

**H12116**

NOAA FORM 76-35A

U.S. DEPARTMENT OF COMMERCE  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
NATIONAL OCEAN SURVEY

**DESCRIPTIVE REPORT**

*Type of Survey*      **Hydrographic Lidar Survey**  
*Field No.*                **H12116**  
*Registry No.*            **OPR-H328-KRL-09**

**LOCALITY**

*State*                      **Florida**  
*General Locality*      **Broward County**  
*Sub-locality*            **Boca Raton to Pompano Beach**

**2009**

CHIEF OF PARTY  
**Scott R. Ramsay**  
HYDROGRAPHER  
**Mark J. Sinclair**

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DATE                      **August 24, 2008**

NOAA FORM 77-28 (11-72)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  <b>HYDROGRAPHIC TITLE SHEET</b>	REGISTRY No.  <b>H12116</b>
State <u>Florida</u> General Locality <u>Broward County</u> Scale <u>1:10,000</u> Date of Survey <u>July 12 – August 24, 2008</u> Instructions dated <u>June 17, 2009</u> Project No <u>OPR-H328-KRL-09</u> Vessel <u>Fugro LADS Aircraft, call sign VH-LCL</u> Hydrographer <u>M.J. Sinclair</u> Chief of Party <u>S.R. Ramsay</u> Surveyed by <u>J.G. Guilford, D.J. Stubbing, J.K. Young, W.T. Newsham, B.A.</u> <u>Weidman, K.J. Oberhofer, C.N. Waite, R.B. Touchstone, V. Sicari</u> Soundings by <u>Laser Airborne Depth Sounder</u> Graphic record scaled by <u>B.A. Weidman</u> Graphic record checked by <u>S.R. Ramsay, J.G. Guilford, <i>Atlantic Hydrographic Branch</i></u> <u><i>Personnel</i></u> Automated Plot <u>N/A</u> Soundings in <u>Meters <i>Feet</i></u> at MLLW		
<b>REMARKS</b> <u>Requisition / Purchase Req. # <u>NCNJ3000-9-15915</u></u> <u>Contractor <u>Fugro LADS, Incorporated, 925 Tommy Munro Dr., Suite J, Biloxi, MS 39532</u></u> <u>Sub-Contractors <u>Baxley Ocean Visions, Inc., 5018 Harrison Street, Hollywood, FL 33021</u></u> <u>Coastal Planning and Engineering, Inc., 2481 NW Boca Raton Blvd., Boca Raton, FL 33431</u> <u>Quester Tangent Corp., 6582 Bryn Road, Saanichton, British Columbia V8M 1X6, Canada</u> <u>Times <u>All times are recorded in UTC.</u></u> <u>Datum and Projection <u>NAD83, UTM (N) Zone 17</u></u> <u>Purpose <u>The purpose of this survey is to provide NOAA with modern, accurate</u></u> <u>hydrographic survey data with which to update the nautical charts of the assigned area.</u> <u>This project was initially conducted by Tenix LADS, Inc., under contract to Baxley Ocean</u> <u>Visions, Inc., for Coastal Planning and Engineering, Inc. and Broward County. The survey</u> <u>has been re-processed and deliverables prepared in accordance with NOS specifications,</u> <u>for use by NOAA.</u> <u>Acronyms <u>A complete list of all acronyms used throughout this report is provided at</u></u> <u><i>*Appendix I of the Separates Report. *Data appended to this report. Bold, Italic, Red notes</i></u> <u><i>in the Descriptive Report were made during office processing. H-Cell units in ft at MLLW.</i></u>		

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**DESCRIPTIVE REPORT TO ACCOMPANY****HYDROGRAPHIC SURVEY H12116****SCALE 1:10,000, SURVEYED IN 2008****FUGRO LADS AIRCRAFT, VH-LCL****FUGRO LADS, INC. (FLI)****MARK SINCLAIR, HYDROGRAPHER****PROJECT****Project Number:** OPR-H328-KRL-09**Original:** DG 133C-06-CQ-0066**Date of Instructions:** June 17, 2009**Task Order:** T0007**Registry Number:** H12116**Sheet:** A**A. AREA SURVEYED**

Survey operations covered the entire coast of Broward County, FL, between Golden Beach and north of Boca Raton Inlet, from above the high waterline to beyond 35m water depth (see Figure 1). *Concur.*

The total seabed area illuminated by bathymetric Lidar, from the 0m curve to extinction depth, was 38 square nautical miles (130 square kilometers). *Concur.*

A total of 26 main scheme lines were flown at 4m laser spot spacing, 100% coverage across the project area. A further 9 lines were flown to provide 200% coverage over most of the near-shore area. Another 9 lines were conducted to improve shallow water coverage and collect additional coverage at Port Everglades. A further 5 cross lines and 5 depth benchmark lines were flown to assess system accuracy. A total of 34 re-fly lines were required to ensure complete coverage across the project area. Thus, a grand total of 88 flight lines were executed during the 2008 Fugro LADS survey of Broward County. *Concur.*

Between July 12 and August 24, 2008, the Fugro LADS aircraft conducted data collection on 10 separate occasions in the Broward County area, based out of Fort Lauderdale. During this period survey operations were also carried out for NOAA in the vicinity of Biscayne Bay, FL (OPR-H328-KRL-08). The specific dates of data acquisition, hours flown and time on task were as follows: *Concur with clarification. Times and dates listed below do not correlate with Appendix IV Abstract Times of Hydrography.*

<b>Date (Local)</b>	<b>Sortie No.</b>	<b>Hours Flown</b>	<b>Time on Task</b>
20-July-08	2	2:50	0:28
26-July-08	3	2:50	0:26
27-July-08	4	4:50	3:56
28-July-08	5	7:05	2:42
06-August-08	7	7:26	2:00
15-August-08	11	5:28	3:50
16-August-08	12	6:09	3:47
17-August-08	13	5:44	0:52
22-August-08	14	6:50	0:25
23-August-08	15	3:20	2:21

**Table 1: Specific Dates of Data Acquisition**

Environmental factors such as water clarity, tide, wind strength and direction and cloud base height influenced the area and duration of data acquisition on a daily basis. See Section B.2.3 for further details. *Concur.*

This Descriptive Report describes Sheet A, which covers Boca Raton to Pompano Beach (see Figure 2). *Concur.*

The sheet limits are as follows for Sheet A (coordinates are NAD83): *Concur.*

<b>H12116 (A)</b>	<b>Latitude (N)</b>	<b>Longitude (W)</b>
<b>NW corner</b>	26° 20' 59.44"	80° 05' 57.80"
<b>SW corner</b>	26° 12' 19.26"	80° 06' 02.16"
<b>SE corner</b>	26° 12' 17.84"	80° 02' 25.84"
<b>NE corner</b>	26° 20' 58.00"	80° 02' 21.12"



Figure 1 – General Locality of Broward County

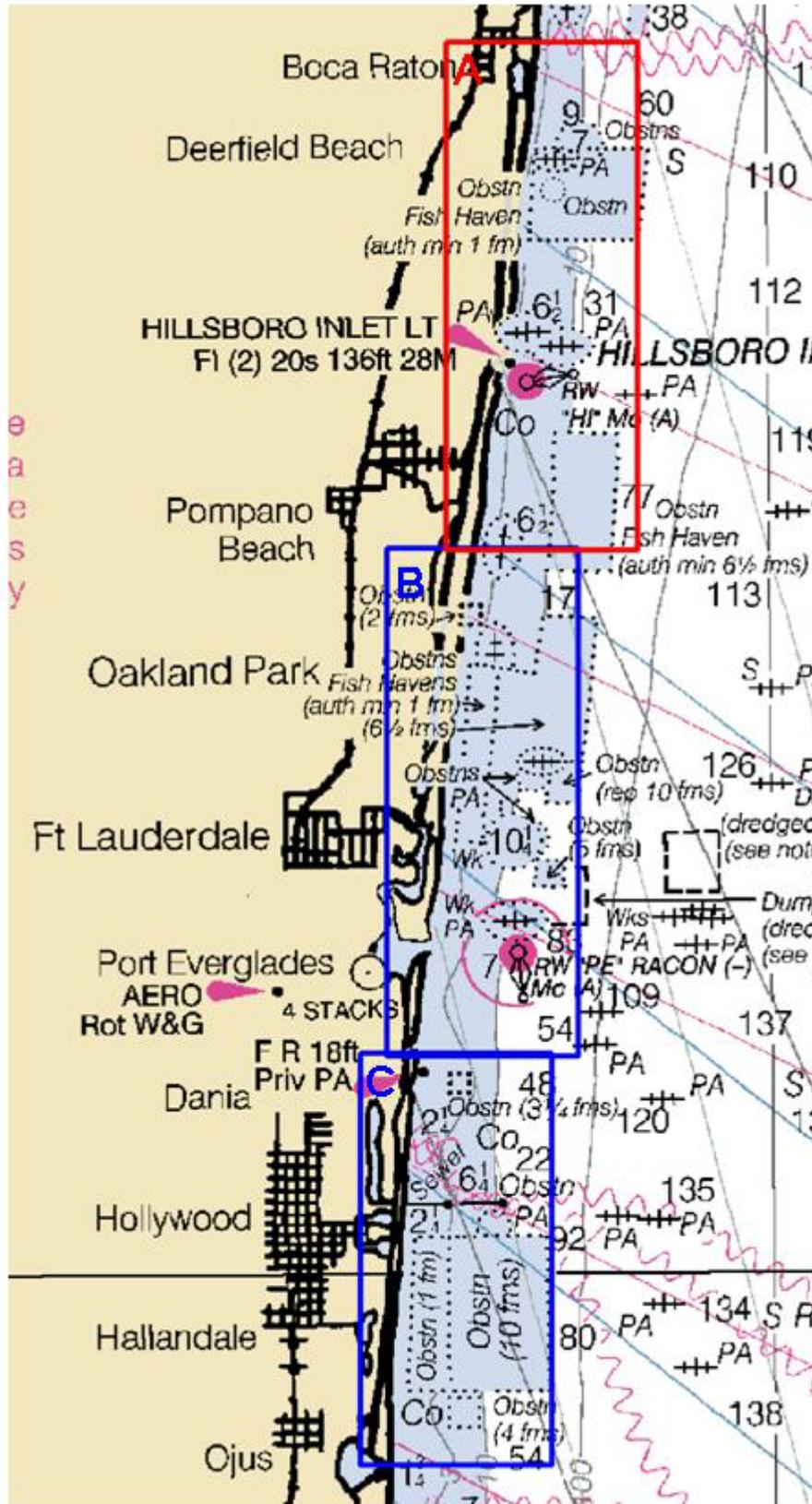


Figure 2 – Sub-Locality of H12116 (Sheet A)

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## **B. DATA ACQUISITION AND PROCESSING** *See also the H-Cell Report*

Refer to the Data Acquisition and Processing Report\* for a detailed description of the equipment, processing, and quality control procedures used during LADS surveys. A general description and items specific to this survey are discussed in the following sections. *\*Data included with survey deliverables.*

### **B.1 EQUIPMENT**

Data collection was conducted using the LADS Mk II Airborne System (AS), data processing using the LADS Mk II Ground System (GS), and data visualization, quality control (QC) and final products using CARIS HIPS and SIPS 6.1 and CARIS BASE Editor 2.1.

