightii* was more prevalent in the north central area (Figure 10) while *S. filiforme* was more abundant in the western and northeastern low to moderate coverage areas. In the sparse (<5%) and low coverage

(5-25%) areas, *S. filiforme*, *H. wrightii,* and *Halophila decipiens* were observed. *Halodule wrightii* and *H. decipiens* were observed in the east along the channel. *Halophila decipiens* coverage extended farther east into the channel. The low *S. filiforme* coverage was observed in the south and western portions of the region. A small area of *Halophila johnsonii* was observed in the low and low to moderate coverage areas in the west. The extent of the observed range of *H. johnsonii* is shown in Figure 1.

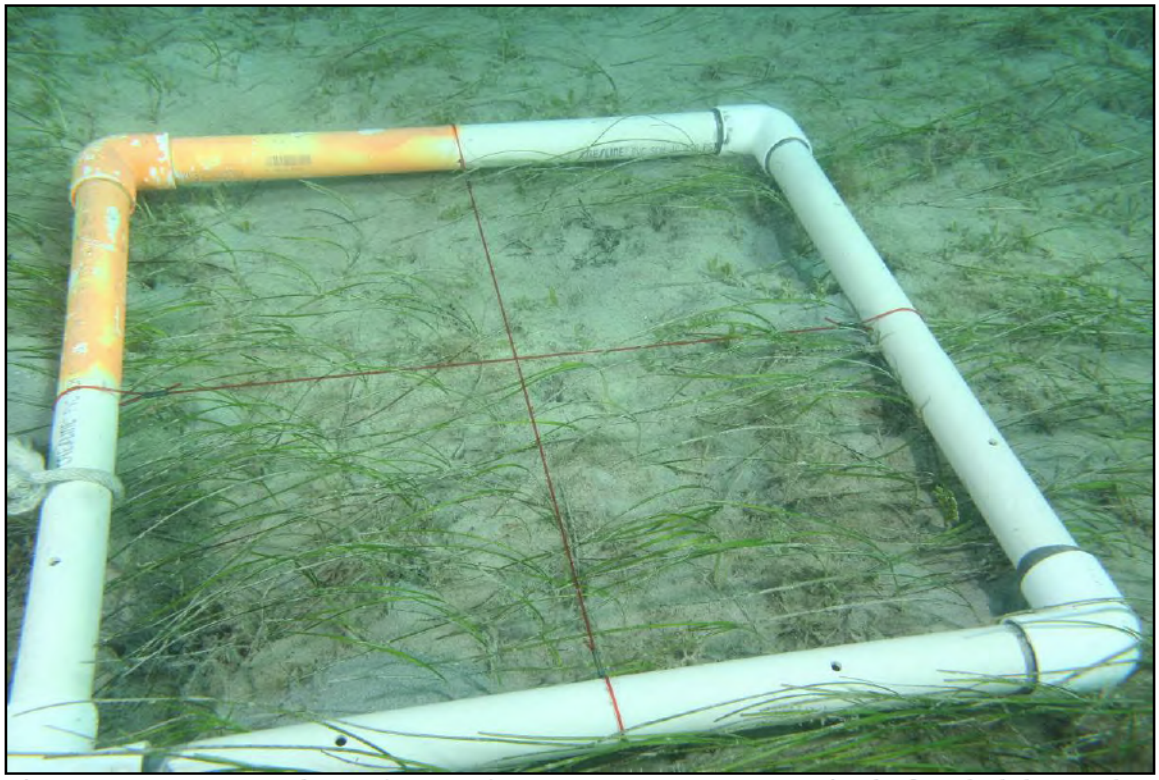

Figure 10. Low to moderate (25-50%) seagrass coverage comprised of *Halodule wrightii* and *Halophila decipiens* in the southwest region.

WEST REGION

One large seagrass area is found within the west region of the 150m mixing zone (Figure 11). The southern portion of this seagrass area does extend into the ICW channel to the east. Through out the seagrass area drift red algae and macro green algae including *Halimeda* spp., *Udotea* spp., *Penicillus* sp., and *Caulerpa* spp. were observed. Outside of the seagrass area to the west is sand with sparse green algal coverage and to the north is an area with sponges, soft coral, algae, and sparse hard coral colonies.

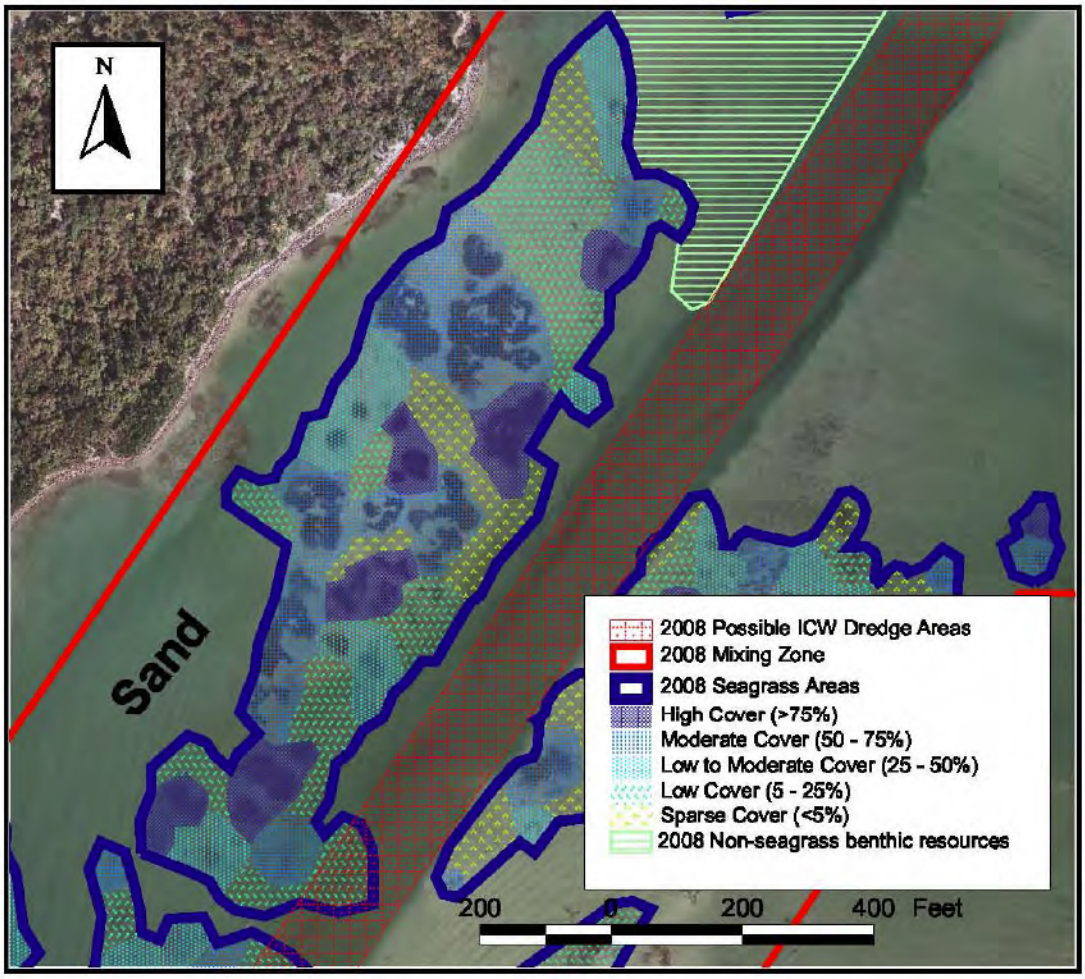

Figure 11. Seagrass areas in the west region of the mixing zone (2007 Aerials).

The high percent cover areas (>75%) within the west region were all dense *Syringodium filiforme* beds. *Syringodium filiforme* was also the dominant seagrass species in the moderate coverage (50-75%) areas through out this region except the northern most area (Figure 12). In this area, both *S. filiforme* and *Halodule wrightii* were abundant. The low to moderate (25-50%) cover areas were comprised of *S. filiforme* in the south and *S. filiforme*, *H. wrightii*, and *Halophila decipiens* in the central and north. *Halophila johnsonii* was also present in the northern most low to moderate coverage areas.

Figure 12. Moderate (50-75% cover) seagrass area with *Syringodium filiforme* and *Halodule wrightii* in the northern part of the west region.

Halodule decipiens was present in the low percent seagrass coverage areas in the south and west. In the central low coverage areas, *S. filiforme* was present in the east and *H. decipiens* in the west. The low coverage areas in the north were composed of *H. wrightii a*nd *H. johnsonii* (Figure 13) with *H. decipiens* toward the east. The sparse seagrass coverage areas were composed of *S. filiforme* in the center and *H. decipiens* and *H. johnsonii* toward the east. The full observed range of *H. johnsonii* in the west region is shown if Figure 1.

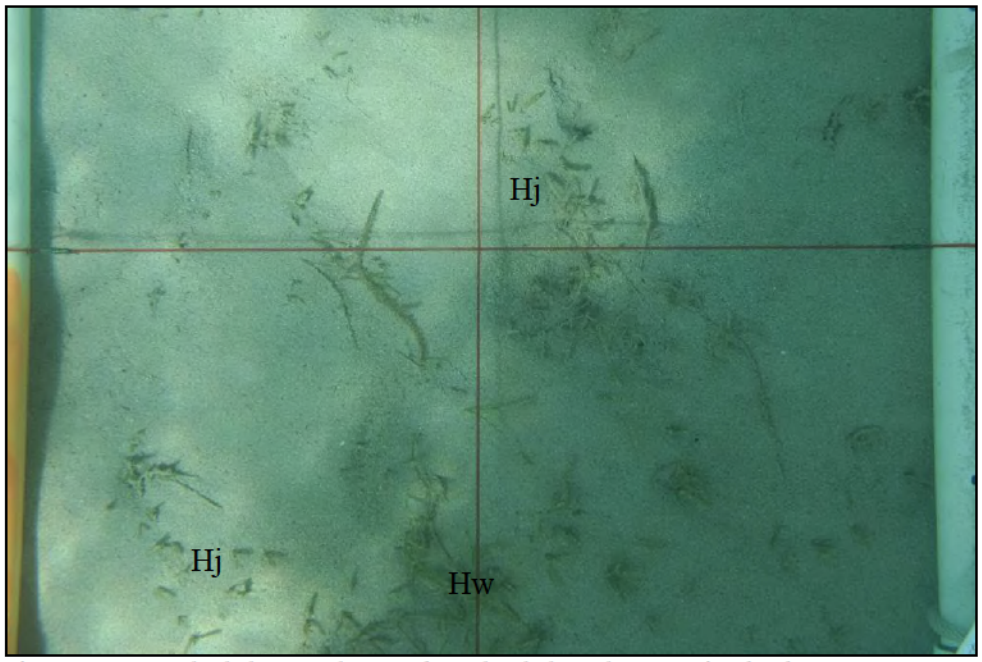

Figure 13. *Halodule wrightii* and *Halophila johnsonii* in the low coverage (5 -25%) areas of the west region.

NORTHWEST REGION

Two seagrass areas were found within the northwest region of the 150m mixing zone (Figure 14). To the west of the seagrass areas was sand with sparse algae (mainly Udotea spp. and *Caulerpa* spp.). To the east of the seagrass area was a sand and rubble area with algae, sponges, soft coral, and occasional stony corals.

In seagrass area **NW-1**, *Syringodium filiforme* beds made up the moderate percent cover area and the southern portion of the low to moderate cover areas. The northern portion of the low to moderate coverage area within NW-1 consisted of *Halodule wrightii*. In **NW-2**, the low to moderate percent cover area consisted of *H. wrightii* in the south and *Thalassia testudinum* in the north. In both seagrass areas, drift red algae and macro green algae including *Halimeda* spp., *Udotea* spp., *Penicillus* sp., and *Caulerpa* spp. were observed.

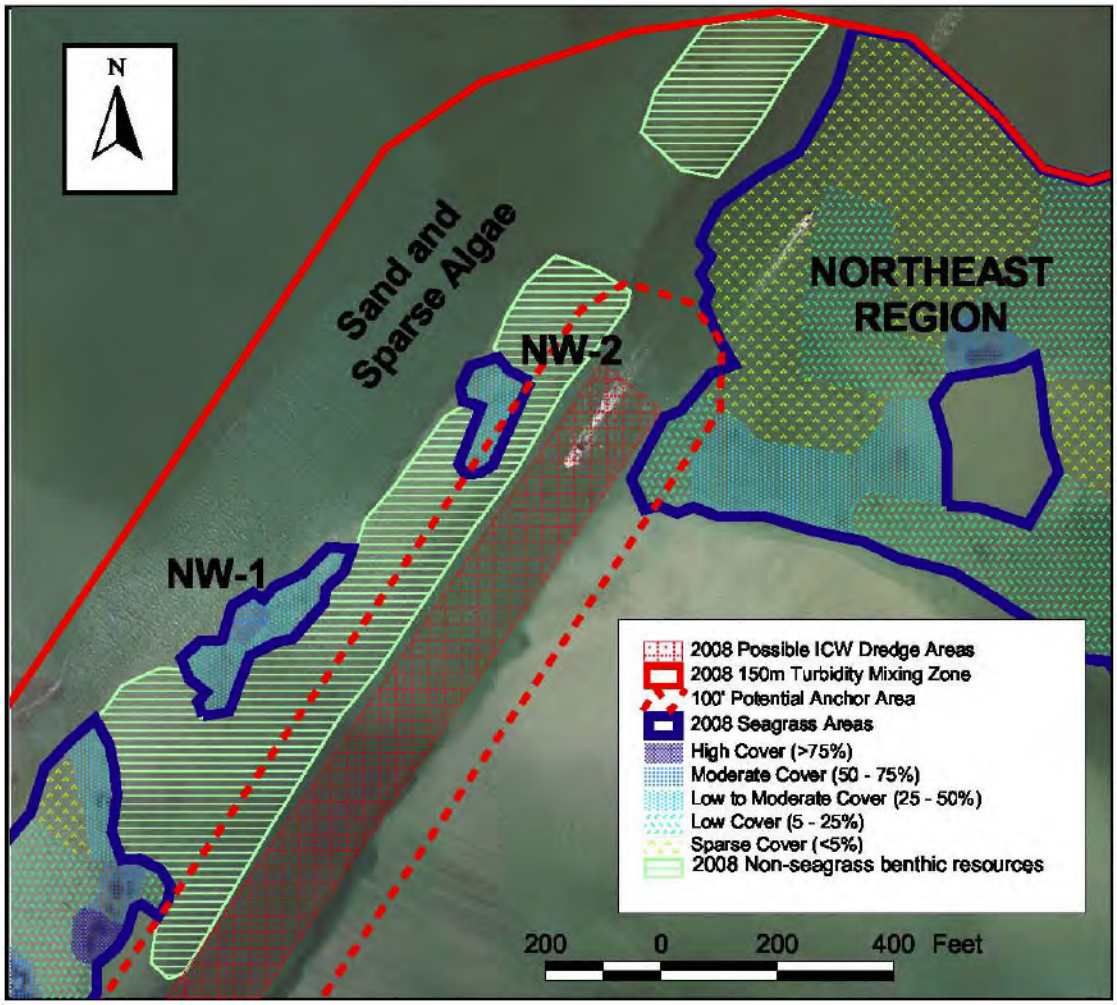

Figure 14. Seagrass areas and other benthic resources in the northwest region of the mixing zone (2007 Aerials).

The west wall of the channel is a small ledge with 1-3' relief. This small ledge extends to the south into the West Region. Along the entire length of this ledge and to the west of the channel, numerous sponge, soft coral, and stony coral species were observed. Some of the stony coral species observed include *Oculina diffusa*, *Stephanocoenia intersepta*, *Siderastrea* spp., *Solenastrea hyades*, *Porities* spp., *Madracis decactis*, *Meandrina meandrites*, and *Colpophyllia natans*. Larger stony coral colonies were mainly found on or close to the ledge. Smaller colonies (< 10cm diameter), mainly *Siderastera* spp., *Porites* spp., and *S. intersepta,* were observed farther to the west. Soft coral species, *Pseudopterogorgia* spp. and *Gorgonia ventalina*, were occasionally observed through out the area. Sponge species observed included *Holopsamma helwigi*, *Dysidea* spp., *Anthosigmella varians*, *Spheciospongia vesparium*, *Cliona* spp., *Chondrilla* spp., *Ircinia* spp., and *Niphates digitalis*.

PIPELINE CORRIDOR:

Figure 15 shows the proposed pipeline corridor. The northern portion of the pipeline corridor is the sand shoal. The central region is characterized by rubble substrate with dense algal cover and large barrel sponges such as *Spheciospongia vesparium*. The southern eastern area does contain seagrass areas that were described as part of the East Region.

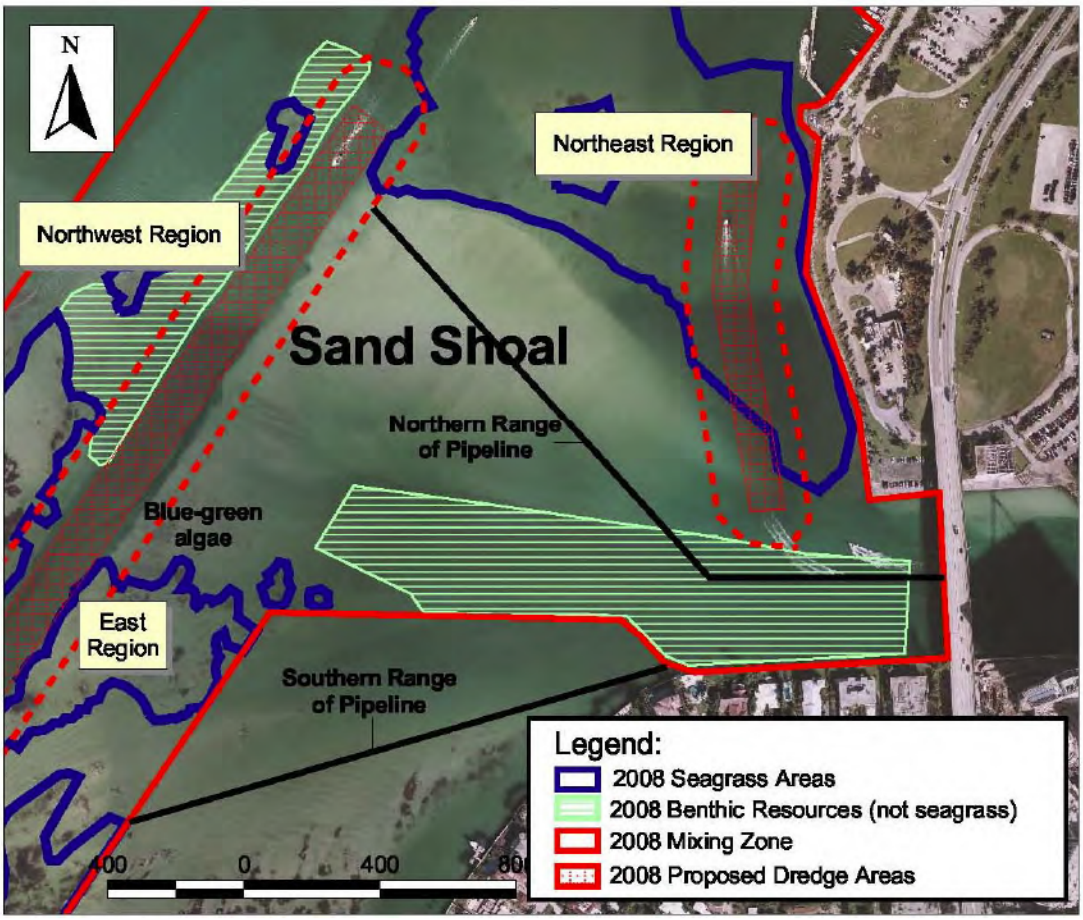

Figure 15: Proposed Pipeline Corridor Area.

COMPARISON BETWEEN 2006 AND 2008 SURVEYS

In June of 2006, approximately 2000 feet of maintenance dredging of the Intracoastal Waterway Channel adjacent to Baker's Haulover Inlet was conducted in the northern portion of the approximately 3000-foot permitted dredge area (from approximately 100 feet southwest of channel marker 6A to approximately 300 feet southwest of channel marker 9). As part of the pre and post construction assessments for the maintenance dredging, the Department of Environmental Resources Management surveyed the benthic community in this area. The pre-construction surveys were conducted in February and March of 2006. The perimeters of the seagrass areas observed during this pre-construction survey are shown in Figure 16 along with the seagrass areas observed in the 2008 survey. Figure 17 shows the approximate percent cover of the seagrass beds from the 2006 surveys while the cover estimates from the 2008 surveys are shown separately by region in Figures 2, 4, 7, 9, 11, and 14. Table 2 lists the approximate seagrass cover in acres by region. The given acreage was calculated from the area of the ArcView shape files created from the traced perimeter of the seagrass beds. Differences in the extent and cover of the seagrass beds were observed between the 2006 and 2008 surveys as indicated in Figure 16 and Table 2.

Table 2. Approximate seagrass acreage based on percent cover estimates.

		Acres of Seagrass based on Percent Cover Estimates					
Region	Year	Sparse (<5%)	Low (5 - 25%)	Low-Mod. (25 -50%)	Moderate (50 -75%)	High (>75%)	Total Acres
Northeast (2006)	2006		2.63	0.16	0.41	0.16	3.36
	2008	2.53	1.95	1.40	0.02		5.90
Northeast (2008 ext.)	2006						N/A
	2008	7.70	8.69	0.01	0.24		16.64
East & Pipeline	2006		0.18	2.02	0.56	1.37	4.13
	2008	10.23	10.63	1.41	0.26		22.53
Southeast	2006		1.25	2.67	2.84	1.68	8.44
	2008	0.45	1.64	3.15	2.94	1.02	9.20
Southwest	2006			3.40	1.23	0.61	5.24
	2008	0.13	4.11	3.39	1.39		9.02
West	2006			0.71	1.05	2.49	4.25
	2008	1.38	2.81	1.32	2.47	0.89	8.87
Northwest	2006						0.00
	2008			0.76	0.09		0.85

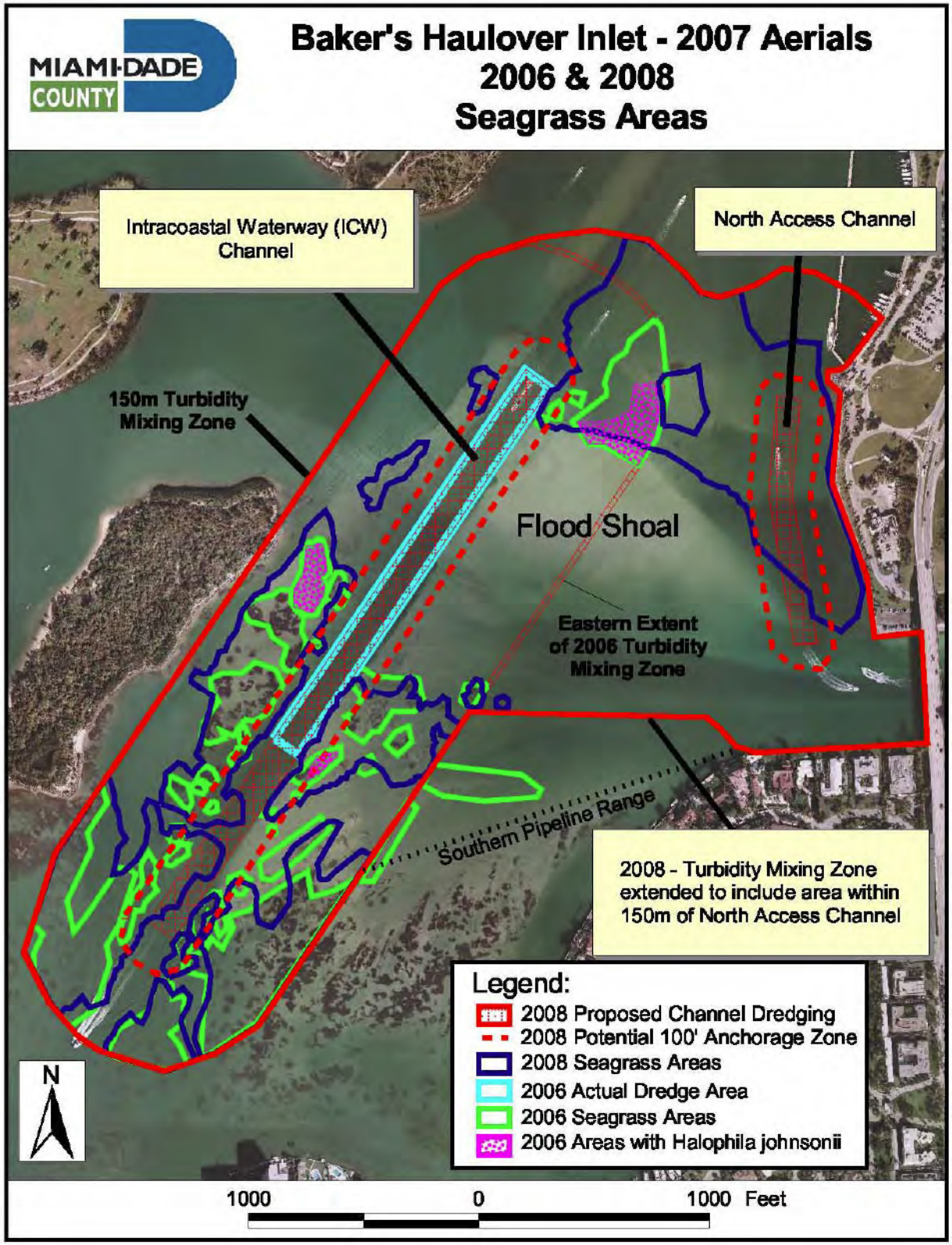

Figure 16. Bakers Haulover Inlet North Access and Intracoastal Waterway Channels maintenance dredging locations depicting the 2006 and 2008 seagrass areas. Note: In 2006, only the northern 2/3 of the proposed dredging area was actually dredged.

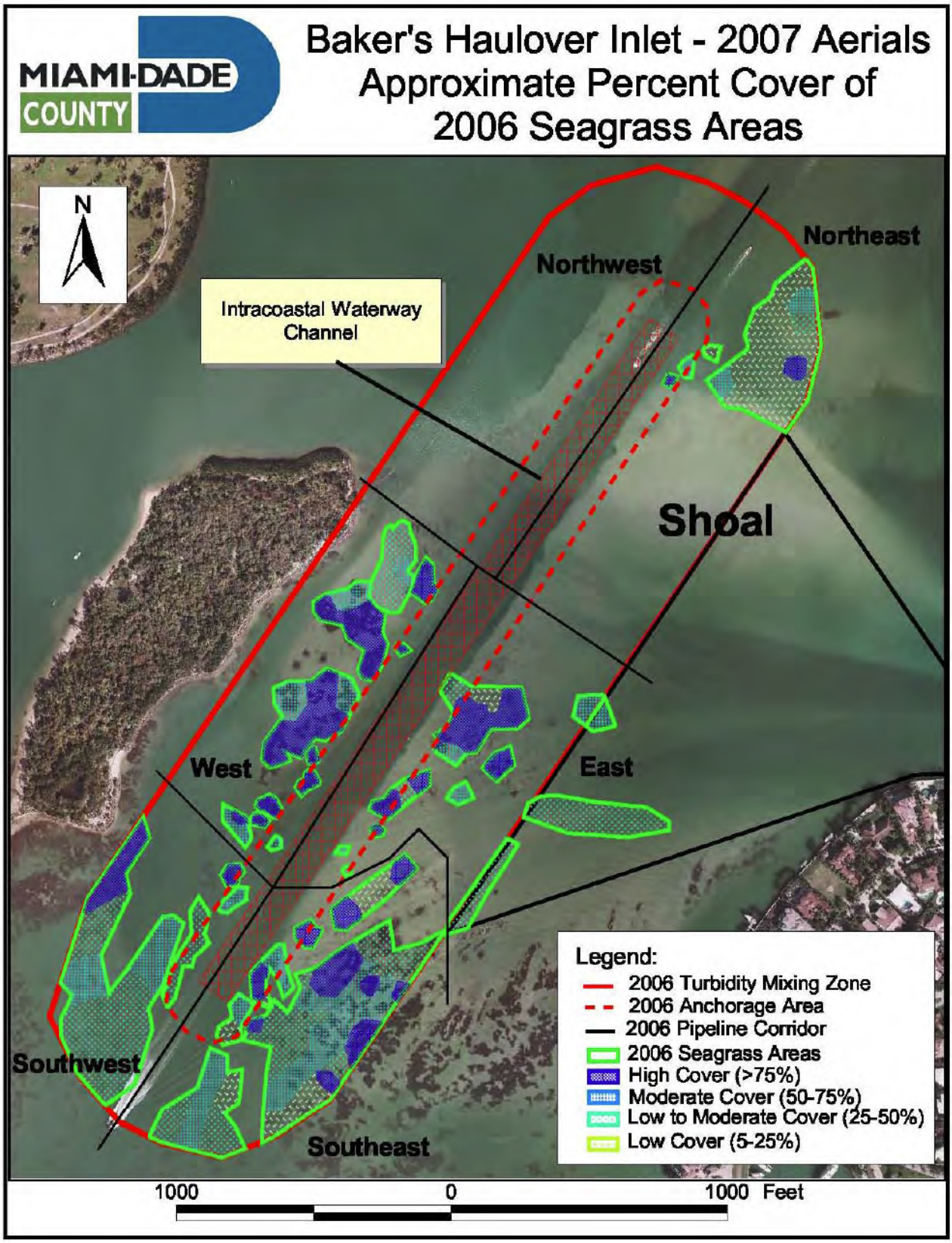

Figure 17. Approximate 2006 seagrass cover near the Intracoastal Waterway Channel adjacent to Bakers Haulover Inlet based on the pre-construction surveys.

Northwest Region: Comparison of the 2006 and 2008 survey data indicates that approximately 0.41 acres of seagrass in the Northeast Region was buried due to the southern expansion/accretion of the sand shoal. This area had low to moderate seagrass coverage (5 - 75%) comprised of *H. wrightii, H. johnsonii, H. decipiens*, and *S. filiforme*. However, overall the area where seagrass was present in the Northwest Region (based on the total area surveyed in 2006) increased from 2006 to 2008. Seagrass areas mainly composed of *H. decipiens* extended farther to the north and west in this region although with sparse coverage of less than 5%. Additional area was surveyed in 2008, to incorporate the mixing zone around the North Access Channel. The acreage of this extended survey area was tabulated separately and also included in Table 2.

Eastern Region: In the Eastern Region and the Pipeline Corridor, seagrass areas were also buried by sand (Figure 16). Approximately 0.51 acres of low to low-moderate coverage (5 – 50%) seagrass areas were buried mainly in the northern portion with a smaller area in the southern portion of the eastern region. In the pipeline corridor, two seagrass areas found in 2006 were not observed in the 2008 surveys totaling approximately 1.52 acres. Both areas in the Eastern and Pipeline Corridor areas buried by sand were primarily composed of *H. wrightii*. Similar to the Northwest Region, the overall seagrass area increased from 2006 to 2008 in the Eastern Region (Table 2). The increase in seagrass coverage is due to the presence of sparse and low cover areas between and surrounding the denser *S. filiforme* seagrass patches (Figure 6). The sparse and low coverage areas were comprised of *H. wrightii* and *H. johnsonii.* In this region, the range of the threatened seagrass, *H. johnsonii,* was larger in the 2008 surveys (Figure 1) than in 2006 (Figure 16). This change could be due expansions of *H. johnsonii* beds or, due to the fact the initial surveys in 2006 were conducted in February and March (as opposed to July to the 2008 surveys), when the abundance and biomass of *H. johnsonii* is lowest.

Southeastern Region: Approximately 0.79 acres of seagrass were lost to sand burial in the Southeastern Region between the 2006 and 2008 surveys (Figure 16). According to the 2006 surveys, the majority of the seagrass areas lost in the Southeast Region had a high percent of *S. filiforme*. Overall, the seagrass acreage increased slightly mainly due to sparse cover areas in the northeast portion of the region. The increase is a result of a sparsely covered area (<5%) of *H. johnsonii* in the western portion of the Southeast Region (see Figure 1) and the areas with low percent cover (5-25%) of *H. wrightii* in the northern portions (Figure 7).

Southwest Region: In this region, the seagrass acreage increased from the 2006 to 2008 surveys (Table 2). In 2008, areas with low percent cover of *H. decipiens* extended farther to the east and into the channel. In the central portion, a larger area of low to moderate cover of *H. wrightii* was found in 2008. A small area of *H. johnsonii* was also observed in this region that was not seen in the 2006 surveys (Figure 1 and 16 respectively).

Western Region: The acreage of seagrass increased from the 2006 to the 2008 surveys in the Western region as well (Table 2). The increase is mainly a result of sparse and low percent cover seagrass areas between and around the higher cover *S. filiforme* seagrass patches. The observed range of *H. johnsonii* in this region also increased from 2006 to 2008 surveys.

Northwest Region: In 2006, seagrass was not observed in the Northwestern Region of the mixing zone (Figure 16 and 17). This area was made up of algae, sponges, occasional soft corals, and sparse hard corals. In 2008, in addition to these benthic resources, two seagrass areas, NW-1 and NW-2, were also observed (see Figure 14).

Overall, the acreage of seagrass increased from the 2006 to the 2008 surveys near the Intracoastal Waterway Channel adjacent to Baker's Haulover Inlet despite some seagrass losses on the eastern side of the channel due to shoal expansion and sand burial. The increase in seagrass coverage was mainly due to the increased observation of sparse and low percent cover seagrass areas throughout the region. It must be noted that some portion of the increased cover of seagrasses noted between the two survey periods may reflect the time of year the surveys were taken. The 2006 surveys were conducted during February and March, which historically the low biomass/cover months for sea grasses (especially *Halophila* sp.), while the 2008 surveys were conducting during July, which historically is a 'high biomass' period for the sea grasses.

MIAMI-DADE COUNTY

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September 22, 2006

David Roach
Executive Director
Florida Inland Navigation District
1314 Marcinski Road
Jupiter, FL 33477-9498

RE: Project # ICW-DA-06-01

Dear David,

Attached please find the draft Post Construction Report in association with ICW Maintenance Dredging Project in the vicinity of Baker's Haulover Inlet. According to the Interlocal Agreement, FIND has 7 days to provide comments on the draft report.

Please feel free to contact me at (305) 372-6853 if you have any questions.

Regards,

Stephen M. Blair, Chief
Restoration and Enhancement Section

POST-CONSTRUCTION SURVEY

MAINTENANCE DREDGING IN THE VICINITY OF BAKERS HAULOVER INLET AND IWW IN THE VICINITY OF VICINITY OF BAKERS HAULOVER INLET
PROJECT #: ICW-DA-06-01

INTRODUCTION:

The following maps and information are submitted as partial fulfillment of an interlocal agreement by and between Miami-Dade County's Department of Environmental Resources Management and the Florida Inland Navigation District for project ICW-DA-06-01. From February 22nd to March 23rd, 2006, the 150m mixing zone surrounding the proposed maintenance dredge area and the proposed pipeline corridor in the vicinity of Bakers Haulover Inlet were surveyed to assess and identify benthic resources including seagrass beds. Seagrass areas were defined and approximate abundance quantified throughout the area. Seagrass areas were traced using Garmin GPS 76, downloaded using Trackmaker software, and subsequently incorporated into ArcView to produce the following maps. All shape files (NAD83) were supplied prior to commencement of dredging. All pre-construction survey information was submitted to the Florida Inland Navigation District in the Pre-Construction Survey Report in April 2006. The maintenance dredging began on June 13, 2006 and concluded with the final beach inspection on July 5th, 2006. Post-construction surveys were carried out from July 24th to August 14th, 2006.

Figure 1 on the following page shows the overall project area including the 150m mixing zone and the proposed pipeline corridor prior to the commencement of dredging. The 150m (~500 ft.) mixing zone was broken down into lettered geographic regions (A-G) to allow for descriptions of the benthic resources on a smaller scale.

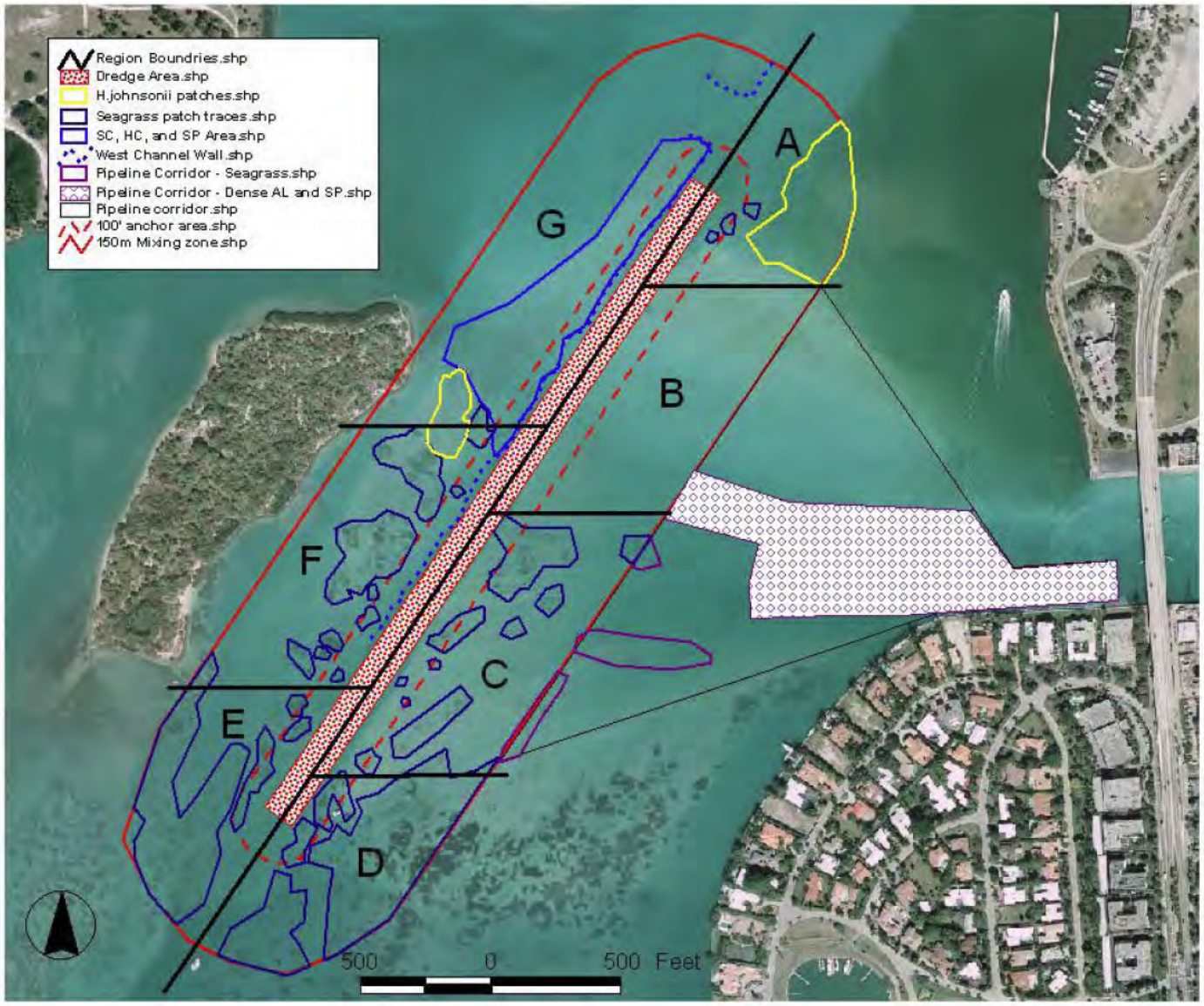


Figure 1: Haulover Intra-coastal Waterway Channel Maintenance Dredging Location.

