Crossroads of the Intracoastal Waterway and Okeechobee Waterway Maintenance Dredging Project in the Vicinity of the St. Lucie Inlet

Pre-Construction Benthic Survey

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1.0 Background

The Florida Inland Navigation District (FIND) contracted CSA Ocean Sciences Inc. (CSA) in June 2016 to conduct a pre-construction benthic resource survey within the Crossroads of the Intracoastal Waterway (ICW) and Okeechobee Waterway (OWW) in the vicinity of the St. Lucie Inlet. The project area (ICW/OWW channel boundaries) for this pre-construction benthic survey was delineated by FIND as an area that may be affected by the proposed maintenance dredging. The survey area (located adjacent to the project area) was described by FIND in the Request for Proposals (RFP) (April 29, 2016; Addendum May 2, 2016) with specific instruction to refer to past benthic survey reports provided with the RFP for detailed location information and prescribed survey methods. CSA reviewed the previous pre-construction survey report (Dial Cordy and Associates, Inc. [DCA], 2013), prior to conducting the survey.

To confirm the current 2016 survey area, CSA contacted Taylor Engineering, Inc. (Taylor), FIND's engineering contractor managing the project. In an e-mail (July 13, 2016) from Mr. Bill Aley, a Professional Geologist with Taylor to Ms. Anne McCarthy (CSA), Taylor confirmed the survey area boundaries and added the two channel widener track lines (dimensions to which the channel may be widened) within the survey area. The project area, survey area, and survey transects for the St. Lucie ICW Crossroads survey are shown in **Figure 1** and included the following:

- Project area (ICW/OWW channel boundary)
- Survey area
- Visual reconnaissance track lines within the survey area and within proposed channel wideners; and
- Quantitative survey transects.

Figure 1. Crossroads survey area in the vicinity of the St. Lucie Inlet.

2.0 Survey Methodology

CSA conducted a benthic resource survey to determine the presence of seagrass, specifically (but not limited to) *Halophila johnsonii*, and any hardbottom habitat in relation to maintenance dredging along the ICW from 19 September through 20 September 2016. CSA conducted the survey to meet sampling requirements set by the National Marine Fisheries Service (NMFS), Southeast Region Habitat Conservation Division for sampling of *Halophila johnsonii* (NMFS, 2002). The survey included visual reconnaissance of the areas and quantitative sampling as the primary sampling method due to low visibility anticipated in the survey area. The survey dates were within the annual timeframe recommended by NMFS for seagrass surveys (1 June through 30 September). The survey was conducted during various tidal conditions, with a max tide height of 1.44 ft relative to Mean Lower Low Water (MLLW) for the survey area (source: www.tidesandcurrents.noaa.gov). Tidal conditions affected visibility and strong currents presented a challenge during peak flows, requiring the field team to survey portions of the survey area when currents were at a minimum. Visibility during the survey ranged from 1 to 3 ft at low/outgoing tide to 5 to 8 ft at high/incoming tide. Weather conditions during the survey consisted of a high temperature of 89°F and wind speeds from 3 to 17 mph from the southwest (source: www.timeanddate.com).

2.1 SURVEY APPROACH

2.1.1 Preliminary Visual Reconnaissance

Preliminary visual reconnaissance swims were conducted parallel to the project area (ICW/OWW channel boundary) to determine areas of benthic resource habitat within which to conduct subsequent quantitative transect sampling. Because hardbottom habitat was not encountered during the survey, only seagrass habitat was identified for quantitative sampling. The dive team swam the pre-plotted visual reconnaissance track lines, including the channel widener track lines, and recorded the location of any seagrass habitat encountered. To ensure the safety of the dive team, sampling was not conducted in close proximity or within navigational channels of the project area where vessel traffic was frequent. In addition, environmental factors such as light-limiting (for seagrass) water depths, and strong tidal currents would not support seagrass growth within these areas.

Throughout the reconnaissance, divers towed a taut-line radio telemetry buoy with an attached DGPS antenna positioned over the diver. An accurate physical trace of where the divers conducted their investigative swims was recorded via continual transmission of their position to the hydrographic survey software (Hypack®) on board the survey vessel. If the dive team encountered seagrass, they notified the boat operator to record the exact location of the radio telemetry buoy. Quantitative transect sampling was conducted only where seagrass habitat was identified during these reconnaissance swims.

2.1.2 Quantitative Transect Sampling

Survey transects were divided into two areas, Northwest transects and Southeast transects. These transects extended approximately east-west and were positioned perpendicular to the project area. CSA typically used buoys to mark the beginning (shoreward side) and end (channel margin) of each survey transect using the survey vessel and Hypack. When water depths were too shallow for safe vessel navigation, a buoy was not deployed and the radio telemetry buoy integrated with Hypack was used to locate the shoreward side of the survey transects.