#### *B.1.1 Airborne System*

The LADS Mk II AS platform consists of a De Havilland Dash 8-200 Series aircraft, which has a transit speed of 250kts at altitudes of up to 25,000ft, and an endurance of up to eight hours. Survey operations are conducted at heights between 1,200 and 2,200ft, at ground speeds of between 140 and 210kts. The aircraft is fitted with an Nd: YAG laser, which is eye safe in accordance with ANSI Z136.1-2000, American National Standard for Safe Use of Lasers. The laser operates at 900 Hertz from a stabilized platform and can provide a number of different laser spot spacings across the seabed.

Green laser pulses are scanned beneath the aircraft in a rectilinear pattern. The pulses are reflected from the land, sea surface, within the water column and from the seabed. The height of the aircraft is determined by the infrared laser return, which is supplemented by the inertial height from the Attitude and Heading Reference System (AHRS) and a Global Positioning System (GPS) receiver. Real-time positioning is obtained by an Ashtech GG24 GPS receiver providing autonomous GPS, or is combined with WADGPS (Fugro Omnistar), to provide a differentially corrected position, when coverage is available. Ashtech Z12 dual-frequency GPS receivers are also provided as part of the AS and GS to log data on the aircraft and at a locally established GPS base station.

A digital camera was installed on the LADS Mk II system platform in 2007. This allowed high quality images to be captured in real-time, georeferenced and overlaid with the processed survey data. As this project was conducted exclusively between 2300 and 0600, to avoid high volumes of air traffic, digital imagery was only useful in discerning illuminated coastline, piers, inlets and vessels. A mosaic of digital images has not been compiled or rendered as part of this project due to the night operation limitation. The specifications for the Redlake MegaPlus II ES 2020 digital camera are provided in the *\*Data Acquisition and Processing Report. \*Data included with survey deliverables.*

#### *B.1.2 Ground System*

The LADS Mk II GS 'Frodo' was used to conduct data processing in the field. Frodo consists of a portable Compaq Alpha ES40 Series 3 processor server with 1 GB EEC RAM, 764 GB disk space, digital linear tape (DLT) drives and magazines, a digital audio tape (DAT) drive, a CD ROM drive, and is networked to up to 12 Compaq 1.5 GHz PCs and a HP 800ps Design

Jet Plotter, printers and QC workstations. The GS supports survey planning, data processing, QC and data export. The GS also includes a KGPS base station, which provides independent post-processed position and height data.

QC checks and editing of the data were conducted on GS 'Katrina', at the FLI office in Biloxi, MS, upon completion of the data collection phase of the survey.

## B.2 QUALITY CONTROL

### B.2.1 Quality Control Checks

The internal relative consistency of the survey data was checked with crossline depth comparisons and depth benchmark comparisons, and by observing position confidence quality factors on the GS. System integrity was checked, in an absolute sense, with the local GPS base station site confirmation and the static position check. **Concur.**

#### B.2.1.1 Crosslines

Specific crosslines were planned through each of the 4 tide zones and flown perpendicular to main scheme survey runs. These crosslines exhibited good water clarity, enabling meaningful statistics to be calculated. Below are the overall depth comparison results. A complete summary is presented in the \*Separates Report. **\*Data filed with original field records. Concur. See DR Separates IV for full details of Crossline Comparisons.**

Total Number of Comparisons	Mean Depth Difference (m)	Mean Standard Deviation (m)
196848	0.04	0.08

#### B.2.1.2 Depth Benchmarks

Following the first sortie, 5 benchmark areas were identified and gridded surfaces created in the GS. These benchmark areas were flown over during each subsequent sortie. The 5 benchmark areas were created in order to assess the consistency of the LADS Mk II system depth performance. Center coordinates for the benchmark areas are as follows:

Benchmark Name	Nominal Depth	NAD83	
		Latitude (N)	Longitude (W)
BM_6	21m	25° 52' 17"	80° 05' 24"
BM_7	19m	25° 53' 08"	80° 05' 36"
BM_8	15m	25° 54' 11"	80° 05' 50"
BM_9	12m	25° 54' 53"	80° 05' 59"
BM_10	11m	25° 56' 08"	80° 06' 16"

The LADS survey data is compared against the gridded benchmark surface in the GS, and statistics are generated which include the number of points compared, the mean depth difference (MDD) and the standard deviation (SD) between the data sets.

A summary of the average of the MDD and SD for all depth benchmark area comparisons is presented below. Refer to the *\*Separates Report* for detailed results of the depth benchmark comparison results. *\*Data filed with original field records.*

GS ID	BM Name	Nominal Depth	MDD (m)	SD (m)
6	BM_6	21m	0.17	0.07
7	BM_7	19m	0.12	0.09
8	BM_8	15m	0.03	0.07
9	BM_9	12m	0.07	0.08
10	BM_10	11m	0.06	0.05

The depth benchmark comparison results and the crossline comparisons results are within expected tolerances and show that the LADS Mk II depth performance was within specifications throughout the survey period.

#### *B.2.1.3 Positioning Checks*

Two independent positioning systems were used during the survey. Real-time positions were determined using an Ashtech GG24 GPS receiver, differentially corrected in real-time by a Fugro Omnistar GPS receiver on the aircraft, termed Wide Area Differential GPS (WADGPS) mode. Post-processed KGPS positions were determined relative to a local GPS base station that was established by Coastal Planning and Engineering (CPE) on the top of a light pole at the Fort Lauderdale Executive Airport. The post-processed KGPS positions were applied to each sounding during processing and the KGPS height was used in the topographic datum filter.

Position checks were conducted prior to, during, and following data collection as follows:

- a. Local GPS Base Station Site Confirmation. A 24-hour certification of the local GPS base station established was conducted on July 18-19, 2008. The results reveal that the local GPS base station is free from site specific problems such as multipath and obstructions. Details are provided in the *\*Horizontal and Vertical Control Report* and scatter plots in the *\*\*Separates Report*.
- b. Static Position Check. Prior to commencing data collection, the coordinates of the aircraft GPS antenna were determined relative to three marks, which were surveyed by CPE on the tarmac at the Fort Lauderdale Executive Airport. Data was logged by each LADS Mk II positioning system while the aircraft was static, enabling the positions to be checked against the known GPS antenna point. The absolute accuracy of the post-processed KGPS solution during the static position check was 0.171m (95% confidence). The results and details of the static position check are enclosed in the *\*Horizontal and Vertical Control Report* and *\*\*Separates Report*.  
*\*Data included with survey deliverables. \*\*Data filed with original field records.*
- c. Dynamic Position Check. During each sortie, GPS data was logged on the aircraft and at

the local GPS base station. This provided a check between the real-time and post-processed GPS solutions. The mean difference between the real-time and post-processed positions was 0.865m, with an average standard deviation of 0.089m. Details are provided in the \*Horizontal and Vertical Control Report. **\*Data included with survey deliverables.**

- d. Position Confidence. The position quality was also monitored on the GS by checking a post-processed position confidence (C3), which is determined from the AS platform error, GPS error, and residual errors between the actual GPS positions and aircraft position, as determined from the line of best fit. No position anomalies were detected.

The position checks were within the expected tolerances and demonstrated that the positioning systems were functioning correctly throughout the survey period.

### *B.2.2 Uncertainty Values*

For this survey area, global horizontal and vertical uncertainties have been assigned based on the defined horizontal and vertical error budget, as stated in the \*Horizontal and Vertical Control Report. The assigned horizontal uncertainty is 2.51m and the assigned vertical uncertainty is 0.41m. **\*Data included with survey deliverables. Concur with clarification. Vertical uncertainty as observed in the data is 0.33m.**

However, when the calculated grid node SD is greater than the assigned vertical uncertainty, the SD is used as the uncertainty value. This has occurred in areas of high relief, such as along the limit of a channel or dredged area. In some cases the SD may exceed IHO Order-1 limits. This could be attributed to the seabed gradient and a 3m grid resolution being used. **Concur**

### *B.2.3 Environmental Factors*

Environmental factors such as water clarity, tide, wind strength and direction and cloud base height influenced the area and duration of data acquisition on a daily basis.

#### *B.2.3.1 Sea Conditions - Sea State, Waves, Swell, White Water*

The sea state ranged from 0 to 2 on the Beaufort Scale throughout the survey period.

Calm seas were experienced on occasions. Under such calm conditions the sea became glassy, which degraded the sea surface model. This sometimes resulted in gaps at nadir, where the sea surface returns were completely saturated and seabed returns attenuated. All gaps for glassy seas were filled with reflly lines.

Long period swell was not significant during the survey. However, an allowance for small swell has been made in the assessment of vertical accuracy.

#### *B.2.3.2 Water Clarity*

The greatest contributor to depth performance, seabed coverage and data quality with a bathymetric Lidar system is water clarity. In order to minimize the errors and data gaps

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attributed to poor water clarity, ongoing analysis of the water column conditions was imperative.

The water clarity at Broward County was monitored effectively by using this survey area as an alternate to the large NOAA survey being conducted concurrently over Biscayne Bay, Florida (OPR-H328-KRL-08). As the Broward County area was approximately 5 minutes flight time from the NOAA area, rapid diversion between the surveys during periods of limiting environmental conditions, such as low cloud and glassy seas, resulted in numerous evaluations of water clarity. It was not until the third attempt at data collection in the area that water clarity conditions were deemed adequate for effective coverage. As 80% of the most critical survey lines were flown during this sortie and the flight on the following evening, water clarity was deemed excellent for the survey, and this is represented by bathymetry generally beyond 35m water depth and good quality LADS Relative Reflectivity across the survey extents.

#### *B.2.3.3 Topography*

The LADS Mk II system can measure topographic heights up to 50m elevation, subject to the depth / topographic logging window selected. For this survey, a 20m topographic height logging window was selected. As a result, the coastline was surveyed and elevations up to 20m were measured. During the processing stage, a maximum height of 4m above datum was generally used to remove trees and high structures and ensure only bare earth topographic heights were retained. For breakwaters and seawalls, that were greater than 4m above datum, the topographic heights were retained. For piers, the topographic heights were removed.

#### *B.2.3.4 Buildings / Towers*

For this survey the presence of tall buildings and towers was a significant issue. With all sorties being flown at night and the survey area being in close proximity to Miami and Fort Lauderdale International Airports, survey lines were flown at 2200ft to adhere to night operation lowest safe altitude guidelines.

#### *B.2.3.5 Wind*

Survey operations were conducted in wind strengths of up to 15kts during the survey. In general, the wind strength during sorties was between 5 and 15kts from the SE. In circumstances when wind speeds were forecast to be greater than 20kts, no flights were planned. On occasions where wind speeds at Fowey Rocks Lighthouse were reported at less than 5kts, sorties were cancelled due to the high likelihood of glassy seas throughout the survey area. During August, Tropical Storm "Fay" passed through Florida and it was necessary to relocate the aircraft to a hangar at West Palm Beach for the duration of inclement weather.