POST-CONSTRUCTION SURVEY METHODOLOGY:

Maintenance dredging was concluded prior to reaching the southern extent of the proposed dredging area. Therefore, Regions D, E, and the southern portion of Region C were excluded in post-construction surveys as they were not impacted by anchors during the dredging activity and were beyond the 150m mixing zone. Region B was also excluded from post-construction surveys as it was found to be void of seagrass and hardbottom communities during pre-construction surveys. Figure 2 shows the adjusted post-construction survey area as well as the anchor placement points provided by ECOES Consulting, Incorporated.

Post-construction surveys involved:

1. Inspecting all anchor placement locations for physical damage to benthic resources;
2. Quantitative evaluation of:
   a. All seagrass beds within 100ft of the channel for changes in species abundance and composition;
   b. All seagrass areas containing the threatened species *Halophila johnsonii* for changes in species abundance and composition and;
   c. Benthic resources (including seagrass) within the mixing zone and along the west channel wall.

Braun-Blanquet methodology was used to quantitative assess seagrass cover and abundance before and after construction. The methodology involved estimating the cover values (see Table 1) for each seagrass species based using a 0.5 x 0.5m quadrat. Random GPS coordinates were selected throughout the seagrass areas during the pre-construction surveys. Those same points were visited again in the post-construction surveys to allow for comparisons before and after dredging.

Table 1: Braun-Blanquet Abundance Scale

Scale	% Cover	Description
5	> 75%	High
4	50-75%	Moderate
3	25-50%	Low to Moderate
2	5-25%	Low
1	<5%	Sparse
0.5		Few individuals with small cover
0.1		Solitary

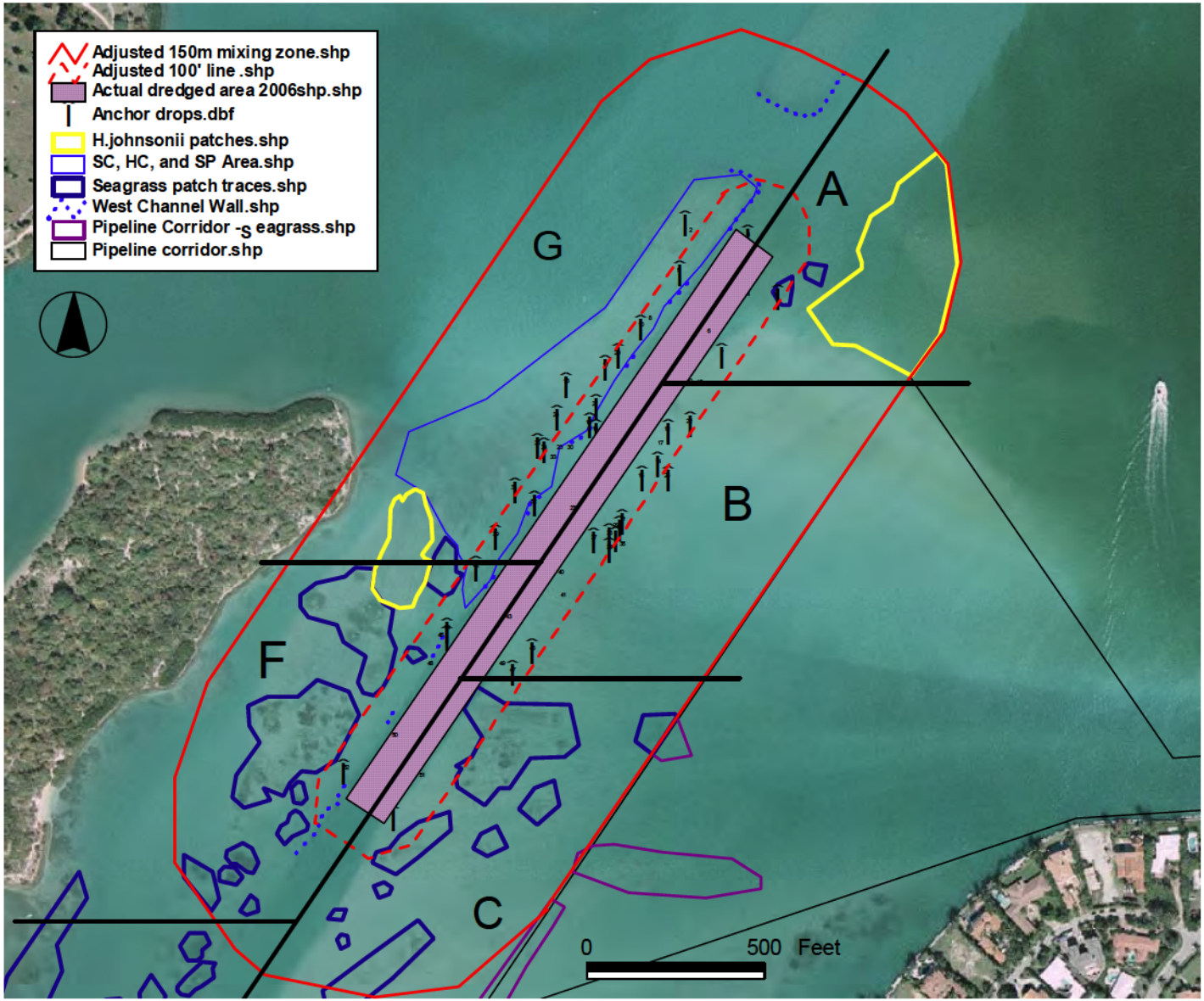


Figure 2: Adjusted Post-Construction Survey Location for the Haulover Intra-coastal Waterway Channel Maintenance Dredging Project.

RESULTS:

In general, negative impacts were not observed to the seagrass beds and other benthic resources in the vicinity of the maintenance dredging near Baker's Haulover Inlet. However, one area was noted with negative impacts to benthic resources. Sand burial of a portion of the western wall of the channel was observed in Region G. This impact is described in detail in the subsequent section for Region G. Quantitative assessments of seagrass beds with in 100ft of the channel and of beds containing the threatened species *Halophila johnsonii* did not show discernable changes in the abundance or composition of species (Table 2). Similarly, no changes in abundance and composition of benthic species were identified from the qualitative assessments of resources within the mixing zone. Specific observations and discussion of the assessments for each region are presented below.

Table 2: Mean Braun-Blanquet Abundance values for seagrass areas within 100ft of the dredging activity or seagrass beds containing *Halophila johnsonii*. (Abbreviations: HW = *Halodule wrightii*; HD = *Halophila decipiens*; HJ = *Halophila johnsonii*; SF = *Syringodium filiforme*; TT = *Thalassia testudinum*).

Area		**HW**	**HD**	**HJ**	**SF**	**TT**
A1	Pre	4.5				
	Post	4.0	1.5			
A2	Pre	3.5	0.13			
	Post	5.0				0.25
A4	Pre	1.7		0.8	0.4	0.03
	Post	1.1	0.9	0.8	0.4	0.06
C1 (West)	Pre	2.6				0.8
	Post	1.9				0.8
C1 (South)	Pre				5	
	Post	1.0			5	
C3 (West)	Pre	1.0			3.2	
	Post	3.3		0.8	1.2	0.8
F9	Pre	4.5	3.5			
	Post	4.0				
G1	Pre	2.0		2.5		
	Post	1.0		2.0		

Region A:

Changes in the benthic communities were not observed in **Seagrass Areas A1, A2, and A3** (Figure 3)**.** All three areas were free from excess sedimentation and continue to have a moderate to high percent cover of *Halodule wrightii* and occasional observations of *Halophila decipiens*. Anchor impacts were not observed in seagrass area A1 and A2 based on the anchor drop coordinates provided by ECOES Consulting.

Seagrass Area A4 was also free from excess sedimentation and continued to support a variety of seagrass species. *Halodule wrightii, Syringodium filiforme, Thalassia testudinum,* and *Halophila johnsonii* were observed in equivalent abundance and cover both before and after the dredging activities.

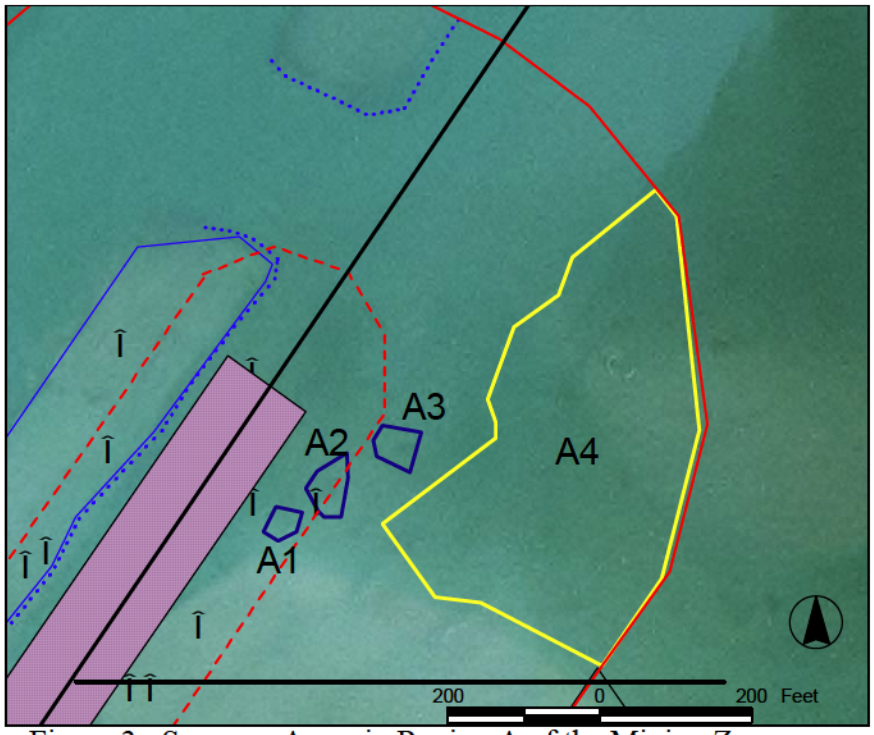


Figure 3: Seagrass Areas in Region A of the Mixing Zone.

Region C:

No changes in either the abundance or cover of the seagrass communities in Region C were observed (Figure 4, Table 2)**.** **Seagrass Area C1** contained three seagrass species—*Halodule wrightii*, *Syringodium filiforme*, and *Thalassia testudinum* with similar abundances before and after the maintenance dredging. In **Area C3**, the post dredging cover of *H. wrightii, S. filiforme, and Halophila johnsonii* also remained similar to pre-dredging conditions with no signs of sedimentation.

Seagrass Area C2 on the eastern edge of the 150m mixing zone stretched over into the potential pipeline corridor. This area continued to have moderate to high percent cover of *H.*

wrightii after dredging with no signs of increased sedimentation. The pipeline was placed north of this area avoiding possible impacts to this seagrass bed due to pipeline placement.

Changes to the size or composition of the seagrass beds within the mixing zone of Region C (**Areas C3, C4, C5, C7, C8, and C9)** were not observed after dredging. All areas maintained similar species abundance after maintenance dredging was complete and showed no signs of increased sedimentation.

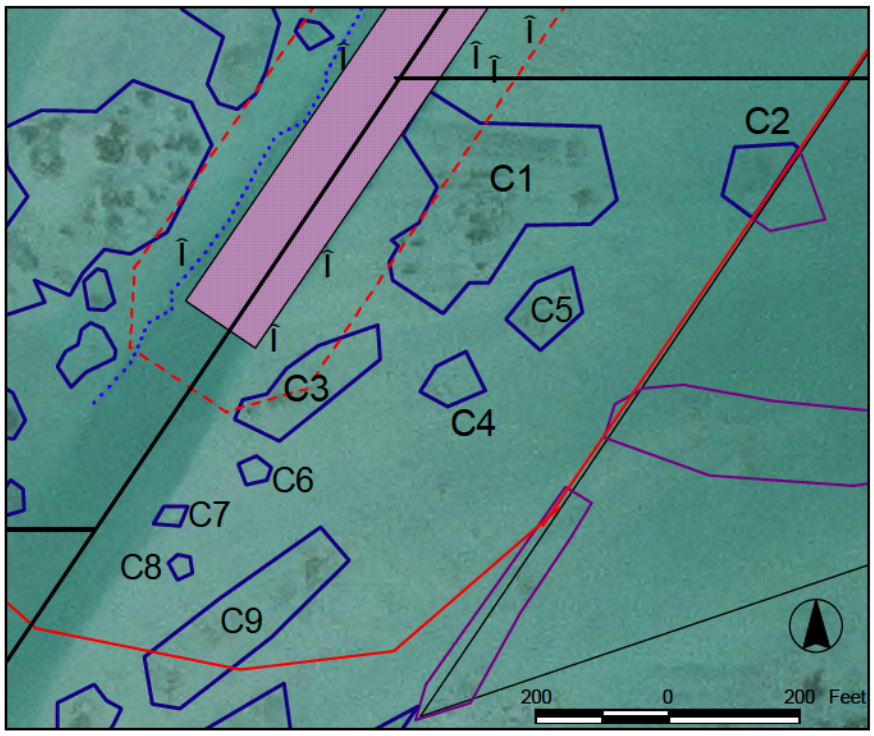


Figure 4: Seagrass Areas in Region C of the Mixing Zone

Region F:

Region F contained nine different seagrass areas as shown in Figure 5. Based on the adjusted southern extent of the dredging only **Seagrass Areas F9** was within the 100' of the channel and subjected to an increased risk from anchor damage. The anchor drop points in the vicinity of Area F9 were investigated and no impacts to benthic species were observed. The abundance of *H. wrightii* and *H. decipiens* in Area F9 after dredging were consistent with pre-dredging conditions with no signs of increased sedimentation.

Seagrass Areas F1, F3, F4, F5, and F6, located within the mixing zone of Region F, continued to be dominated by a high abundance of *S. filiforme* with no increased sedimentation. The abundance of *H. decipiens* in Areas F5 also remained consistent with pre-construction conditions. **Seagrass Area F2** continued to have a moderate coverage of *H. decipiens* after the dredging was complete.

The large **Seagrass Areas F7 and F8** continued to be characterized by a large abundance of *S. filiforme* throughout the area with *H. wrightii* observed with lower abundance in select areas post dredging.

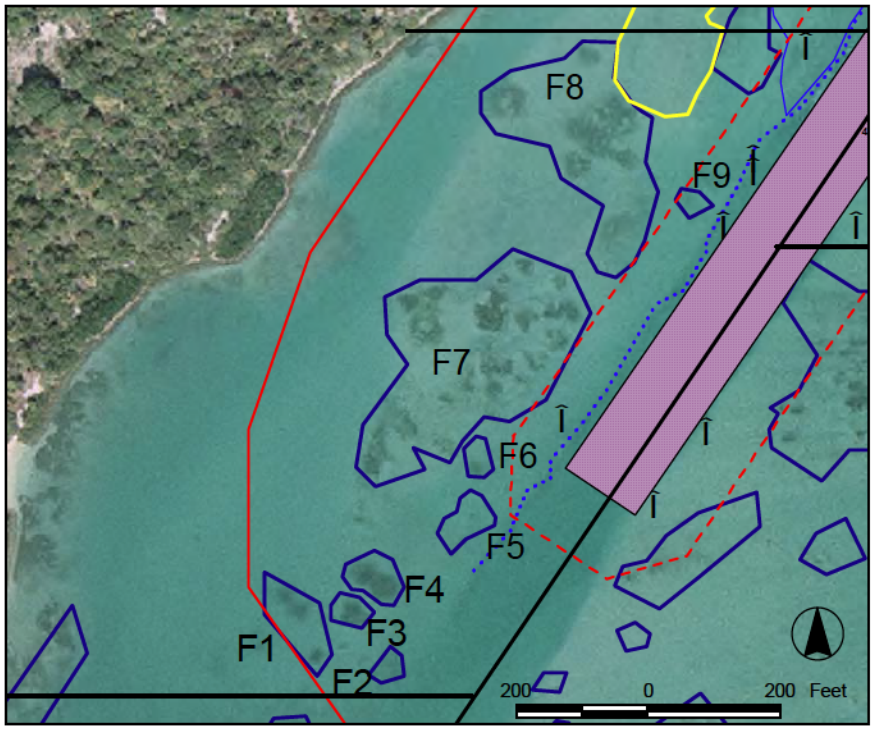


Figure 5: Seagrass Areas in Region F of the Mixing Zone

The dotted blue line shown in Fig. 5 denotes a small ledge (0.5-1m relief) that is part of the west wall of the channel. This small ledge extends to the north into Region G. The portion of this ledge in Region F did not show any adverse impacts associated with the maintenance dredging of the channel. The anchor placement sites were inspected and no physical damage to habitat was observed.

Region G:

In the southern portion of Region G, two seagrass areas were noted. Both extend south into Region F (Fig. 6) and were west of the anchor areas. The abundance of *Halophila johnsonii* and *H. wrightii* in **Seagrass Area G1** and the abundance of *H. decipiens*, *H. wrightii*, and *S. filiforme* in **Seagrass Area G2** were equivalent in the pre and post dredging surveys.

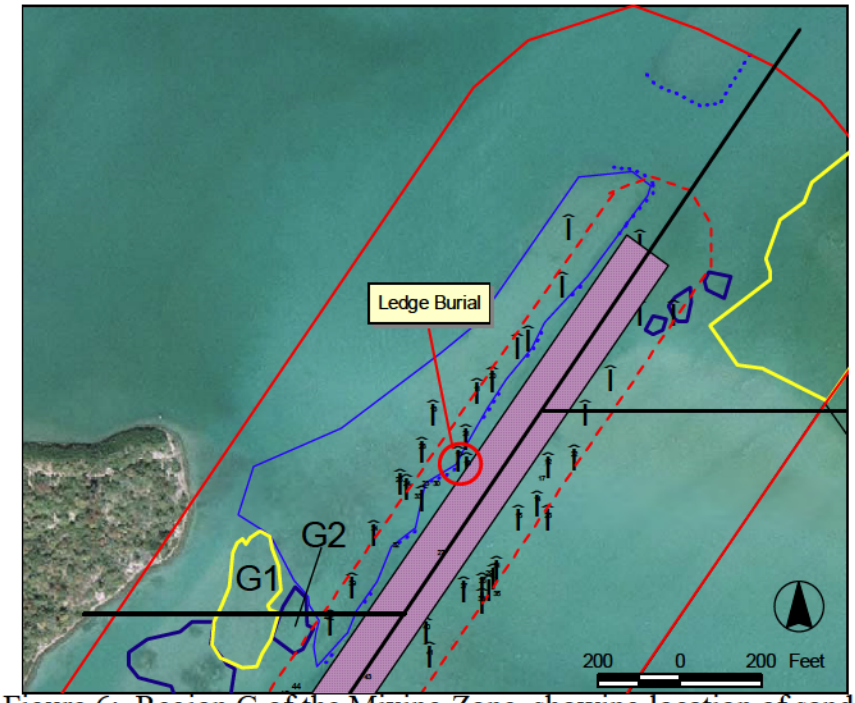


Figure 6: Region G of the Mixing Zone, showing location of sand burial impact.

Sand deposition on ledge in Region G. The ledge making up the west wall of the channel (dotted blue line in Fig. 6) extends north from Region F. This portion of the ledge is inhabited by numerous hard coral, soft coral, and sponge species. Upon inspecting the ledge and anchor placement sites in the region on July 24, 2006, an area of the ledge was found buried by approximately one foot of sand (Figure 7).

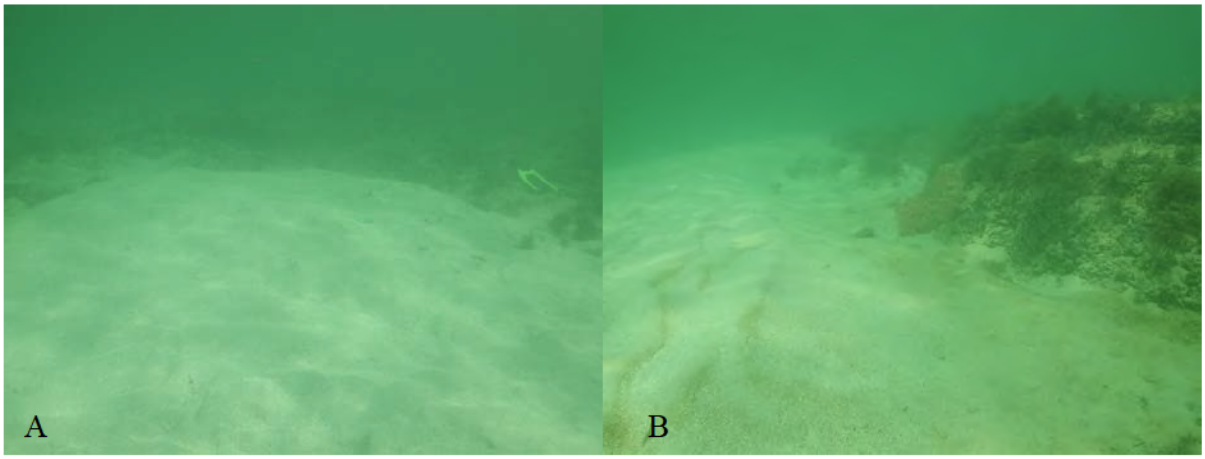


Figure 7: A) Aerial view of sand burial; B) Side view of sand burial from north side.

The sand deposit was unusual, in that there were no indications of 'prop-wash' or regions of sand displacement to have caused this. Rather, the sand appeared to have been placed (rather than displaced) on the ledge area. DERM has requested information from the US ACOE

regarding any records or logs of the contractor, to assess if any activities or equipment malfunctions occurred while working in this area that may explain the sand deposition. The location of the sand burial was near two anchor placement locations (provided by ECOES Consulting—Table 3).

Table 3: GPS locations of anchor placements near sand burial.

Date	Time	Waypoint	Latitude	Longitude	Accuracy	Observer
June 21	7:25 EDT	16	N25 54' 08.4"	W080 07' 52.4"	18 feet	CD
June 21	11:20 EDT	18	N25 54' 08.2"	W080 07' 52.2"	15 feet	CD

The width of buried hardbottom was 7m at the edge of the ledge and extended 6.5m onto the hard bottom area forming a "triangle" (see Figure 8) impacting 22.75m^2 of horizontal hardbottom. The vertical surface of the ledge (~1m) was also buried adding an additional 7m^2 of buried hardbottom. Therefore, the total area of hardbottom impacted by sand burial was 29.25 m^2.

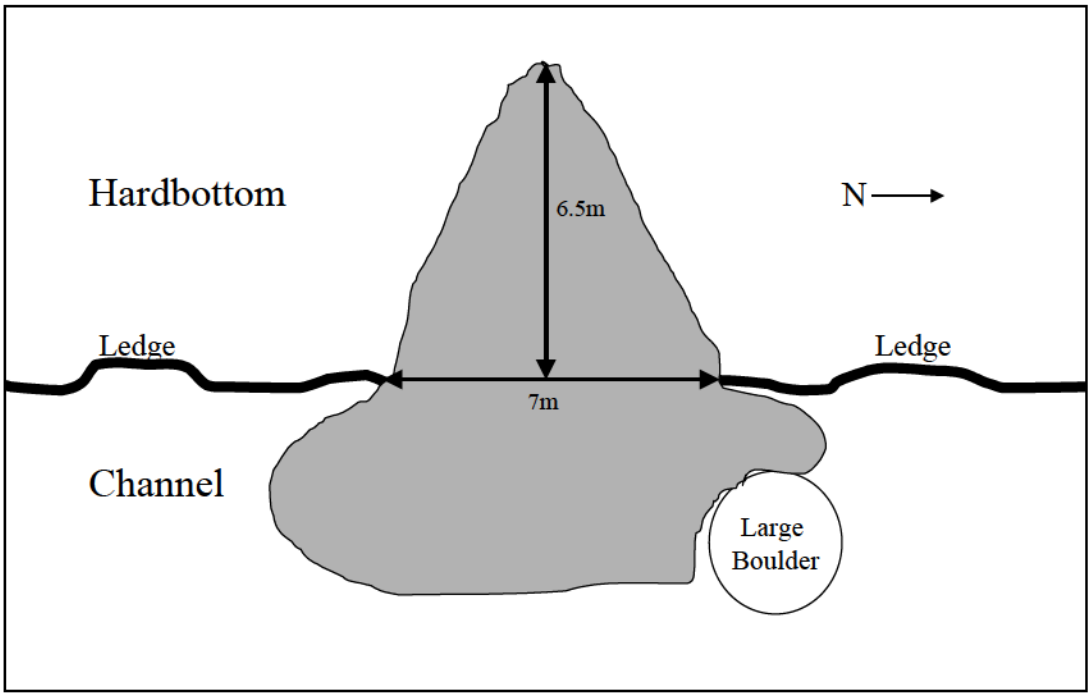


Figure 8: Aerial view of hardbottom burial adjacent west of the Haulover ICW Channel.

The area impacted was composed of hardbottom and rubble with algae, soft corals, occasional small hard corals, and sponges. Figure 9 shows the benthic community in unaffected hardground adjacent to the impact areas.

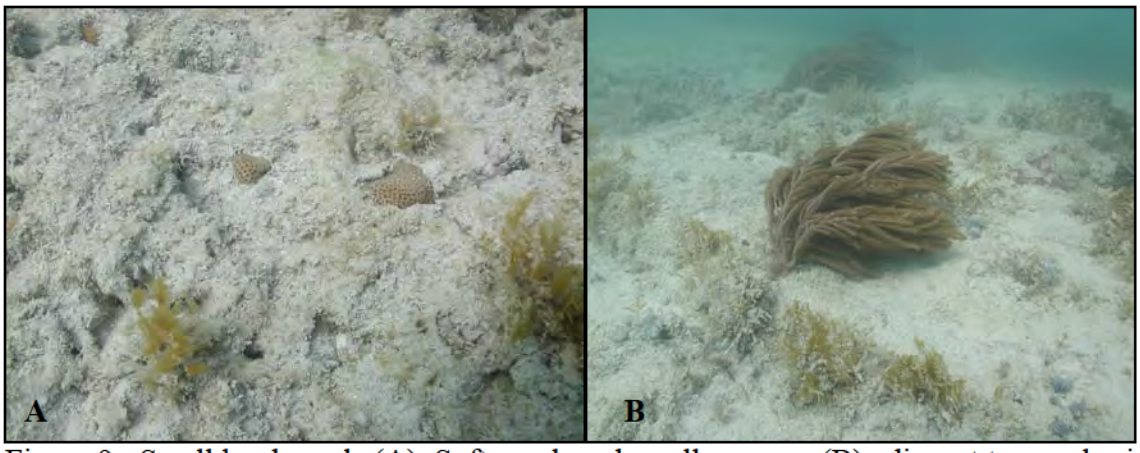


Figure 9: Small hard corals (A), Soft coral, and small sponges (B) adjacent to area buried by sand.

Pipeline Corridor:

The dredge slurry/discharge pipeline was placed in the projected pipeline corridor north of the seagrass areas on the eastern side of the channel. It ran along the south side of Baker's Haulover Cut, and discharged onto the beach at Bal Harbour (see Fig. 1 and 10). Surveys conduced while the pipeline was in place showed it was on a sand bottom with scattered rubble, and no impact to seagrass beds or hardbottom areas were noted.

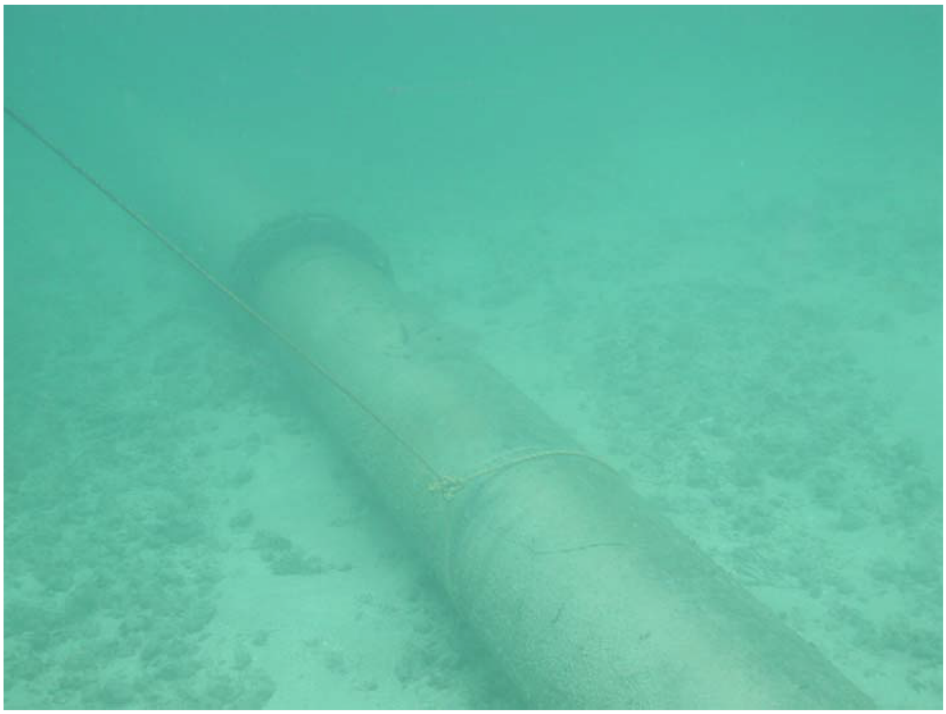


Figure 10: Pipeline placed on sand and algae.

SUMMARY

Regions of seagrass and benthic habitat within the 150 m mixing zone of the "Maintenance Dredging of the IWW in the Vicinity of Bakers Haulover (PROJECT #: ICW-DA-06-01) Project" were surveyed following dredging operations. The surveys were initiated within 14 days following completion of dredging operations. Quantitative assessments of seagrasses and benthic habitats were conducted prior to and following dredging activities. Comparison of the pre and post construction surveys indicated that no impacts to the seagrass communities within the 150 m impact zone were discernable.

One region of impact (via sand burial) was apparent in on western channel ledge, in the northern portion of Region "G". The area had a significant deposition of sand on the ledge, the area immediately adjacent to the ledge, and in the channel. A 29.25 m^2 of hardbottom was impacted by the sand deposition. The deposition and volume of sand indicate the ledge burial was most likely attributed to the movement and deposition of a large volume of sand. This type of sand deposition is not consistent with other commercial or recreational boating activities (i.e., propeller blast by tug boats or groundings).

PRE-CONSTRUCTION SURVEY

MAINTENANCE DREDGING IN THE VICINITY OF BAKERS HAULOVER INLET AND IWW IN THE VICINITY OF VICINITY OF BAKERS HAULOVER INLET
PROJECT #: ICW-DA-06-01

INTRODUCTION:

The following maps and information are submitted as partial fulfillment of an interlocal agreement by and between Miami-Dade County's Department of Environmental Resources Management and the Florida Inland Navigation District for project ICW-DA-06-01. From February 22nd to March 23rd, 2006, the 150m mixing zone surrounding the proposed maintenance dredge area and the proposed pipeline corridor in the vicinity of Bakers Haulover Inlet were surveyed to assess and identify benthic resources including seagrass beds. Seagrass areas were defined and approximate abundance quantified throughout the area. Seagrass areas were traced using Garmin GPS 76, downloaded using Trackmaker software, and subsequently incorporated into ArcView to produce the following maps. All shape files (NAD83) will be provided. Approximate abundance or cover values were assessed using Braun-Blanquet methodology. Complete methodology and semi-quantitative results will be provided in the post-construction evaluation. The abundance estimates provided in the subsequent text are based on the following abundance scale:

Table 1: Braun-Blanquet Abundance Scale

Scale	% Cover	Description
5	> 75%	High
4	50-75%	Moderate
3	25-50%	Low to Moderate
2	5-25%	Low
1	<5%	Sparse
0.5		Few individuals with small cover
0.1		Solitary

RESULTS:

Figure 1 on the following page shows the overall project area including the 150m. mixing zone and the proposed pipeline corridor. The 500 ft. mixing zone was broken down into lettered geographic regions (A-G) to allow for descriptions of the benthic resources on a smaller scale.

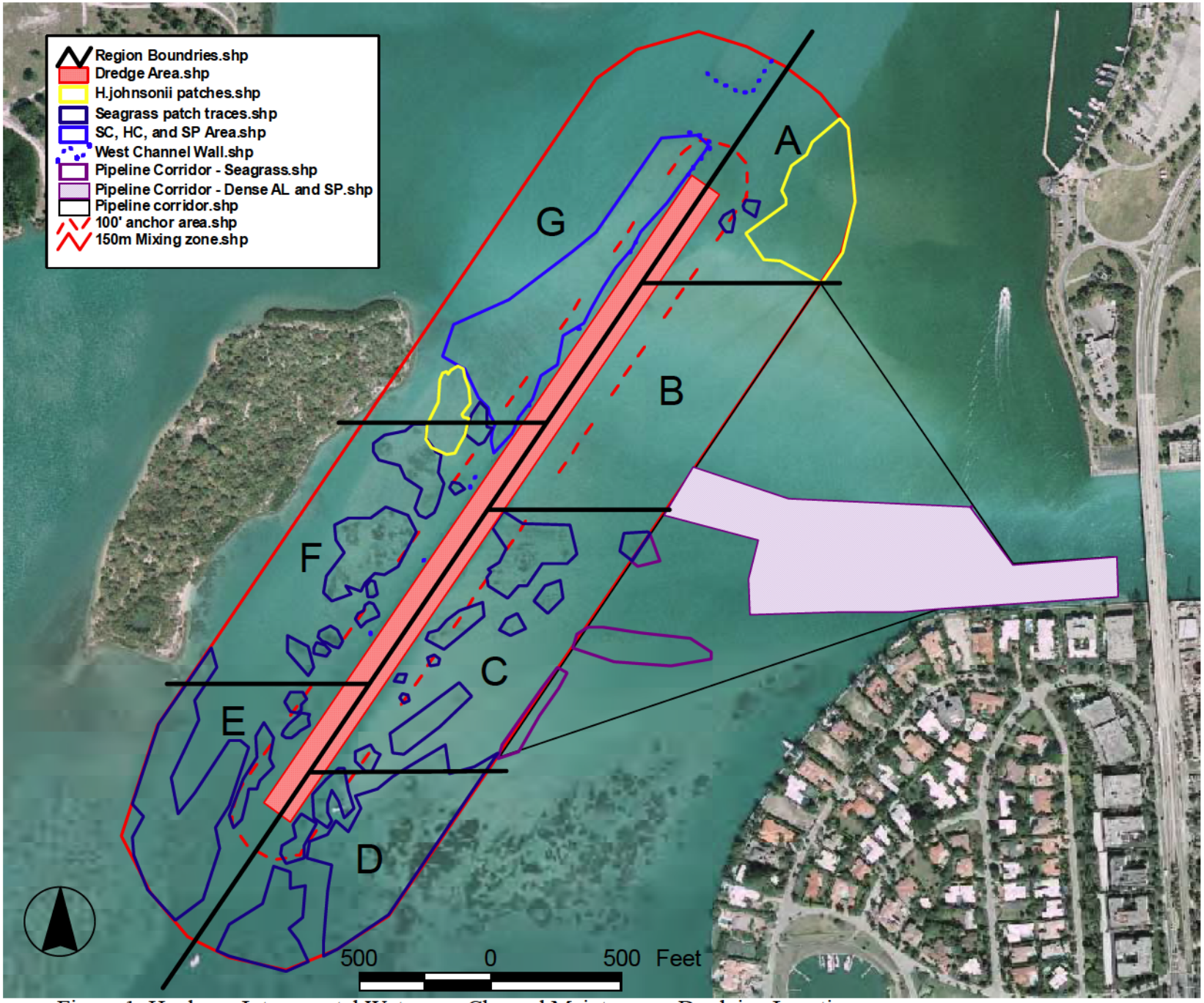


Figure 1: Haulover Intra-coastal Waterway Channel Maintenance Dredging Location.

REGION A:

Seagrass Areas A1, A2, and A3 have a moderate to high percent cover of *Halodule wrightii* and *Halophila decipiens* was occasional observations (Fig. 2). Seagrass area A1 and A2 are within 100' of the proposed dredge area and subject to an increased risk from anchor damage.

Seagrass Area A4 is a large area with varying densities of several types of seagrass (Fig. 2). *Halodule wrightii* is found throughout the area with low to moderate coverage toward the western portion and moderate to high coverage in the shallower areas toward the east (Fig. 3). *Syringodium filiforme* was observed with low to moderate percent cover in the eastern portion. Areas with sparse *Thalassia testudinum* cover were also found in the eastern portion of Seagrass Area 4. The threatened seagrass *Halophila johnsonii* was found in the south and eastern areas (Fig. 3).