Line Intercept Sampling

Line intercept data sampling was conducted to delineate seagrass extent (distances along transect where seagrass cover started and stopped; sum of transect length where seagrass occurred yields percent cover) were collected by a scientific diver towing the radio telemetry buoy (**Photo 1**); divers also recorded the seagrass species composition. Again, survey data logging for each transect began on the shoreward side and continued towards the project area. The DGPS position of the radio telemetry buoy was recorded at the beginning (start) and end (stop) of any seagrass habitat encountered. The diver also recorded the qualitative estimate of the width (in meters), as far as seagrass could be visually observed perpendicular to the transect of the seagrass habitat, a visual estimate of relative coverage (i.e., sparse, dense) and seagrass species composition, particularly the presence or absence of *H. johnsonii*.

Quadrat Sampling

Where seagrass occurred, the dive team used a quantitative quadrat sampling approach to determine percent cover, abundance, and species composition of seagrass along the survey transects. A scientific diver used a 0.25-m^2 quadrat subdivided into 25, 10-cm^2 cells to determine percent cover and abundance (**Photo 2**). Due to the sparse, patchy nature of seagrass encountered along survey transects, quadrats were arbitrarily placed only within boundaries of seagrass cover to specifically characterize areas of seagrass habitat. Seagrass abundance was determined by counting the number of cells containing at least one seagrass shoot. Frequency of occurrence of seagrass within each quadrat was expressed as a percentage and was determined by dividing the average number of occupied cells containing seagrass by the total number of cells.

Photo 1. Scientific diver and the radio telemetry buoy.

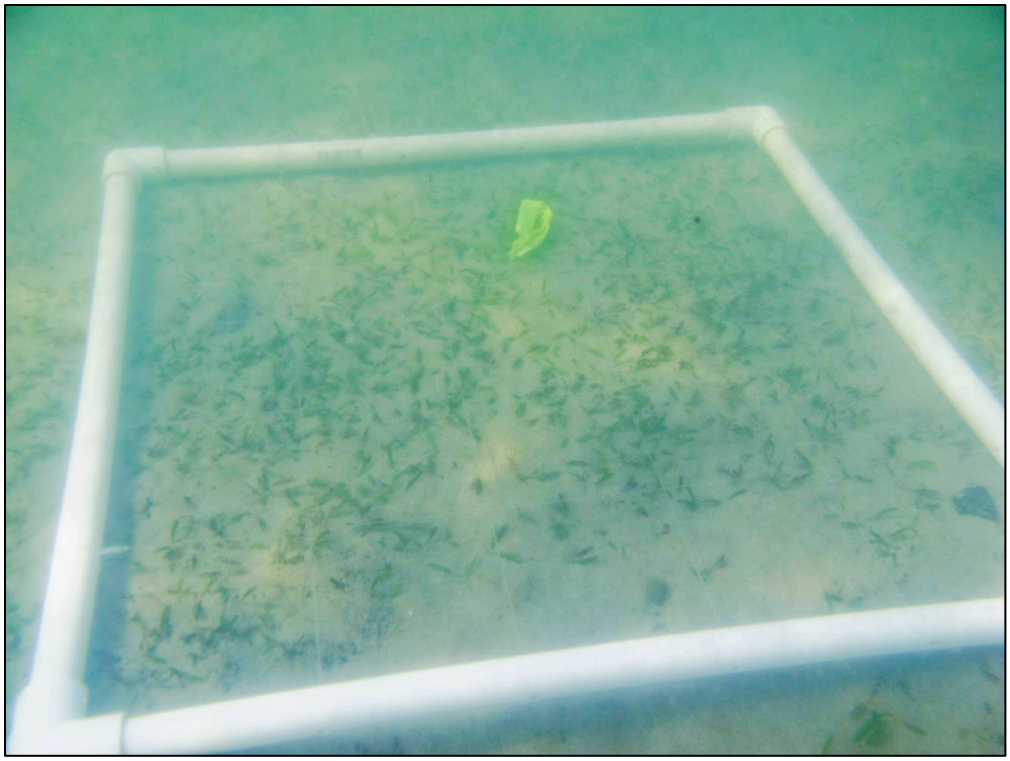

Photo 2. Quadrat sampling using a 0.25 m^2 quadrat.

An average Braun-Blanquet cover abundance score (B-B score) was recorded for each seagrass species and total (combined) seagrass, within the entire 0.25-m^2 quadrat by using the Braun-Blanquet cover-abundance scale (Braun-Blanquet, 1972, Fourqurean et al., 2001) shown in **Table 1**. The average B-B scores were then converted to percent cover for each area to allow interpolation of averaged B-B scores that fall between B-B scale values (**Table 2**; conversion was conducted by regressing the mid-point of percent cover within the range of each B-B scale value: Percent Cover = $2.8108*[BB]^{2.2325}$), representing the status of seagrass within the boundaries of where it occurred.