#### *B.2.3.6 Cloud*

Low cloud coverage, rain and thunderstorms were a significant factor during the survey. 'Low cloud' is typically defined as cloud below the minimum operating altitude of the aircraft. Due to the requirement for night operations and the proximity of high towers to the survey area, cloud below 2,200ft was considered 'low' and was a hindrance to the execution

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of the project. On nights when low cloud was observed and / or forecast, no flights were planned. Poor weather was monitored using, and decisions on the flying program were based on:

- National Weather Service forecasts – aviation and marine
- National Hurricane Center forecasts
- Real-time satellite imagery
- Real-time radar data
- Real-time TLI staff weather reconnaissance reports from the Broward County coastline
- Weather buoy data

#### *B.2.4 Data Coverage, Gaps and Object Detection*

##### *B.2.4.1 Nature of the Seabed*

The seafloor covers the Florida Reef Tract, which is comprised of several reefal facies running parallel to the coastline. The Reef Tract runs from the Florida Keys up to Martin County and for the most part, sits on a relatively narrow section of shelf. Approximately 40% of the survey area is defined as hard bottom, comprising near-shore reefs (limestone bedrock and coral reef), and offshore coral marine terraces. The reefs running parallel to the shoreline are separated by sand flats. Numerous wrecks (recreational diving sites) and man-made obstructions were detected by the LADS Mk II system, and those that are not currently represented on applicable nautical charts are listed in Section **D C** of this report. **Concur.**

##### *B.2.4.2 Data Coverage*

The survey area was illuminated at 4x4m laser spot spacing, resulting in a 192m swath width. Mainlines of sounding were spaced at 160m, which provided the required 100% coverage. **Concur.**

Additional lines were flown along most of the coastline, providing 200% coverage along much of the near-shore area. Certain reflly lines also provided 200% coverage in some offshore areas. **Concur.**

Coverage was generally achieved from above the high waterline to beyond the 35m depth curve. In some locations the Lidar extinction depth was beyond 45m. **Concur.**

##### *B.2.4.3 Gaps in Lidar Coverage*

Three types of gaps exist in the final Broward County bathymetry dataset. The first is attributed to very shallow water depth detection limitations, called the Secondary Exclusion Zone (SEZ). The SEZ processing parameter automatically removes inaccurate depth detections in the first 0.5m of water. In this shallow water zone the sea surface and subsurface detections merge and discernment of an accurate leading edge on the depth return proves

difficult. These gaps were minimized by flying additional coverage lines along much of the coast. **Concur.**

The second type of gap was attributed to a combination of low cloud laser dropout during good water clarity conditions and marginal water clarity conditions during subsequent reflly lines. In the case of one gap due to a cloud laser dropout, in the SE of the survey area, depth detection beyond 30m was not achieved again on five separate attempts, due to water clarity degradation. **Concur.**

A third cause of gaps in the bathymetry collected was the presence of surface vessels. Where gaps due to boats were present, reflies and additional coverage lines were flown to try to fill the gaps. The only gaps for surface vessels present in the final bathymetry dataset occur within the Boca Raton Marina. **Concur.**

#### *B.2.4.4 Object Detection*

At the sea surface the footprint of the laser beam is approximately 2.5m in diameter. As the beam passes through the water column, it slowly diverges due to scattering. It should be noted that at 4x4m laser spot spacing, there is a gap of 1.0 to 1.5m between the illuminated area of adjacent soundings at the sea surface. There is a possibility that small objects in shallow water along the coastline may fall between consecutive 4x4m soundings, and not be detected. A description of the Bottom Object Detection (BOD) algorithm used in data processing is presented in the **\*Data Acquisition and Processing Report. \*Data included with survey deliverables.**

### **B.3 CORRECTIONS TO SOUNDINGS**

Refer to the **\*Data Acquisition and Processing Report** for a description of corrections to soundings. There were no deviations from the corrections described therein. **\*Data included with survey deliverables.**

### **B.4 DATA PROCESSING**

#### *B.4.1 Data Management*

The database is identified as follows:

<b>Database Name</b>	<b>Sub-Locality</b>	<b>Sheet</b>
09_Bro	Boca Raton to Pompano Beach	A

A detailed table of survey line identifiers is presented in the **\*Data Acquisition and Processing Report. \*Data included with survey deliverables.**

#### *B.4.2 Data Processing Sites*

The data acquired during survey flights was processed at the operating site in Pompano Beach, FL, following each sortie. Final data validation, checking, QC and approving, and report and product compilations were conducted at the FLI office in Biloxi, MS.

#### B.4.3 CARIS BASE Surface

One BASE Surface covers the extents of each sheet area. The “Shoal” layer of the BASE Surface is to be considered the official record of hydrography for the survey. A grid resolution of 3m was used for the BASE Surface. Grid resolution does not change relative to depth, as the laser pulse footprint stays relatively constant regardless of depth, and the laser spot spacing is constant irrespective of aircraft altitude. The 3m grid provides the largest amount of detail that can be supported by the Lidar density. **Concur.**

#### B.4.4 Tagging

During data processing on the GS, the operators have the ability to assign S-57 and user-defined tags to gaps and features in the data. This enables accurate delineation and attribution of unsurveyed polygons, cultural features, artificial shoreline and navigation aids for the S-57 feature file (US512116.000). **Concur.**

For this survey, the following tags were used:

Tag	Abbrv	Description
BCNSPP	BC	Beacon, special purpose / general
BLDG	BLDG	Building
BOYSPP	BY	Buoy, special purpose / general
BRIDGE	BR	Bridge
BRKWTR	BW	Breakwater
GROYNE	GR	Groyne
JETTY	JE	Jetty
OBSTRN	OB	Obstruction
PILPNT	PL	Pile
PIPSOL	PI	Pipeline, submerged / on land
SEAWALL	SE	Seawall
SNDWAV	SW	Sand waves
WRECKS	WR	Wreck
UWTROC	RK	Underwater / awash rock
GAPBOAT	GB	Gap due to boat, boat wake and / or dragged nets
SEZ	SEZ	Gap due to the secondary exclusion zone (SEZ)

Detailed descriptions of the gaps in seabed coverage are presented in Section B.8 of the **\*Data Acquisition and Processing Report. \*Data included with survey deliverables.**

#### B.4.5 Georeferenced Imagery

Due to nighttime operations, no digital imagery was available for the validating, checking, and approval stages of survey data cleaning. No georeferenced mosaics were produced for the survey area. However, publicly available imagery from the Florida Department of

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Environmental Protection was used as a guide during product compilation. The imagery used can be downloaded from the following website:

- [http://data.labins.org/2003/MappingData/DOQQ/doqq\\_04\\_utm\\_sid.cfm](http://data.labins.org/2003/MappingData/DOQQ/doqq_04_utm_sid.cfm)

Google Earth coupled with EarthNC was also used extensively during the data validation, checking and approval process, in lieu of the LADS digital imagery typically acquired during daylight operations.

#### *B.4.6 Progress Sketches*

Progress graphics were not provided to NOAA for this survey, as the service contract was not in place until after Lidar acquisition was completed. Interim and final progress graphics provided to the original client, Coastal Planning and Engineering, are presented at \*Appendix III. \* **Concur.** \**Data appended to this report.*

#### *B.4.7 Deliverables Data Formats*

Data is provided in the following formats:

- Digital S-57 feature file **Concur.**
- CARIS BASE Surface **Concur.**
- Lidar coverage and Lidar uncertainty images in geo .tif format **Concur.**
- Chart comparison file in CARIS .hob format and corresponding GS screen captures in .jpg format **Concur with clarification.** *HOB file was submitted however it contains no S-57 objects within.*
- Chart Comparison Spreadsheet in .xls format **Concur.**
- CARIS compatible data – CAF Format – LADS soundings and waveforms, which can be imported into CARIS HIPS **Concur.**
- CARIS compatible data – HDCS Format – LADS soundings in CARIS HIPS native format **Concur.**
- Tidal data provided in ASCII, .xls and .csv formats **Concur.**
- LADS Relative Reflectivity provided in ASCII format **Concur.**

Refer to the \*Data Acquisition and Processing Report for specific details. \***Data included with survey deliverables.**

Refer to the \*Horizontal and Vertical Control Report for a detailed description of the horizontal and vertical control used during this survey. A summary of horizontal and vertical control used for the survey follows. *\*Data included with survey deliverables.*

## B.5 VERTICAL CONTROL

The initial vertical control for this survey was based on the National Water Level Observation Network (NWLON) station at Virginia Key, FL (8723214). Preliminary tide zoning for the project was set out using time and range correctors relative to the continuously operating Virginia Key NWLON tide station. Preliminary tide corrections were used to reduce depth soundings during the data collection period, in order to assess the integrity of bathymetry and plan necessary reflies. *Concur.*

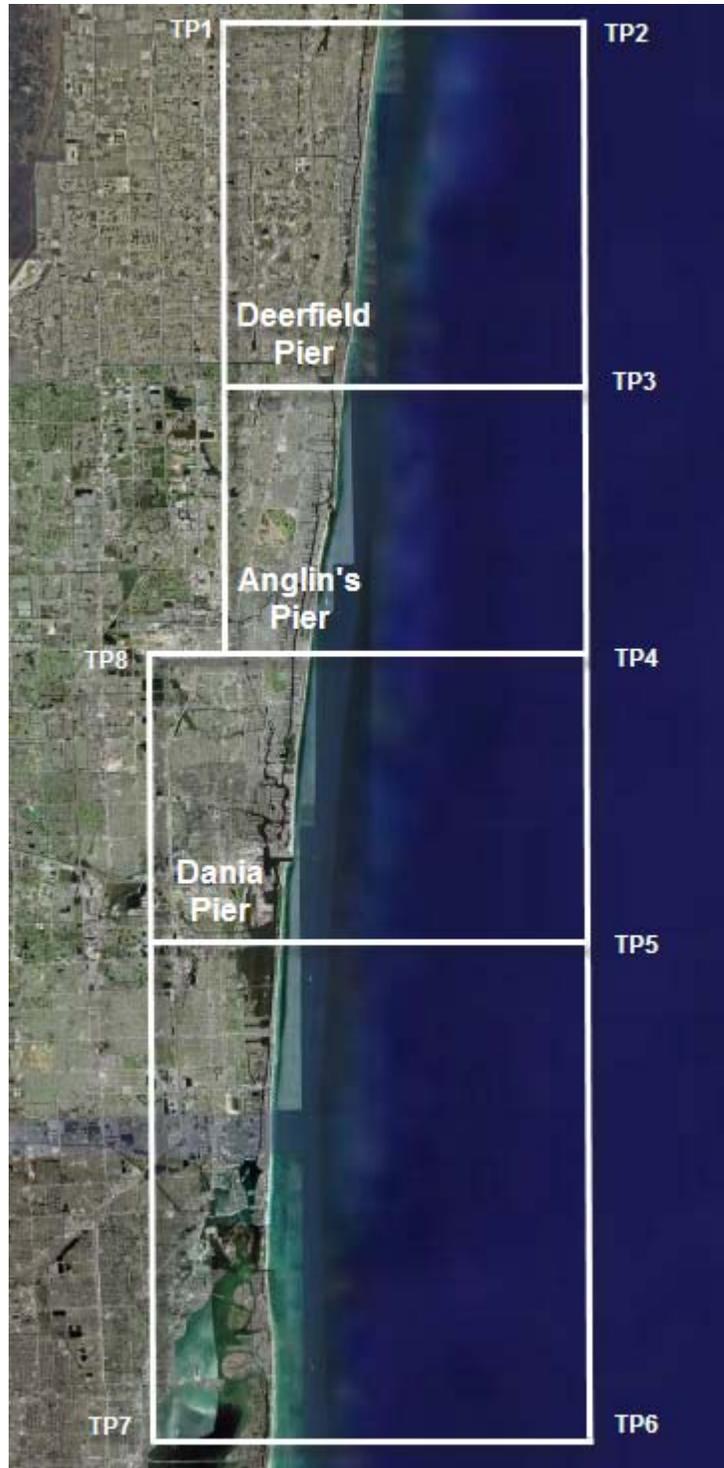
Final vertical control was based on tide stations established on Deerfield Pier, Anglin's Pier and Dania Pier by Baxley Ocean Visions (BOV). The three tide gauges were related to the initial survey datum (NAVD88) by CPE on July 12, 2008. Tide records were corrected to MLLW for the NOAA work using the values in the table below. Further details on the derivation of these corrections are provided in the \*Horizontal and Vertical Control Report. The tide gauges operated continuously from July 12, 2008 through to August 24, 2008. *\*Data included with survey deliverables.*