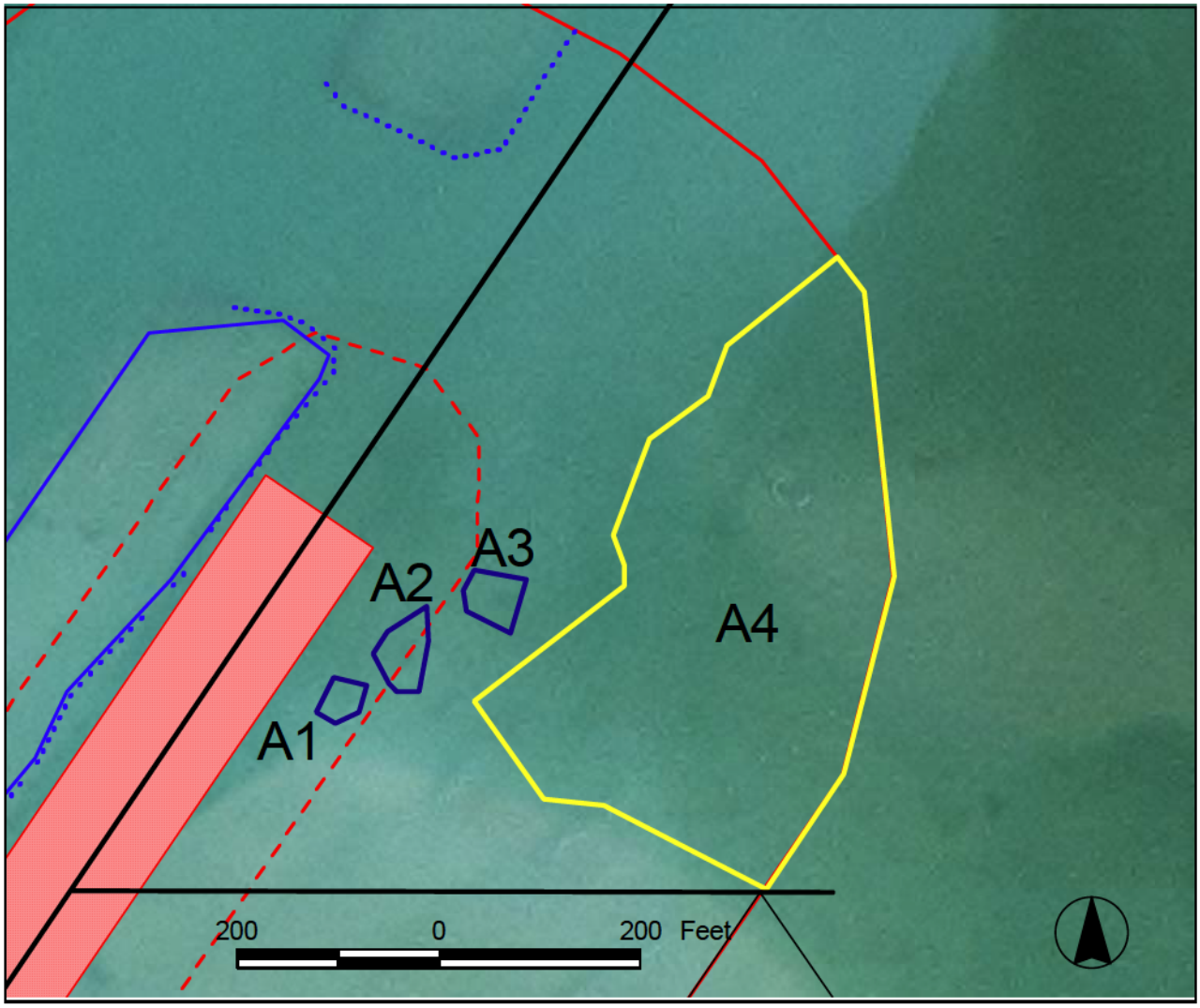


Figure 2: Seagrass Areas in Region A of the Mixing Zone

REGION A (Continued):

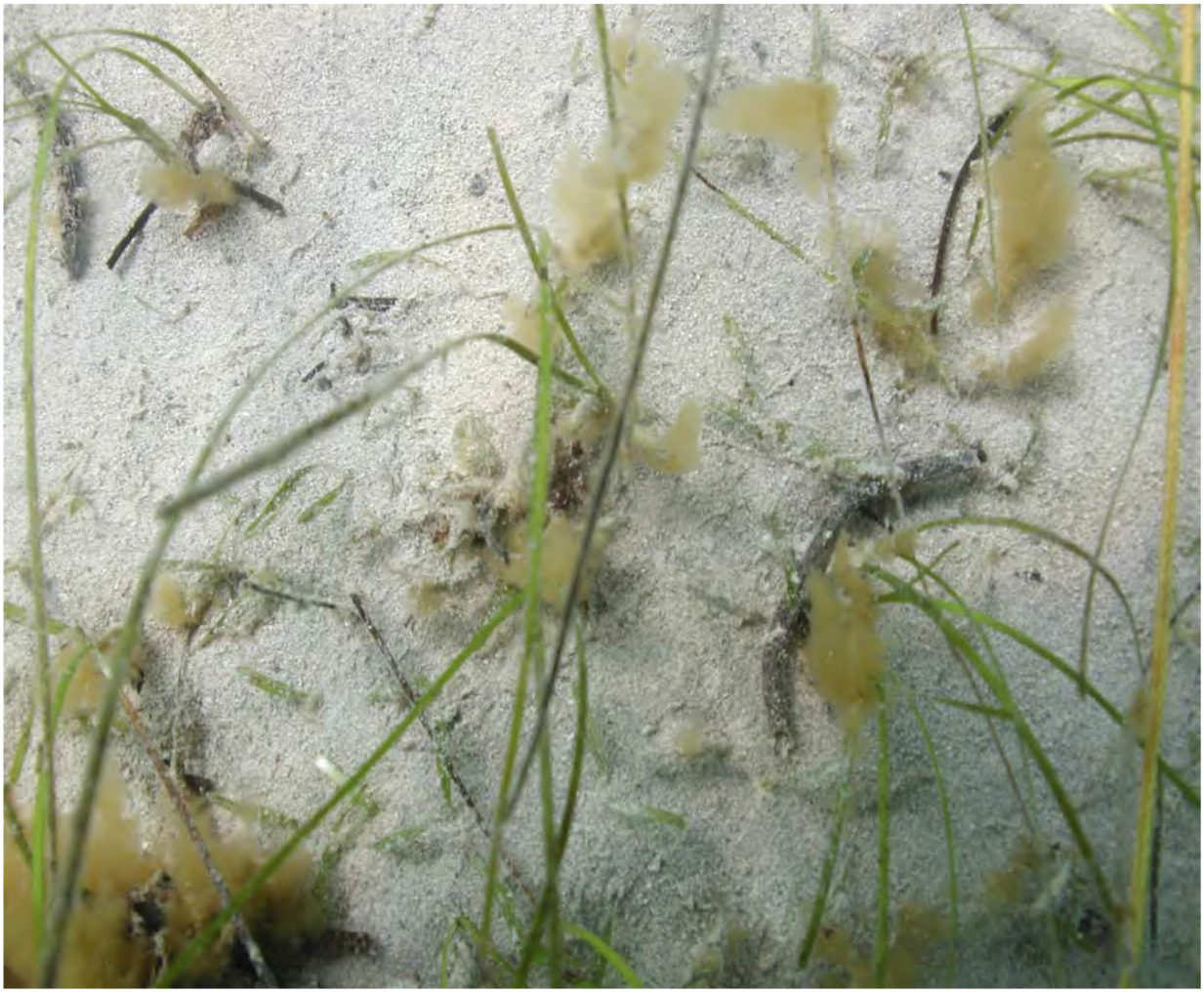


Figure 3: Close up of *Halodule wrightii* and *Halophila johnsonii* in Seagrass Area A4.

REGION B:

Seagrass was not observed in Region B of the mixing zone (Fig. 4). The northern portion of this area is a sand shoal void of any vegetation. In the southern end, moderate coverage of turf, blue green, and red algae was noted. Cushion sea stars, *Oreaster reticulatus*, were also observed in this area.

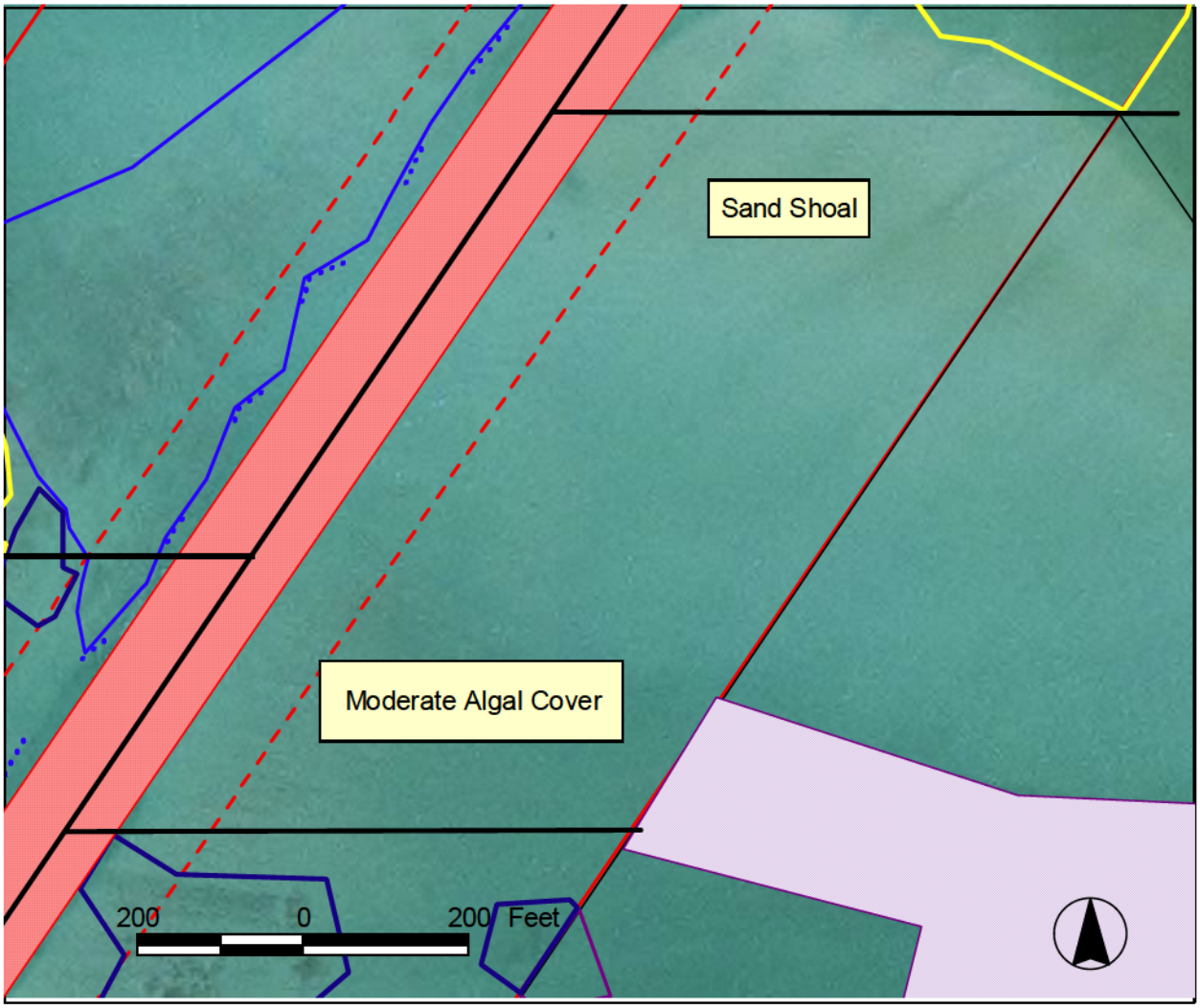


Figure 4: Region B of the Mixing Zone

REGION C:

Ten different seagrass areas were found within Region C (Fig. 5). All or portions of Area C1, C3, C6, C7, C8, and C10 are within 100' of the channel and are subject to an increase chance of damage due to anchoring.

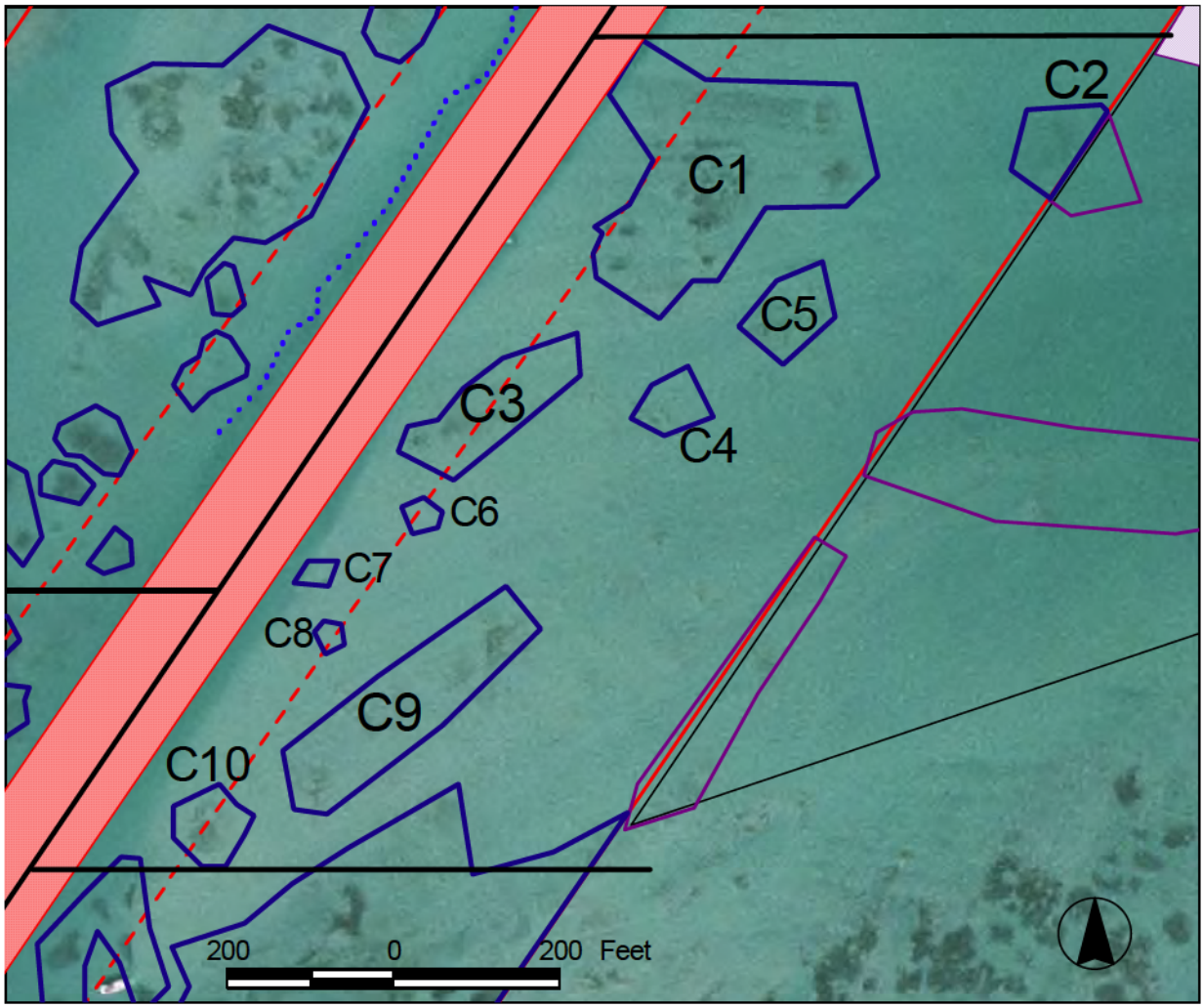


Figure 5: Seagrass Areas in Region C of the Mixing Zone

Seagrass Area C1 in the northern portion of Region C contained 3 types of seagrass species—*Halodule wrightii*, *Syringodium filiforme*, and *Thalassia testudinum* (Fig. 5). The central portion of Area C1 had moderate to high percent cover of all three species. The eastern portion was dominated by *T. testudinum* (Fig. 6) while the western portion had both *T. testudinum* and *H. wrightii*. The southern portion of Area 1 is characterized by moderate cover of *H. wrightii* and moderate to high densities of *S. filiforme*.

REGION C (continued):

Figure 6: Dense *Thalassia testudinum* bed in Seagrass Area C1.

Seagrass Area C2 on the eastern edge of the 500 ft. Mixing Zone stretches over into the potential pipeline corridor. This area has moderate to high percent cover of *H. wrightii*.

Seagrass Areas C4, C7, C8, and C10 are also characterized by moderate to high percent cover of one seagrass species, *H. wrightii*.

In **Seagrass Areas C3, C5, and C9**, both *H. wrightii* and *S. filiforme* were observed (Fig. 5). In Area 3, *H. wrightii* cover was moderate while *S. filiforme* cover was moderate to high. Both *H. wrightii* and *S. filiforme* had moderate abundance in Area C5. Area C9 was dominated by *H. wrightii* throughout with a small amount of *S. filiforme* toward the southern end.

In **Seagrass Area C6**, only a high coverage of *S. filiforme* was observed (Fig. 5).

REGION D:

In Region D, four large seagrass areas were observed (Fig. 7). Seagrass areas D1 and D2 are within 100 ft. of the proposed dredge area and subject to an increased risk from anchor damage.

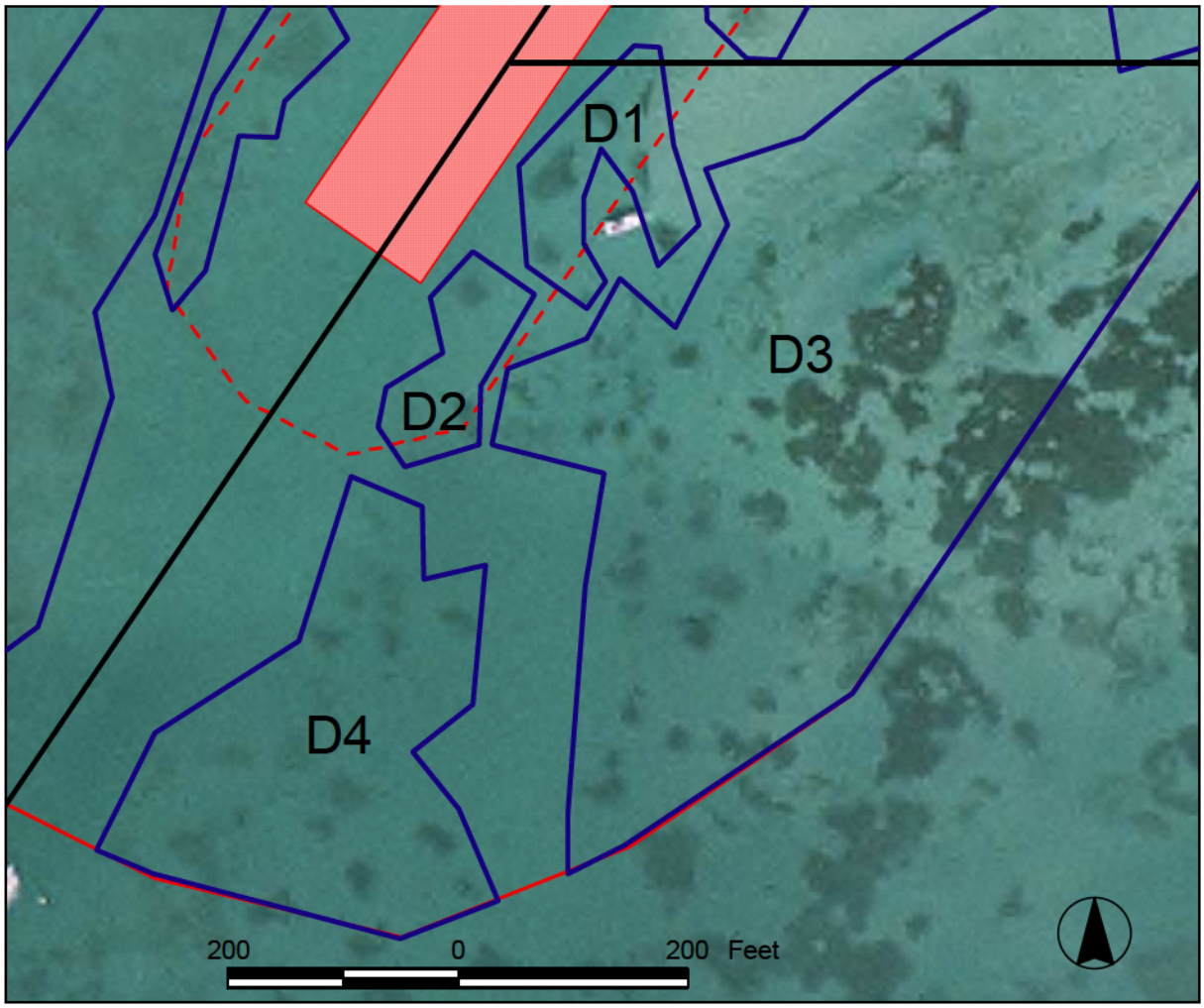


Figure 7: Seagrass Areas in Region D of the Mixing Zone

Seagrass Area D1 is comprised of several dense patches of *S. filiforme*.

Seagrass Area D2 is comprised of patches of moderate to high densities of *H. wrightii*.

Seagrass Area D3, the largest seagrass area in Zone D, contained 4 types of seagrass species—*H. wrightii*, *S. filiforme*, *T. testudinum*, and *H. decipiens*. The dark patches in the eastern portion of Area 3 (as seen the aerial photograph in Fig. 7) are large, very dense beds of *S. filiforme* and *T. testudinum*. The areas to the north, south, and west of the large seagrass beds are smaller patches with moderate to high cover of *S. filiforme* (Fig. 8) and moderate to high cover of *H. wrightii*. In the extreme western areas close to Seagrass Area 2, *H. decipiens* was also observed in low to moderate densities along with higher densities of *S. filiforme*.

REGION D (continued):

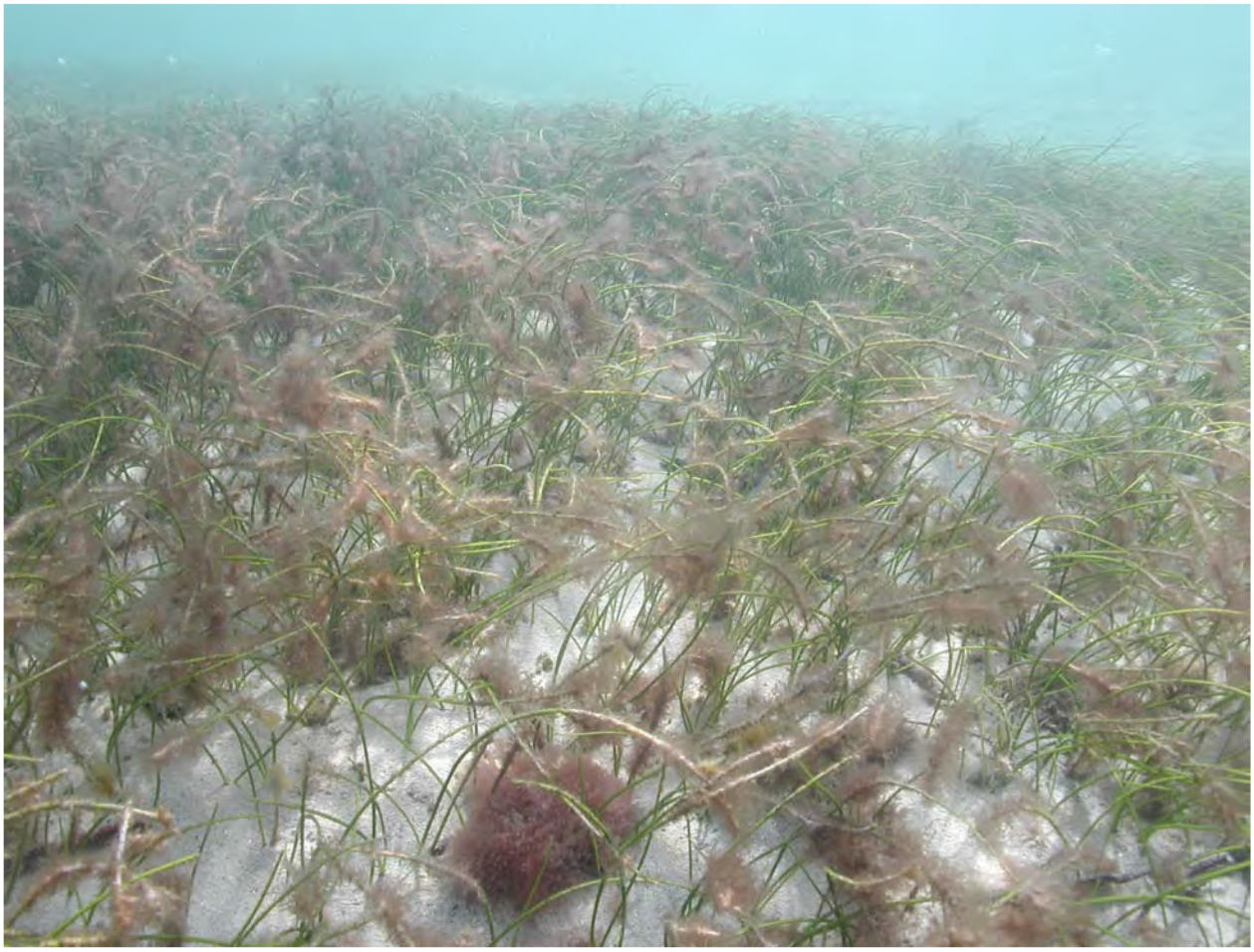


Figure 8: *Syringodium filiforme* bed in Region D.

Throughout **Seagrass Area D4** moderate percent cover of *S. filiforme* was observed with the occasional observation of *T. testudinum* in the extreme southern portion at the edge of the 500' mixing zone.

REGION E:

One large (E1) and three smaller (E2, E3, and E4) seagrass areas were noted in Region E (Fig. 9). The three smaller areas are within 100 ft. of the proposed dredge area and subject to an increased risk from anchor damage.

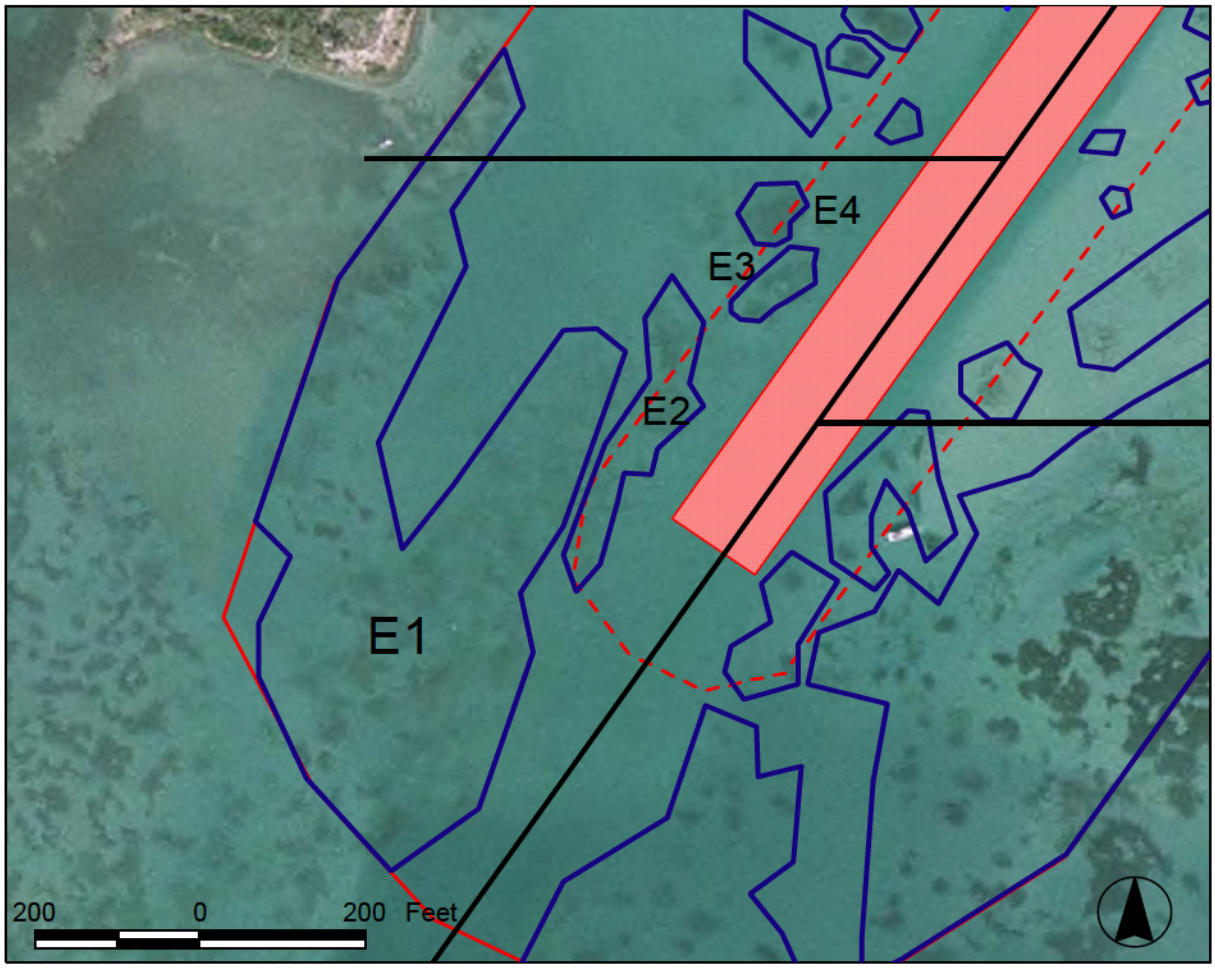


Figure 9: Seagrass Areas in Region E of the Mixing Zone

Seagrass Area E1 is a large area with several types of seagrass. *Syringodium filiforme* dominate this area with moderate coverage found throughout the south and northeast portions. The highest cover of *S. filiforme* was observed in west bordering the spoil island. *Thalassia testudinum* was also found in the western portion of Area E1 with moderate to high percent cover. In the extreme northwest portion of the E1, a low percent cover of *H. wrightii* was also found.

In **Seagrass Area E2**, only *S. filiforme* was observed with low to moderate cover in the south and moderate cover in the central and northern portions.

Seagrass Area E3 was dominated by moderate to high percent cover of *S. filiforme*.

The northern **Seagrass Area E4** was dominated by a high abundance of *H. wrightii*.

REGION F:

Region F contained nine different seagrass areas as shown in Figure 10. Seagrass Areas F2, F5, and F9 are within the 100 ft. of the proposed dredge area and subject to an increased risk from anchor damage.

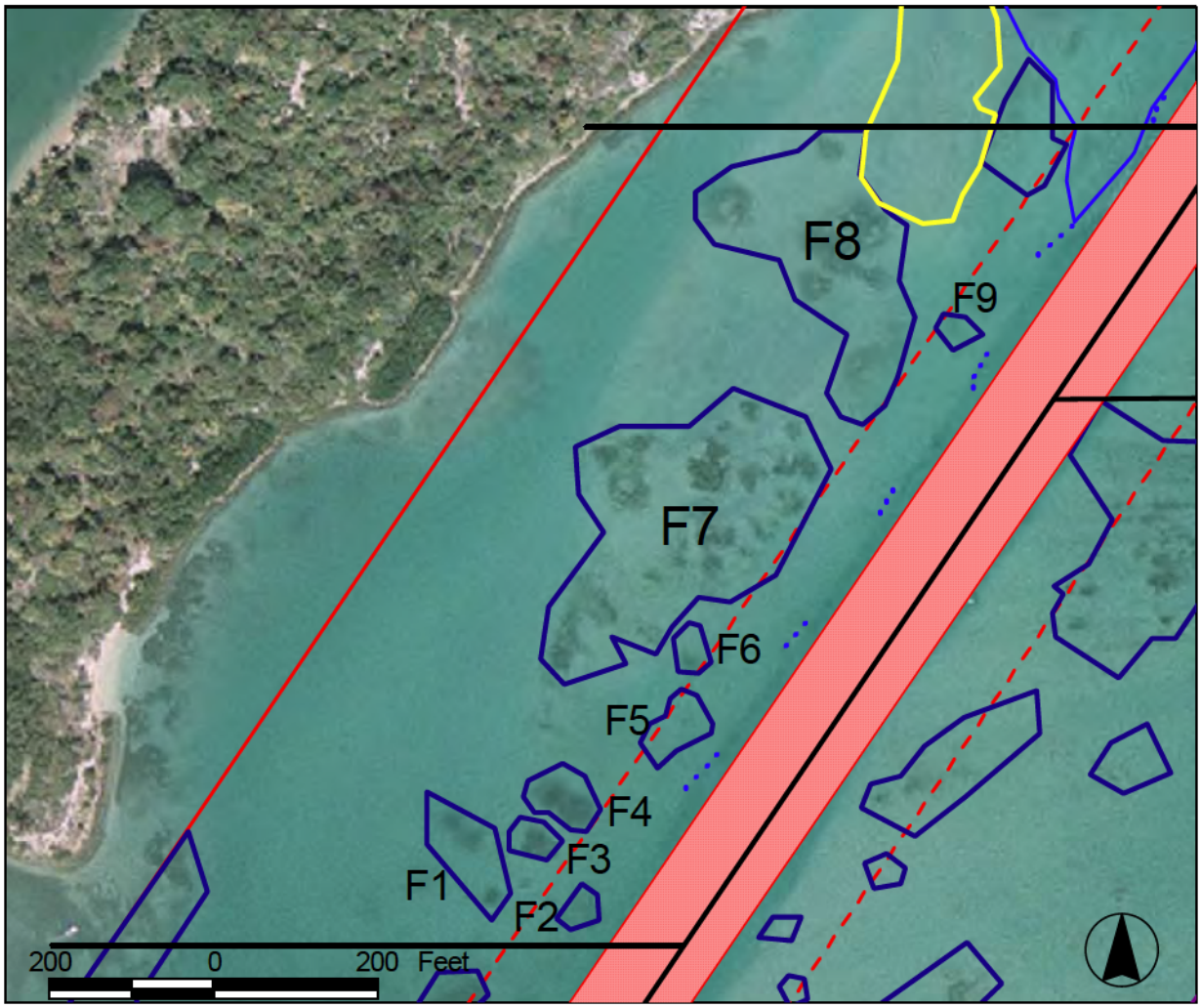


Figure 10: Seagrass Areas in Region F of the Mixing Zone

Seagrass Areas F1, F3, F4, and F6 were all dominated by a high abundance of one seagrass species—*S. filiforme*.

Seagrass Area F2 lacked *S. filiforme* but had moderate coverage of *H. decipiens*.

Seagrass Area F5 had a moderate to high abundance of *S. filiforme*. A large abundance of *H. wrightii* was also observed, but only in the southern portion. *Halophila decipiens* was observed with a low percent cover through the area.

REGION F (continued):

Seagrass Area F7 in the central portion of Region F is a large area characterized by a large abundance of *S. filiforme* throughout. In addition to *S. filiforme*, *H. wrightii* was observed with low abundance in the central area and moderate abundance in the southern area.

A high percent cover of *S. filiforme* dominated **Seagrass Area F8** throughout. Small areas with high abundance of *H. wrightii* were also observed in the southern portion.

In **Seagrass Area F9**, *H. wrightii* was the dominant seagrass species with high densities. *Halophila decipiens* was also present with moderate abundance.

The dotted blue line shown in Fig. 10 denotes a small ledge (1-3' relief) that is part of the west wall of the channel. This small ledge extends to the north into Region G. Along the entire length of this ledge numerous coral species and sponges were observed (Fig. 11). Some of the hard coral species observed include *Oculina diffusa* (Fig. 11b), *Stephanocoenia michillini*, *Siderastrea* spp., *Solenastrea hyades*, *Porities* spp., *Madracis decactis* (11c), *Meandrina meandrites* (Fig 11c), and *Colpophyllia natans*. Sponge species observed included *Holopsamma helwigi* (Fig. 11a and 11b), *Dysidea* spp., *Anthosigmella varians*, *Spheciospongia vesparium*, *Cliona* spp., *Chondrilla* spp., *Ircinia* spp., and *Niphates digitalis*.