Table 1. Braun-Blanquet scale (score) and percent cover scale values (Braun-Blanquet, 1972).

Braun-Blanquet Scale Values (Score)	Percent Cover (%)
0.0	Not present
0.1	Solitary specimen
0.5	Few with small cover
1	Numerous, but <5
2	5 to 25
3	25 to 50
4	50 to 75
5	75 to 100

Table 2. Interpolation of the mid-point Braun-Blanquet scores to percent cover conversion table.

Braun-Blanquet Score	Percent Cover	Braun-Blanquet Score	Percent Cover
0.00	0.00	2.60	23.73
0.10	0.02	2.70	25.81
0.20	0.08	2.80	28.00
0.30	0.19	2.90	30.28
0.40	0.36	3.00	32.66
0.50	0.60	3.10	35.14
0.60	0.90	3.20	37.72
0.70	1.27	3.30	40.40
0.80	1.71	3.40	43.19
0.90	2.22	3.50	46.07
1.00	2.81	3.60	49.07
1.10	3.48	3.70	52.16
1.20	4.22	3.80	55.36
1.30	5.05	3.90	58.67
1.40	5.96	4.00	62.08
1.50	6.95	4.10	65.59
1.60	8.03	4.20	69.22
1.70	9.19	4.30	72.95
1.80	10.44	4.40	76.80
1.90	11.78	4.50	80.75
2.00	13.21	4.60	84.81
2.10	14.73	4.70	88.98
2.20	16.34	4.80	93.26
2.30	18.05	4.90	97.65
2.40	19.85	5.00	100.00
2.50	21.74		

3.0 Results

3.1 PRELIMINARY VISUAL RECONNAISSENCE

During the preliminary visual reconnaissance swims, divers swam along a pre-plotted survey line to identify areas of benthic resource habitat (**Figure 2**). Because hardbottom habitat was not observed within the project or survey areas, only seagrass habitat was quantified. Seagrass habitat was observed in shallow waters along the shorelines within the northwest and southeast portions of the survey area. Northwest and Southeast transects were established to quantify the seagrass habitat within these areas. Although seagrass had was previously documented along the southwestern portion of the survey area (DCA, 2013), no seagrass habitat was encountered within this area during the visual reconnaissance swims.

Seagrass habitat was not observed within the project area or within the channel widener areas. These areas devoid of seagrass generally had deeper water depths than areas with seagrass and with presumably limited sunlight penetration, high wave energy from wind and vessel traffic, or a combination of these conditions. Hydroids and macroalgae were also occasionally observed in deeper waters throughout the reconnaissance swims (**Photo 3**). Within the channel widener areas, coarse sand and shell hash were the primary sediments noted (**Photo 4**). Substrate varied throughout the survey area but was primarily composed of coarse and fine sand, with occasional shell hash and rubble noted. A large piece of debris (possibly a vessel or shipping container) was identified at the southeast intersection of the survey area. As the divers continued south along the southeastern shoreline, the substrate was composed of large rubble which was conterminous with rip rap associated with shoreline protection within the survey area.

Figure 2. Preliminary visual reconnaissance swims during the pre-construction benthic survey.