Station details are as follows:

Location	NAD83		NAVD88 – MLLW Correction (m)
	Latitude (N)	Longitude (W)	
Deerfield Pier	26° 19.0'	80° 08.3'	+ 0.660
Anglin's Pier	26° 11.4'	80° 08.4'	+ 0.702
Dania Pier	26° 03.3'	80° 10.8'	+ 0.623

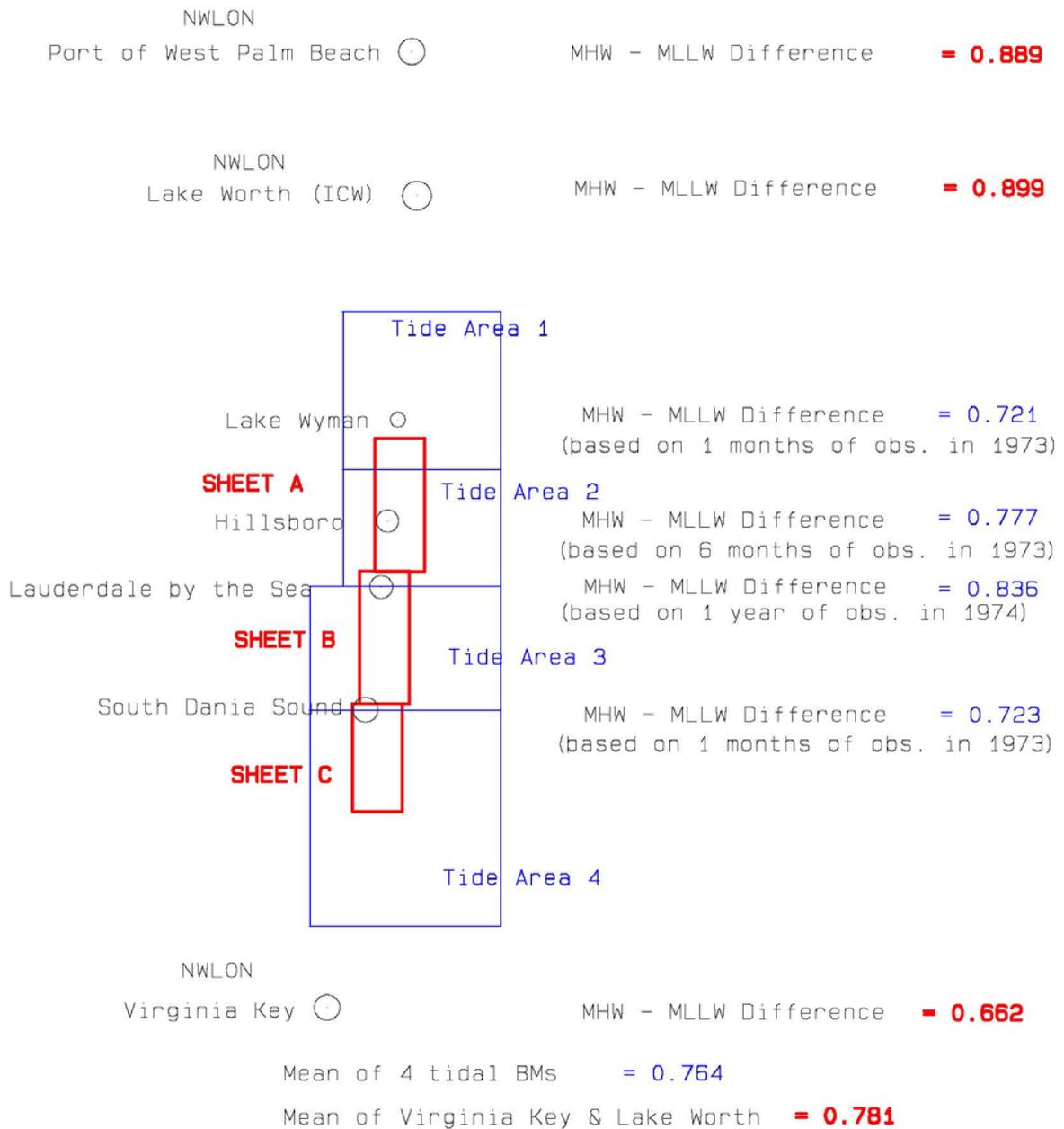
## B.6 ZONING

The final tide zones were designed to incorporate at least one observed tide station (established by BOV). In some of the zones two observed tide stations were used to provide a co-tidal model. An analysis of depth benchmark and crossline comparisons, and overlaps of the mainlines of sounding concluded that final tide zoning was adequate. The final tide zones superseded the preliminary tide zone. *Concur.*



**Figure 3 – Final Tide Zones in the LADS GS**

The values for the differences between MLLW and MHW for adjacent tidal benchmarks and NWLON gauges are shown in the diagram below:



**Figure 4 – Vertical Difference between MLLW and MHW for Tidal Benchmarks and NWLON Gauges**

The mean value of MLLW – MHW differences for tidal benchmarks is 0.764m. The mean value of MLLW – MHW differences for adjacent NWLON gauges is 0.781m. Therefore, for all registered sheets under OPR-H328-KRL-09, including H12116, a MHW value of 0.77m has been used.

## B.7 HORIZONTAL CONTROL

Data collection and processing were conducted in the AS and GS on World Geodetic System 1984 (WGS84) on Universal Transverse Mercator (Northern Hemisphere) projection UTM (N) in Zone 17, Central Meridian 81° W. This data was post-processed and all soundings are positioned relative to the North American Datum 1983 (NAD83). All units are in ~~meters~~ *feet at MLLW*.

### B.7.1 LADS Local GPS Base Station – Fort Lauderdale

Real-time positions were determined using an Ashtech GG24 GPS receiver, differentially corrected in real-time by a Fugro Omnistar GPS receiver on the aircraft (WADGPS mode). A local GPS base station was coordinated by CPE on the top of a light pole at the Ft. Lauderdale Executive Airport on July 10, 2008, in order to post-process more accurate KGPS positions following survey flights.

The derived NAD83 coordinates for the local GPS base station are:

NAD83			UTM (N) Zone 17	
Latitude (N)	Longitude (W)	Ellipsoidal Height (m)	Easting (m)	Northing (m)
26° 11' 42.4877"	80° 10' 17.4843"	-14.957	582776.318	2897558.340

Post-processed KGPS positions were determined offline using data logged at the local GPS base station and on the aircraft. This data was processed with Waypoint GrafNav Software to calculate a KGPS position solution for the survey flights. The post-processed KGPS positions were imported into the GS and applied to all soundings. This provided increased sounding position accuracy from the real-time WADGPS.

### C. RESULTS *See also the H-Cell Report*

The results for the H12116 survey are submitted separately to this Descriptive Report as the S-57 feature file, BASE Surface, CARIS .hob files, Chart Comparison Spreadsheet, LADS Relative Reflectivity, etc. on the USB hard drive. Refer to \*Appendix II of the Data Acquisition and Processing Report for a list of all the deliverable files from H12116. *\*Data included with survey deliverables. See also the Evaluation Report.*

Below is a table listing the S-57 feature objects found in the S-57 feature file (US512116.000): *Concur.*

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Spatial Attribute	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Comments
Beacon, Lateral	BCNLAT	P	A lateral beacon is used to indicate the port or starboard hand side of the route to be followed.		Object Name (OBJNAM)	Status (STATUS)			The attribute STATUS is used to identify the Beacons as being privately maintained. OBJNAM defines the beacon name as indicated in the ENC.
Beacon, Special purpose/general	BCNSPP	P	Beacon in general: A beacon whose appearance or purpose is not adequately known.		Object Name (OBJNAM)	Status (STATUS)			The attribute STATUS is used to identify the Beacons as being privately maintained. OBJNAM defines the beacon name as indicated in the ENC.
Bridge	BRIDGE	A	A structure erected over a depression or an obstacle such as a body of water		Category of Bridge (CATBRG)				
Coastline	COALNE	L	The line where shore and water meet.	Quality of position (QUAPOS)	Category of Coastline (CATCOA)				QUAPOS is used to identify interpolated coastline.
Depth Contour	DEPCNT	L	A line connecting points of equal water depth.		Value of contour (VALDCO)				DEPCNT used to define the MLLW line.

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Spatial Attribute	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Comments
Pipeline	PIPSOL	L	A pipeline is a string of interconnected pipes used for the transport of matter, nowadays mainly oil or gas.		Category of pipeline (CATPIP)				Used for identifying both pipelines and sewers.
Shoreline Construction	SLCONS	L, A	A fixed (not afloat) artificial structure between the water and the land, i.e. a man-made coastline.		Category of Shoreline Construction (CATSLC)				CATSLC used to identify man-made shoreline features such as seawalls, piers, jetties.
Sounding	SOUNDG	P	A measured water depth or spot which has been reduced to a vertical datum.						Used for defining surveyed depths that differ significantly from the chart.
Unsurveyed Areas	UNSARE	A	Unsurveyed area.		Information (INFORM)				Used to define gaps in data coverage. INFORM has been identified as SEZ, or boat gaps, based on the GS tags.
Underwater/awash Rock	UWTROC	P	A concreted mass of stony material or coral which dries, is awash or is below the water surface.		Value of Sounding (VALSOU)	Water Level Effect (WATLEV)			Some of the Rocks may have been man made objects. Bottom objects were not investigated.
Wreck	WRECKS	P	The ruined remains of a stranded or sunken vessel which has been rendered useless.		Category of Wreck (CATWRK)	Value of sounding (VALSOU)			Used for identifying wrecks or artificial reef structures.
<i>Meta Objects</i>									
Coverage	M_COVR	A	A geographical area that describes the coverage and the extent of spatial objects.		Category of coverage (CATCOV)				M_COVR: CATCOV = 1 polygons define the extents of good Lidar data coverage.

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Spatial Attribute	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Comments
Quality of Data	M_QUAL	A	An area within which a uniform assessment of the quality of the data exists.		Category of zone of confidence in data (CATZOC)	Category of quality of data (CATQUA)			Used for attributing survey quality metadata to the data coverage.

**Table 2: S-57 Attribution for the S-57 feature file (US512116.000)**

Recommendations for registry number H12116 are divided into 2 components:

1. Recommended charting action, primarily for MCD.
2. Recommended further boatwork to sufficiently junction with Lidar seabed coverage and confirm uncertain Lidar features.