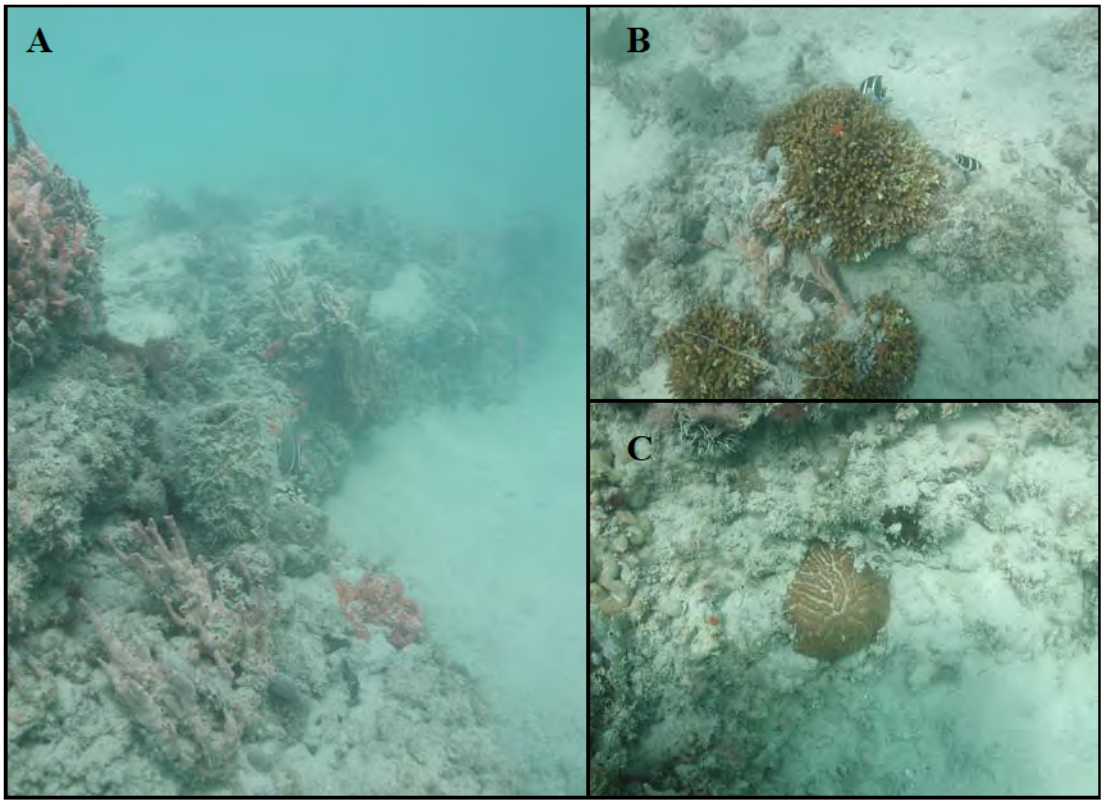


Figure 11: A) West wall of channel; B) *Oculina diffusa* on west wall; C) *Meandrina meandrites* on west wall of channel.

REGION G:

In the southern portion of Region G, two seagrass areas were noted. Both extend south into Region F (Fig. 12).

Seagrass Area G1 is comprised of moderate abundance of the threatened seagrass *Halophila johnsonii*. Moderate to high densities of *H. wrightii* were also observed in the southern portion of Area G1.

In **Seagrass Area G2**, a high percent cover of *H. decipiens* was observed throughout with moderate to high cover of *H. wrightii*. In the southern portion, low to moderate abundance of S. filiforme was also observed.

The ledge making up the west wall of the channel (dotted blue line in Fig. 12) extends north from Region F. Similar to the ledge in Region F, this portion of the ledge is also inhabited by numerous coral and sponge species.

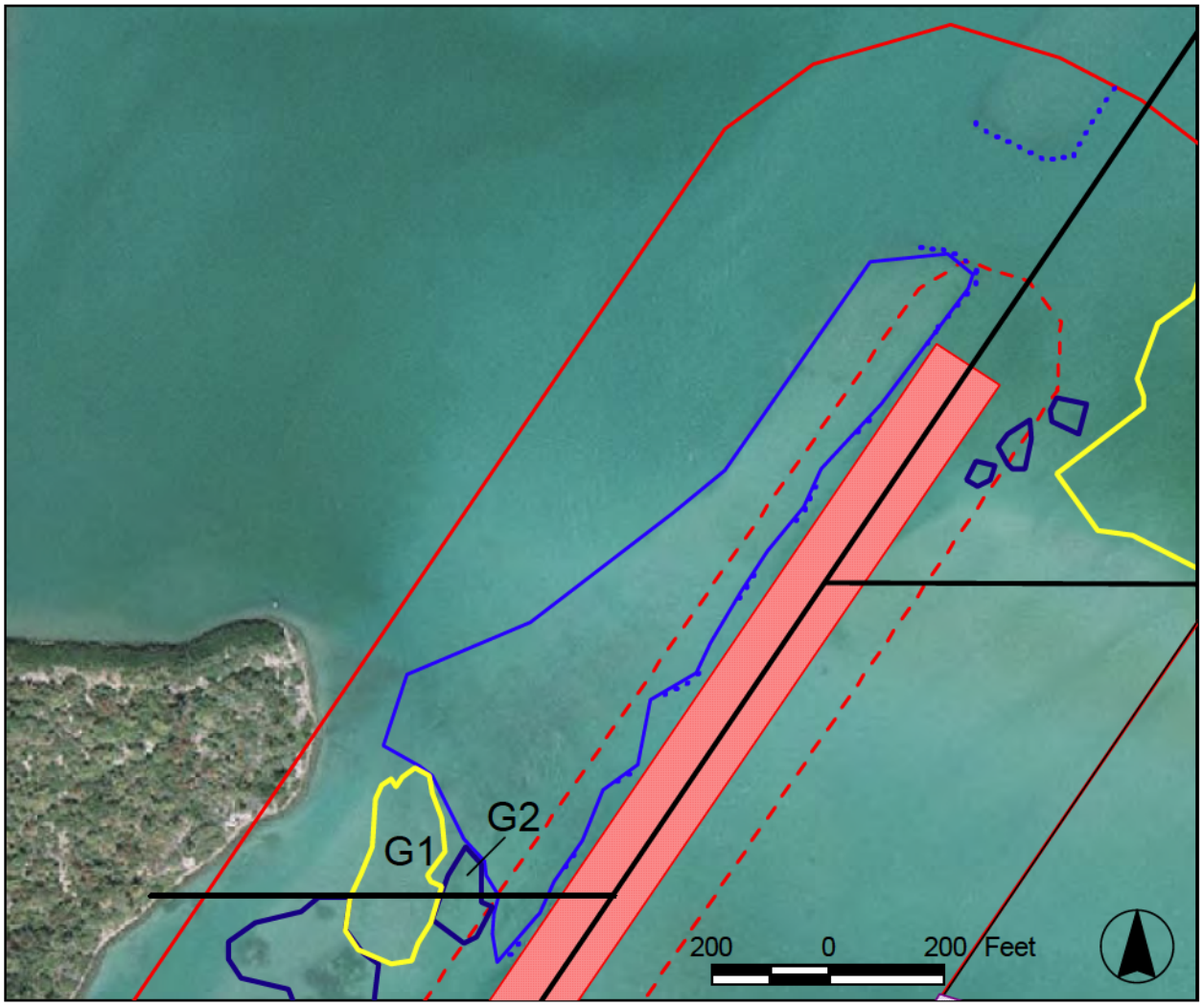


Figure 12: Region G of the Mixing Zone

REGION G (continued):

The area in Figure 12 outlined in blue extends from the wall of the channel out to the west. Hard coral, soft coral and sponge species were found in this area. Some of the hard coral species observed include *O. diffusa*, *S. michillini*, *Siderastrea* spp., *S. hyades*, *Porities* spp., *M. decactis*, *M. meandrites*, and *C. natans*. Larger colonies were mainly found on or close to the ledge. Smaller colonies (< 10cm diameter), mainly *Siderastera* spp., *Porites* spp., and *S. michillini,* were observed farther to the west (Fig 13a). Soft coral species, Pseudopterogorgia spp (Fig 13c). and Gorgonia ventalina, were observed through the area, but more frequently in the southern half. Sponge species were observed through out this area and included *H. helwigi*, *Dysidea* spp., *A. varians*, *S. vesparium*, *Cliona* spp., *Chondrilla* spp., *Ircinia* spp. (Fig 13b), and *N. digitalis*.

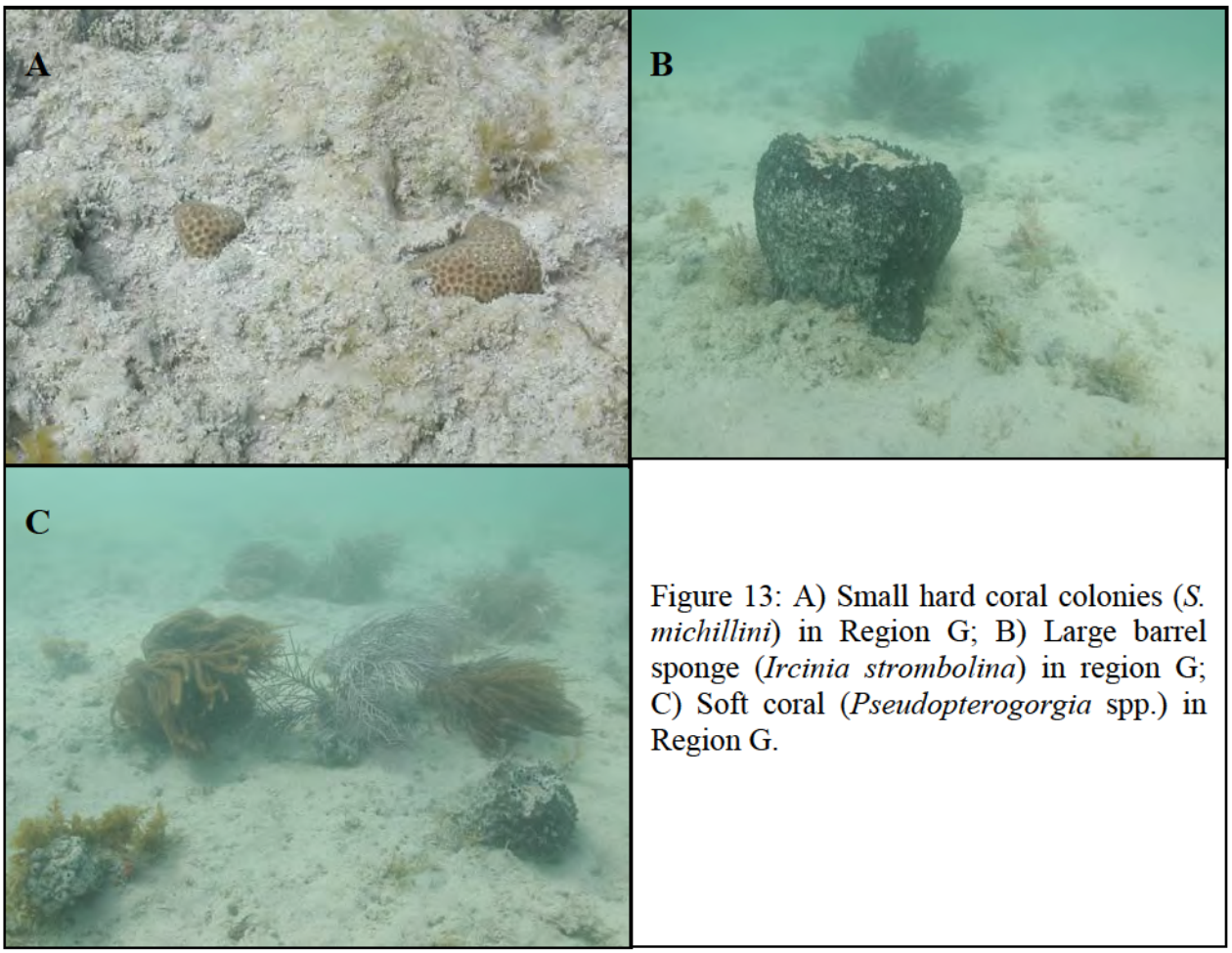


Figure 13: A) Small hard coral colonies (*S. michillini*) in Region G; B) Large barrel sponge (*Ircinia strombolina*) in region G; C) Soft coral (*Pseudopterogorgia* spp.) in Region G.

PIPELINE CORRIDOR:

Figure 14 shows the proposed pipeline corridor. The northern portion of the pipeline corridor is the sand shoal. The central region is characterized by rubbles substrate with dense algal cover and large barrel sponges such as *Spheciospongia vesparium*.

As previously mentioned, **Seagrass Area C2**, is located on the border between the mixing zone and the proposed pipeline corridor. This area has moderate to high cover of *H. wrightii*.

Seagrass Areas PC1 and PC2 also had moderate coverage of *H. wrightii*.

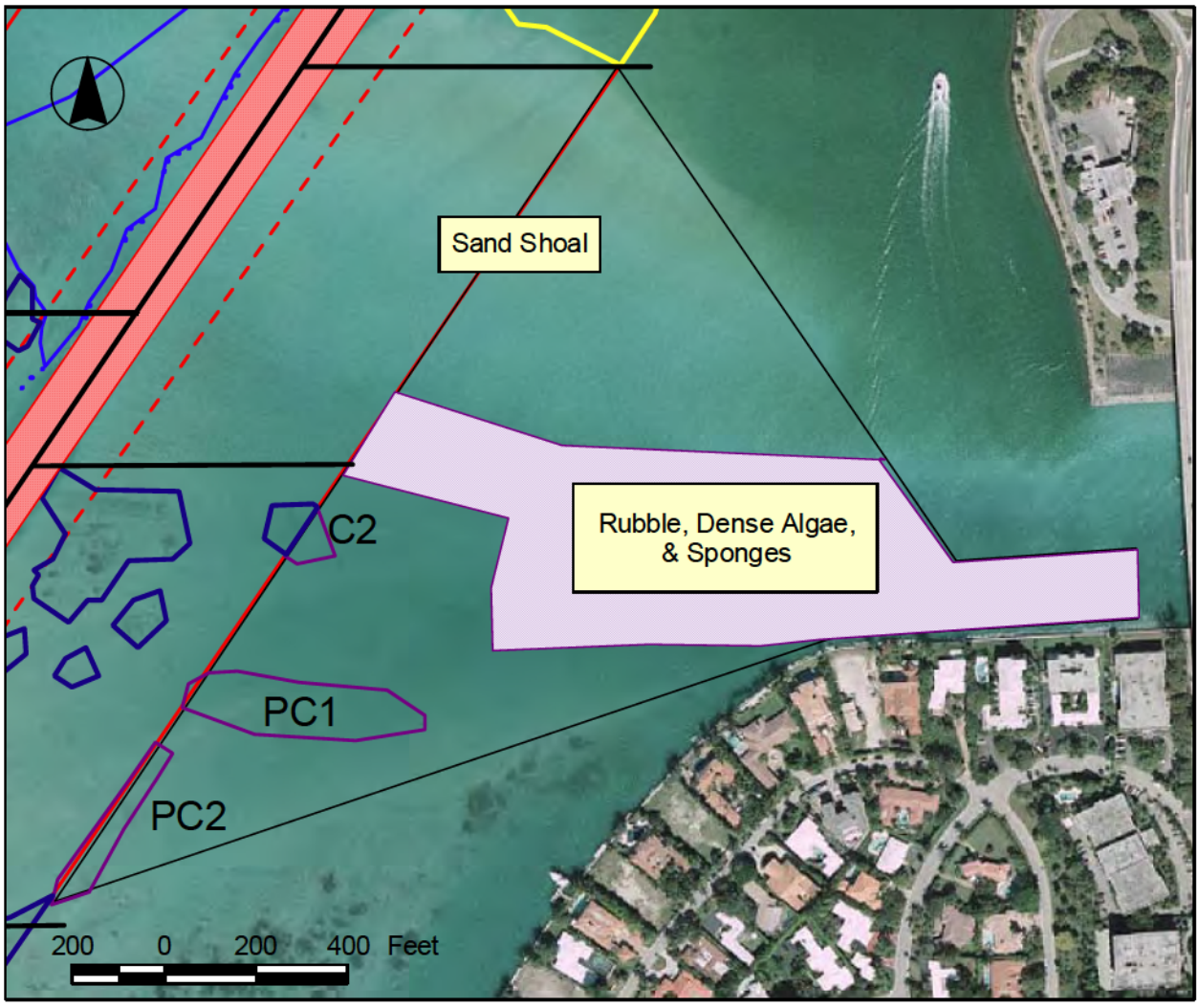


Figure 14: Proposed Pipeline Corridor

EPIBENTHIC SURVEY OF THE HAULOVER INLET REGION OF BISCAYNE BAY: FLOOD SHOAL AND ADJACENT AREAS APRIL 2004

INTRODUCTION.

The US Army Corps of Engineers (USACE) is responsible for maintaining the channels and areas comprising the "IntraCoastal Waterway" (ICW) within Miami-Dade County inclusive of the region of "Baker's Haulover Inlet" and the adjacent ICW within Biscayne Bay. This area comprises the 'Flood Shoal' region for Baker's Haulover Inlet, and as such is prone to sand accumulations that occlude the ICW and require periodic maintenance dredging, to insure navigability of the waterway.

The USACE is in the process of applying for necessary permits to conduct required maintenance dredging. Miami-Dade Department of Environmental Resources Management (DERM) was requested by the USACE, to provide information regarding potential environmental resources in and around "Baker's Haulover Inlet" and the adjacent ICW.

This report provides information on surveys conducted to date and summaries of available data. Not all regions within the anticipated dredging areas or surrounding regions have been assessed at this time; however, the general findings of this report are anticipated to be characteristic of the region.

METHODS:

Survey sites were selected utilizing Arcview® GIS mapping, Miami-Dade County 2003 color digital aerial photographs and the USACE project drawings. For the purposes of this survey, polygons were identified on the USACE project drawings and arbitrarily designated A, B and C (Figure 1) from north to south. Two survey sites were selected within the shoaling areas of Polygons B & C as evident in the color aerial photographs and the USACE project drawings. Survey sites, and recording points of interest, were located in the field utilizing a Wide Area Augmentation System (WAAS) enabled Garmin GPS 76® unit.

DERM divers experienced in epibenthic assessment conducted the in-water surveys. Surveys consisted of visual estimates of percent cover of the submerged aquatic vegetation, as well as identification the components of the epibenthic community assessed. An initial epibenthic "spot-check" survey was conducted in Polygon C, at point 1C where two $0.25m^2$ grids were assessed for epibenthic coverage abundance. To maximize the area surveyed within the shoaling areas, a diver utilizing SCUBA was towed behind a small boat on a general heading toward the SE corner of Polygon C. The yellow line in Figure 1 indicates the general path of the diver-towed portion of the survey. Epibenthic coverage abundance estimates (four individual $0.25m^2$ grids) were also conducted at survey Site 2B.

Four sites were selected in the surrounding area to provide additional background data on the neighboring epibenthic assemblages. At Sites 1 & 2 on west side of the ICW, the diver made qualitative assessments of the epibenthic communities during short drift dives, moving with the current to the southwest and covering a distance of about a 100 ft. Assessments of Sites 3 & 4

consisted of the diver utilizing SCUBA and estimating epibenthic percent cover within two $0.25m^2$ grids at each site.

Additionally, Miami-Dade County DERM has maintained a network of permanent estuarine epibenthic monitoring stations in the region since 1985. These monitoring stations consist of fixed transects 150 feet in length with three permanent one square meter sampling locations distributed long the transect to sample the dominant epibenthic components at each station. Data from two of these stations (Station 6 and 6a) were reviewed for this assessment.

RESULTS AND DISCUSSION

Epibenthic Communities in the Proposed Dredging Areas and Adjacent areas

The present report provides information for the shoaling areas with in the southern portion of polygon B, the majority of area in polygon C, and adjacent regions to the west and south of the project areas. The area within polygon A is not addressed in this report.

Within the 'Polygon C" area, the survey at Station '1C' showed a sand bottom without any epibenthic growth. The Survey of Site '2C' found a single patch of the seagrass *Syringodium filiforme*, approximately 15ft in diameter, with a coverage ranging from 15-50%. The majority of this portion of the survey covered the deeper water within the eastern portion of 'Polygon C'. The epibenthic community within this area was predominantly sparse soft corals and *S. filiforme*, which is approximately delineated by the triangle marked 'Mixed' on Figure 1. The survey continued onto the shoal in the southern end of Polygon B, where a mixed seagrass bed composed of *Halodule wrightii, Halophila johnsonii*, and *Halophila dicipiens* was encountered (site 2B). Four $0.25m^2$ grids were surveyed at this site. *Halodule wrightii* was encountered in all four grids and had a coverage ranging from 10-75%, *Halophila. johnsonii* was present in two of the four grids with coverage ranging from 3-15%, and *H. dicipiens* was present in one grid with a coverage of 15%. The west-east extent of this bed is denoted on the map by 1B and 3B respectively.

Of the two sites west of the ICW, Site 1 is predominately rubble with occasional *Caulerpa mexicana* (green algal) while Site 2 is a sand/rubble mix with patches of the seagrass *Thalassia testudinum* and *H. dicipiens*. Site 3 is located in a predominately sandy area with an overall cover of *T. testudinum* of 5-15%. It should be noted that the *T. testudinum* patches found in this area, while scattered, were small, dense (≅100% cover) patches of the seagrass. Site 4, located in an extremely dynamic area just inside the mouth of the inlet (i.e., apparent frequent benthic substrate movement), is predominately rubble with encrusting sponges, red algae and minor amounts the green algae *C. mexicana* and *Halimeda tuna.*

Data from historic and existing fixed stations

Station 6 is located just east of the Intracostal Waterway adjacent to the mouth of Haulover Inlet (Figure 1). Historically, this station supported moderate to dense mixed seagrass beds composed of *Thalassia testudinum* and *Syringodium filiforme*. Notable declines in these seagrass beds began in 1996 with marked decreases in *T. testudinum* shoot density and transect percent cover, followed by decreases in *S. filiforme* in 1998. Currently, this station supports sparse aggregations

of the seagrass *Halophila dicipiens* and the red alga *Wrangelia argus*. Field records also indicate the presence of green algae in the *Halimeda* sp., *Udotea* sp., and *Penicillus* sp..

Station 6a was established in June of 2003 approximately 0.25 miles to the south of Station 6 due to the sand inundation of the latter. With one sampling event conducted to date, the dominant seagrass recorded at this location was *S. filiforme,* with minimal presences noted for *T. testudinum* and *Halodule wrightii*. Additionally, field records indicate the presence of the green alga *Caulerpa mexicana,* and the red alga *Laurencia intricata*.

SUMMARY

The project region is the area immediately inside Baker's Haulover Inlet, and encompasses the 'flood shoal' of the Inlet. This is the only inlet in northern Biscayne Bay, and is subject to strong tidal exchange and currents. As a result there is a high rate of sediment movement, deposition and re-distribution. These factors serve to limit the development of benthic communities throughout the region. However, specific species and benthic communities are adapted to these environments, and are present in and around the project area. The general region has scattered areas of subaquatic vegetation (seagrasses and algae), with occasional minor sponge communities and extremely sparse soft coral.

The previously dredged flood shoal area (Polygon C) is presently mostly sand with no epibenthic organisms, however scattered seagrasses are found in the eastern, and northern deeper regions of that area. Sparse soft coral and seagrass have been identified in the northeastern portion of Polygon C. The southern region of Polygon B (just north of Polygon C) supports a sparse mixture of seagrass, including Johnson's Seagrass (*Halophila johnsonii*). The regions surrounding the designated dredging areas support sparse seagrasses and/or algal assemblages on sand and rubble. The presence and density of these assemblages is seasonally dependant.

Figure 1. 2003 Aerial photograph of the 'Flood Shoal' with the USACE project drawings overlayed, and survey site references.

Table 1. Survey sites' geographical positions and NAD 83 state plane coordinates.

SITE	LATITUDE	LONGITUDE	X-COORD	Y-COORD
1	25 54.361	80 07.713	942619	572478
2	25 54.204	80 07.852	941866	571519
3	25 53.989	80 07.919	941508	570216
4	25 54.019	80 07.686	942783	570405
1C	25 54.168	80 07.765	942340	571306
2C	25 54.135	80 07.690	942764	571116
1B	25 54.231	80 07.710	942651	571696
2B	25 54.219	80 07.680	942815	571625
3B	25 54.228	80 07.636	943056	571681
SE corner	25 54.064	80 07.593	943288	570685
SW corner	25 54.073	80 07.878	941729	570729
6	25 53.945	80 07.971	941231	569954
6A	25 53.778	80 07.996	941101	568941

Table 2. Epibenthic presence/absence for all sites presented in this survey.

	Polygon B	**Polygon C**			**Surrounding**				**Fixed**	
SPECIES	1B-3B	1C	2C	Mixed'	1	2	3	4	6	6A
Halodule wrightii	X									X
Halophila dicipiens	X					X			X	
Halophila johnsonii	X									
Syringodium filiforme			X	X						X
Thalassia testudinum						X	X			X
Unid. Red algae sp.								X		
Laurencia intricata										X
Wrangelia argus									X	
Caulerpa mexicana					X			X		
Halimeda sp.								X	X	
Penicillus sp.									X	
Udotea sp.									X	
Soft coral				X						
Sponge								X		X
Sand/Rubble		X		X	X		X		X	

HARDBOTTOM SURVEYS

Identification of Benthic Resources in the Nearshore Zone
Sunny Isles Beach, Miami-Dade County, Fl
DNR Monuments: R-15 to R-22

Introduction:

Due to beach erosion along Miami-Dade County's coast and in anticipation of potential sand placement activities using upland sand sources (i.e., tuck haul renourishment) at erosion areas under FDEP Joint Coastal Permit 0233882-005-JM and corresponding US Army Corps of Engineers and Miami-Dade County Class I Permit/s, surveys of benthic resources were needed. In September 2015, nearshore surveys were conducted in the region between the State's 'DNR' beach Monuments R-7 and R-15[1]. Permit modifications are being sought to extend the fill placement area farther south from R-15 through R-19. Surveys were conducted to document nearshore resources offshore of the extended fill area between R-15 and R-19 as well as south downstream to R-22.

Methods:

The geographic scope of this survey effort was designed to cover the nearshore areas (within 1000ft of the equilibrium toe of fill) adjacent to Sunny Isles Beach from DNR Monument R-15 south to R-22 (Figure 1). Shore-perpendicular transects were established at approximately 500ft intervals between the monuments noted above resulting in the establishment of 16 transects. Each transect extended east from the equilibrium toe of fill (ETOF) line provided by the Army Corps of Engineers to approximately 1000ft offshore resulting in transects that were approximately 1,250ft in length. Numerous survey points were also established to aid in resource edge traces based on aerial photography and mapped resources[2].

Each transect was surveyed by biologists from the Restoration and Enhancement Section of the Division of Environmental Resources Management (DERM) while scuba diving. The survey path along each transect was traced by the biologist towing a Garmin GPS unit secured to a surface float (foam board). During these surveys, specific GPS coordinates were also recorded documenting the location of observed benthic resources, artificial structures (i.e., groins, submerged breakwaters), or hardbottom. Surveys were completed from December 15, 2016 through March 23, 2017.

[1] Miami-Dade County. 2015. Identification of Benthic Resources in the Nearshore Zone of Sunny Isles Beach, Miami-Dade County, FL: DNR Monuments R-7 to R15 (September 2015). Pp. 9.

[2] Walker, B.K. 2009. Benthic Habitat Mapping of Miami-Dade County: Visual Interpretation of LADS Bathymetry and Aerial Photography. Florida DEP report #RM069. Miami Beach, FL. Pp. 47.

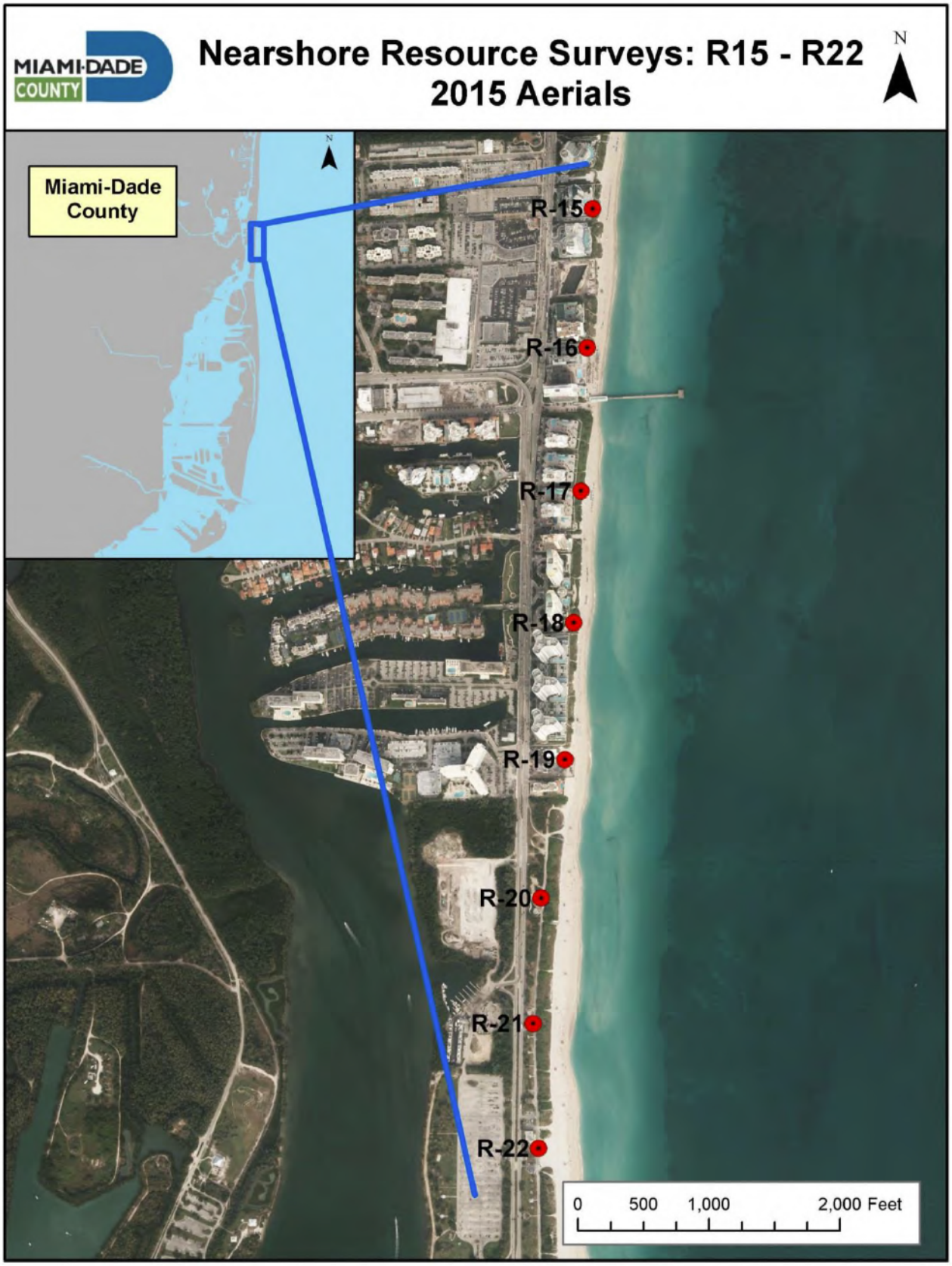


Figure 1. Nearshore survey area from DNR Monument R-15 south to R-22 over 2015 aerials.

Results:

Appendices 1 through 3 show the survey paths along each transect as well as the traces along the resource edges. All transects from shore (high water line) out minimally to 750ft (228m) consisted of open sand without benthic growth (Figure 2) with the exception of an area of rubble between Transect 11 and 12 described with more detail later. Between approximately 650ft and 800ft (198-244m) from shore the sand transitioned from fine, lighter colored sand to coarser, darker colored sand (Figure 3). The color change is discernable on the aerials (Figure 1, Appendices 1-3). Occasionally, along this sand transition, a slight slope (<1ft) was observed with detrital accumulation (unattached, dead sponges and octocorals) on the east side.

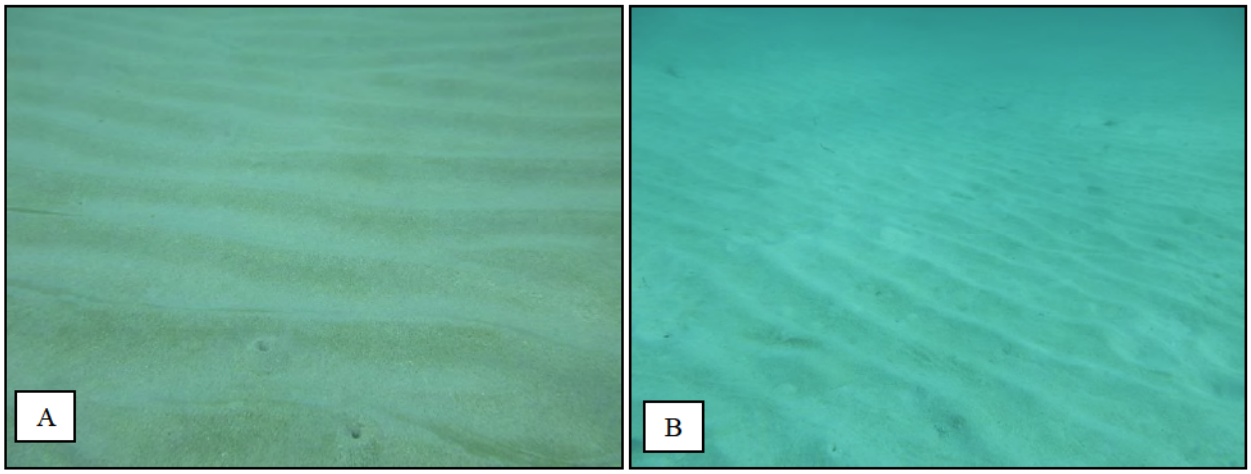


Figure 2. Barren sand observed along the survey transects. A). Transect 4 (~R-16). B). Transect 8 (~R18).

Figure 3. Sand transition area from finer, lighter sand in the west to darker, coarser sand toward the east along Transect 7 (~R17.5).

East of the sand areas four categories of resources were observed as mapped in Appendices 1-3 and described in greater detail below: rubble with emergent biota, emergent biota with occasional exposed hardbottom, rubble with algae, and algae only.

Rubble with Emergent Biota

The rubble and emergent biota areas toward the end of Transect 4 and between Transects 11 and 12 are associated with dredged sewer outfall pipeline corridors (Appendices 1-3). The rubble around the northern corridor had up to 2ft of relief and began approximately 900ft from shore (Figure 4). The southern corridor had up to 4ft of relief with larger boulders in some areas and began approximately 500ft from shore (Figure 5). Biota in both areas included porifera, octocorals, and scleractinians (Table 1).

Figure 4. Rubble and emergent biota toward the east end of Transect 4.

Figure 5. Rubble and emergent biota between the east end of Transect 11 and 12.

Emergent Biota with Occasional Exposed Hardbottom

Between the eastern end of Transects 1-3, a definable, continuous edge of emergent biota was observed and traced (Appendix 1-2). This edge followed closely the edge of colonized pavement mapped by Walker (2009) and was approximately 800ft (244m) from shore. This area was

mainly emergent octocorals and algae (Figure 6) with sparse exposed hardbottom with porifera and small scleractinians (Figure 7). Observed species are listed in Table 1.

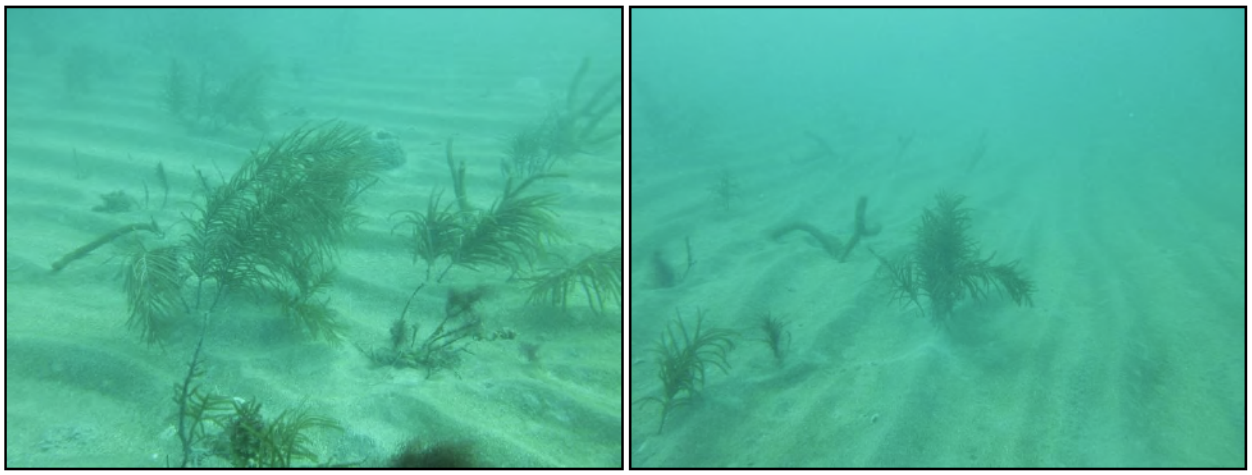


Figure 6. Emergent biota observed along the resource trace at the eastern end of Transects 1-3.

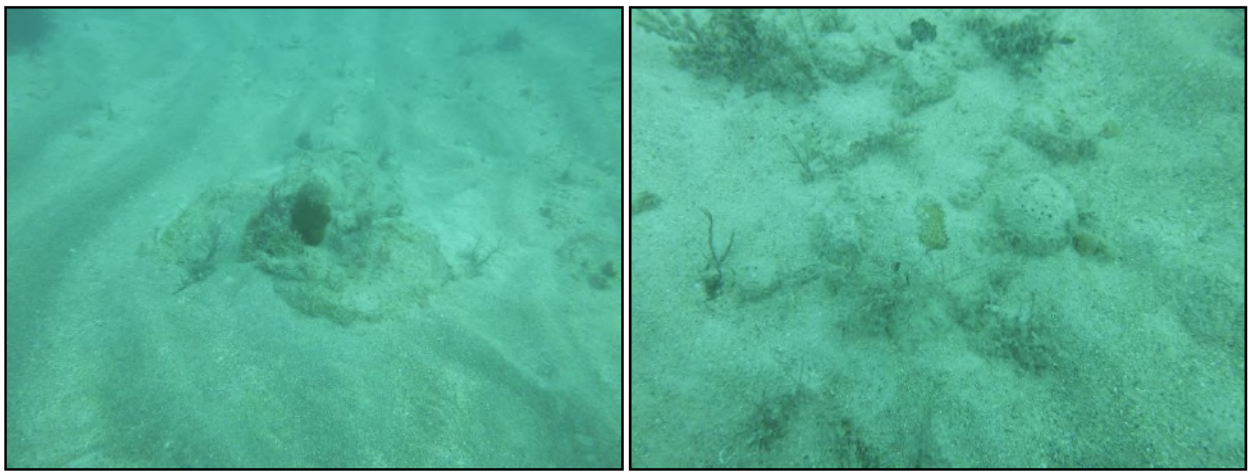


Figure 7. Occasional exposed hardbottom along the emergent biota trace at the eastern end of Transects 1-3.