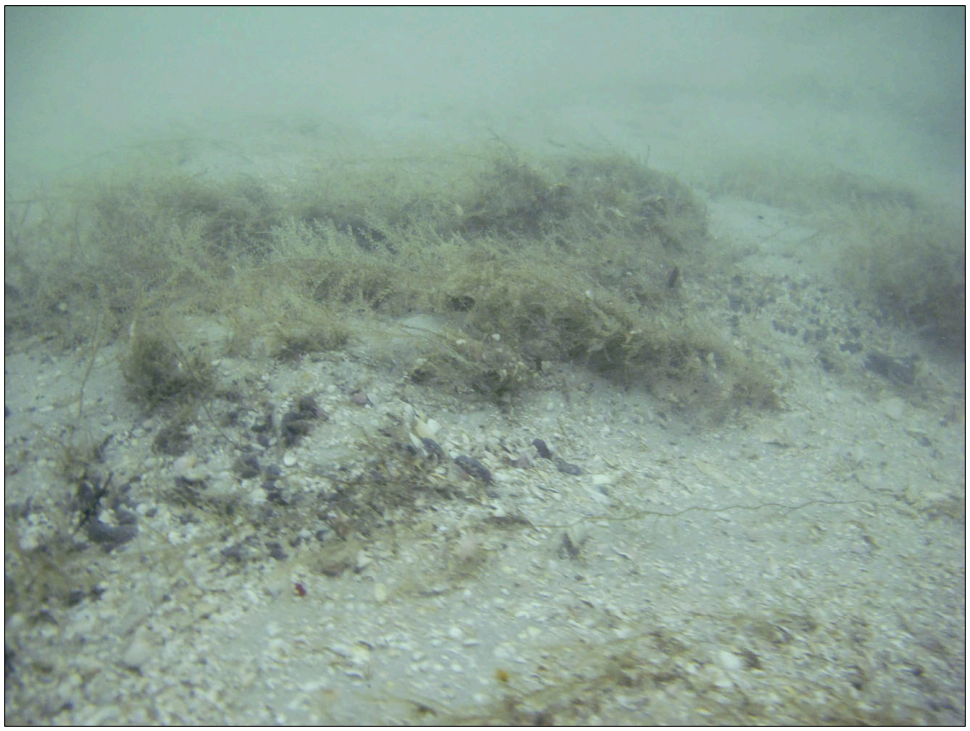

Photo 3. Hydroids observed in the northeastern portion of the survey area during the reconnaissance swims.

Photo 4. Coarse sand and shell hash observed within the channel widener areas during the reconnaissance swims.

3.2 QUANTITATIVE TRANSECTS

The divers conducted the survey across 175,572 ft^2 (4.0 acres) or 2.2% of the total defined survey area, estimated to be 7,933,641 ft^2 (182.1 acres). The diver survey area was calculated by the linear distance the divers surveyed across each transect times a conservative minimum field of view of 3 ft (0.9 m) to either side of the transects, or a total of 6 ft (1.8 m). The total survey area (2.2%) met the minimum required sampling area of 1% to 30% for large project sites following NMFS (2002). *H. johnsonii* (Johnson grass) and *Halodule wrightii* (Shoal grass) were the only two seagrass species observed within the survey area. *H. wrightii* was found in water depths ranging from approximately 0.8 ft (0.2 m) to 4 ft (1.2 m) whereas *H. johnsonii* occurred at approximate water depths ranging from 2 ft (0.6 m) to 4 ft (1.2 m). Overall, the total coverage of seagrass was less than previously quantified during the 2013 pre-construction survey (DCA, 2013). The resultant seagrass polygons in the geospatial figures were generated from combining data collected during the reconnaissance swims and line intercept sampling.

3.2.1 Northwest Transects

Seagrass was quantitatively assessed within 12 transects in the northwest portion of the survey area, identified as the Northwest transects (**Figure 3**). A total of 171,797 ft^2 (3.9 acres) of seagrass was mapped in these Northwest transects (**Table 3**). Seagrass habitat was comprised of monospecific *H. johnsonii* (6,097 ft^2 (0.1 acres), monospecific *H. wrightii* (78,072 ft^2 [1.8 acres]), and mixed *H. wrightii* with *H. johnsonii* (87,629 ft^2 [2.0 acres]) (**Photo 5**).

Table 3. Total seagrass coverage by survey area derived from the point-intercept sampling along the Northwest and Southeast transects.

Survey area	Seagrass Coverage (ft^2)			
	Halophila johnsonii (*Hj*)	*Halodule wrightii* (*Hw*)	Mixed *Hw* and *Hj*	Total Seagrass
Northwest Transects	6,097	78,072	87,629	171,797
Southeast Transects	0	5,448	31,591	37,039
Project Area (ICW/OWW channel boundary)	0	0	0	0
Total (ft^2)	**6,097**	**83,520**	**119,220**	**208,837**
Total (acres)	**0.1**	**1.9**	**2.8**	**4.8**

Seagrass within the Northwest transects was described as very sparse and patchy with a low percent cover for both species. *H. wrightii* (**Photo 6**) and had a slightly higher percent cover (1.8%) than *H. johnsonii* (1.2%) (**Table 4**). Although seagrass within the Northwest transects had low percent coverages, the frequency of occurrence was higher (66.1%) as compared to the Southeast transects (20.2%). The eastern edge of the seagrass habitat within the Northwest transects began approximately 100-150 ft (30.5-45.7 m) from the project area in maximum water depths of approximately 4 ft (1.2 m). Coarse sandy sediment was the primary substrate type noted (**Photo 7**).

Figure 3. Seagrass delineation within the Northwest transects during the pre-construction benthic survey.

Table 4. Average Braun-Blanquet scores (B-B scores), converted percent cover (% cover) from regression, and frequency of occurrence taken from quadrats placed only within areas of seagrass cover along the quantitative transects.