Recommendations for charting action for registry number H12116 are provided in Sections D.1.1 to D.1.6 below. Features that appear in the chart comparison, where there is doubt that the least depth has been determined by Lidar, have been given a charting recommendation of “Confirm”. The determination of least depth is at the discretion of the ships conducting junctioning / confirmations and their results should be reported for charting action to MCD in due course.

Recommendations for ship junctioning are provided in Section D.2.1.

A summary of charting actions is provided in Section D.2.2. No features have been recommended for confirmation for Sheet A.

### **C.1 CHART COMPARISON *\*See also the H-Cell Report.***

H12116 LADS survey deliverables were compared to:

- *\*ENC US5FL33M 10th Edition, issued April 20, 2009.*
- *\*Raster Chart 11466 37th Edition, issued June 1, 2008.*

The charts were downloaded from the NOAA Office of Coast Survey – NOAA Chart download website on June 11, 2009.  
(<http://www.charts.noaa.gov>)

#### *C.1.1 Dangers to Navigation*

No DTONs were detected by Lidar within the extents of the survey area. ***Concur.***

#### *C.1.2 Automated Wreck and Observation Information System (AWOIS)*

No AWOIS were assigned under this contract. ***Concur.***

*C.1.3 Aids to Navigation*

Thirteen (13) Aids to Navigation exist within the extents of the Lidar coverage for H12116. Six (6) of these Aids to Navigation were identified by Lidar. The Aids to Navigation are listed below: ***Recommend retaining ATON's as charted unless specified in the table below. See also H-Cell Report, section C.1.3. Defer to MCD Nautical Data Branch for final charting disposition.***

No.	Navigation Aid Identifier	Charted Position		Surveyed Position		Lidar Hits	Diff. in Positions (m)	Comments
		NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)			
1	Central Boca Raton Beach Danger Daybeacon (private)	26°20'27.18"	80°04'11.45"			0		Not detected by Lidar. <i>Retain as charted.</i>
2	Boca Raton Inlet North Jetty Light 2 (private)	26°20'09.80"	80°04'10.55"			0		Not detected by Lidar. <i>Retain as charted.</i>
3	Boca Raton Inlet South Jetty Light 1 (private)	26°20'06.68"	80°04'11.24"	26°20'08.02"	80°04'13.25"	1	68	<i>Delete charted light; add light in present survey position.</i>
4	Deerfield Fishing Pier North Light (private)	26°18'59.04"	80°04'25.46"			0		Not detected by Lidar. <i>Retain as charted.</i>
5	Deerfield Fishing Pier South Light (private)	26°18'58.40"	80°04'25.00"			0		Not detected by Lidar. <i>Not on raster chart or ENC. No changes to charting necessary.</i>
6	Hillsboro River Light 71	26°15'47.38"	80°04'57.98"	26°15'47.37"	80°04'57.91"	2	2	<i>No changes to charting necessary.</i>
7	Hillsboro Inlet Entrance Light 4	26°15'25.01"	80°04'48.76"	26°15'25.04"	80°04'48.75"	5	1	<i>No changes to charting necessary.</i>
8	Hillsboro Inlet Entrance Daybeacon 5	26°15'24.04"	80°04'50.73"			0		Not detected by Lidar. <i>No changes to charting necessary.</i>
9	Hillsboro Inlet Entrance Light 2	26°15'22.99"	80°04'44.04"	26°15'23.05"	80°04'43.92"	6	4	<i>No changes to charting necessary.</i>
10	Hillsboro Inlet Entrance Shoal Daybeacon (private)	26°15'22.84"	80°04'50.87"			0		Not detected by Lidar. <i>Retain as charted</i>
11	Hillsboro Inlet Entrance Daybeacon 3	26°15'19.55"	80°04'48.19"			0		Not detected by Lidar. <i>No changes to charting necessary.</i>

No.	Navigation Aid Identifier	Charted Position		Surveyed Position		Lidar Hits	Diff. in Positions (m)	Comments
		NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)			
12	Hillsboro Inlet Entrance Light 1	26°15'17.23"	80°04'45.87"	26°15'16.99"	80°04'46.96"	7	30	<i>No changes to charting necessary.</i>
13	Hillsboro Inlet Entrance Lighted Buoy HI	26°15'07.25"	80°04'29.21"	26°15'08.70"	80°04'28.70"	2	47	<i>No changes to charting necessary.</i>

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### *C.1.4 Charted Depths and Features*

Registry number H12116 lies over part of NOAA charts 11466 and 11467, in the vicinity of Hillsboro Inlet. From the Source Diagrams, the area covered by H12116 was covered by NOS surveys between 1900 and 1939, presumably by lead line. Partial bottom coverage was achieved. The charts in this area appear to be well surveyed, although sounding density appears to decrease towards the north of the sheet. Also, no soundings are portrayed on the chart within designated fish havens. There are ~~two~~ **five** fish havens that fall within the limits of H12116. The coastline appears to be well portrayed. ***Concur. See also the H-Cell Report***

The area surveyed is represented by the BASE Surface and S-57 feature file in considerably more detail than is currently shown on the chart. The following general recommendations are relevant:

- a. **Coastline.** The charted coastline agrees fairly well with the surveyed coastline. The surveyed coastline differs from the charted position by a maximum of 40m along one section of the coast. Numerous cultural features, differing types of artificial coastline, along with the small tidal range made the delineation of the MHW line difficult in some areas. Where small SEZ gaps occur at the mean high water line, the delineated coastline has been interpolated and attributed as approximate. It is recommended that the coastline on the chart be amended to match the LADS surveyed and interpolated MHW line. ***Concur. See also the H-Cell Report.***
- b. **Inshore Islets.** No islets were surveyed within the extents of Sheet A. ***Concur.***
- c. **Rocks.** The seafloor covering H12116 covers the Florida Reef Tract, which is comprised of several reefal facies running parallel to the coastline. The Reef Tract runs from the Florida Keys up to Martin County and for the most part, sits on a relatively narrow section of shelf. Approximately 40% of the survey area is defined as hard bottom, comprising near-shore reefs (limestone bedrock and coral reef), and offshore coral marine terraces. The reefs running parallel to the shoreline are separated by sand flats. Several seabed objects associated with the reef system have been identified. Where a significant difference in depth existed between the chart and the BASE Surface, a sounding or rock was placed in the S-57 feature file and was referenced in the Chart Comparison Spreadsheet in Section ~~D.1.6~~ ***C.1.6. Concur with conditions. See also the H-Cell Report.***
- d. **Wrecks.** Numerous wrecks (recreation diving sites) and man-made artificial reefs were surveyed. Where a wreck was detected, a Wreck object was placed in the S-57 feature file. Where the wreck was not charted and a significant difference between the surveyed depth and charted depth existed, the wreck was referenced in the Chart Comparison Spreadsheet in Section ~~D.1.6~~ ***C.1.6. Concur. See also the H-Cell Report.***

### *C.1.5 Detailed Chart Comparison*

In addition to the general recommendations above, 31 specific differences between the chart and the LADS survey have been identified and are described in Section D.1.6. An expanded version of the spreadsheet is included digitally on the USB hard drive (H12116\_ChartComp.xls). A CARIS .hob file containing just the chart comparison items has

also been compiled and is provided as part of survey deliverables (H12116\_ChartComp.hob). The attribution methodology for this file is presented below: ***Concur with clarification. Data within HOB file could not be viewed or accessed.***

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Attribute 1	Attribute 2	Attribute 3	Attribute 4
Built-up Area	BUAARE	P	Used as a placeholder to store information relating to the chart comparison	OBJNAM (used for storing a unique chart comparison ID)	INFORM (used for storing the charting recommendation)	NINFOM (used for indicating whether feature should be confirmed)	PICREP (used for storing a link to GS screen captures)

The chart comparison was conducted by reviewing the chart and the LADS survey deliverable. For each item identified, screen dumps of the Local Area Display and Raw Waveform Display were extracted from the LADS Mk II GS.

These have been reviewed in order to make the following assessments:

- a. Type of Feature
- b. Full Coverage
- c. Least Depth Found
- d. Charting Recommendation
- e. Remarks

When full coverage exists over a feature identified within the chart comparison, the Full Coverage Column is populated with a 'Y' for yes. When the least depth has been adequately surveyed by Lidar, the LDF Column is populated with a 'Y' for yes. The charting recommendation for a feature that has an adequately surveyed least depth will be either 'Insert' for a new feature, 'Replace' for an amendment to an existing charted feature or 'Remove' for a disproved charted feature.

When the least depth has NOT been found by Lidar (populated with an 'N'), the charting recommendation has been populated with "Confirm".

Each chart comparison was categorized as follows:

1. New shoal found
2. Charted shoal disproved / not found

The fields in the Chart Comparison Spreadsheet have been developed from experience learned and feedback received from previous Lidar surveys in Alaska, witnessing survey operations aboard NOAA ship Rainier, from meetings at PHB and UNH and the 2007 NOAA Field Procedures Workshop. They have been designed for ease of use and to minimize double

handling of data and transcription. Continued feedback is welcomed in order to develop these formats to achieve further efficiencies in data handling.

C.1.6 Chart Comparison Spreadsheet

Sequence No	Shoal No	Category	CHARTED			SURVEYED			Type of Feature	Full Coverage	Least Depth Found	Charting Recommendation	Remarks
			Charted Depth (meters)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	Surveyed Depth (meters)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)					
1	A1	2	16.4	26° 20' 19.1"	80° 3' 26.28"	14.96 <i>49 ft.</i>	26° 20' 20.92"	80° 3' 25.95"	Shoal	Y	Y	Replace	<i>Do not concur, update area with present survey depths and add rocky area feature.</i>
2	A2	1				1.16 <i>4 ft</i>	26° 20' 8.65"	80° 4' 6.75"	Shoal	Y	Y	Insert	<i>Concur, chart 4 foot depth.</i>
3	A3	2	16.1	26° 19' 49.22"	80° 3' 29.41"	14.90 <i>49 ft</i>	26° 19' 48.98"	80° 3' 31.3"	Shoal	Y	Y	Replace	<i>Do not concur. 49 foot depth is new least depth in charted Fish Haven. Revise fish haven min depth. Also part of new rocky feature area.</i>
4	A4	1				13.97 <i>46 ft</i>	26° 18' 7.12"	80° 3' 43.61"	Wreck	Y	Y	Insert	<i>Do not concur. Wreck is inside Fish Haven limits and is deeper than new auth min depth of 33 ft.</i>
5	A5	1				16.17 <i>53 ft</i>	26° 18' 5.24"	80° 3' 41.11"	Wreck	Y	Y	Insert	<i>Do not concur. Wreck is inside Fish Haven limits and is deeper than new auth min depth of 33 ft.</i>
6	A6	1				17.94 <i>59 ft</i>	26° 17' 58.6"	80° 3' 42.18"	Wreck	Y	Y	Insert	<i>Do not concur. Wreck is inside Fish Haven limits and is deeper than new auth min depth of 33 ft.</i>