Between and beyond the eastern end of Transects 6-10, several smaller areas of emergent biota and sparse exposed hardbottom were also observed and traced (Appendix 1-3). South of Transect 6 to south of Transect 7, the traced edge of emergent biota encompassed an area of mapped colonized pavement. This area was approximately 1,150ft (350m) east of shore and contained algae, octocorals, and sparse scleractinians (Figure 8). Along Transect 7, one isolated area with four emerging octocorals (*Pseudopterogorgia* species) was observed approximately 900ft (274m) from shore (Figure 9). Between Transects 7 and 8, approximately 850ft (259m) from shore, a patch of emergent biota with small rubble and exposed hardbottom was observed and traced. This area was predominantly dense algae with sparse gorgonians and isolated small scleractinians (<4cm diameter) (Figure 10). Farther east of this patch and beyond the eastern ends of Transects 8 and 9 was another area of emergent biota containing mainly algae and sparse octocorals with no exposed hardbottom (Figure 11). Between Transect 9 and 10, just east of the

sand transition area, a small area of dense algae and sparse gorgonians and sponges was observed approximately 775' (236m) from shore (Figure 12). Beyond the eastern ends of Transects 10 and 11, the edges of two emergent biota areas were observed and traced. The northern emergent biota area was mainly algae with sparse octocorals and followed closely to the mapped edge of colonized pavement (Figure 13). The southern of these two areas contained octocorals, isolated small (<4cm) scleractinians, and a small patch (~25ft diameter) with the seagrass *Thalassia testudinum* (Figure 14). Observed species are listed in Table 1.

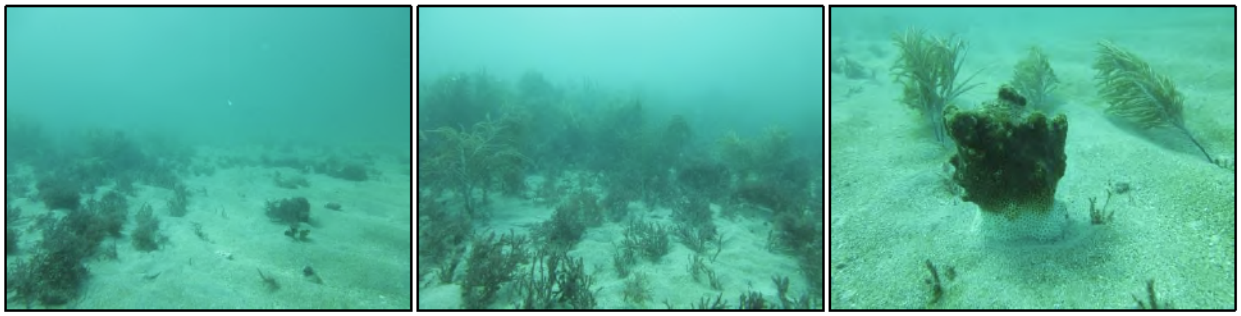


Figure 8. Emergent biota between the eastern end of Transect 6 and 7.

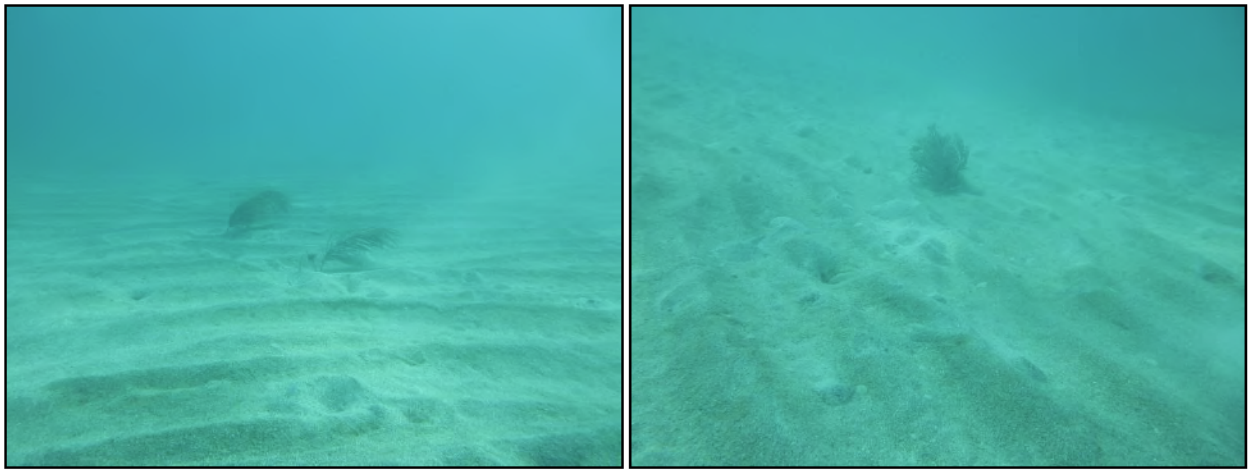


Figure 9. Isolated octocorals observed along Transect 7

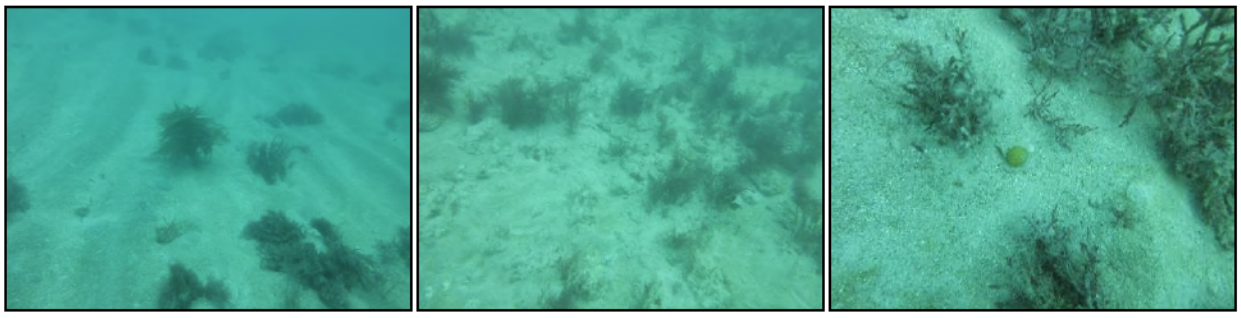


Figure 10. Emergent biota patch between Transects 7 and 8.

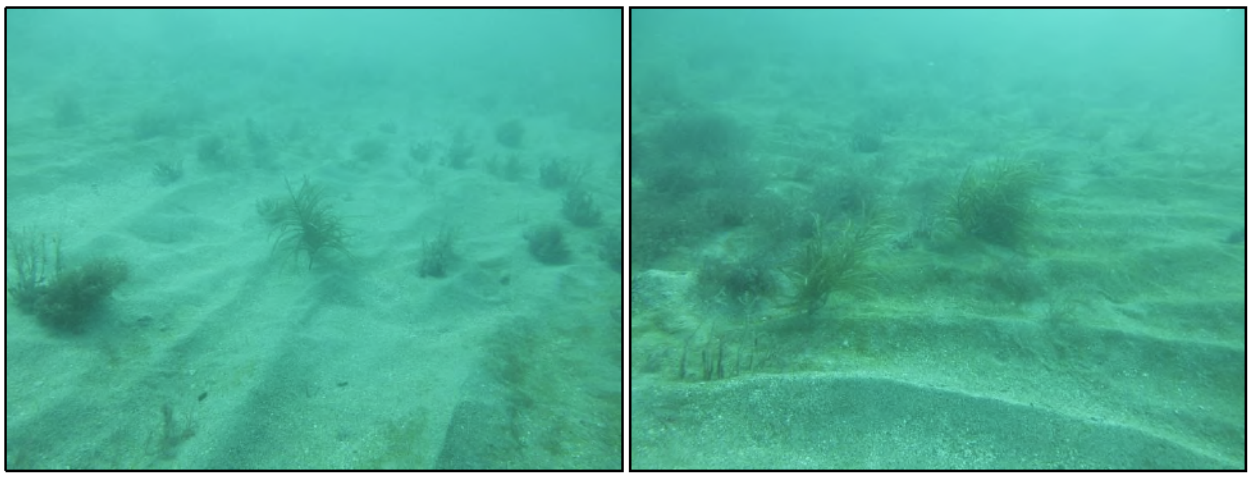


Figure 11. Emergent biota beyond the east end of Transects 8 and 9.

Figure 12. Emergent biota in small patch between Transects 9 and 10.

Figure 13. Northern emergent biota edge beyond the eastern end of Transects 10 and 11.

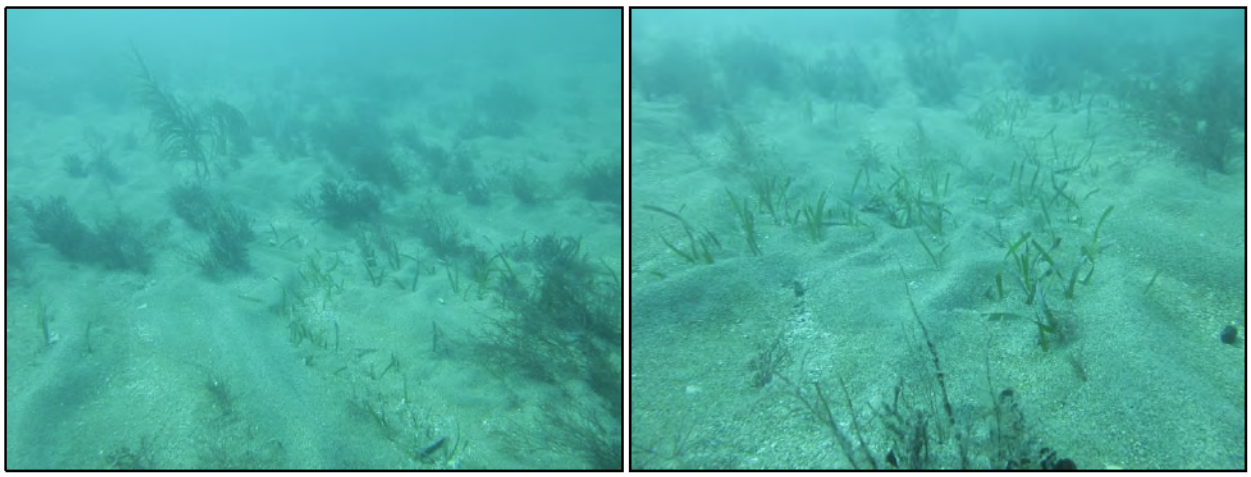


Figure 14. Southern emergent biota edge beyond the eastern end of Transect 10 and 11.

South of the rubble corridor, from Transects 12 through 16, the western edge of emergent biota was traced. The emergent biota edge was approximately from 1,000ft to 1,300ft (305m to 396m) from shore. This far southern emergent biota area was comprised predominantly of emergent octocorals, algae, and sparse exposed hardbottom with porifera and generally small (<4cm) scleractinians (Figure 15). Occasionally, areas with denser biota patches with more exposed hardbottom and larger scleractinians (~20cm diameter) were observed (Figure 16). Along this trace, a few areas were also observed with clusters of metal tire rims (Figure 17). Observed species are listed in Table 1.

Figure 15. Emergent biota and exposed hardbottom between and beyond the eastern ends of Transects 12 through 16.

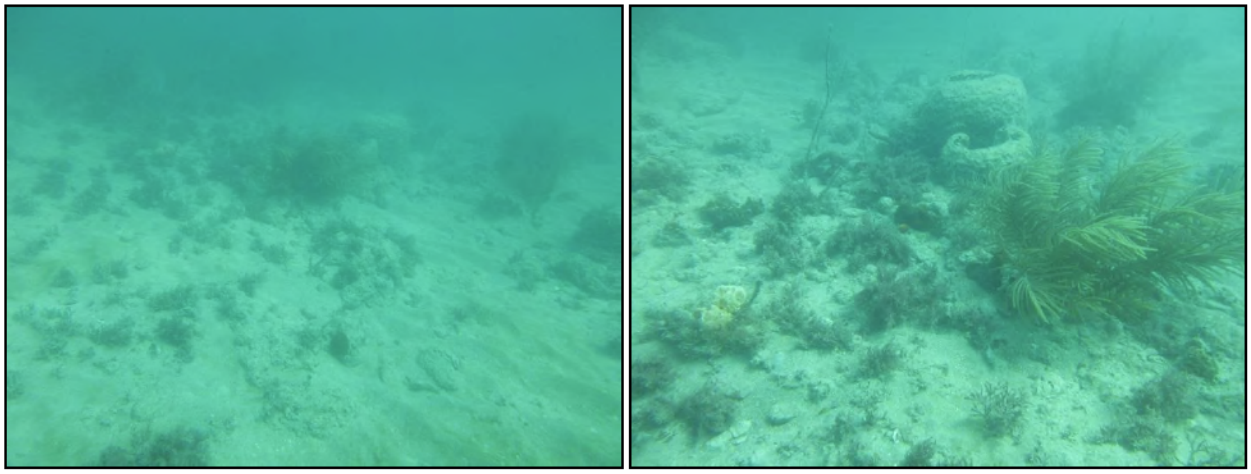


Figure 16. Denser areas of emergent biota and exposed hardbottom between and beyond the eastern ends of Transects 12 through 16.

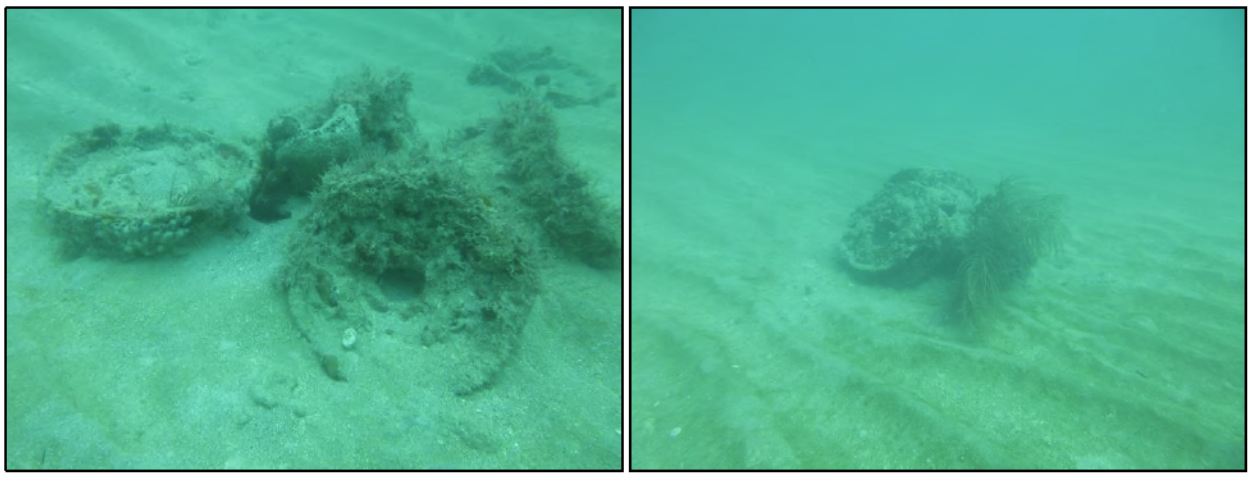


Figure 17. Tire rims along the emergent biota area between and beyond the eastern ends of Transects 12 through 16.

Rubble and Algae Area

One area of unconsolidated rubble with algae and hydroids was observed between Transects 7 and 8 just east of the sand transition area (Figure 18; Appendix 1 and 2). This area is approximately 750' (229m) from shore. Scleractinians and attached octocorals were not observed in this area. Only a single boring sponge was observed on a large piece or rubble. Dislodged octocorals and sponges were observed mixed in with rubble, hydroids, and algae. Observed species are listed in Table 1.

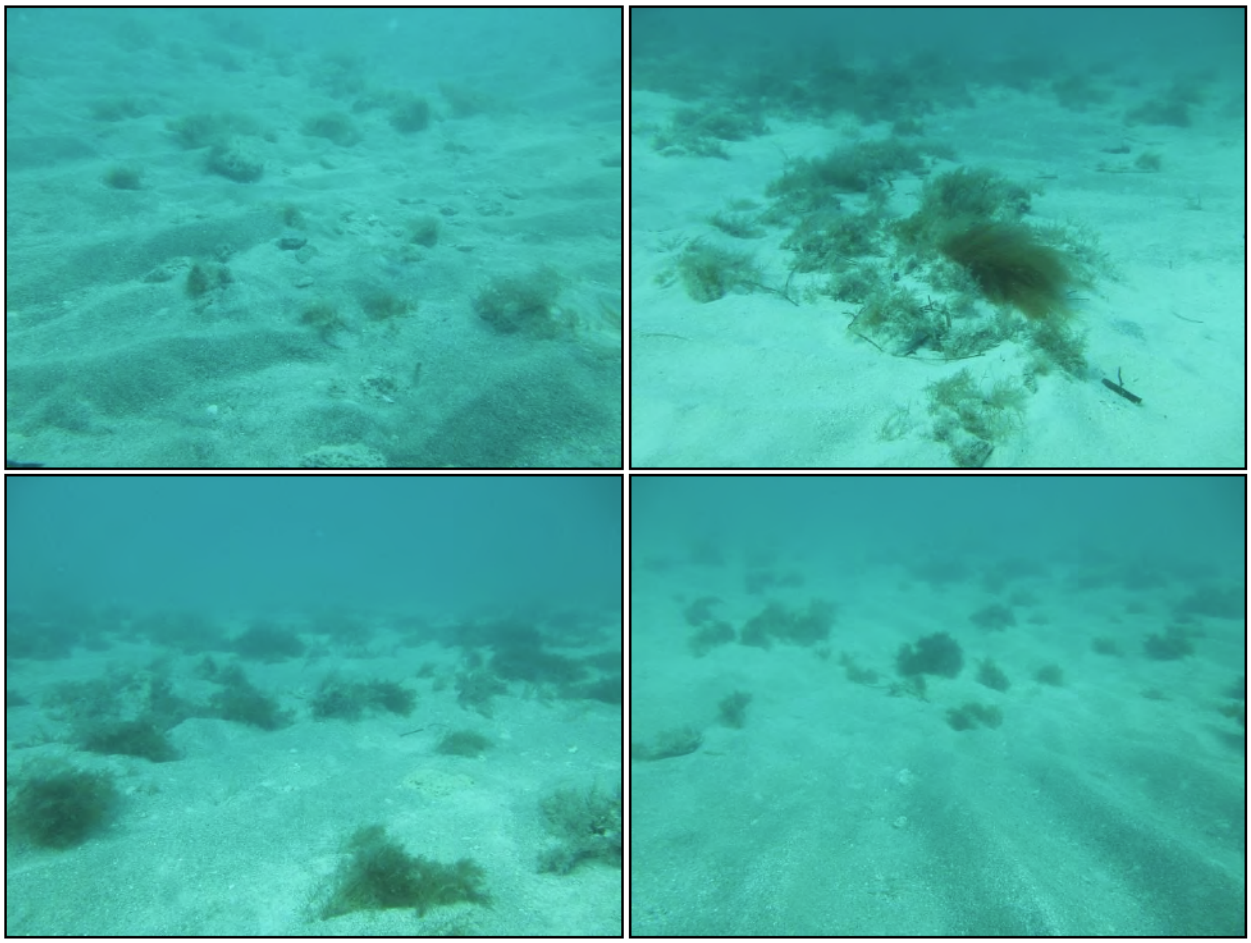


Figure 18 Rubble and algae area between Transects 7 and 8.

Algae Areas

South of the eastern end of Transect 3, the definable edge of emergent biota faded out to an area with algae only (Appendices 1-3). The algae area extends south toward the eastern end of Transect 6 (Figure 19), flanking both north and south sides of an area with rubble and emergent biota. An additional smaller algae (Figure 20) area was observed between the eastern end of Transect 7 and 8 to the east of a patch of emergent biota and between two definable areas of emergent biota and occasional exposed hardbottom to the north and south. A third algae area (Figure 21) was observed from just north of Transect 10 to Transect 13 flanking both the north and south sides of an area of rubble and emergent biota. DERM biologist attempted to trace the western extent of this algae area but the varying densities and visibility only provided an approximate trace. *Chondria* species, *Bryothamnion* species, and hydroids were the most abundant species. All observed species are listed in Table 1.

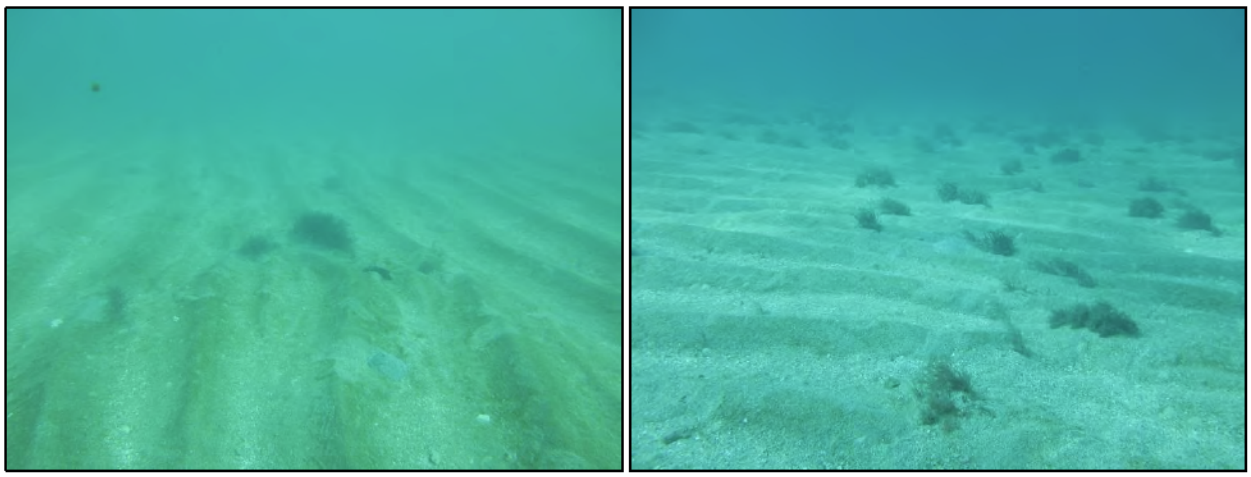


Figure 19. Algae area toward the eastern extent of Transects 4-6.

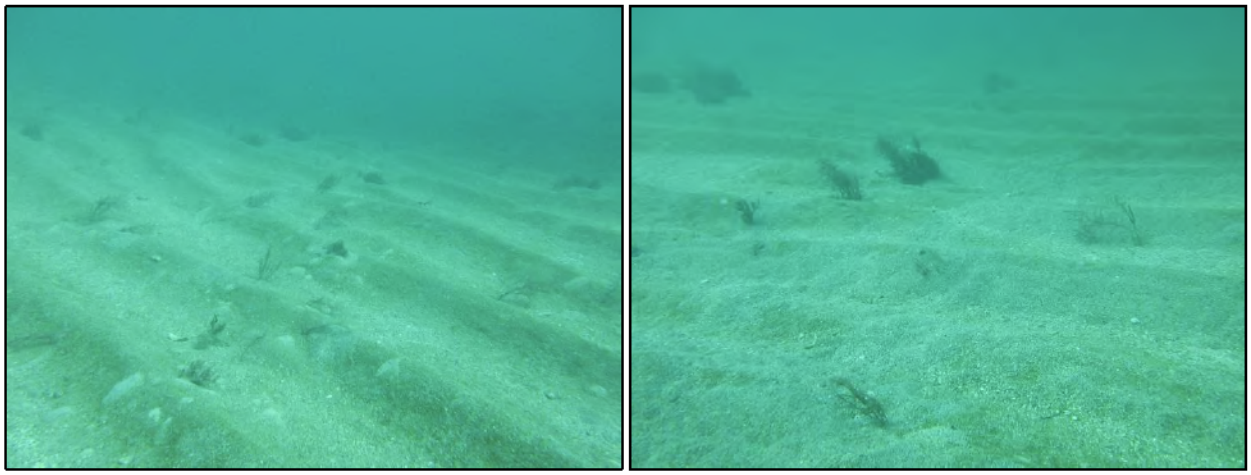


Figure 20. Algae area between Transects 7-8.

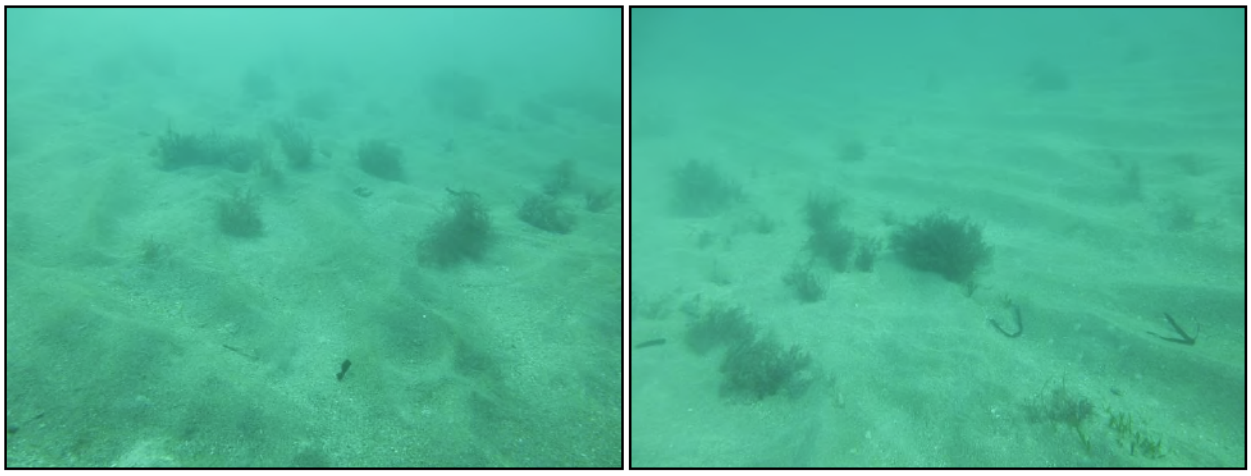


Figure 21. Algae area along Transect 10.

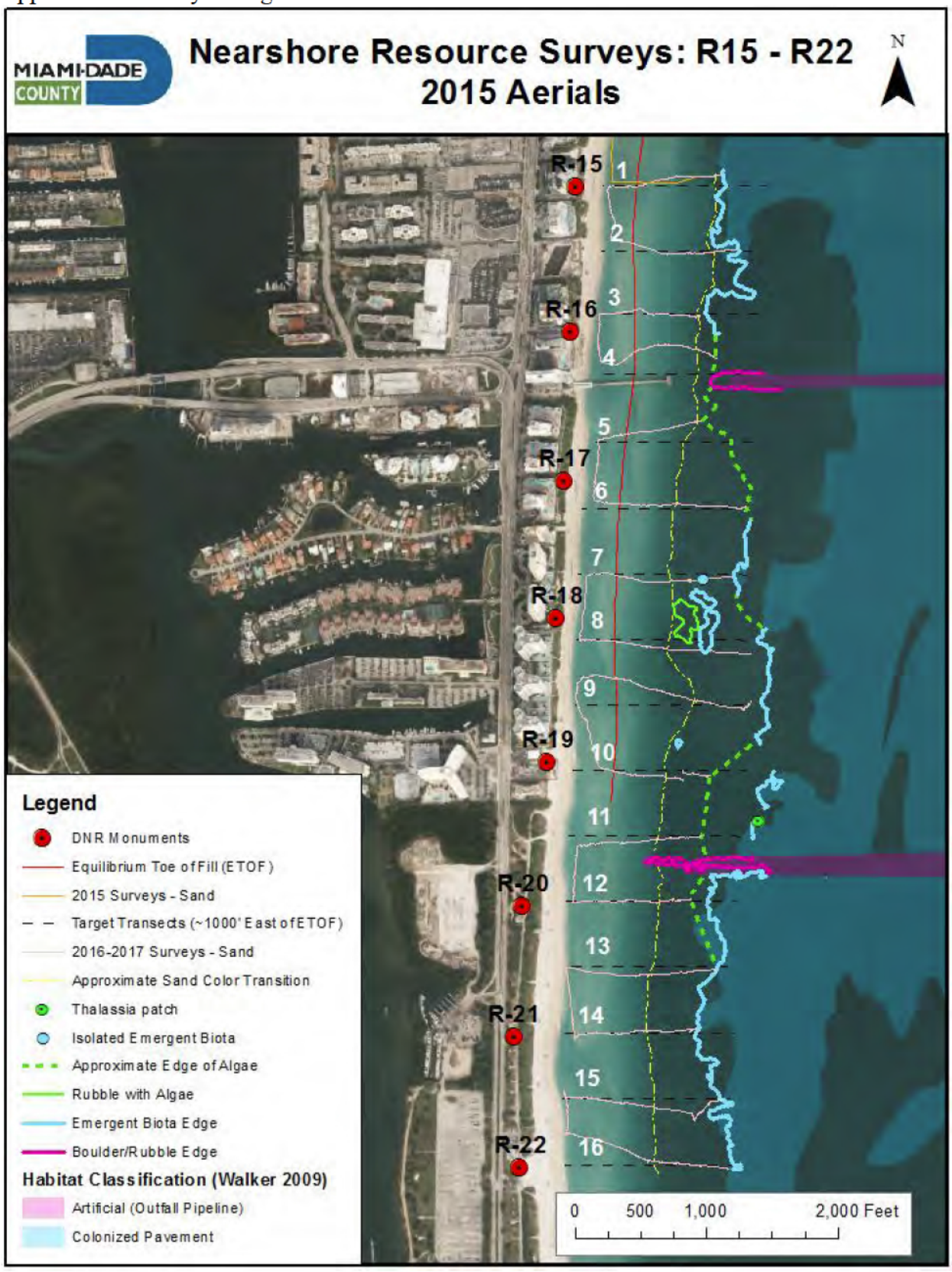
Table 1. Benthos observed in the nearshore region between R-15 and R-22. Presence denoted by an 'X'.

Category	Benthic Biota	Rubble with Biota	Emergent Biota	Rubble with Algae	Algae Areas
Algae	*Acetabularia* species			X	
	Blue-green algae (unk. species)	X	X	X	X
	Bryothamnion species		X		X
	Calcareous algae (unk. species)		X		
	Caulerpa prolifera		X		X
	Caulerpa mexicana		X	X	
	Caulerpa sertularioides		X		X
	Chondria species		X	X	X
	Dasya species		X	X	X
	Gelidiella species				X
	Gracilaria species		X	X	X
	Halimeda species		X	X	X
	Hypnea species			X	
	Laurencia species		X	X	X
	Neomeris species		X		
	Peyssonnelia species	X			
	Turf algae (unk. species)	X	X		
	Udotea species		X		
Scleractinia	*Colphophyllia natans*	X			
	Dichocoenia stokesii	X			
	Montastraea cavernosa	X			
	Porites astreoides	X			
	Pseudodiploria strigosa	X			
	Siderastrea radians	X	X		
	Siderastrea siderea	X	X		
	Solenastrea bournoni	X	X		
	Solenastrea hyades		X		
	Stephanocoenia intersepta	X			
Ocotcorallia	*Eunicea* species		X		
	Gorgonia ventalina	X	X		
	Muricea species		X		
	Plexaurella species	X	X		
	Pseudoplexaura species	X	X		
	Pseudopterogorgia acerosa	X	X		
	Pseudopterogorgia americana	X	X		
	Pterogorgia anceps		X		
	Pterogorgia guadalupensis		X		

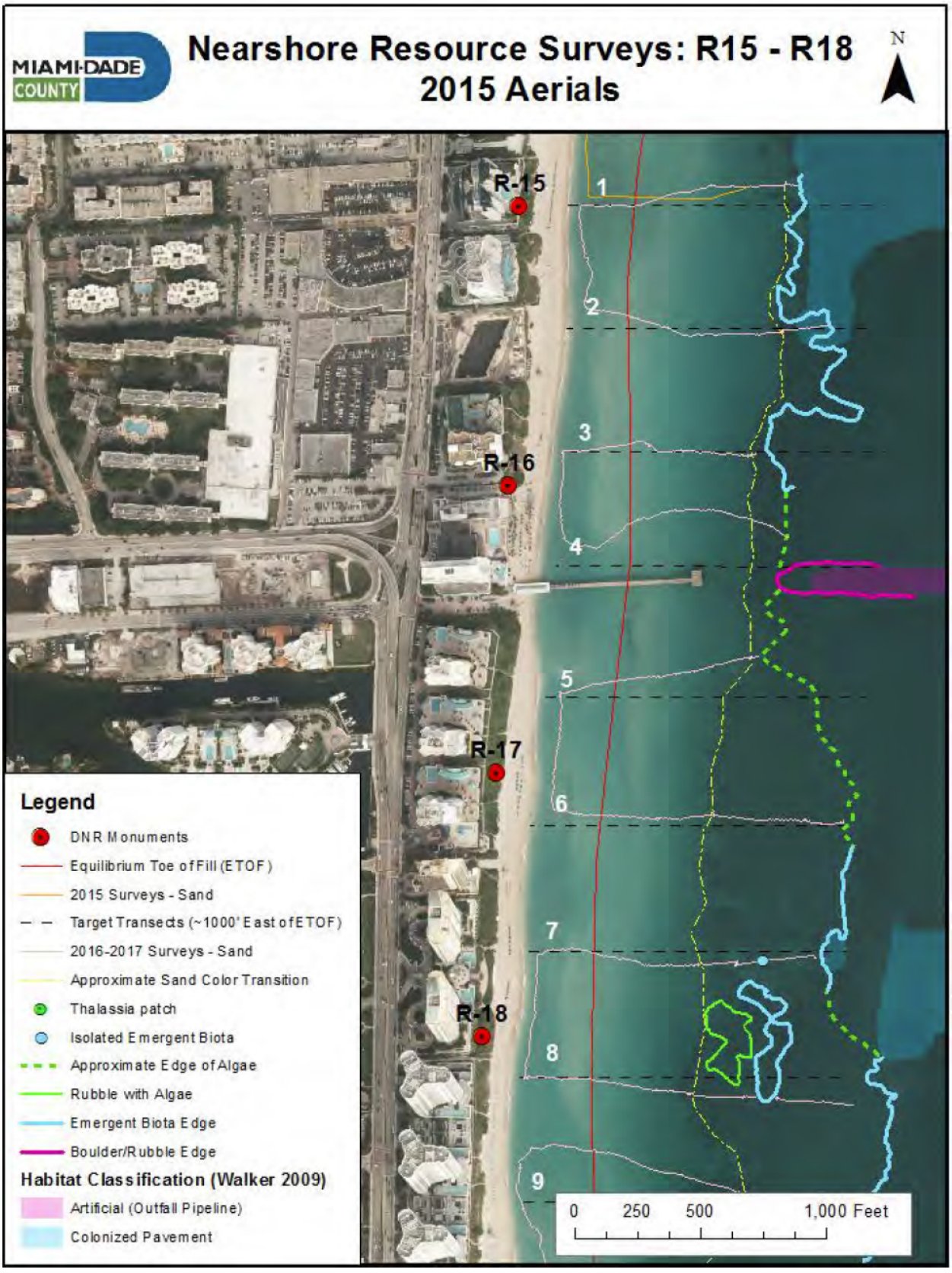
Table 1 (continued). Benthos observed in the nearshore region between R-15 and R-22. Presence denoted by an 'X'.

Category	Benthic Biota	Rubble with Biota	Emergent Biota	Rubble with Algae	Algae Areas
Porifera	*Amphimedon compressa*	X	X		
	Aplysina cauliformis	X			
	Aplysina fulva	X			
	Cinachyra species		X		
	Cliona delitrix	X			
	Cliona species			X	
	Cliona varians	X	X		
	Desmapsamma anchorata	X			
	Dysidea species	X	X		
	Haliscara species	X			
	Igernella notabilis	X			
	Ircinia campana	X			
	Ircinia felix	X			
	Ircinia strobilina	X	X		
	Iotrochota birotulata	X			
	Niphates erecta	X			
	Pione lampa	X	X		
	Scopalina ruetzleri	X			
	Spheciospongia vesparium	X	X		
	Strongylacidon species	X			
	Xestospongia muta	X			
Other	Bivalve (unk. species)	X	X		
	Bryozoan (unk. encrusting species)	X			
	Eudistoma species	X			
	Hydroid (unk. species)		X	X	X
	Millepora alcicornis	X	X		
	Palythoa caribaeorum	X			
	Thalassia testudinum		X		
	Zoanthid (unk. species)	X			

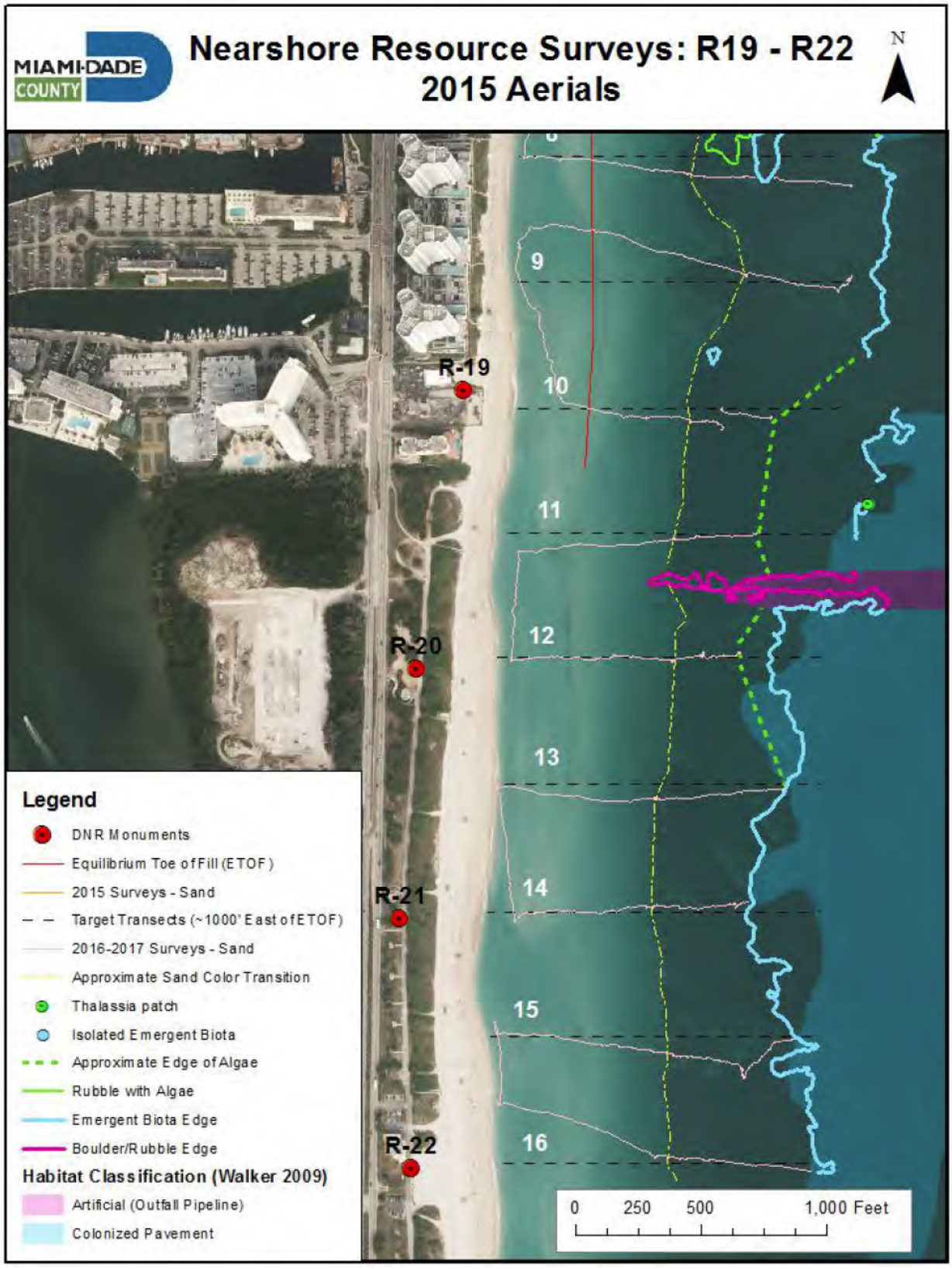
Appendix 1. Surveys along full assessment area R-15 to R-22.