Survey Area	*Halodule johnsonii*		*Halophila wrightii*		All Seagrass (Combined)		
	Avg. B-B Score	% Cover	Avg. B-B Score	% Cover	Avg. B-B Score	% Cover	Frequency of Occurrence (%)
Northwest Transects	0.7	1.2	0.8	1.8	1.3	5.1	66.1
Southeast Transects	0.3	0.2	0.5	0.5	0.6	0.9	20.2

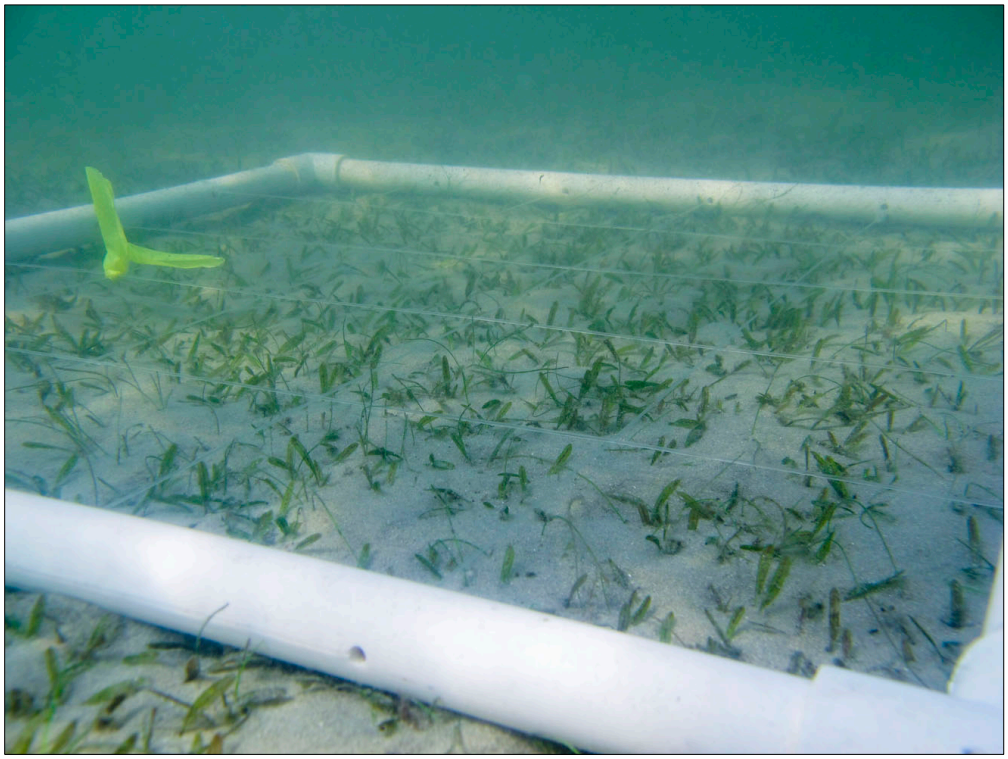

Photo 5. *Halophila johnsonii* (wider blades) and *Halodule wrightii* (narrower blades) within the Northwest transects during the pre-construction benthic survey.

Photo 6. *Halodule wrightii* located within the Northwest transects during the pre-construction benthic survey.

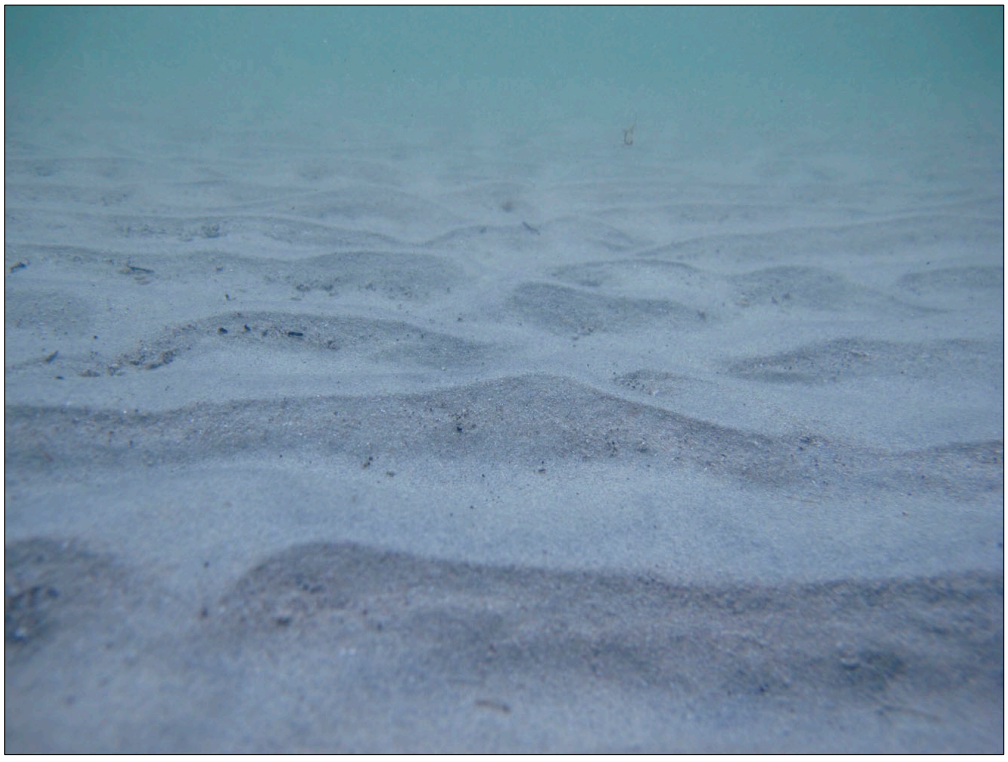

Photo 7. Coarse sandy sediments observed within the Northwest transects during the pre-construction benthic survey.