Sequence No	Shoal No	Category	CHARTED			SURVEYED			Type of Feature	Full Coverage	Least Depth Found	Charting Recommendation	Remarks
			Charted Depth (meters)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	Surveyed Depth (meters)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)					
7	A7	2	22.8	26° 16' 56.81"	80° 3' 57.47"	20.59 <i>67 ft</i>	26° 16' 52.61"	80° 3' 59.39"	Shoal	Y	Y	Replace	<i>Do not concur, update area with present survey depths.</i>
8	A8	2	13.4	26° 16' 44.17"	80° 4' 17"	10.42 <i>34 ft.</i>	26° 16' 47.69"	80° 4' 14.73"	Shoal	Y	Y	Replace	<i>Do not concur, update area with present survey depths and add rocky area feature.</i>
9	A9	2	21.3	26° 16' 39.89"	80° 3' 44.86"	19.79 <i>65 ft</i>	26° 16' 40.13"	80° 3' 46.12"	Shoal	Y	Y	Replace	<i>Do not concur, update area with present survey depths and add rocky area feature.</i>
10	A10	1				10.07 <i>33 ft</i>	26° 16' 27.32"	80° 4' 15.65"	Rk	Y	Y	Insert	<i>Concur with conditions. Chart present survey depth and add rocky area feature.</i>
11	A11	2	11.8	26° 16' 14.8"	80° 4' 16.98"	10.09 <i>33 ft</i>	26° 16' 11.42"	80° 4' 14.48"	Rk	Y	Y	Replace	<i>Do not concur, update area with present survey depths and add rocky area feature.</i>
12	A12	1				10.11 <i>33 ft</i>	26° 15' 54.97"	80° 4' 16.81"	Rk	Y	Y	Insert	<i>Do not concur, update area with present survey depths and add rocky area feature.</i>
13	A13	2	11.8	26° 15' 50.5"	80° 4' 17.73"	10.18 <i>33 ft</i>	26° 15' 49.01"	80° 4' 18.49"	Shoal	Y	Y	Replace	<i>Concur with conditions. Chart present survey depth and add rocky area feature.</i>
14	A14	1				10.57 <i>34 ft</i>	26° 15' 18.62"	80° 4' 19.5"	Rk	Y	Y	Insert	<i>Concur with conditions. Chart present survey depth and add rocky area feature.</i>

Sequence No	Shoal No	Category	CHARTED			SURVEYED			Type of Feature	Full Coverage	Least Depth Found	Charting Recommendation	Remarks
			Charted Depth (meters)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	Surveyed Depth (meters)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)					
15	A15	1				11.78 <i>38 ft</i>	26° 15' 9.37"	80° 4' 22.7"	Rk	Y	Y	Insert	Note: Feature may be related to pipeline in vicinity. <i>Do not concur, update area with present survey depths and add rocky area feature.</i>
16	A16	1				20.33 <i>66 ft</i>	26° 15' 7.51"	80° 4' 8.79"	Rk	Y	Y	Insert	Note: Feature may be related to pipeline in vicinity. <i>Do not concur, update area with present survey depths.</i>
17	A17	1				36.33 <i>119 ft</i>	26° 14' 11.5"	80° 3' 39.92"	Wreck	Y	Y	Insert	<i>Do not concur. Wreck is inside Fish Haven limits and is deeper than auth min depth of 39 ft.</i>
18	A18	1				26.48 <i>87 ft</i>	26° 14' 4.42"	80° 3' 52.17"	Wreck	Y	Y	Insert	Note: Two additional surveyed wrecks in vicinity. <i>Do not concur. Wrecks are inside Fish Haven limits and are deeper than auth min depth of 39 ft.</i>
19	A19	1				8.07 <i>26 ft</i>	26° 14' 15.82"	80° 4' 45.82"	Rk	Y	Y	Insert	<i>Do not concur, update area with present survey depths and add rocky area feature.</i>
20	A20	2	4.5	26° 14' 8.96"	80° 4' 55.84"	2.87 <i>9 ft</i>	26° 14' 9.31"	80° 4' 55.67"	Shoal	Y	Y	Replace	<i>Concur with conditions. Chart present survey depth and add rocky area feature.</i>
21	A21	2	5.1	26° 14' 4.42"	80° 5' 7.71"	3.82 <i>12 ft</i>	26° 14' 5.6"	80° 5' 4.36"	Rk	Y	Y	Replace	<i>Concur with conditions. Chart present survey depth and add rocky area feature.</i>

Sequence No	Shoal No	Category	CHARTED			SURVEYED			Type of Feature	Full Coverage	Least Depth Found	Charting Recommendation	Remarks
			Charted Depth (meters)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	Surveyed Depth (meters)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)					
22	A22	1				6.96 <i>23 ft</i>	26° 14' 1.9"	80° 4' 50.61"	Shoal	Y	Y	Insert	<i>Do not concur, update area with present survey depths and add rocky area feature.</i>
23	A23	1				15.59 <i>51 ft</i>	26° 13' 50.65"	80° 4' 10.87"	Rk	Y	Y	Insert	<i>Do not concur, update area with present survey depths and add rocky area feature.</i>
24	A24	2	16.4	26° 13' 58.58"	80° 4' 3.9"	14.63 <i>48 ft</i>	26° 13' 58.75"	80° 4' 5.7"	Rk	Y	Y	Replace	<i>Do not concur, update area with present survey depths and add rocky area feature.</i>
25	A25	1				46.24 <i>151 ft</i>	26° 14' 3.79"	80° 3' 40.28"	Wreck	N	Y	Insert	<i>Do not concur. Wreck is inside Fish Haven limits and is deeper than auth min depth of 39 ft.</i>
26	A26	1				27.80 <i>91 ft</i>	26° 13' 52.28"	80° 3' 49.8"	Wreck	Y	Y	Insert	Note: One additional surveyed wreck in vicinity. <i>Do not concur. Wreck is inside Fish Haven limits and is deeper than auth min depth of 39 ft.</i>
27	A27	1				22.98 <i>75 ft</i>	26° 13' 38.4"	80° 3' 54.8"	Wreck	Y	Y	Insert	<i>Do not concur. Wreck is inside Fish Haven limits and is deeper than auth min depth of 39 ft.</i>

Sequence No	Shoal No	Category	CHARTED			SURVEYED			Type of Feature	Full Coverage	Least Depth Found	Charting Recommendation	Remarks
			Charted Depth (meters)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	Surveyed Depth (meters)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)					
28	A28	2	13.4	26° 13' 41.78"	80° 4' 38.24"	10.85 <i>35 ft</i> 72 ft	26° 13' 40.31"	80° 4' 35.36"	Rk	Y	Y	Replace	<i>Do not concur, update area with present survey depths and add rocky area feature.</i>
29	A29	1				21.99 <i>72 ft</i>	26° 13' 7.51"	80° 3' 58.33"	Wreck	Y	Y	Insert	<i>Do not concur. Wreck is inside Fish Haven limits and is deeper than auth min depth of 39 ft.</i>
30	A30	2	11.5	26° 13' 11.18"	80° 4' 43.19"	10.23 <i>33 ft</i>	26° 13' 12.06"	80° 4' 38.93"	Rk	Y	Y	Replace	<i>Concur with conditions. Chart present survey depth and add rocky area feature.</i>
31	A31	1				33.54 <i>110 ft</i>	26° 12' 40.37"	80° 3' 56.54"	Wreck	Y	Y	Insert	<i>Do not concur. Wreck is inside Fish Haven limits and is deeper than auth min depth of 39 ft.</i>

Table 3: Chart Comparison Spreadsheet

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## C.2 ADDITIONAL RESULTS

### C.2.1 *Supplemental Information for Boatwork*

For the H12116 survey, the supplemental information for further boatwork was compiled by defining the seaward limit of good Lidar seabed coverage as a M\_COVR, CATCOV=1 polygon. **Concur.**

#### C.2.1.1 *Seaward Limit of Lidar Coverage*

The Lidar coverage across H12116 is fairly consistent except for a number of expansive very shallow water gaps due to the SEZ parallel to the coastline in the intertidal zone. This is reflected by the extents of, and gaps within, the BASE Surface. **Concur.**

The seaward limit of good Lidar data coverage has been described by the S-57 feature object M\_COVR in the S-57 feature file (US512116.000). **Concur.**

#### C.2.1.2 *Recommended Junctioning with Unsurveyed Lidar Areas*

The ‘unsurveyed’ gaps in Lidar seabed coverage are defined as polygons in the S-57 feature file. They were constructed utilizing the export of the operator assigned gap tags described in Section B.4.4. In the case of ‘unsurveyed’ areas for the SEZ, junctioning is not recommended for the obvious risks to surface vessels. **Concur.**

#### C.2.1.3 *Comparison with prior Surveys*

Comparison with prior surveys was not required under this Task Order. See Section D.1.5 for comparison to the nautical charts. **Concur.**

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*C.2.2 \*Summary of Charting Actions and Confirmations – H12116*

*C.2.3 Summary of Charting Actions – H12116*

Total number of new significant islets recommended for insertion on chart: 0

Total number of new significant drying rocks recommended for insertion on chart: 0

Total number of new significant rocks awash recommended for insertion on chart: 0

Total number of new significant rocks recommended for insertion on chart: 7

Total number of new significant shoals recommended for insertion on chart: 2

Total number of new significant wrecks recommended for insertion on chart: 10

Total number of new significant obstructions recommended for insertion on chart: 0

Total number of charted features disproved by Lidar (Remove): 0

Total number of charted features recommended for amendment by Lidar (Replace): 12

Total number of chart comparison items requiring confirmation: 0

Total number of DTONs submitted to AHB during data acquisition: 0

Total number of DTONs submitted to AHB during data processing: 0

**Total number of DTONs submitted to AHB for H12116: 0**

*C.2.3.1 Summary of Lidar Features Requiring Confirmation – H12116*

Total number of confirmations recommended during data processing: 0

Total number of confirmations recommended from chart comparison compilation: 0

**Total number of recommended feature confirmations: 0**

***\* See bold, italic, red notes in Section C.1.6.above and H-Cell Report for final charting recommendations.***

**D. APPROVAL SHEET****LETTER OF APPROVAL – OPR-H328-KRL-09**

This report and the accompanying digital data are respectfully submitted.

Field operations contributing to the accomplishment of this survey were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report and the accompanying digital data have been closely reviewed and are considered complete and adequate as per the Hydrographic Survey Project Instructions.