Appendix 2. Surveys along the northern assessment area R-15 to R-18.



Appendix 3. Surveys along the southern assessment area R-19 to R-22.



Identification of Benthic Resources in the Nearshore zone Surfside and Bal Harbour Beach, Miami-Dade County, Fl (DNR Monuments: R-29 to R-37) July 2009

Methods:

The geographic scope of this survey effort was designed to cover the nearshore areas (within 600 feet of shore) adjacent to Bal Harbour Beach from DNR Monument R-29 south to R-37 (Figure 1). Shore-perpendicular transects were established at approximately 500' intervals between the monuments noted above resulting in establishment of 22 transects. Each transect extended east from the estimated high water line to approximately 600' offshore. The nearshore swash zone region (from 1-2' east of the low water mark to approximately 50' offshore) was also surveyed along the length of the area investigated.

The western portion of each transect was surveyed by biologists out to 300' or the eastern end of the vessel exclusion zone (which ever was furthest). The surveys were conducted while snorkeling. During longer transects, the snorkelers utilized underwater scooters to assist in the surveys. The survey path along each transect and in the swash zone was traced by the snorkelers towing a Garmin GPS unit secured to a surface float (foam board). During these surveys, specific GPS coordinates were also recorded documenting the location of any benthic resources or substrates observed included exposed groins. The portion of each transect seaward of the vessel exclusion zone out to 600' was surveyed by snorkelers towed by a small boat. The survey path was traced using a Garmin GPS unit aboard the small vessel.

The area from 300' to 1500' from shore for Transects 1 through 5 covering R-27 to R-29 were surveyed in July of 2008 in response to a Request for Additional Information (RAI) for an application to the Florida Department of Environmental Protection (FDEP; File Number 023382-00-JM). A copy of this response is included as Appendix 5. For Transects 4 and 5, the swash zone and portion of each transect from shore out to 300' were also evaluated during the present surveys.

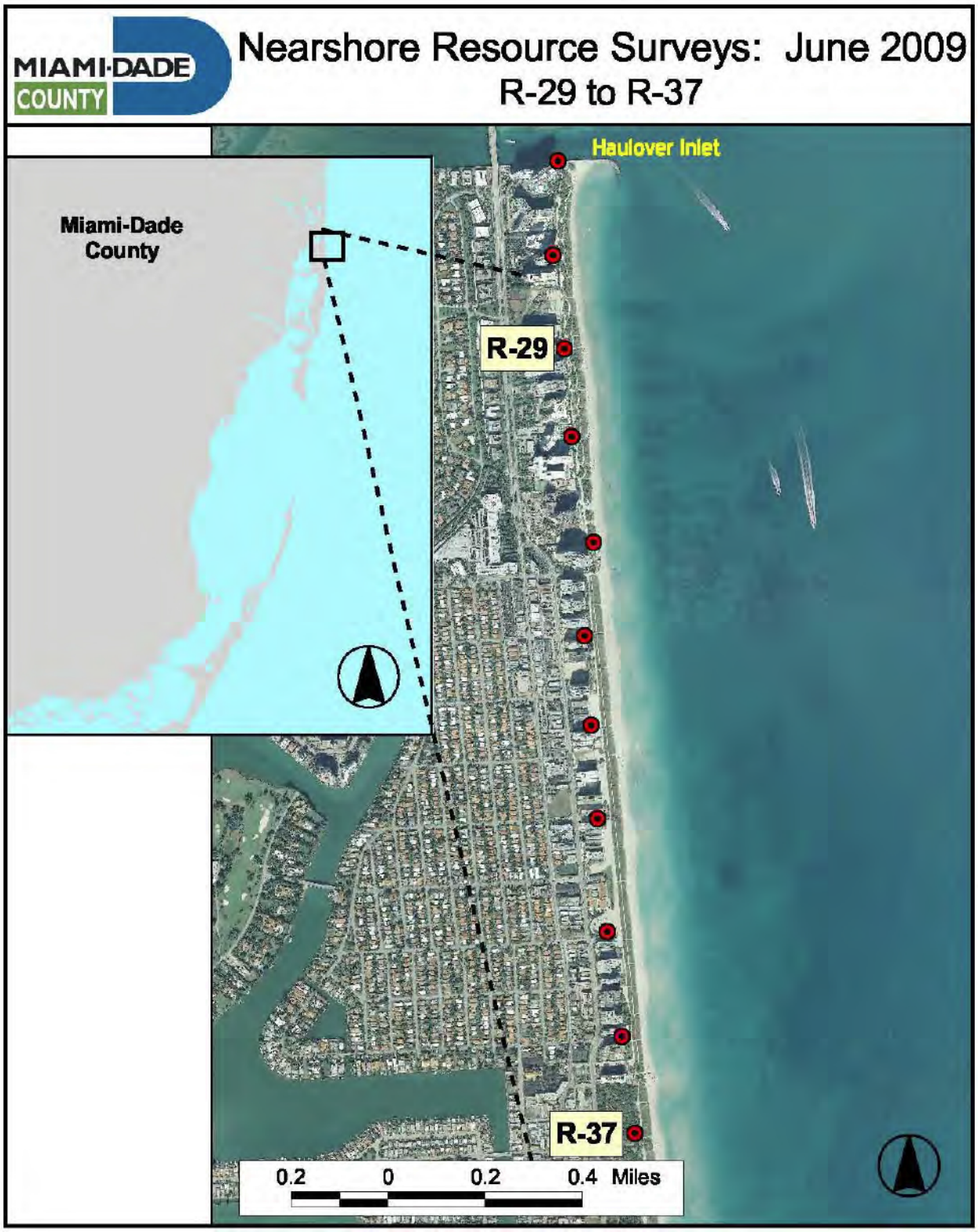


Figure 1: Nearshore survey area from DNR Monument R-29 south to R-37.

Results:
Appendices 1 through 4 show the survey paths along each transect as well as in the swash zone surveyed from June 16th – 22nd, 2009. All transects from shore (high water line) out to 600' consisted of open sand without benthic growth with exceptions of the exposed groins described in more detail below. Sand dollars were occasionally observed in the eastern portion of the survey area and drift algae (*Sargassum* sp.) was observed throughout the region. Threatened and endangered species were not observed in the survey area.

The northern portion of the survey area (Bal Harbour Beach) has five exposed shore-perpendicular groins extending offshore from the beach between R28 and R32 (Figure 1 and Appendix 1-2). These groins have been buried and unburied through nourishment/erosion process. Portions of the groins are tidally exposed. The groins are composed of concrete pilings, wood, and limerock boulders. At this time, the groins support benthic species including sponges (*Cliona* spp.), bryozoans, hydroids, tunicates, and algae. Numerous fish species and other motile invertebrates are also observed along the groin structures. The northernmost groin (Groin A) was only evaluated in the 2008 Survey and the results are included in the groin description as part of the RAI response in Appendix 5. The remaining four groins (Groins B- E) were evaluated during these surveys. The species of benthic and motile species observed on these four southern groins are listed in Table 1. Figures 2 -5 illustrate the resources found on groins B through E respectively. The area the groins and associated biota cover are listed in Table 2.

Figure 1. Beach view of exposed groin (E) on Bal Harbour Beach.

Table 1. Species observed in the nearshore region from R29 –R37 during transect and 'swash zone' surveys.

		Substrate				
Common Name	**Scientific Name**	**Sand**	**Groin B**	**Groin C**	**Groin D**	**Groin E**
Barnacles (sessile)	*Cirripedia* spp.		X	X	X	X
Blue-green algae	Unidentified species		X	X	X	X
Brown algae	*Padina* spp.				X	X
Burgundy crust algae	*Peyssonnelia* spp.		X	X	X	X
Encrusting tunicate	Unidentified species		X	X	X	X
Fire coral	*Millepora alcicornis*				X	
Green feather algae	*Caulerpa sertulariodes*		X		X	X
Red boring sponge	*Cliona* spp.		X			X
Red algae	*Laurencia* spp.		X		X	X
Turf algae	Unidentified species		X	X	X	X
Worm reef	*Phragmatopoma caudata*		X	X	X	X
Yellow boring sponge	Unidentified species		X			X
Florida stone crab	*Menippe mercenaria*		X			
Hermit crabs	Unidentified species					X
Mollusks- Bivalvia	Unidentified species			X		
Mollusks- Gastropoda	Unidentified species				X	X
Six-keyhole sand dollar	*Leodia sexiesperforata*	X				
True Crabs- Brachyura	Unidentified species		X			
Bar Jack (juvenile)	*Caranx ruber*	X				
Beaugregory	*Stegastes leucostictus*					X
Bermuda Chub	*Kyphosus sectatrix*				X	X
Common snook	*Centropomus undecimalia*	X				
Crevalle jack	*Caranx hippos*			X		X
Flagfin mojarra	*Eucinostomus melanopterus*	X				
Glassy sweepers (juvenile)	*Pemphris schomburgki*		X			
Grunts (unid. juvenile)	*Haemulon* species		X	X	X	X
Hairy blenny	*Labrisomus nuchipinnis*		X			
Highhat	*Pareques acuminates*			X		X
Lane snapper (juvenile)	*Lutjanus synagris*				X	
Leatherjacket	*Oligoplites saurus*	X				
Molly miller	*Scartella cristata*		X	X	X	X
Porkfish	*Anisotremus virginicus*		X		X	
Redlip blenny	*Ophioblennius macclurei*		X			
Sea bream	*Archosargus rhomboidalis*					X
Sergeant major	*Abudefduf saxatilis*		X	X	X	X
Slender filefish	*Monacanthus tuckeri*				X	
Snapper (unid. Juvenile)	*Lutjanus* species		X			

Table 1 (continued).

		Substrate				
Common Name	**Scientific Name**	**Sand**	**Groin B**	**Groin C**	**Groin D**	**Groin E**
Southern stingray	*Dasyatis americana*	X			X	
Spottail pinfish	*Diplodus holbrookii*					X
Tarpon	*Megalops atlanticus*	X				
Yellow jack (juvenile)	*Caranx bartholomaei*				X	X
Yellowfin mojarra	*Gerres cinereus*		X			X
Yellow Stingray	*Urolophus jamaaicensis*	X				
Unidentified juvenile fish	Unidentified species		X	X	X	X
Manatee	*Trichechus manatus latirostris*	X				

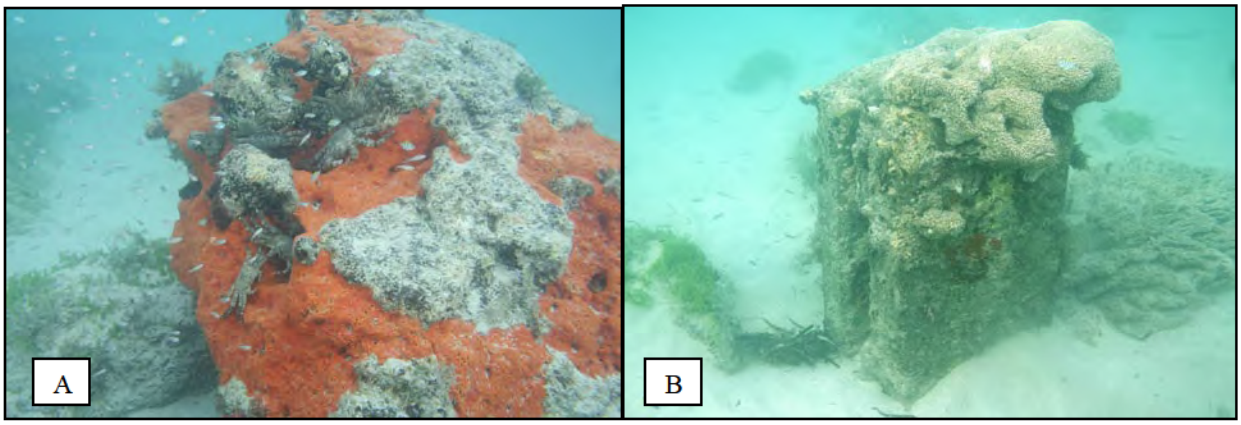


Figure 2. Biota on Groin B. A.) Cliona species, true crabs (Brachyura), and numerous juvenile fish. B.) Worm reef (*Phragmatopoma caudata*) on and adjacent to groin structure.

Figure 3. Worm reef (*Phragmatopoma caudata*) adjacent to structure at Groin C.

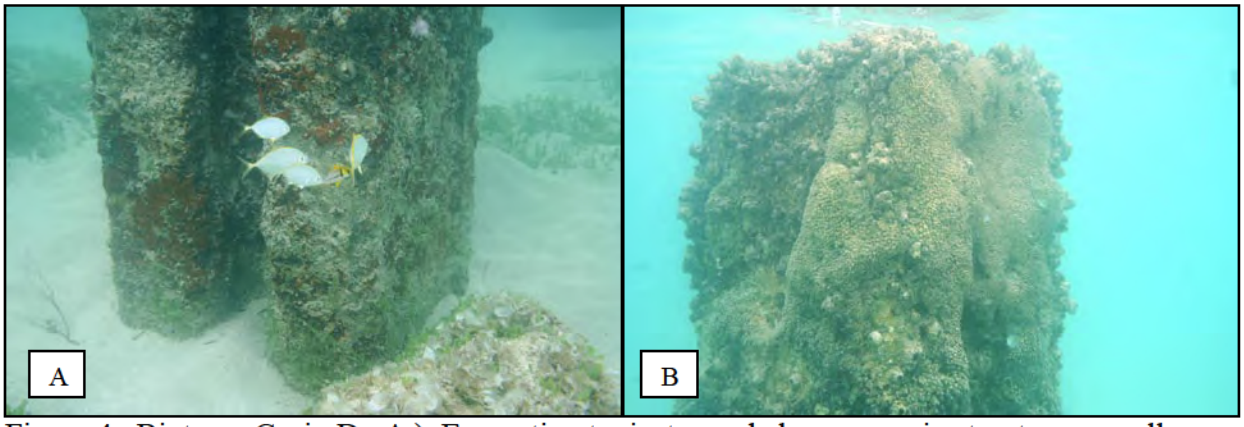


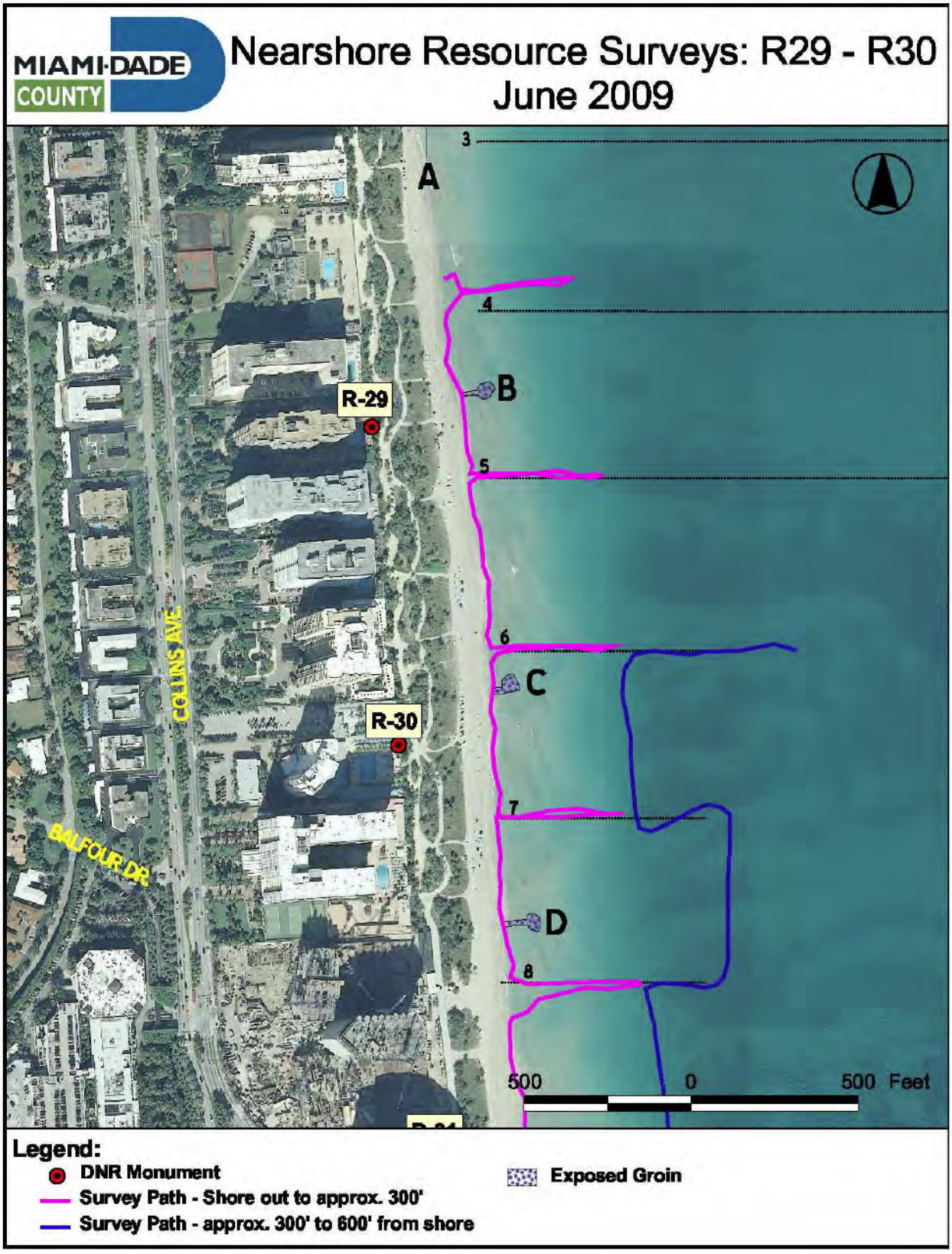
Figure 4. Biota on Groin D. A.) Encrusting tunicates and algae on groin structure as well as juvenile Yellow Jacks (*Caranx bartholomaei)* and Porkfish (*Anisotremus virginicus*). B.) Worm reef (*Phragmatopoma caudata*) and barnacles (*Cirripedia* spp.) on groin structure.

Figure 5. Worm reef (*Phragmatopoma caudata*) and algae along with numerous fish at Groin E.

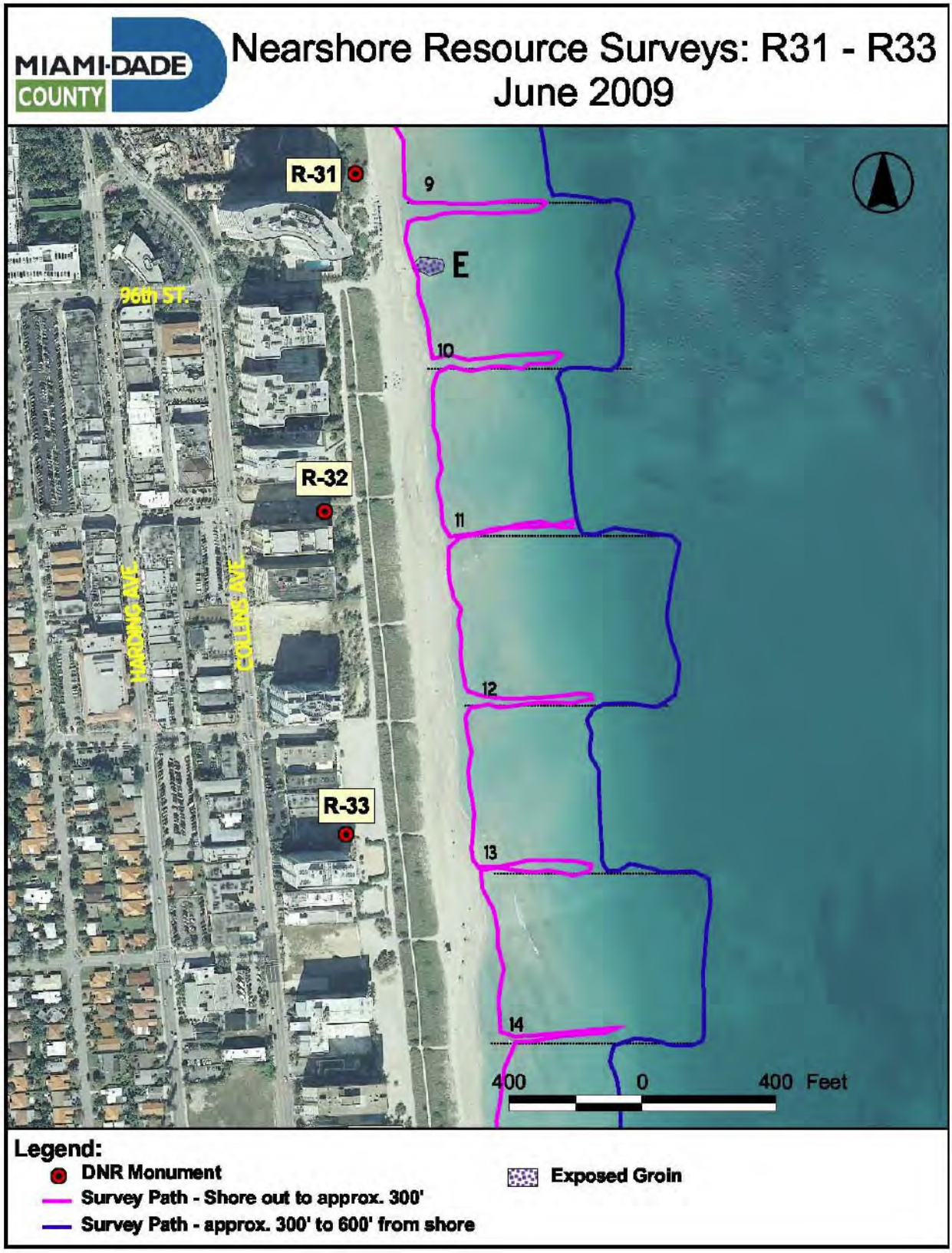
Table 2. Approximate area of groins between R29 and R37. Each groin area was traced using a Garmin GPS unit. These traces were used in GIS software (ArcView®) to create defining polygons to allow calculation of areal extent of the areas.

	Area	
Groin	(m^2)	(acres)
B	235.9	0.058
C	258.9	0.064
D	264.5	0.065
E	355.0	0.0877
Total	1114.3	0.275

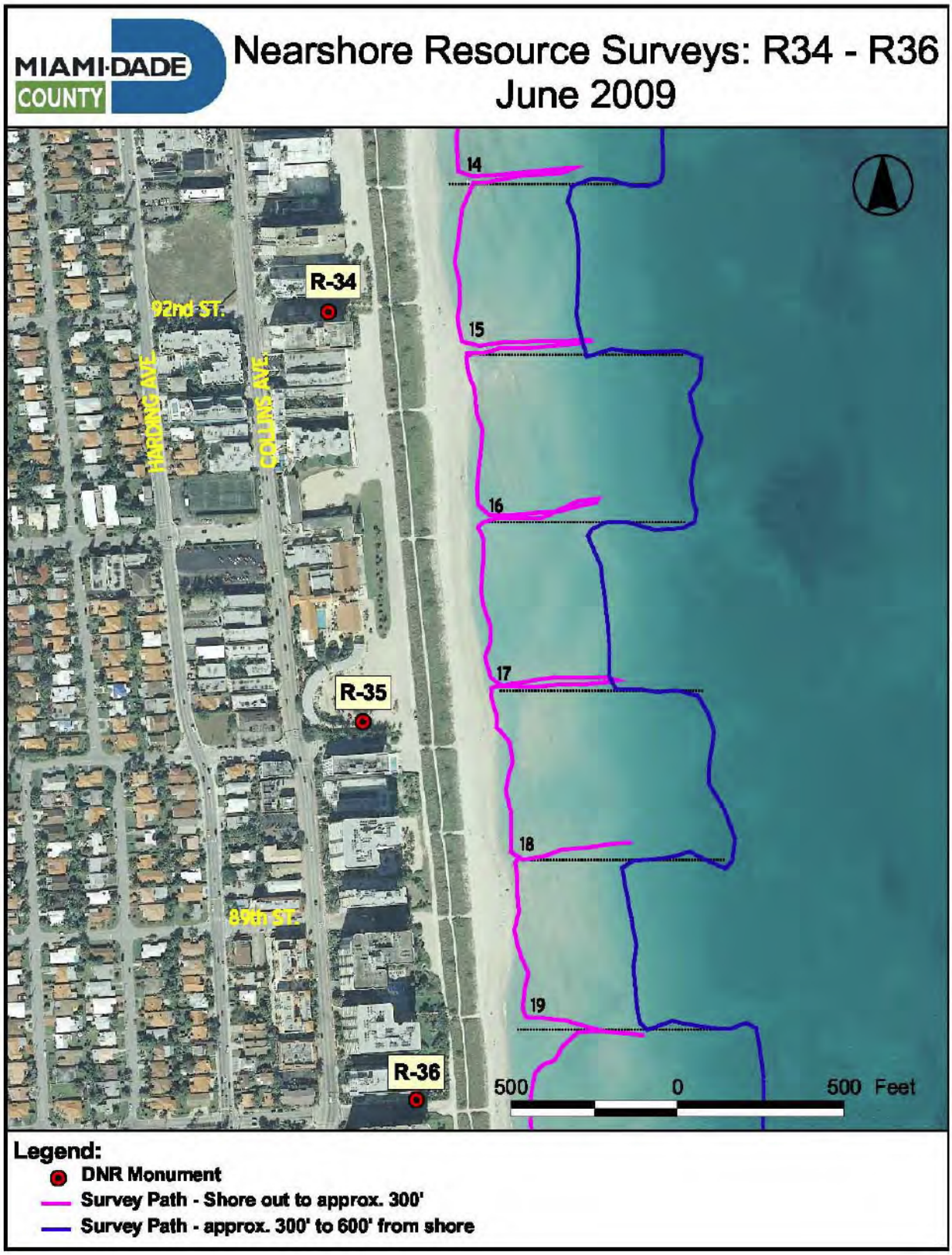
Appendix 1.


MIAMI-DADE COUNTY
Nearshore Resource Surveys: R29 - R30
June 2009
3
A
4
B
R-29
5
6
C
R-30
7
D
8
COLLINS AVE
BALFOUR DR
500
0
500 Feet
Legend:
DNR Monument
Survey Path - Shore out to approx. 300'
Survey Path - approx. 300' to 600' from shore
Exposed Groin

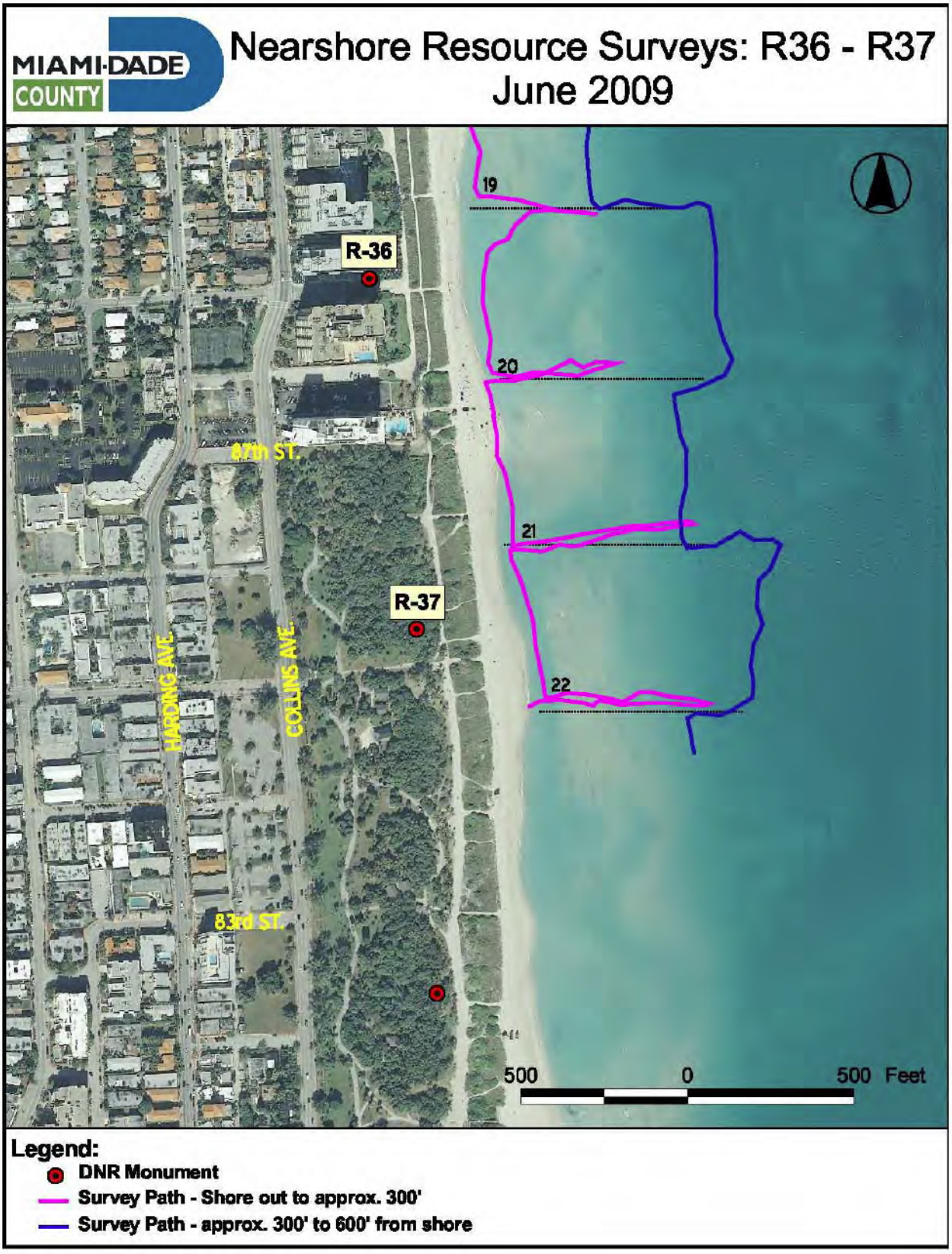
Appendix 2.


MIAMI-DADE COUNTY
Nearshore Resource Surveys: R31 - R33
June 2009
R-31
R-32
R-33
9
E
10
11
12
13
14
96th ST.
HARDING AVE
COLLINS AVE
400 0 400 Feet
Legend:
DNR Monument
Survey Path - Shore out to approx. 300'
Survey Path - approx. 300' to 600' from shore
Exposed Groin

Appendix 3.


MIAMI-DADE COUNTY
Nearshore Resource Surveys: R34 - R36
June 2009
R-34
R-35
R-36
92nd ST.
89th ST.
HARDING AVE.
COLLINS AVE.
14
15
16
17
18
19
500 0 500 Feet
Legend:
DNR Monument
Survey Path - Shore out to approx. 300'
Survey Path - approx. 300' to 600' from shore

Appendix 4.


MIAMI-DADE COUNTY
Nearshore Resource Surveys: R36 - R37
June 2009
19
20
21
22
R-36
R-37
87th ST.
83rd ST.
HARDING AVE.
COLLINS AVE.
500
0
500 Feet
Legend:
DNR Monument
Survey Path - Shore out to approx. 300'
Survey Path - approx. 300' to 600' from shore

Appendix 9:

RE: **JCP FILE NUMBER: 023382-004-JM, MIAMI DADE COUNTY**
RAI #2: Item 23: Field verification of benthic communities in the nearshore region for segments of Miami Beach, Bal Harbor, and Sunny Isle, Miami-Dade county

BACKGROUND

Miami-Dade County manages the approximate fifteen miles of coastal beach resources within the County. This includes periodic nourishment of eroded segments of the beach. Miami-Dade County conducts annual surveys of the beach to determine their status relative to providing appropriate storm protection for upland resources, as well as appropriate recreational and environmental benefits. At this time, three segments of the coastal Miami-Dade beaches are in need of nourishment in order to maintain the storm protection functions of the beach. Miami-Dade submitted a permit application to the Florida Department of Environmental Protection (FDEP; File Number 023382-00-JM), for authorization to nourish these segments. The FDEP has requested additional information regarding the location and type of nearshore communities offshore of those beach segments needing nourishment.

Miami-Dade County conducted in-water field investigations of the ocean floor off each of the three segments referenced in the application, to identify location and community composition of any nearshore resources of the beach segments. The inspections were conducted out to 1500' from the shoreline. Specifics of the methodology and the results of these investigations are presented below.

METHODS

Survey Transect Distribution and Orientation within the Project Area

The geographic scope of this survey effort was designed to cover the nearshore area (within 1500 feet of shore), adjacent to three segments of beach identified in the application: Miami Beach (DNR Monuments R-43 to R-44+500), Bal Harbor (R-27 to R29), and Sunny Isle Beach (R-7 to R-12). Shore-perpendicular transects were established with approximately 500' intervals at and between the monuments noted above. Each survey transect started approximately 300' off the beach, at the outer limit of the 300' vessel exclusion zone extending to a point roughly 1500' off the beach. No emergent or attached biota has been documented within the "Swim-zone" region off Miami-Dade, with the exception of relic shore-perpendicular groins within the Bal Harbor region of the study. These groins have historically supported Sabellariid (*Phragmatopoma*) aggregations on the pilings, when erosion has exposed the remnant pilings.

Tracing Significant Habitat[1] Communities

The ocean bottom along each transect was visually inspected and characterized by biologists using mask & snorkel and/or scuba. The surveys and inspections were conducted in two phases. The first phase involved visualization of the bottom to determine the general presence and location of benthic resources. For this task, biologists were towed by a small boat, starting at "Swim-Zone" line, and progressing offshore. Along each transect, if and when "significant habitat" or hard bottom resources were observed, the location (using GPS with <= 3m accuracy)

[1] For the purposes of this report "Significant Habitat" is defined as any aggregation of stabilized emergent epibenthic biota. This is to include regions of algae, sponge, soft corals, and or hard corals that may be attached to sand inundated (covered) hard bottom or stabilized rubble areas.

was documented. The second phase of the survey involved the divers swimming the western most edge of each of the habitat areas noted, while towing a surface GPS unit. For this, a Garmin GPS unit (*GPSMap 76* model) was secured onto a foam board and the floating board was towed by the diver (with as short a "scope" on the tow line as conditions would allow). Each "tracing" of the habitat/reef areas were downloaded from the GPS and subsequently imported as a layer into a GIS program (ESRI ArcView). The traces were then 'over-laid' on Miami-Dade County geo-rectified aerial photographs or laser airborne depth sounder surveys to produce the maps contained herein.

RESULTS

All surveys started at 300ft from shore, on the seaward side of the 'swim-zone' and continued to a point 1500ft offshore. Sand-bottom was found along two of the 4 Miami-Beach, and one of the five Bal Harbor transects (e.g., all sand-bottom out to at least 1500 ft from shore. On those transects where 'significant habitat was found, it was minimally 1200 ft from the shoreline. The Sunny Isles segment was the 'exception', with epibenthic communities (algae, sponge and soft coral) being found 650 ft to 1200 ft offshore. Along the transects surveyed, open sand with no epibenthic resources was found along 65% to 96% of the overall transect length for each segment.

As described below, most areas of significant habitat had dense seasonally-abundant macro algae, providing a 'lush' appearance to the communities. It should be noted that the surveys were conducted during the middle of the summer when macroalgal biomass is at its highest. Permanent (e.g., non-seasonal) components were abundant in places, but much less so that the seasonal macro algae.

Miami Beach Segment (R-43 to R-44+500):
Significant habitat was observed on two of the four transects off this segment: approximately 1400' from shore on the eastern end of the northern-most transect, MB-1, and approximately 1250' from shore on the eastern end of the southern-most transect, MB-4 (Figure 1). The 'significant habitats' were drift algae/sponge/soft coral dominated communities. Thus, approximately 94% of the total transect distance was of open sand with no epibenthic resources seen.