3.2.2 Southeast Transects

The Southeast transects were located on the southeast portion of the survey area and were composed of 10 transects (**Figure 4**). A total of 37,039 ft^2 (0.9 acres) of seagrass was mapped in the Southeast transects, and the majority of the seagrass was mixed *H. johnsonii* and *H. wrightii* (31,591 ft^2 [0.7 acres]) (**Table 3**). Divers began data collection at the eastern shoreline (**Photo 8**) and continued west towards the project area until seagrass habitat was no longer encountered. Seagrass within the Southeast transects was sparse with a low frequency of occurrence (20.2%) (**Table 4**). Where seagrasses occurred, *H. johnsonii* and *H. wrightii* had low percent coverages (<1% for each species) and discontinuous patches were recorded in shallow waters near the eastern shoreline (**Photos 9** and **10**). Fine sand was the primary sediment type observed throughout this area.

Photo 8. Mangrove habitat encountered on the east side of the Southeast transects during the pre-construction benthic survey.

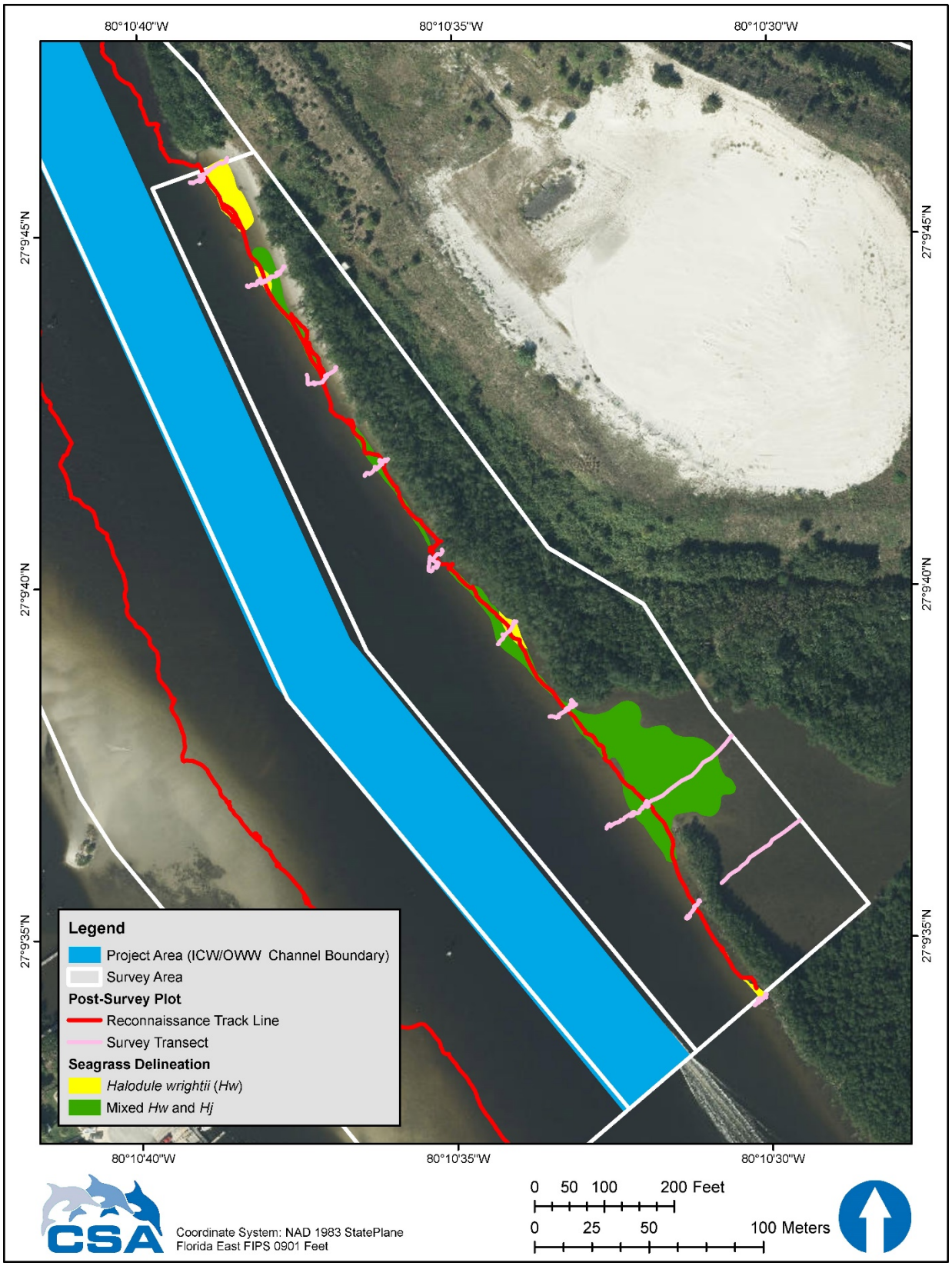

Figure 4. Seagrass delineation within the Southeast transects during the pre-construction benthic survey.

Photo 9. *Halophila johnsonii* (bright green leaves) and turf algae within the Southeast transects during the pre-construction benthic survey.

Photo 10. *Halodule wrightii* within the Southeast transects during the pre-construction benthic survey.

3.3 WILDLIFE OBSERVATIONS

Wildlife observations during the pre-construction benthic survey included a nine-armed sea star (*Luidia senegalensis*; **Photo 11**), sheepshead (*Archsargus probatocephalus*; **Photo 12**), a flounder (*Paralichthys* sp.; **Photo 13**), and Florida fighting conchs (*Strombus alatus*; **Photo 14**).

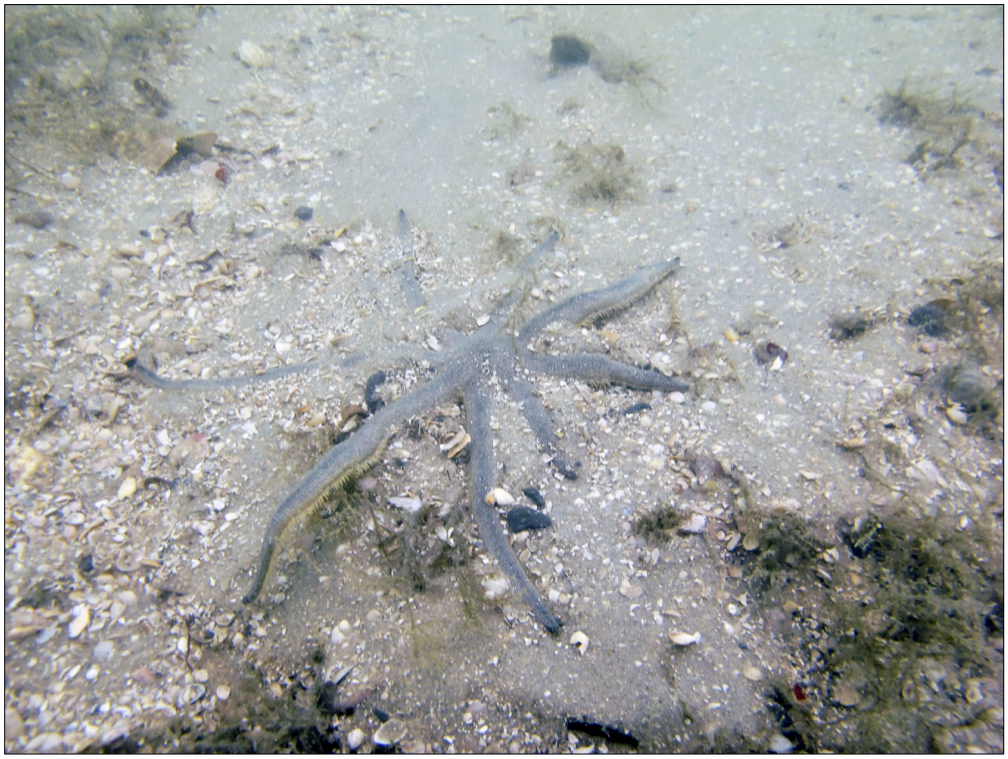

Photo 11. Nine-armed sea star (*Luidia senegalensis*) observed during the pre-construction benthic survey.