<u>Report</u>	<u>Submission Date</u>
Descriptive Report – H12116	October 28, 2009



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Mark Sinclair  
Hydrographer

Fugro LADS, Incorporated

Date: October 28, 2009

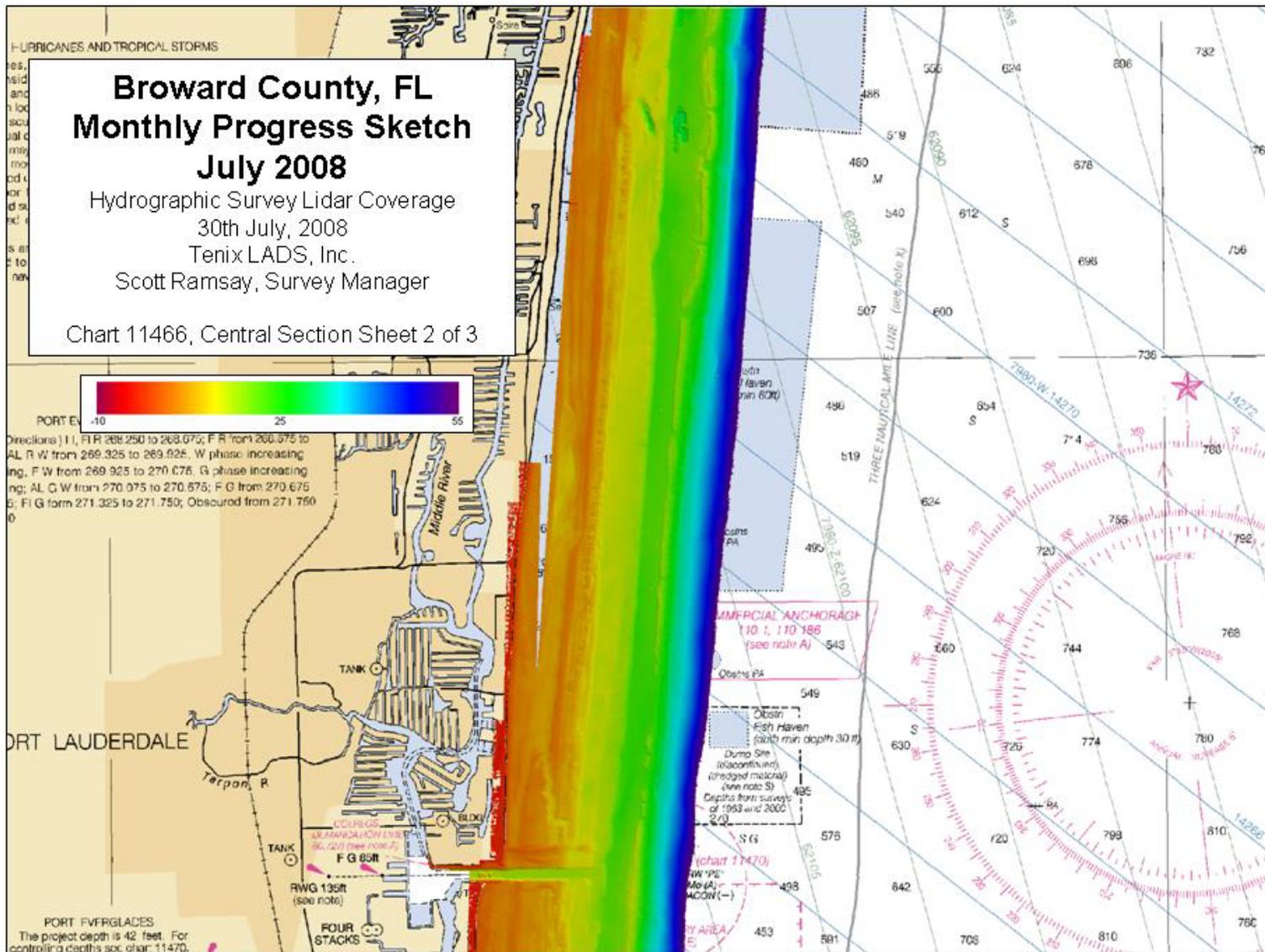
## **APPENDIX I – DANGERS TO NAVIGATION**

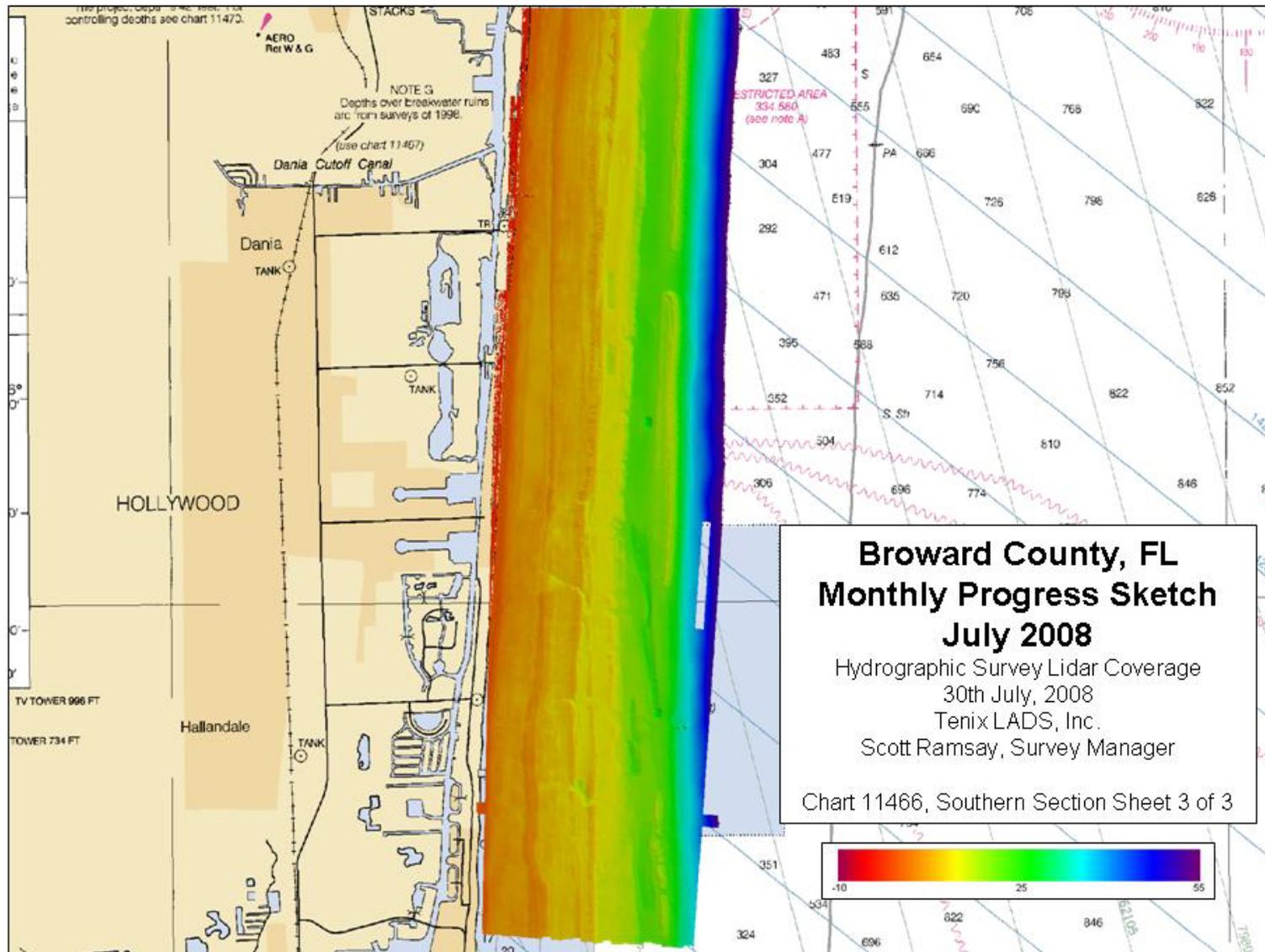
No DTONS were submitted to AHB.

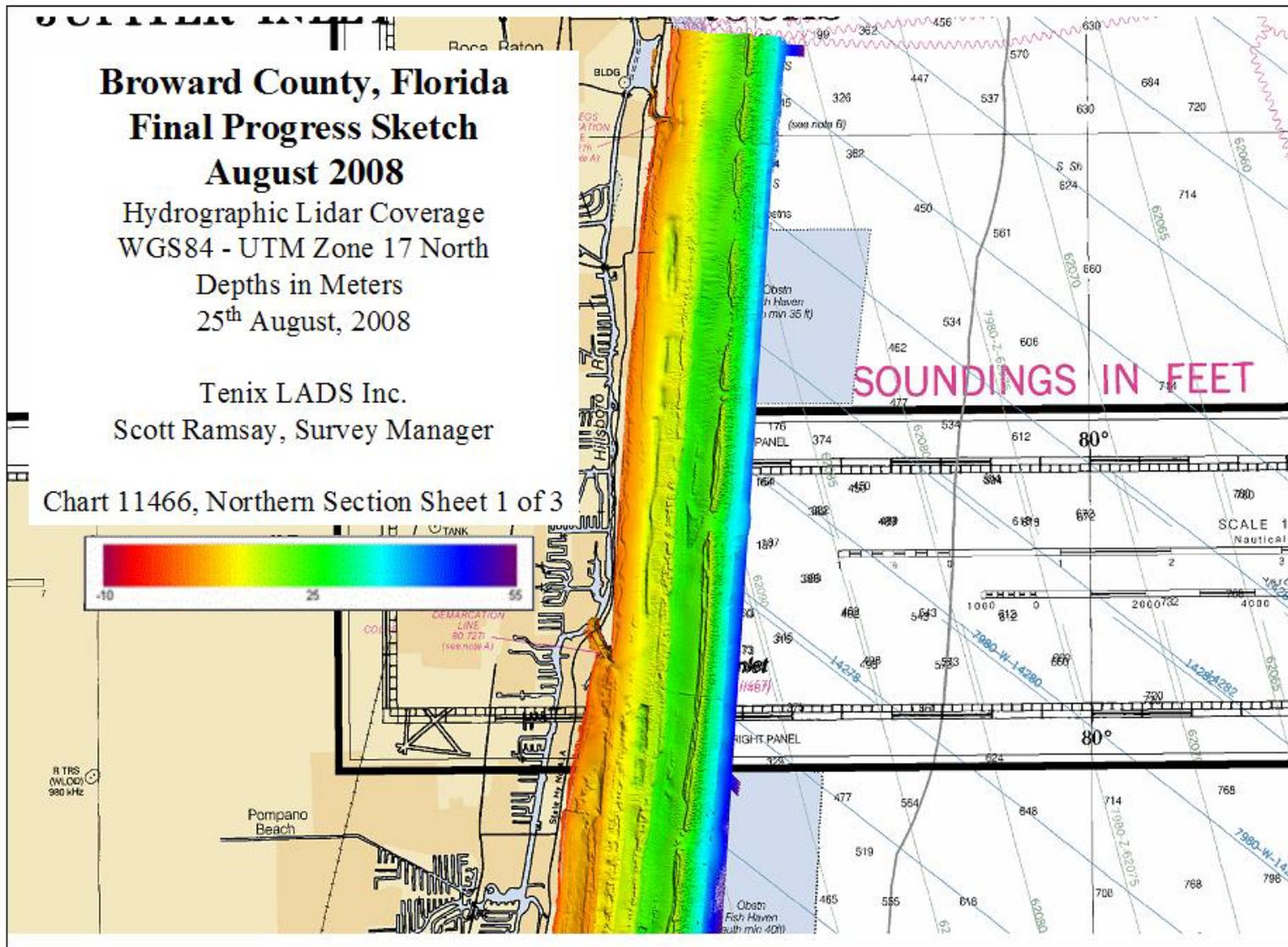
## **APPENDIX II – SURVEY FEATURE REPORT**