The areas of significant habitat accounted for less than 6% (5.8%) of the overall distance of the transects surveyed. In both of the significant habitat areas, the western most edge were mainly rubble and hardbottom covered with a sand veneer (< 0.5m deep). Exposed hardbottom was observed occasionally within this area. Drift red algae (*Chondria* sp., *Acanthophora. spicifera*, *Spyridia filamentosa*) were the most abundant component in both areas (Figure 2). Other macroalgae species (e.g., *Halimeda* spp., *Caulerpa* sp., *Dictyota* sp., *Dasya bailouviana*) were also common to abundant components of the community. Sponges, soft coral and hard corals were present throughout the area with varying abundance. More species and higher abundances were observed on the northern significant habitat area at the eastern end of transect MB-1. Figures 3 through 5 provide representative illustrations of the significant habitat of this area. Table 1 provides a species list and relative abundance for the components of the benthic community and fish identified during the surveys for the Miami Beach Segment.

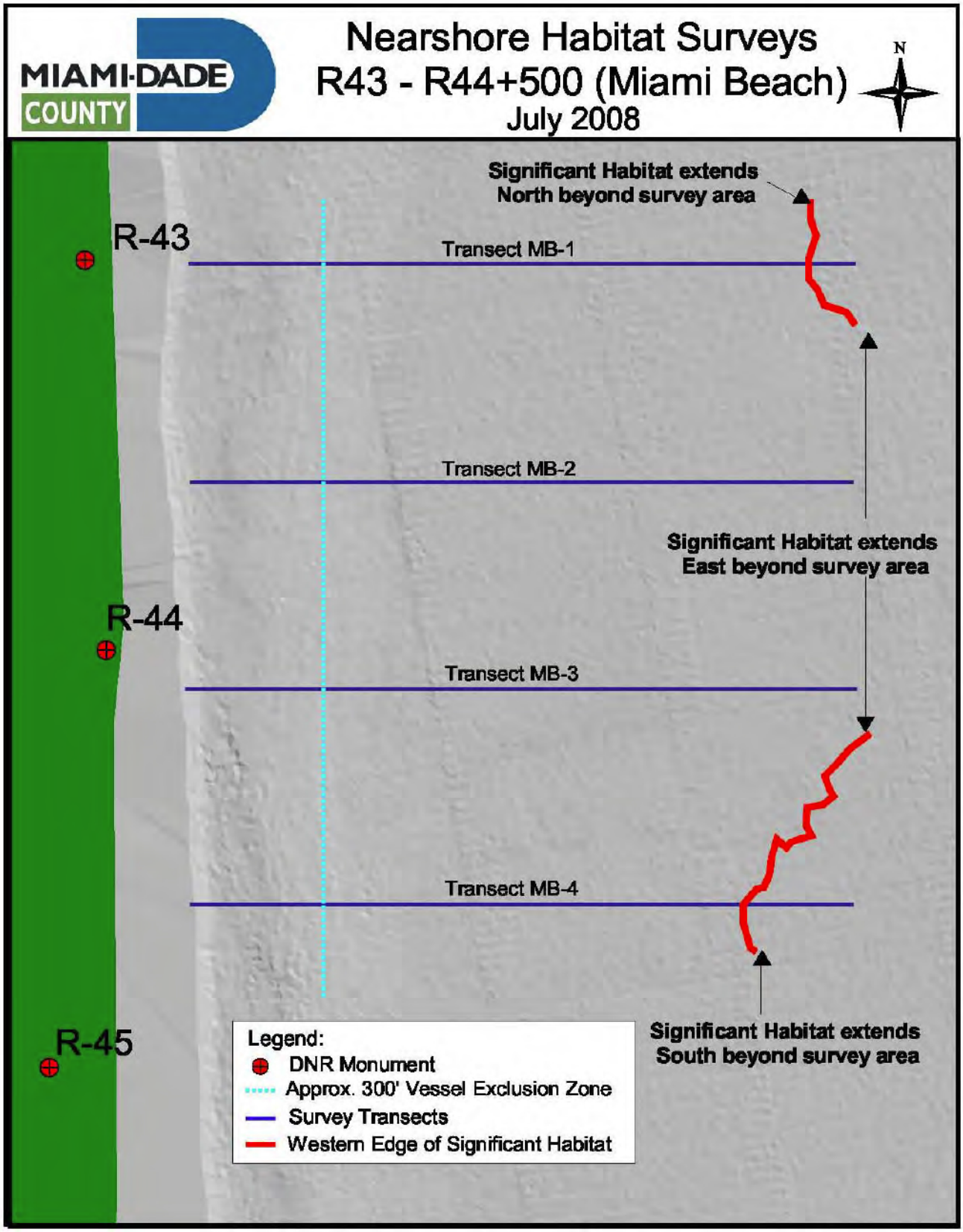


Figure 1. Location of significant habitat within the Miami Beach Segment—R43 to R44+500.

Figure 2. Significant habitat and drift red algae community on sand veneer at eastern end of the northern transect (MB-1) of Miami Beach segment

Figure 3. Sponges and juvenile soft coral (*Pseudopterogorgia* sp.) in the northern significant habitat area (off transect MB-1) of Miami Beach segment.

Figure 4. *Pseudopterogorgia* spp. among a drift red algae community in northern significant habitat area within the Miami Beach segment.

Figure 5. *Pseudopterogorgia* spp. among a drift red algae in southern significant habitat area within the Miami Beach Segment.

Table 1. Benthic and fish species observed while tracing western edge of significant habitat for Miami Beach Segment. Approximate abundance scale given: Single (1 individual); few (2-10 individuals); many (10-50 individuals); abundant (> 50 individuals).

	Species	Northern Abundance	Southern Abundance
Algae	*Acanthophora spicifera*	Abundant	Abundant
	Lyngbya sp	Abundant	Abundant
	Caulerpa mexicana	Abundant	Abundant
	Chondria sp.	Abundant	Abundant
	Dasya baillouviana	Abundant	Abundant
	Dictyota sp.	Many	Many
	Halimeda discoidea	Abundant	Abundant
	Halimeda incrassata	Abundant	Abundant
	Hypnea sp.	Abundant	Abundant
	Laurencia sp.	Abundant	Abundant
	Spyridia filamentosa	Abundant	Abundant
Sponges	*Anthosigmella varians*	Many	Many
	Cliona sp.	Few	
	Dysidea sp.	Few	
	Iotrochorta birotulata	Few	
	Spheciospongia vesparium	Many	
	Unidentified sponge	Few	
Hard Coral	*Siderastrea radians*		Few
Soft Coral	*Pseudopterogorgia acerosa*	Many	Few
	Pseudopterogorgia americana	Many	Few
Other benthic	Unidentified hydroids	Abundant	Abundant
Fish	*Balistes capriscus*	Many	Many
	Halichoeres bivittatus	Many	Many
	Scarus iserti		Few

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Bal Harbor Segment (R-27 to R-29):

Significant habitat was observed on one of the 5 transects off the Bal Harbor Beach Segment; approximately 1200' from shore (off R-29) on the southern-most transect, BH-5 (Figure 6). Thus, 96% of the transect length surveyed was of open sand, with no epibenthic resources.

Significant habitat was found along approximately 4 % of the overall transect length within this area, and was restricted to the eastern most portion of the transect on which it was seen. The western-most edge of the 'significant habitat' was mainly rubble and hardbottom covered with a sand veneer to the north transitioning to more exposed hardbottom in the south. Seasonal drift red algae communities (*Chondria* sp., *Acanthophora*. *spicifera*, *Spyridia filamentosa*) were abundant in this area particularly the northern portion. Macroalgae (e.g., *Halimeda* spp., *Caulerpa* spp., *Dictyota* sp., *Dasya bailouviana*) were also common throughout. In addition to the algae, occasional soft corals, sponges, and hard corals were observed in the northern area with increasing abundance toward the south. Figures 9 through 12 provide representative illustrations of the significant habitat in this area. Benthic and fish species identified during the surveys for the Bal Harbor Segment and their relative abundance are listed in Tables 2 and 3 respectively.

At this location, seasonal and seasonally abundant macroalgae give a very dense appearance to the communities, however, the persistent components of the community, while at times "abundant" are not as common or high in cover as the seasonally abundant macroalgae.

The Bal Harbor Beach segment has two exposed shore-perpendicular groins extending offshore from the beach between R27 and R29 (Figure 6). Three more groins are farther to the south. These groins have been buried and unburied through nourishment/erosion process. Portions of the groins are tidally exposed. At this time, the groins support benthic species including sponges (*Cliona* spp.), bryozoans, hydroids, tunicates, and algae. Numerous fish species and other motile invertebrates were also found along the groin structures. Figures 7 and 8 illustrate the resources found on the groins while Tables 2 and 3 list the species of benthic and motile species respectively.

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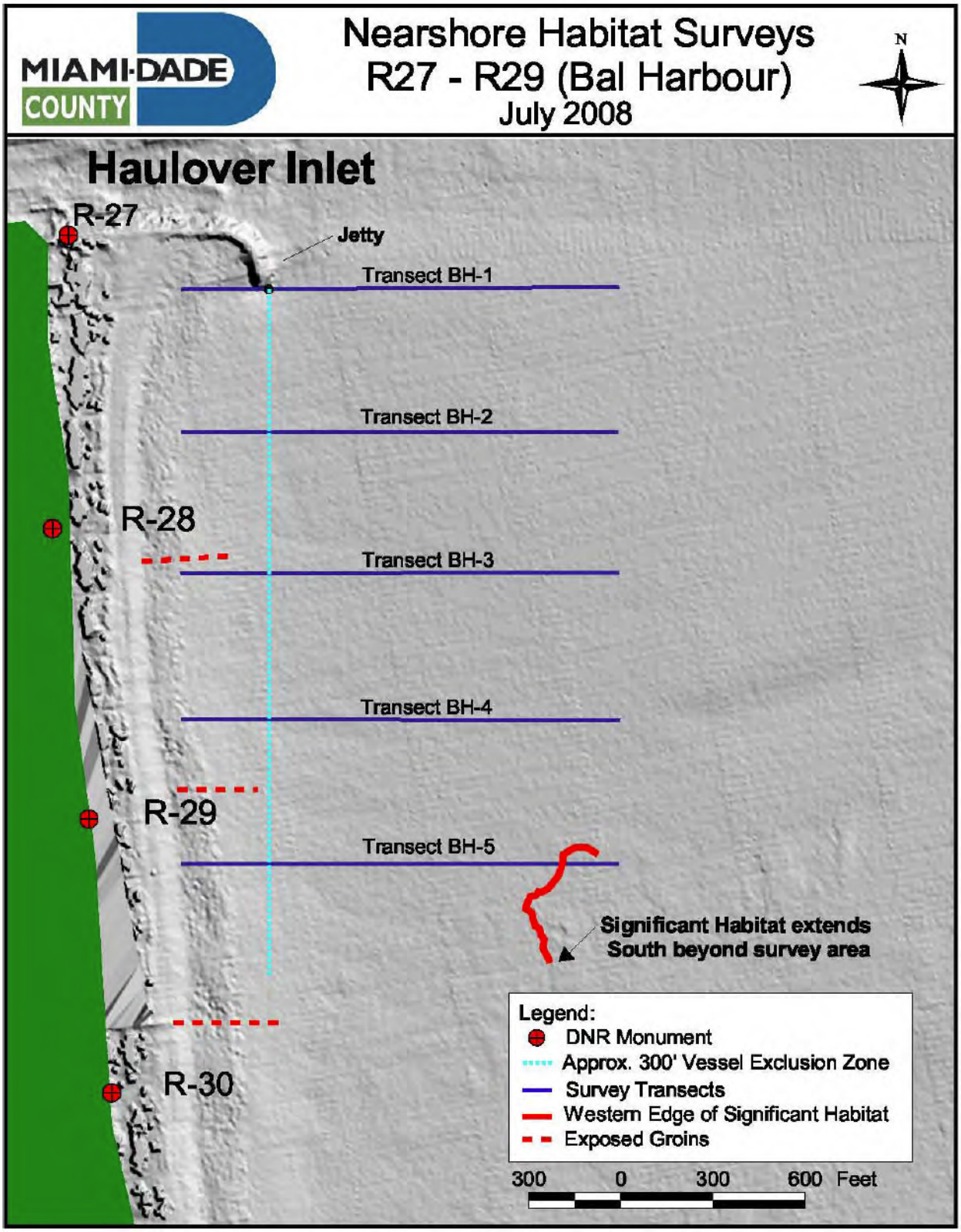

Figure 6. Location of groin structures and significant habitat within the Miami Beach Segment—R43 to R44+500.

Figure 7. Juvenile *Equetus punctatus* and *Lutjanus synagris* among algae (*Padina* spp.) and hydroids on the exposed portions of the shore beach groin structures off the Bal Harbour Beach Segment.

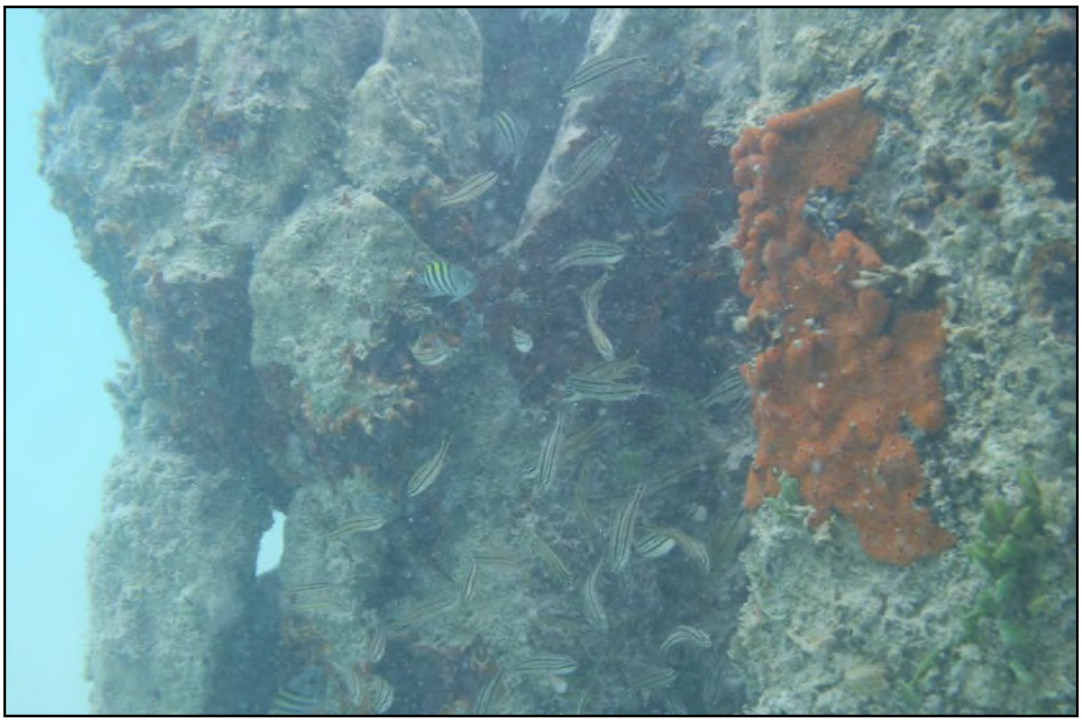

Figure 8. Juvenile grunts (*Haemulon* spp.) and *Abudefduf saxatilis* along with encrusting tunicates, sponges, and algae (*Caulerpa sertulariodes*) on the groin structures off the Bal Harbour Beach Segment.

Figure 9. Attached and drift macroalgae and *Pseudopterogorgia* spp. on rubble and sand veneer in northern portion of significant habitat area within the Bal Harbour Beach segment.

Figure 10. *Solenastrea bournoni* and *Pseudopterogorgia* spp. in significant habitat area within the Bal Harbour Beach segment.

Figure 11. Exposed hardbottom with *Pseudopterogorgia* spp. in significant habitat area within the Bal Harbour Beach segment.

Figure 12. Hardbottom with soft corals and large barrel sponge, *Spheciospongia vesparium*, in significant habitat area within the Bal Harbour Beach segment.

Table 2. Benthic species observed while surveying the exposed groins and tracing western edge of significant habitat for the Bal Harbour Beach Segment. Approximate abundance scale given: Single (1 individual); few (2-10 individuals); many (10-50 individuals); abundant (> 50 individuals).

	Species	Groin Abundance	Sig. Habitat Abundance
Algae	*Acanthophora spicifera*		Abundant
	Blue-Green Algae		Abundant
	Unidentified Brown Algae	Many	
	Caulerpa racemosa		Few
	Caulerpa sertioldes	Abundant	
	Chondria sp.		Abundant
	Dasya baillouviana		Abundant
	Dictyota sp.		Abundant
	Halimeda discoidea		Many
	Halimeda incrassata		Many
	Hypnea spp.		Abundant
	Laurencia sp.		Abundant
	Padina spp.	Abundant	
	Spyridia filamentosa		Abundant
	Udotea sp.		Many
Sponges	*Anthosigmella varians*		Many
	Cliona sp.	Abundant	Few
	Spheciospongia vesparium		Many
Hard Coral	*Siderastrea radians*		Many
	Siderastrea siderea		Many
	Solenastrea bournoni		Many
	Stephanocoenia intersepta		Many
Soft Coral	*Plexaurella* spp.ecies		Many
	Pseudoplexaura sp.		Many
	Pseudopterogorgia americana		Abundant
	Pseudopterogorgia acerosa		Abundant
	Pterogorgia anceps		Many
Other benthic	Unidentified barnacles	Abundant	
	Unidentified bryozoans (encrust)	Many	
	Unidentified hydroids	Abundant	Abundant
	Unidentified tunicates	Abundant	
	Phragmatopoma caudata	Many	

Table 3. Fish and motile invertebrate species observed while surveying the exposed groins and tracing western edge of significant habitat for the Bal Harbour Beach Segment. Approximate abundance scale given: Single (1 individual); few (2-10 individuals); many (10-50 individuals); abundant (> 50 individuals).

	Species	Groin Abundance	Sig. Habitat Abundance
Fish	*Abudefduf saxatilis*	Abundant	
	Balistes capriscus		Many
	Caranx ruber (juv.)	Many	Few
	Caranx spp. (juv.)	Abundant	
	Diodon holocanthus		Single
	Equetus punctatus	Few	
	Gerres cinereus	Many	
	Haemulon aurolineatum	Single	Few
	Haemulon sciurus		Few
	Haemulon spp. (juv.)	Abundant	
	Halichoeres bivittatus		Many
	Lutjanus synagris (juv.)	Many	Single
	Parablennius marmoreus	Few	
	Seriola dumerili (juv.)		Few
	Sparisoma chrysopterum		Few
	Urolophus jamaicensis		Single
Other Motile	*Sepioteuthis sepiodea*	Few	
	Unidentified crabs	Few	
	Unidentified Cerith snails	Many	

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Sunny Isles (R-7 to R-12):

Significant habitat was found within the survey on each of the transects surveyed off the Sunny Isles Beach segment; with the closest habitat occurring approximately 650' on transect SI-4, and as far off as approximately 1500' offshore on transect SI-12 (Figure 13), with an average distance from shore of 930 ft. Approximately 62 % of the region was of open sand with no epibenthic resources. The western most edge of the significant habitat was mainly rubble and hardbottom covered with a sand veneer with occasional exposed hardbottom. Seasonal drift red algae communities were dominant throughout this area (*Chondria* sp., *Acanthophora spicifera*, *Laurencia* spp., *Spyridia filamentosa*) and the most apparent component of the benthic community (Figure 14). Attached macroalgae (e.g., *Halimeda* spp., *Caulerpa* spp., *Dictyota* sp., *Dasya bailouviana*) were also an abundant community component throughout the area.

The abundance of sponges, soft coral and hard corals ranged greatly from a solitary soft coral (*Pseudopterogorgia* sp.) surrounded by sand to a few soft corals surrounded by the drift red algae community to denser areas with several soft corals, sponges, and hard corals. Figures 15 through 17 illustrate some of the variation in the components of the significant habitat in this area. Worm rock (*Phragmatopoma caudata*) was also occasionally observed in this area (Figure 19 and 20). Benthic and fish species identified during the surveys for the Sunny Isles Segment and their relative abundance are listed in Tables 4 and 5 respectively. More extensive exposed hardbottom (with 1-2' relief) and dense benthic assemblages were observed farther to the east approximately 1500' offshore at the eastern transect edges.

In addition to the natural habitat described above, two submerged breakwater structures are located approximately 400' from shore between R-7 and R-8 (transects SI-1 to SI-3) as shown in Figure 13. The breakwater structures off the Sunny Isles Segment were constructed from limerock boulders during the summer and fall of 2001 and now support benthic invertebrate, algal, and fish assemblages (Figures 21 and 22). Benthic and fish species observed on the boulders are included in Tables 4 and 5 respectively.

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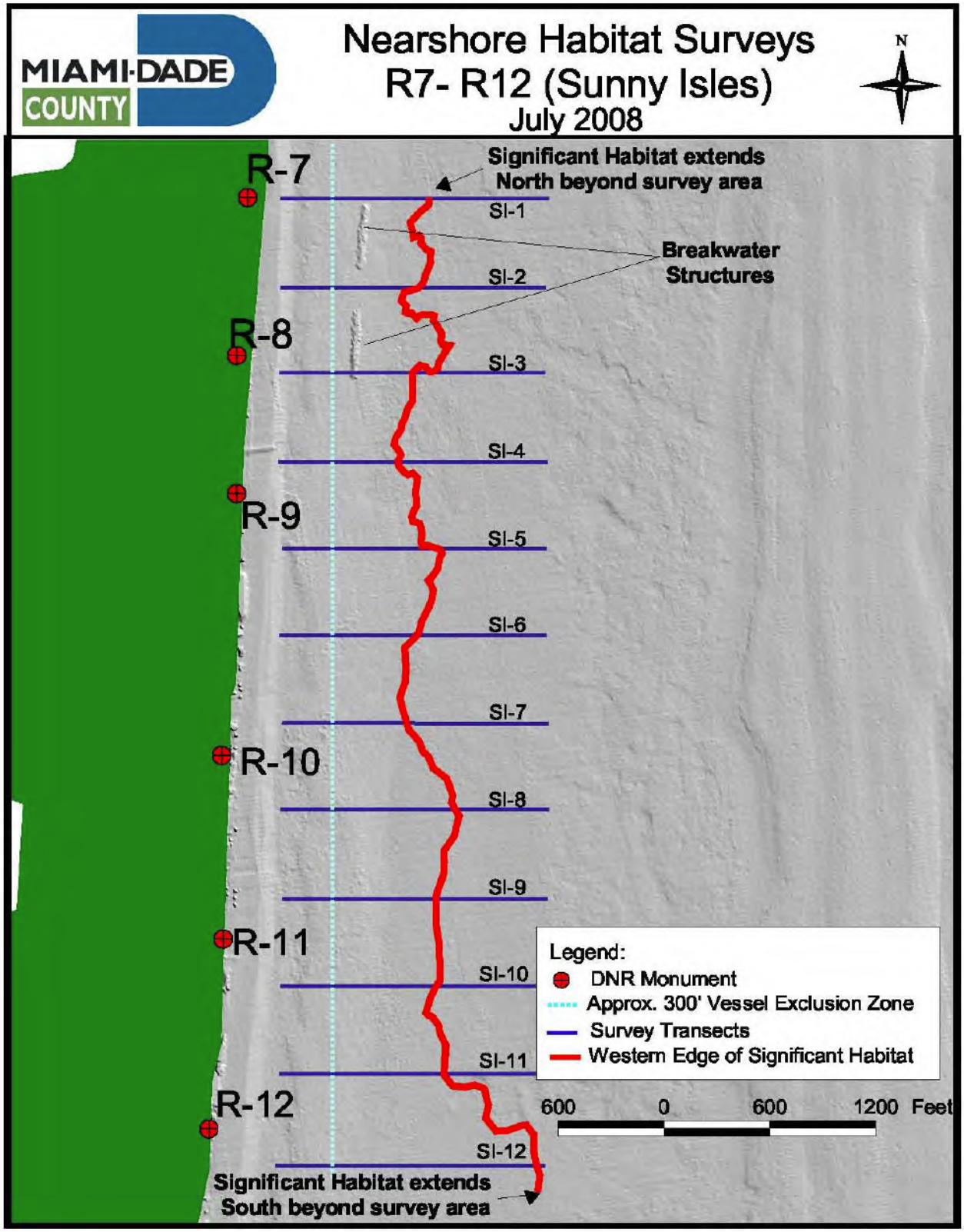

Figure 13. Location of significant habitat within the Miami Beach Segment—R43 to R44+500.

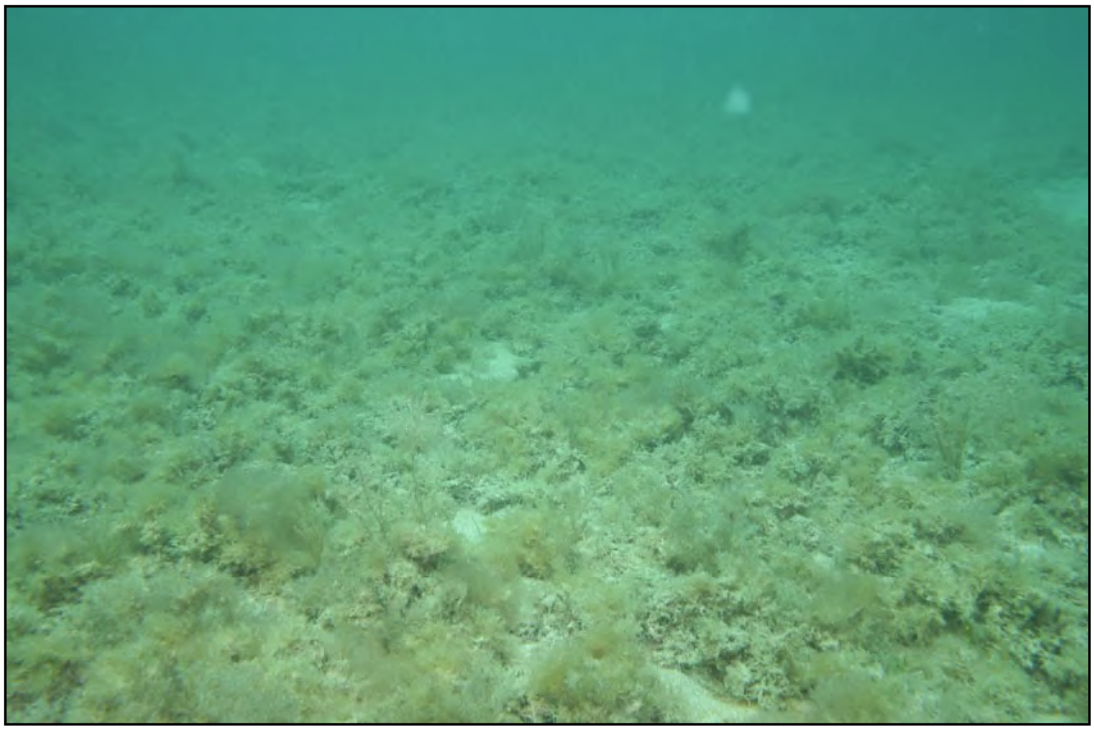

Figure 14. Abundant drift red algae dominated area of the Sunny Isles Beach Segment.

Figure 15. *Pseudopterogorgia* sp. surrounded by sand within the Sunny Isles Beach segment.

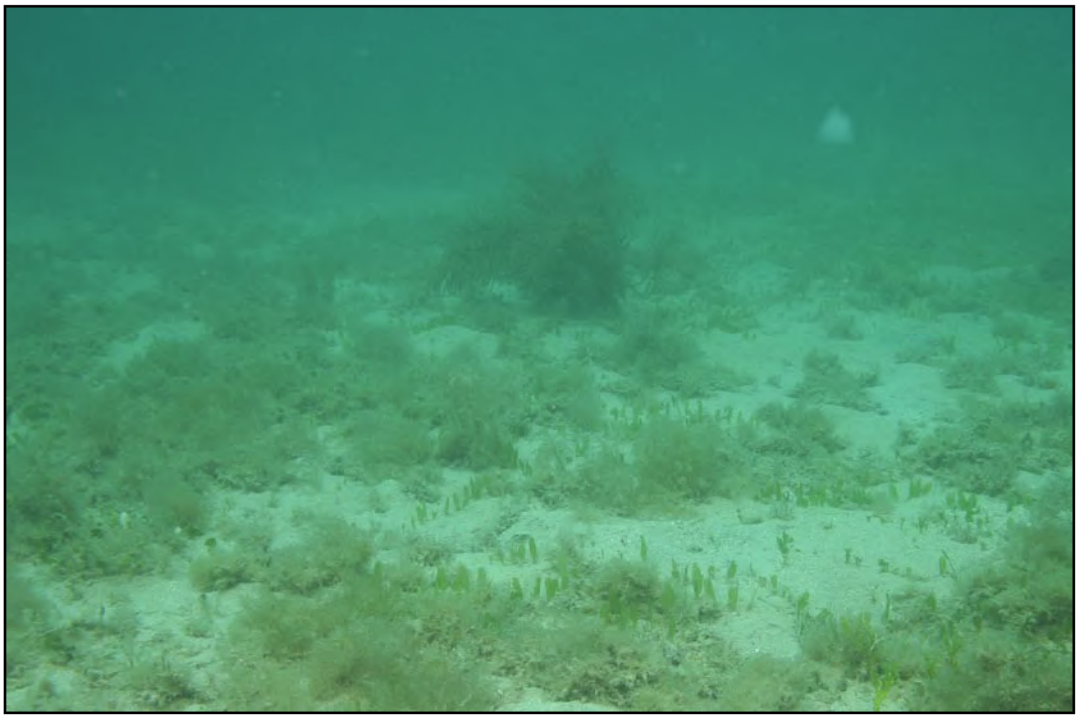

Figure 16. *Pseudopterogorgia* sp. surrounded by algae within the Sunny Isles Beach Segment.

Figure 17. Soft coral (*Pseudopterogorgia* spp. and *Plexaurella* spp.), sponges (*Anthosigmella varians* and *Spheciospongia vesparium*), and algae within the Sunny Isles Beach Segment.

Figure 18. Hard coral, *Solenastrea bournoni*, and sponge, *Anthosigmella varians,* within the Sunny Isles Beach Segment.

Figure 19. Significant habitat area with soft corals (*Pseudopterogorgia* sp.) and worm rock (*Phragmatopoma caudata*) within the Sunny Isles Segment.

Figure 20. Worm rock (*Phragmatopoma caudata*) and algae within the Sunny Isles Segment.

Figure 21. Northern breakwater structure with sponge growth (*Cliona* sp.) and juvenile grunts (*Haemulon* spp.) sheltered by boulders.

Figure 22. Southern breakwater structure with sponge growth (*Cliona* sp.) and Sergeant Majors (*Abudefduf saxatilis*).

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Table 4. Benthic species observed on western edge of significant habitat and breakwater structures for the Sunny Isles Beach Segment. Approximate abundance scale given: Single (1 individual); few (2-10 individuals); many (10-50 individuals); abundant (> 50 individuals).

	Species	Sig. Habitat Abundance	Breakwater Abundance
Algae	*Acanthophora spicifera*	Abundant	
	Blue-Green Algae	Abundant	Abundant
	Caulerpa mexicana	Abundant	
	Chondria sp.	Abundant	
	Dasya baillouviana	Abundant	
	Dictyota sp.	Abundant	
	Halimeda discoidea	Abundant	
	Halimeda incrassata	Abundant	Many
	Halimeda monile	Many	
	Halymenia floresia	Few	
	Hypnea spp.	Abundant	
	Laurencia sp.	Abundant	
	Spyridia filamentosa	Abundant	
	Udotea sp.	Many	
Sponges	*Anthosigmella varians*	Many	
	Cliona delitrix	Few	
	Cliona sp.	Few	Abundant
	Dysidea sp.	Few	
	Iotrochorta birotulata	Few	
	Holopsamma helwigi		Few
	Monanchora barbadensis		Many
	Niphates erecta	Many	
	Spheciospongia vesparium	Many	
	Unidentified sponge	Few	
Hard Coral	*Dichocoenia stoksi*	Few	
	Diploria strigosa	Few	
	Montastrea cavernosa	Few	
	Siderastrea radians	Many	
	Siderastrea siderea	Many	
	Solenastrea hyades	Single	
	Solenastrea bournoni	Many	
Soft Coral	*Pseudopterogorgia acerosa*	Abundant	
	Pseudopterogorgia americana	Abundant	
	Plexaurella spp.	Many	
Other benthic	*Millepora alcicornis*	Many	
	Palythoa caribaeorum		Few
	Phragmatopoma caudata	Many	Many
	Unidentified hydroid	Abundant	
	Unidentified tunicate	Few	

Table 5. Fish and motile vertebrate species observed while tracing western edge of significant habitat for the Sunny Isles Beach Segment. Approximate abundance scale given: Single (1 individual); few (2-10 individuals); many (10-50 individuals); abundant (> 50 individuals).

Species	Sig. Habitat Abundance	Breakwater Abundance
Acanthurs bahianus	Many	
Abudefduf saxatilis		Abundant
Acanthurus chirurgus	Many	
Anisotremus virginicus		Few
Balistes capriscus	Many	
Coryphopterus glaucofraenum	Few	
Cryptotomus roseus	Few	
Dasyatis sabina		Single
Diplodus holbrookii		Abundant
Gerres cinereus		Many
Gymnura micrura	Single	
Haemulon aurolineatum		Few
Haemulon plumeri	Few	
Haemulon sciurus	Few	
Haemulon spp. (juv.)	Many	Few
Halichoeres bivittatus	Many	Few
Lutjanus synagris (juv.)	Single	
Megalops atlanticus	Single	
Ocyurus chrysurus	Single (juv.)	Few
Pareques acuminatus		Single
Pomacanthus paru	Single	
Sphyraena barracuda	Single	
Stegastes leucostictus	Single	
Synodus intermedius	Few	
Thalossoma bifasciatum	Many	Few
Urolophus jamaicensis	Single	
Xyrichtys splendens	Few	
Chelonia mydas	Single	

SUMMARY

The reef and habitat areas off Miami-Dade County are normally found 500 to +1500 ft offshore. Low relief, exposed bedrock reefs are most commonly found at least 1000 feet offshore. Benthic assemblages often establish on non-consolidated rubble, which can support persistent benthic assemblages for a given period of time (until a storm disrupts the stability of the rubble). These areas are often inundated with sand, create conditions of high sedimentation due to the shifting sands which often disrupt and scour available substrate. Despite these conditions, these areas of often support algal, sponge, soft coral, and very limited hard coral; and are composed of species with high tolerance of sedimentation.

Of the areas evaluated, two segments (Miami Beach and Bal Harbor Segments) showed >= 94% open sand, with no epibenthic resources. Less than 6% of the area surveyed in off each of these segments contained significant habitat. The location of the habitat was on the far eastern portions of the transects, at a minimum of 1200 ft from the shoreline. One area, Sunny Isles segment had attached epibenthic resources along on each of the transects surveyed. These resources were found between 650ft and 1500 ft from the shoreline (average distance 930 ft), thus approximately 62% of the area was of open sand with no epibenthic resources.

As described herein, most areas of significant habitat had dense seasonally-abundant macro algae, providing a 'lush' appearance to the communities. It should be noted that the surveys were conducted during the middle of the summer when macroalgal biomass is at its highest. Permanent (e.g., non-seasonal) components were abundant in places, but much less so that the seasonal macro algae.

Due to the location of these communities (in regions unconsolidated sand sediments), they experience considerable levels of suspended sediments and associated sedimentation. Thus, these communities are tolerant of a high level of sand scour and sedimentation. Considering the fact that the anticipated nourishment activities will involve dry placement above the mean high water line (associated with trucked in sand), and the areas of significant habitat found were at distances equivalent to 1.6 to 3.0 times the maximum "buffer" distance required in beach renourishment permits involving hydraulic dredging and wet placement of dredged material. The distance from sand placement activities (e.g., project related turbidity or sedimentation) is sufficient to provide protection of habitat areas noted above.

Appendix 9:

RE: **JCP FILE NUMBER: 023382-004-JM, MIAMI DADE COUNTY**
RAI #2: Item 23: Field verification of benthic communities in the nearshore region for segments of Miami Beach, Bal Harbor, and Sunny Isle, Miami-Dade county

BACKGROUND

Miami-Dade County manages the approximate fifteen miles of coastal beach resources within the County. This includes periodic nourishment of eroded segments of the beach. Miami-Dade County conducts annual surveys of the beach to determine their status relative to providing appropriate storm protection for upland resources, as well as appropriate recreational and environmental benefits. At this time, three segments of the coastal Miami-Dade beaches are in need of nourishment in order to maintain the storm protection functions of the beach. Miami-Dade submitted a permit application to the Florida Department of Environmental Protection (FDEP; File Number 023382-00-JM), for authorization to nourish these segments. The FDEP has requested additional information regarding the location and type of nearshore communities offshore of those beach segments needing nourishment.

Miami-Dade County conducted in-water field investigations of the ocean floor off each of the three segments referenced in the application, to identify location and community composition of any nearshore resources of the beach segments. The inspections were conducted out to 1500' from the shoreline. Specifics of the methodology and the results of these investigations are presented below.

METHODS

Survey Transect Distribution and Orientation within the Project Area

The geographic scope of this survey effort was designed to cover the nearshore area (within 1500 feet of shore), adjacent to three segments of beach identified in the application: Miami Beach (DNR Monuments R-43 to R-44+500), Bal Harbor (R-27 to R29), and Sunny Isle Beach (R-7 to R-12). Shore-perpendicular transects were established with approximately 500' intervals at and between the monuments noted above. Each survey transect started approximately 300' off the beach, at the outer limit of the 300' vessel exclusion zone extending to a point roughly 1500' off the beach. No emergent or attached biota has been documented within the "Swim-zone" region off Miami-Dade, with the exception of relic shore-perpendicular groins within the Bal Harbor region of the study. These groins have historically supported Sabellariid (*Phragmatopoma*) aggregations on the pilings, when erosion has exposed the remnant pilings.