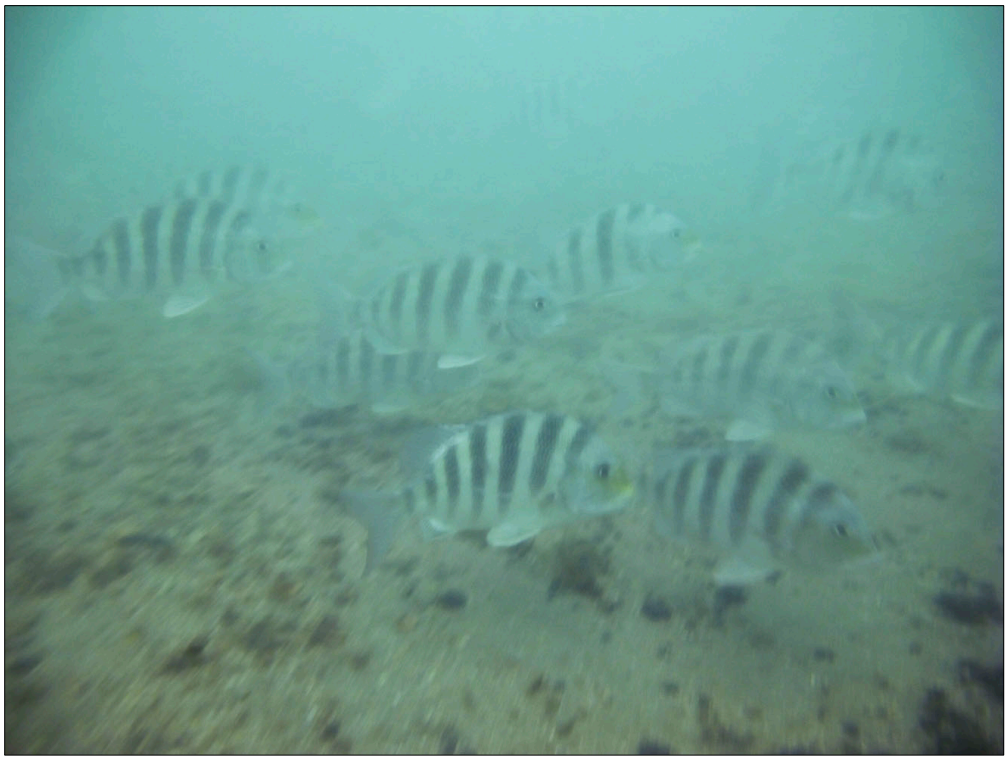

Photo 12. A school of sheepshead (*Archsargus probatocephalus*) observed during the pre-construction benthic survey.

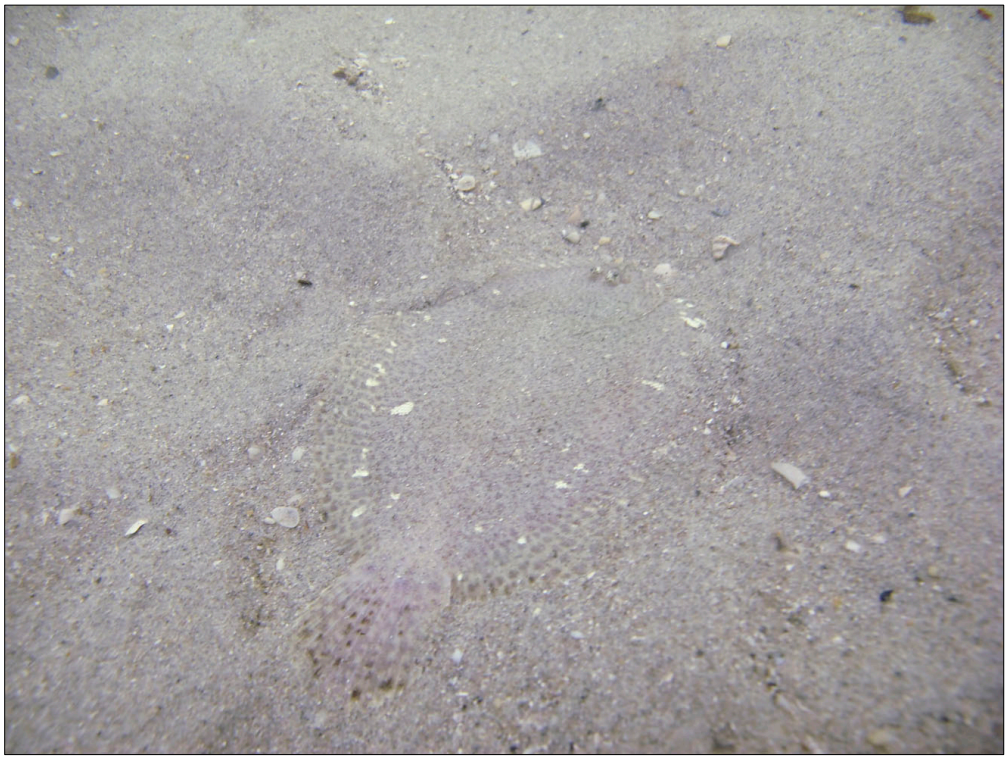

Photo 13. A flounder (*Paralichthys* sp.) observed during the pre-construction benthic survey.

Photo 14. Florida fighting conchs (*Strombus alatus*) observed during the pre-construction benthic survey.

4.0 References

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