Tracing Significant Habitat[1] Communities

The ocean bottom along each transect was visually inspected and characterized by biologists using mask & snorkel and/or scuba. The surveys and inspections were conducted in two phases. The first phase involved visualization of the bottom to determine the general presence and location of benthic resources. For this task, biologists were towed by a small boat, starting at "Swim-Zone" line, and progressing offshore. Along each transect, if and when "significant habitat" or hard bottom resources were observed, the location (using GPS with <= 3m accuracy)

[1] For the purposes of this report "Significant Habitat" is defined as any aggregation of stabilized emergent epibenthic biota. This is to include regions of algae, sponge, soft corals, and or hard corals that may be attached to sand inundated (covered) hard bottom or stabilized rubble areas.

was documented. The second phase of the survey involved the divers swimming the western most edge of each of the habitat areas noted, while towing a surface GPS unit. For this, a Garmin GPS unit (*GPSMap 76* model) was secured onto a foam board and the floating board was towed by the diver (with as short a "scope" on the tow line as conditions would allow). Each "tracing" of the habitat/reef areas were downloaded from the GPS and subsequently imported as a layer into a GIS program (ESRI ArcView). The traces were then 'over-laid' on Miami-Dade County geo-rectified aerial photographs or laser airborne depth sounder surveys to produce the maps contained herein.

RESULTS

All surveys started at 300ft from shore, on the seaward side of the 'swim-zone' and continued to a point 1500ft offshore. Sand-bottom was found along two of the 4 Miami-Beach, and one of the five Bal Harbor transects (e.g., all sand-bottom out to at least 1500 ft from shore. On those transects where 'significant habitat was found, it was minimally 1200 ft from the shoreline. The Sunny Isles segment was the 'exception', with epibenthic communities (algae, sponge and soft coral) being found 650 ft to 1200 ft offshore. Along the transects surveyed, open sand with no epibenthic resources was found along 65% to 96% of the overall transect length for each segment.

As described below, most areas of significant habitat had dense seasonally-abundant macro algae, providing a 'lush' appearance to the communities. It should be noted that the surveys were conducted during the middle of the summer when macroalgal biomass is at its highest. Permanent (e.g., non-seasonal) components were abundant in places, but much less so that the seasonal macro algae.

Miami Beach Segment (R-43 to R-44+500):
Significant habitat was observed on two of the four transects off this segment: approximately 1400' from shore on the eastern end of the northern-most transect, MB-1, and approximately 1250' from shore on the eastern end of the southern-most transect, MB-4 (Figure 1). The 'significant habitats' were drift algae/sponge/soft coral dominated communities. Thus, approximately 94% of the total transect distance was of open sand with no epibenthic resources seen.

The areas of significant habitat accounted for less than 6% (5.8%) of the overall distance of the transects surveyed. In both of the significant habitat areas, the western most edge were mainly rubble and hardbottom covered with a sand veneer (< 0.5m deep). Exposed hardbottom was observed occasionally within this area. Drift red algae (*Chondria* sp., *Acanthophora. spicifera*, *Spyridia filamentosa*) were the most abundant component in both areas (Figure 2). Other macroalgae species (e.g., *Halimeda* spp., *Caulerpa* sp., *Dictyota* sp., *Dasya bailouviana*) were also common to abundant components of the community. Sponges, soft coral and hard corals were present throughout the area with varying abundance. More species and higher abundances were observed on the northern significant habitat area at the eastern end of transect MB-1. Figures 3 through 5 provide representative illustrations of the significant habitat of this area. Table 1 provides a species list and relative abundance for the components of the benthic community and fish identified during the surveys for the Miami Beach Segment.

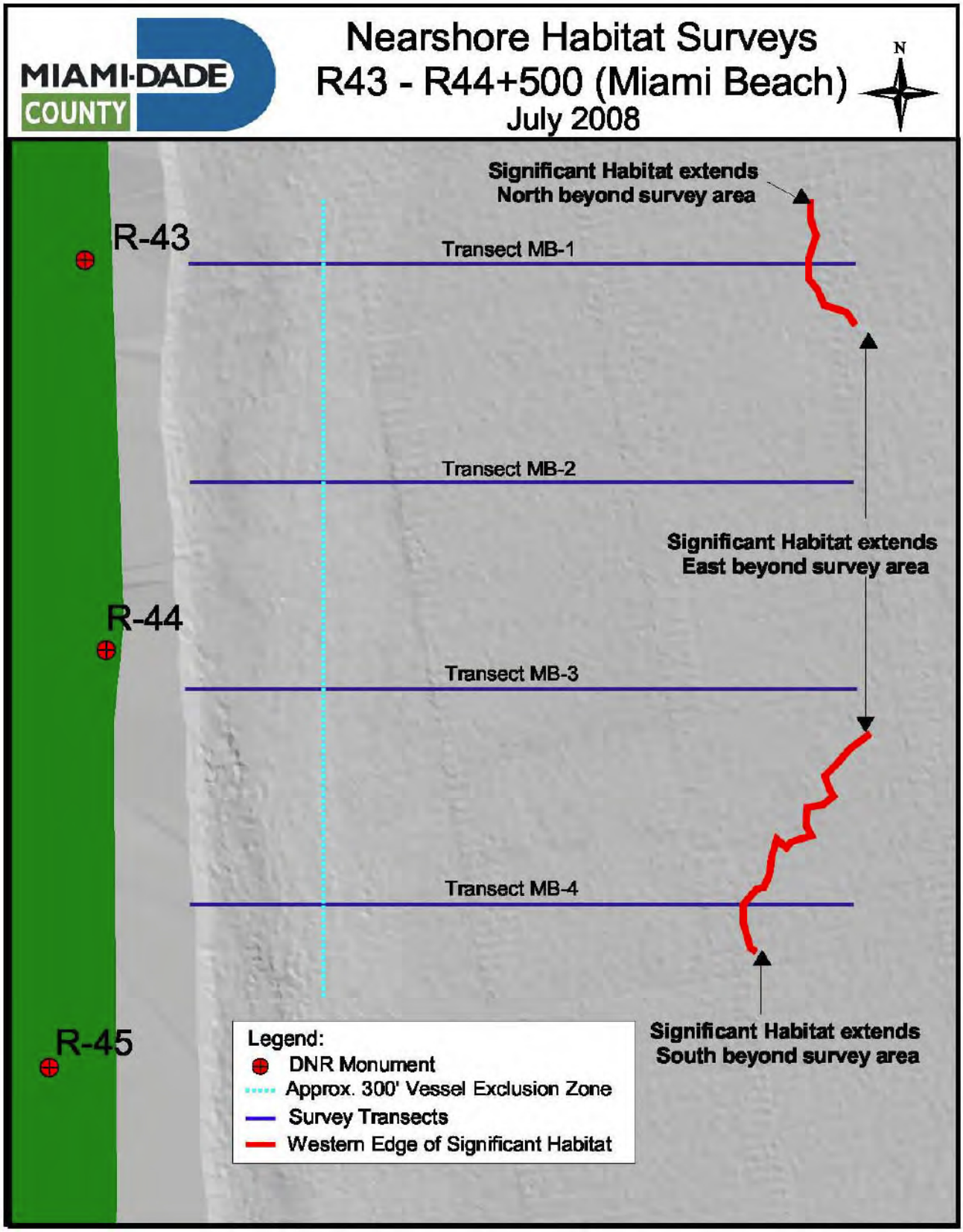

Figure 1. Location of significant habitat within the Miami Beach Segment—R43 to R44+500.

Figure 2. Significant habitat and drift red algae community on sand veneer at eastern end of the northern transect (MB-1) of Miami Beach segment

Figure 3. Sponges and juvenile soft coral (*Pseudopterogorgia* sp.) in the northern significant habitat area (off transect MB-1) of Miami Beach segment.

Figure 4. *Pseudopterogorgia* spp. among a drift red algae community in northern significant habitat area within the Miami Beach segment.

Figure 5. *Pseudopterogorgia* spp. among a drift red algae in southern significant habitat area within the Miami Beach Segment.

Table 1. Benthic and fish species observed while tracing western edge of significant habitat for Miami Beach Segment. Approximate abundance scale given: Single (1 individual); few (2-10 individuals); many (10-50 individuals); abundant (> 50 individuals).

	Species	Northern Abundance	Southern Abundance
Algae	*Acanthophora spicifera*	Abundant	Abundant
	Lyngbya sp	Abundant	Abundant
	Caulerpa mexicana	Abundant	Abundant
	Chondria sp.	Abundant	Abundant
	Dasya baillouviana	Abundant	Abundant
	Dictyota sp.	Many	Many
	Halimeda discoidea	Abundant	Abundant
	Halimeda incrassata	Abundant	Abundant
	Hypnea sp.	Abundant	Abundant
	Laurencia sp.	Abundant	Abundant
	Spyridia filamentosa	Abundant	Abundant
Sponges	*Anthosigmella varians*	Many	Many
	Cliona sp.	Few	
	Dysidea sp.	Few	
	Iotrochorta birotulata	Few	
	Spheciospongia vesparium	Many	
	Unidentified sponge	Few	
Hard Coral	*Siderastrea radians*		Few
Soft Coral	*Pseudopterogorgia acerosa*	Many	Few
	Pseudopterogorgia americana	Many	Few
Other benthic	Unidentified hydroids	Abundant	Abundant
Fish	*Balistes capriscus*	Many	Many
	Halichoeres bivittatus	Many	Many
	Scarus iserti		Few

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Bal Harbor Segment (R-27 to R-29):

Significant habitat was observed on one of the 5 transects off the Bal Harbor Beach Segment; approximately 1200' from shore (off R-29) on the southern-most transect, BH-5 (Figure 6). Thus, 96% of the transect length surveyed was of open sand, with no epibenthic resources.

Significant habitat was found along approximately 4 % of the overall transect length within this area, and was restricted to the eastern most portion of the transect on which it was seen. The western-most edge of the 'significant habitat' was mainly rubble and hardbottom covered with a sand veneer to the north transitioning to more exposed hardbottom in the south. Seasonal drift red algae communities (*Chondria* sp., *Acanthophora*. *spicifera*, *Spyridia filamentosa*) were abundant in this area particularly the northern portion. Macroalgae (e.g., *Halimeda* spp., *Caulerpa* spp., *Dictyota* sp., *Dasya bailouviana*) were also common throughout. In addition to the algae, occasional soft corals, sponges, and hard corals were observed in the northern area with increasing abundance toward the south. Figures 9 through 12 provide representative illustrations of the significant habitat in this area. Benthic and fish species identified during the surveys for the Bal Harbor Segment and their relative abundance are listed in Tables 2 and 3 respectively.

At this location, seasonal and seasonally abundant macroalgae give a very dense appearance to the communities, however, the persistent components of the community, while at times "abundant" are not as common or high in cover as the seasonally abundant macroalgae.

The Bal Harbor Beach segment has two exposed shore-perpendicular groins extending offshore from the beach between R27 and R29 (Figure 6). Three more groins are farther to the south. These groins have been buried and unburied through nourishment/erosion process. Portions of the groins are tidally exposed. At this time, the groins support benthic species including sponges (*Cliona* spp.), bryozoans, hydroids, tunicates, and algae. Numerous fish species and other motile invertebrates were also found along the groin structures. Figures 7 and 8 illustrate the resources found on the groins while Tables 2 and 3 list the species of benthic and motile species respectively.

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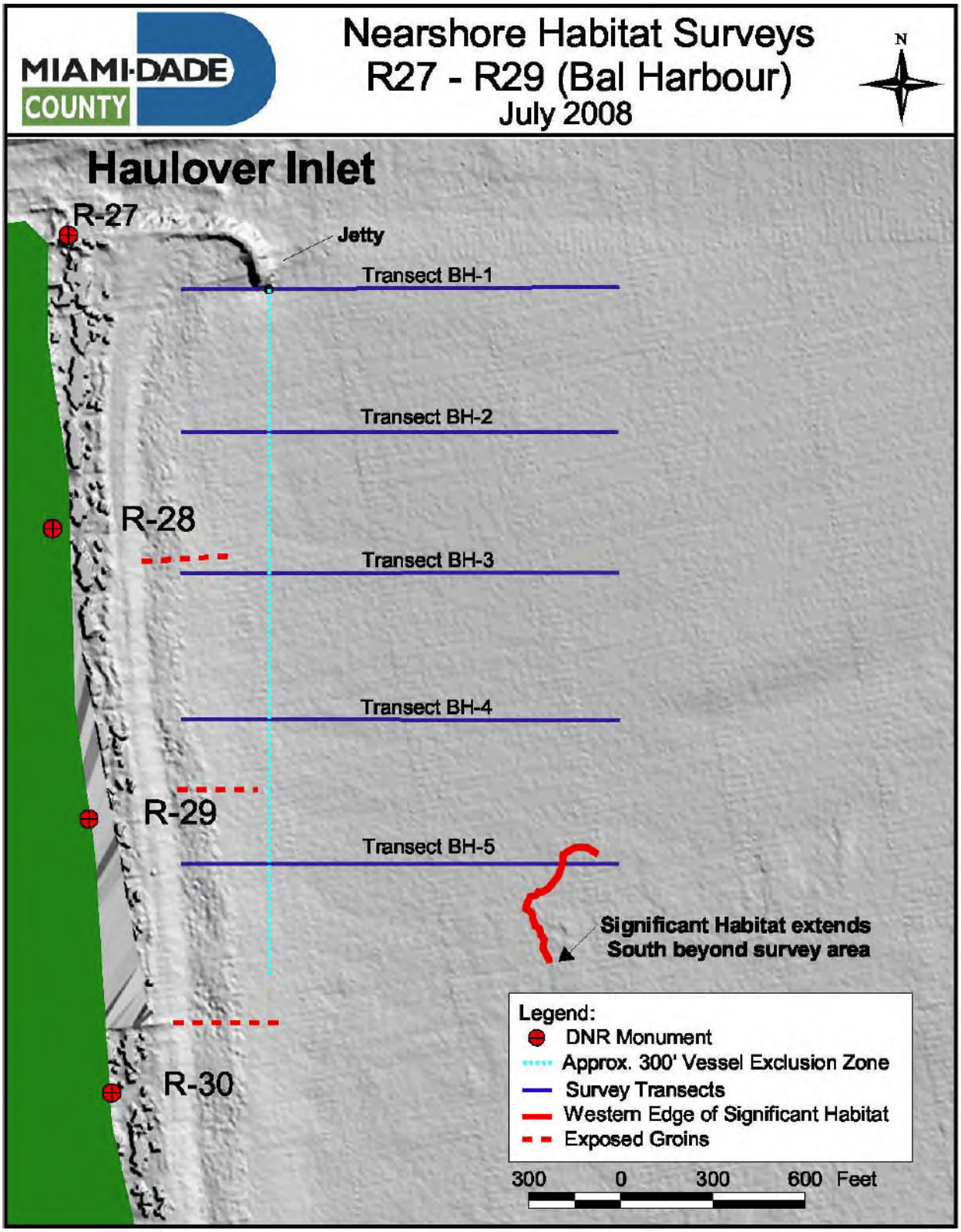

Figure 6. Location of groin structures and significant habitat within the Miami Beach Segment—R43 to R44+500.

Figure 7. Juvenile *Equetus punctatus* and *Lutjanus synagris* among algae (*Padina* spp.) and hydroids on the exposed portions of the shore beach groin structures off the Bal Harbour Beach Segment.

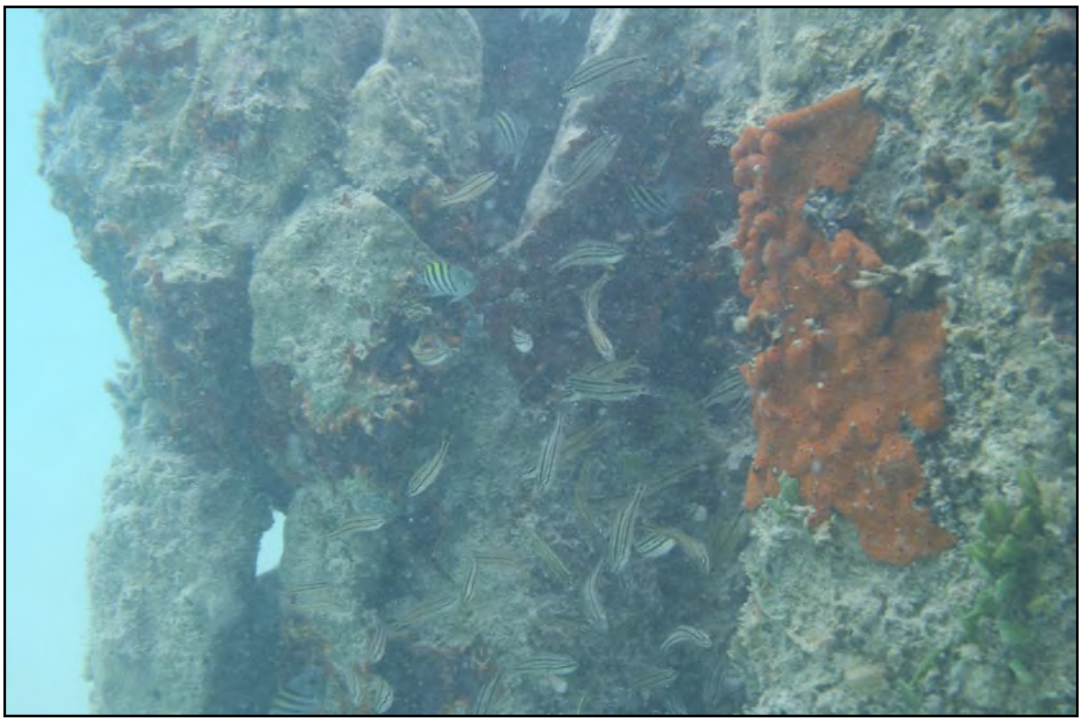

Figure 8. Juvenile grunts (*Haemulon* spp.) and *Abudefduf saxatilis* along with encrusting tunicates, sponges, and algae (*Caulerpa sertulariodes*) on the groin structures off the Bal Harbour Beach Segment.

Figure 9. Attached and drift macroalgae and *Pseudopterogorgia* spp. on rubble and sand veneer in northern portion of significant habitat area within the Bal Harbour Beach segment.

Figure 10. *Solenastrea bournoni* and *Pseudopterogorgia* spp. in significant habitat area within the Bal Harbour Beach segment.

Figure 11. Exposed hardbottom with *Pseudopterogorgia* spp. in significant habitat area within the Bal Harbour Beach segment.

Figure 12. Hardbottom with soft corals and large barrel sponge, *Spheciospongia vesparium*, in significant habitat area within the Bal Harbour Beach segment.

Table 2. Benthic species observed while surveying the exposed groins and tracing western edge of significant habitat for the Bal Harbour Beach Segment. Approximate abundance scale given: Single (1 individual); few (2-10 individuals); many (10-50 individuals); abundant (> 50 individuals).

	Species	Groin Abundance	Sig. Habitat Abundance
Algae	*Acanthophora spicifera*		Abundant
	Blue-Green Algae		Abundant
	Unidentified Brown Algae	Many	
	Caulerpa racemosa		Few
	Caulerpa sertioldes	Abundant	
	Chondria sp.		Abundant
	Dasya baillouviana		Abundant
	Dictyota sp.		Abundant
	Halimeda discoidea		Many
	Halimeda incrassata		Many
	Hypnea spp.		Abundant
	Laurencia sp.		Abundant
	Padina spp.	Abundant	
	Spyridia filamentosa		Abundant
	Udotea sp.		Many
Sponges	*Anthosigmella varians*		Many
	Cliona sp.	Abundant	Few
	Spheciospongia vesparium		Many
Hard Coral	*Siderastrea radians*		Many
	Siderastrea siderea		Many
	Solenastrea bournoni		Many
	Stephanocoenia intersepta		Many
Soft Coral	*Plexaurella* spp.ecies		Many
	Pseudoplexaura sp.		Many
	Pseudopterogorgia americana		Abundant
	Pseudopterogorgia acerosa		Abundant
	Pterogorgia anceps		Many
Other benthic	Unidentified barnacles	Abundant	
	Unidentified bryozoans (encrust)	Many	
	Unidentified hydroids	Abundant	Abundant
	Unidentified tunicates	Abundant	
	Phragmatopoma caudata	Many	

Table 3. Fish and motile invertebrate species observed while surveying the exposed groins and tracing western edge of significant habitat for the Bal Harbour Beach Segment. Approximate abundance scale given: Single (1 individual); few (2-10 individuals); many (10-50 individuals); abundant (> 50 individuals).

	Species	Groin Abundance	Sig. Habitat Abundance
Fish	*Abudefduf saxatilis*	Abundant	
	Balistes capriscus		Many
	Caranx ruber (juv.)	Many	Few
	Caranx spp. (juv.)	Abundant	
	Diodon holocanthus		Single
	Equetus punctatus	Few	
	Gerres cinereus	Many	
	Haemulon aurolineatum	Single	Few
	Haemulon sciurus		Few
	Haemulon spp. (juv.)	Abundant	
	Halichoeres bivittatus		Many
	Lutjanus synagris (juv.)	Many	Single
	Parablennius marmoreus	Few	
	Seriola dumerili (juv.)		Few
	Sparisoma chrysopterum		Few
	Urolophus jamaicensis		Single
Other Motile	*Sepioteuthis sepiodea*	Few	
	Unidentified crabs	Few	
	Unidentified Cerith snails	Many	

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Sunny Isles (R-7 to R-12):

Significant habitat was found within the survey on each of the transects surveyed off the Sunny Isles Beach segment; with the closest habitat occurring approximately 650' on transect SI-4, and as far off as approximately 1500' offshore on transect SI-12 (Figure 13), with an average distance from shore of 930 ft. Approximately 62 % of the region was of open sand with no epibenthic resources. The western most edge of the significant habitat was mainly rubble and hardbottom covered with a sand veneer with occasional exposed hardbottom. Seasonal drift red algae communities were dominant throughout this area (*Chondria* sp., *Acanthophora spicifera*, *Laurencia* spp., *Spyridia filamentosa*) and the most apparent component of the benthic community (Figure 14). Attached macroalgae (e.g., *Halimeda* spp., *Caulerpa* spp., *Dictyota* sp., *Dasya bailouviana*) were also an abundant community component throughout the area.

The abundance of sponges, soft coral and hard corals ranged greatly from a solitary soft coral (*Pseudopterogorgia* sp.) surrounded by sand to a few soft corals surrounded by the drift red algae community to denser areas with several soft corals, sponges, and hard corals. Figures 15 through 17 illustrate some of the variation in the components of the significant habitat in this area. Worm rock (*Phragmatopoma caudata*) was also occasionally observed in this area (Figure 19 and 20). Benthic and fish species identified during the surveys for the Sunny Isles Segment and their relative abundance are listed in Tables 4 and 5 respectively. More extensive exposed hardbottom (with 1-2' relief) and dense benthic assemblages were observed farther to the east approximately 1500' offshore at the eastern transect edges.

In addition to the natural habitat described above, two submerged breakwater structures are located approximately 400' from shore between R-7 and R-8 (transects SI-1 to SI-3) as shown in Figure 13. The breakwater structures off the Sunny Isles Segment were constructed from limerock boulders during the summer and fall of 2001 and now support benthic invertebrate, algal, and fish assemblages (Figures 21 and 22). Benthic and fish species observed on the boulders are included in Tables 4 and 5 respectively.

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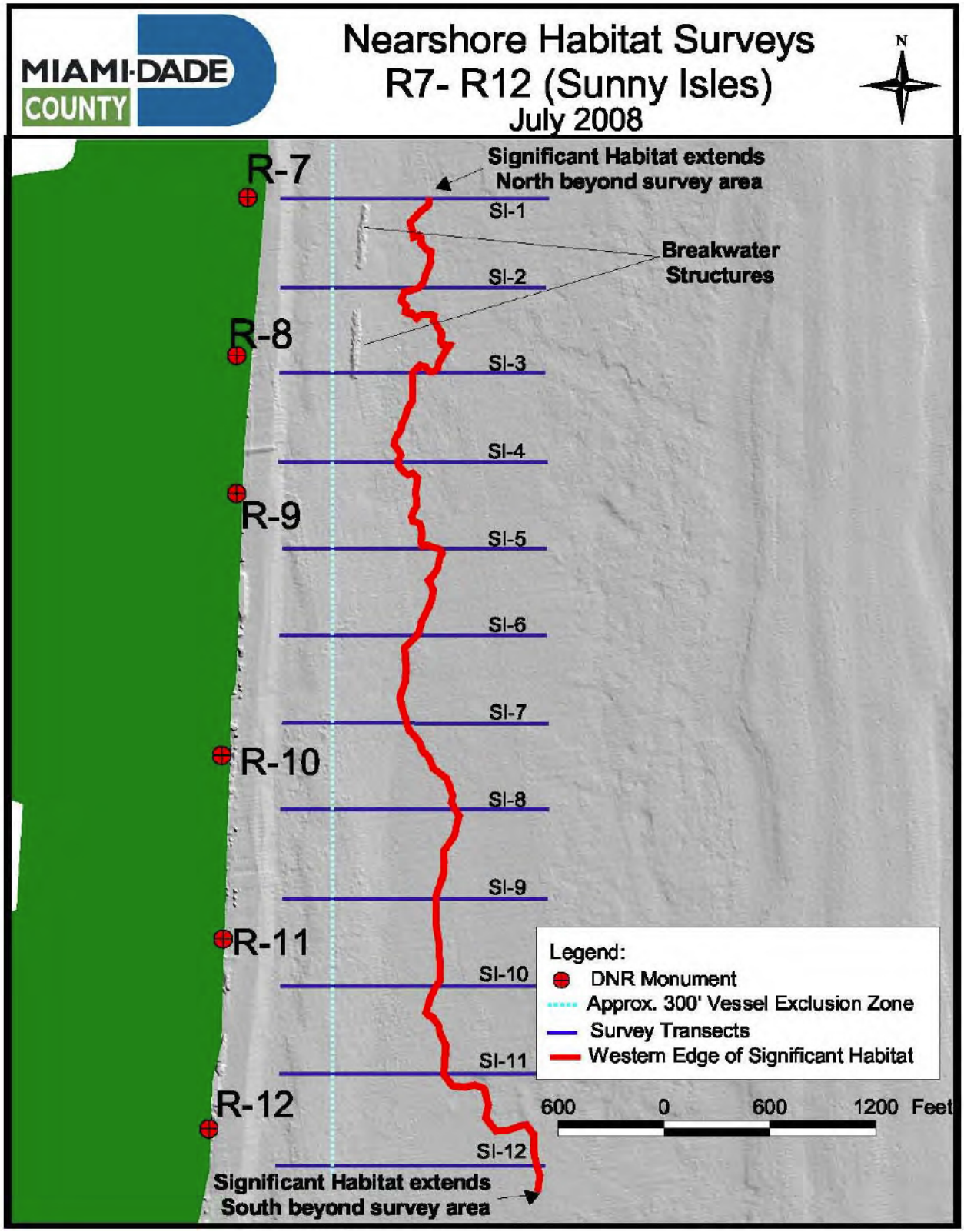

Figure 13. Location of significant habitat within the Miami Beach Segment—R43 to R44+500.

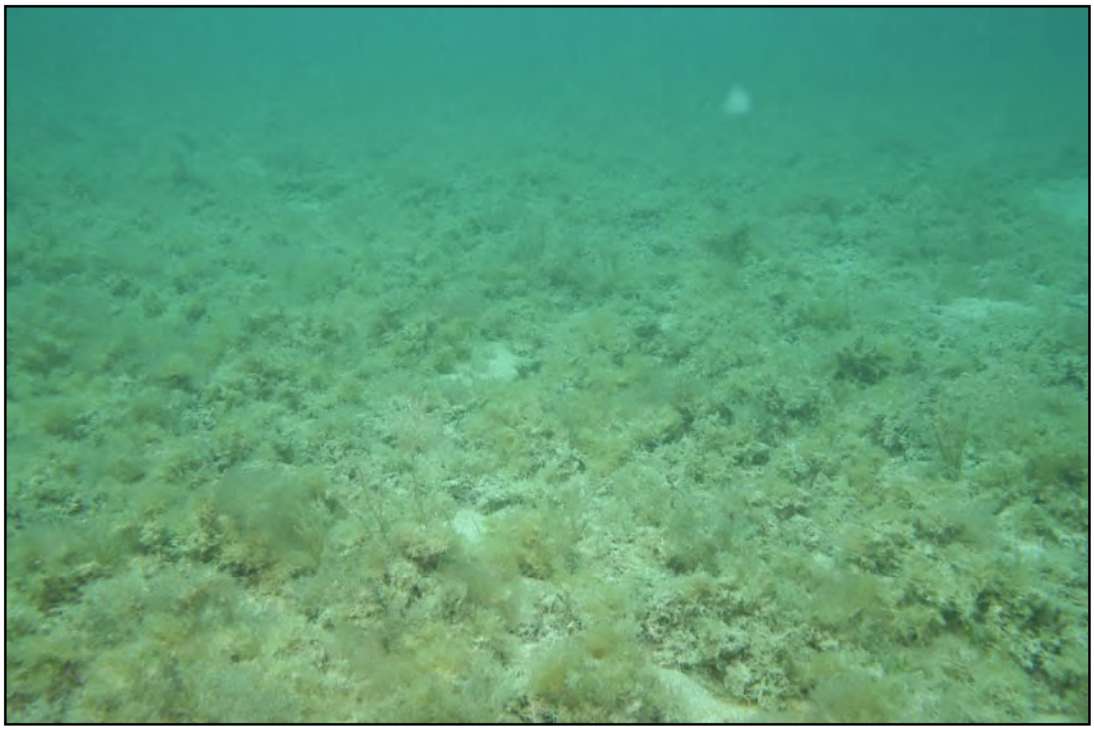

Figure 14. Abundant drift red algae dominated area of the Sunny Isles Beach Segment.

Figure 15. *Pseudopterogorgia* sp. surrounded by sand within the Sunny Isles Beach segment.

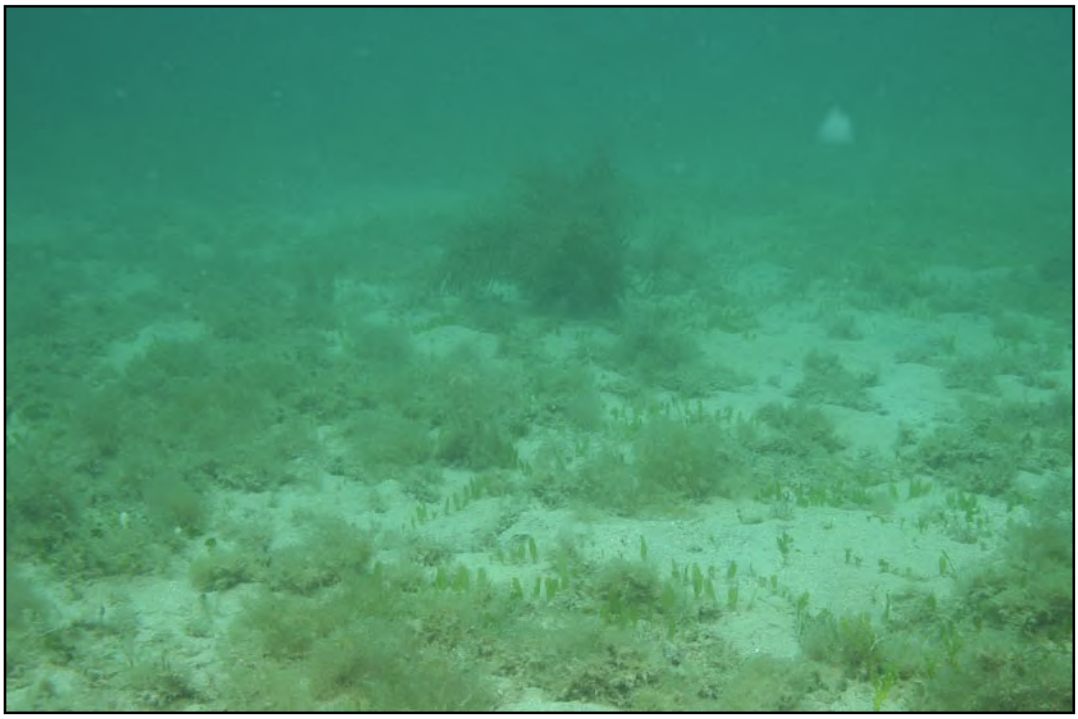

Figure 16. *Pseudopterogorgia* sp. surrounded by algae within the Sunny Isles Beach Segment.

Figure 17. Soft coral (*Pseudopterogorgia* spp. and *Plexaurella* spp.), sponges (*Anthosigmella varians* and *Spheciospongia vesparium*), and algae within the Sunny Isles Beach Segment.

Figure 18. Hard coral, *Solenastrea bournoni*, and sponge, *Anthosigmella varians,* within the Sunny Isles Beach Segment.

Figure 19. Significant habitat area with soft corals (*Pseudopterogorgia* sp.) and worm rock (*Phragmatopoma caudata*) within the Sunny Isles Segment.

Figure 20. Worm rock (*Phragmatopoma caudata*) and algae within the Sunny Isles Segment.

Figure 21. Northern breakwater structure with sponge growth (*Cliona* sp.) and juvenile grunts (*Haemulon* spp.) sheltered by boulders.

Figure 22. Southern breakwater structure with sponge growth (*Cliona* sp.) and Sergeant Majors (*Abudefduf saxatilis*).

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Table 4. Benthic species observed on western edge of significant habitat and breakwater structures for the Sunny Isles Beach Segment. Approximate abundance scale given: Single (1 individual); few (2-10 individuals); many (10-50 individuals); abundant (> 50 individuals).

	Species	Sig. Habitat Abundance	Breakwater Abundance
Algae	*Acanthophora spicifera*	Abundant	
	Blue-Green Algae	Abundant	Abundant
	Caulerpa mexicana	Abundant	
	Chondria sp.	Abundant	
	Dasya baillouviana	Abundant	
	Dictyota sp.	Abundant	
	Halimeda discoidea	Abundant	
	Halimeda incrassata	Abundant	Many
	Halimeda monile	Many	
	Halymenia floresia	Few	
	Hypnea spp.	Abundant	
	Laurencia sp.	Abundant	
	Spyridia filamentosa	Abundant	
	Udotea sp.	Many	
Sponges	*Anthosigmella varians*	Many	
	Cliona delitrix	Few	
	Cliona sp.	Few	Abundant
	Dysidea sp.	Few	
	Iotrochorta birotulata	Few	
	Holopsamma helwigi		Few
	Monanchora barbadensis		Many
	Niphates erecta	Many	
	Spheciospongia vesparium	Many	
	Unidentified sponge	Few	
Hard Coral	*Dichocoenia stoksi*	Few	
	Diploria strigosa	Few	
	Montastrea cavernosa	Few	
	Siderastrea radians	Many	
	Siderastrea siderea	Many	
	Solenastrea hyades	Single	
	Solenastrea bournoni	Many	
Soft Coral	*Pseudopterogorgia acerosa*	Abundant	
	Pseudopterogorgia americana	Abundant	
	Plexaurella spp.	Many	
Other benthic	*Millepora alcicornis*	Many	
	Palythoa caribaeorum		Few
	Phragmatopoma caudata	Many	Many
	Unidentified hydroid	Abundant	
	Unidentified tunicate	Few	

Table 5. Fish and motile vertebrate species observed while tracing western edge of significant habitat for the Sunny Isles Beach Segment. Approximate abundance scale given: Single (1 individual); few (2-10 individuals); many (10-50 individuals); abundant (> 50 individuals).

Species	Sig. Habitat Abundance	Breakwater Abundance
Acanthurs bahianus	Many	
Abudefduf saxatilis		Abundant
Acanthurus chirurgus	Many	
Anisotremus virginicus		Few
Balistes capriscus	Many	
Coryphopterus glaucofraenum	Few	
Cryptotomus roseus	Few	
Dasyatis sabina		Single
Diplodus holbrookii		Abundant
Gerres cinereus		Many
Gymnura micrura	Single	
Haemulon aurolineatum		Few
Haemulon plumeri	Few	
Haemulon sciurus	Few	
Haemulon spp. (juv.)	Many	Few
Halichoeres bivittatus	Many	Few
Lutjanus synagris (juv.)	Single	
Megalops atlanticus	Single	
Ocyurus chrysurus	Single (juv.)	Few
Pareques acuminatus		Single
Pomacanthus paru	Single	
Sphyraena barracuda	Single	
Stegastes leucostictus	Single	
Synodus intermedius	Few	
Thalossoma bifasciatum	Many	Few
Urolophus jamaicensis	Single	
Xyrichtys splendens	Few	
Chelonia mydas	Single	

SUMMARY

The reef and habitat areas off Miami-Dade County are normally found 500 to +1500 ft offshore. Low relief, exposed bedrock reefs are most commonly found at least 1000 feet offshore. Benthic assemblages often establish on non-consolidated rubble, which can support persistent benthic assemblages for a given period of time (until a storm disrupts the stability of the rubble). These areas are often inundated with sand, create conditions of high sedimentation due to the shifting sands which often disrupt and scour available substrate. Despite these conditions, these areas of often support algal, sponge, soft coral, and very limited hard coral; and are composed of species with high tolerance of sedimentation.

Of the areas evaluated, two segments (Miami Beach and Bal Harbor Segments) showed >= 94% open sand, with no epibenthic resources. Less than 6% of the area surveyed in off each of these segments contained significant habitat. The location of the habitat was on the far eastern portions of the transects, at a minimum of 1200 ft from the shoreline. One area, Sunny Isles segment had attached epibenthic resources along on each of the transects surveyed. These resources were found between 650ft and 1500 ft from the shoreline (average distance 930 ft), thus approximately 62% of the area was of open sand with no epibenthic resources.

As described herein, most areas of significant habitat had dense seasonally-abundant macro algae, providing a 'lush' appearance to the communities. It should be noted that the surveys were conducted during the middle of the summer when macroalgal biomass is at its highest. Permanent (e.g., non-seasonal) components were abundant in places, but much less so that the seasonal macro algae.

Due to the location of these communities (in regions unconsolidated sand sediments), they experience considerable levels of suspended sediments and associated sedimentation. Thus, these communities are tolerant of a high level of sand scour and sedimentation. Considering the fact that the anticipated nourishment activities will involve dry placement above the mean high water line (associated with trucked in sand), and the areas of significant habitat found were at distances equivalent to 1.6 to 3.0 times the maximum "buffer" distance required in beach renourishment permits involving hydraulic dredging and wet placement of dredged material. The distance from sand placement activities (e.g., project related turbidity or sedimentation) is sufficient to provide protection of habitat areas noted above.