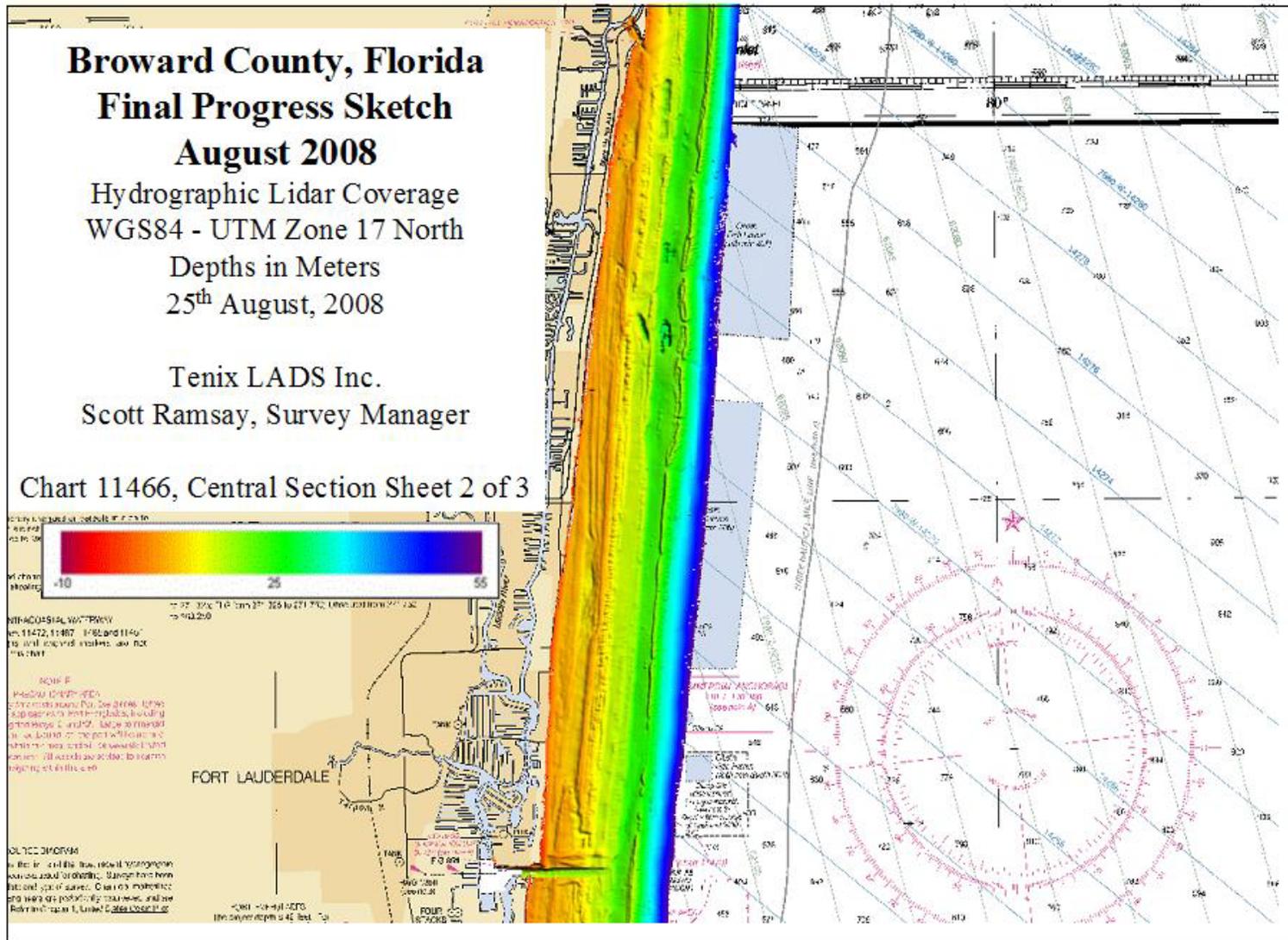
No AWOIS were assigned to this project.

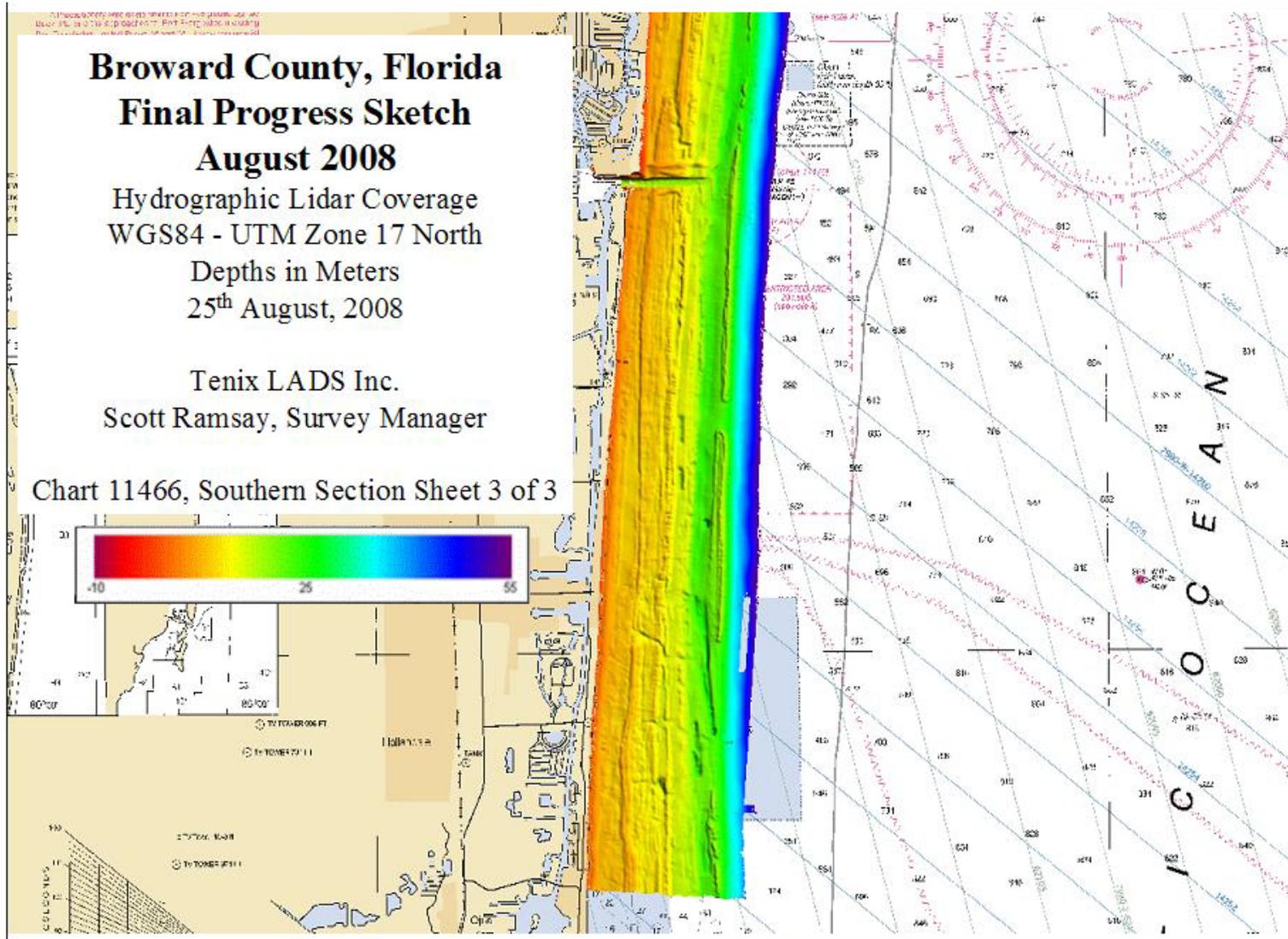












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## APPENDIX IV – TIDES AND WATER LEVELS

### Abstract of Times of Hydrography

Start and End times refer to tidal applications requirement.

Time on Task indicates actual time of task in the survey area. All times and dates are in UTC.

### 09\_Bro

Date	JD	Sortie	Start Time	End Time	Tide Duration	Time on Task
21-Jul-08	203	2	01:00	06:00	5:00	0:28
27-Jul-08	209	3	01:00	06:00	5:00	0:26
28-Jul-08	210	4	01:00	11:00	10:00	3:56
29-Jul-08	211	5	06:00	11:00	05:00	2:43
07-Aug-08	220	7	07:00	12:00	5:00	2:00
16-Aug-08	229	11	03:00	10:00	07:00	3:50
17-Aug-08	230	12	00:54	10:00	09:06	1:35
18-Aug-08	231	13	00:54	09:00	08:06	0:52
23-Aug-08	236	14	Sortie not processed due to poor water clarity			0:52
24-Aug-08	237	15	00:54	09:00	08:06	0:24

APPENDIX V  
SUPPLEMENTAL SURVEY AND  
CORRESPONDENCE

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## AHB COMPILATION LOG

General Survey Information	
REGISTRY No.	H12116
PROJECT No.	<u>OPR-H328-KRL-09</u>
FIELD UNIT	FUGRO LADS, INC (FLI)
DATE OF SURVEY	July 12 – August 24, 2008
LARGEST SCALE CHART	11467_1, edition 41, 20080601, 1:40,000 and 11467_5, edition 41, 20080601, 1:40,000
ADDITIONAL CHARTS	
SOUNDING UNITS	Feet at MLLW
COMPILER	Deborah A. Bland

Source Grids	File Name
	H:\Compilation\H12116_H328_FU\AHB_H12116\
	E-SAR Final Products\GRIDS\ H12116_Shoal_Extracted_3m.hns
Surfaces	File Name
	H:\Compilation\ H12116_H328_FU \AHB_H12116\COMPILE\Working
<i>Combined</i>	
<i>Interpolated TIN</i>	\Interpolated TIN\H12116_10m_InterpTIN.hns
<i>Shifted Interpolated TIN</i>	\Interpolated TIN\Shifted Surface\H12116_10m_InterpTIN_Shifted.hns
<i>Product Surface</i>	N/A
Final HOBs	File Name
	H:\Compilation\ H12116_H328_FU \AHB_H12116\COMPILE\Final_Hobs\
<i>Survey Scale Soundings</i>	<b>H12116_SS_Soundings.hob</b>
<i>Chart Scale Soundings</i>	<b>H12116_CS_Soundings.hob</b>
<i>Contour Layer</i>	<b>H12116_Contours.hob</b>
<i>Feature Layer</i>	<b>H12116_Features.hob</b>
<i>Meta-Objects Layer</i>	<b>H12116_Meta_Objects.hob</b>
<i>Blue Notes</i>	<b>H12116_BlueNotes.hob</b>
<i>ENC Retain</i>	<b>H12116_ENC_Retain.hob</b>

Meta-Objects Attribution	
Acronym	Value
<b>M_COVR</b>	
CATCOV	Coverage available
SORDAT	20080824
SORIND	US,US,graph,H12116
<b>M_QUAL</b>	
CATZOC	Zone of confidence U
INFORM	Fugro LADS Aircraft, VH-LCL
POSACC	10
SORDAT	20080824
SORIND	US,US,graph,H12116
SUREND	20080824
SURSTA	20080712

[Type text]

<b>DEPARE</b>	
DRVALV 1	<b>0</b>
DRVALV2	<b>180.87270</b>
SORDAT	<b>20080824</b>
SORIND	<b>US,US,graph,H12116</b>
<b>DEPARE</b>	
DRVALV 1	<b>0</b>
DRVALV2	<b>16.46982</b>
SORDAT	<b>20080824</b>
SORIND	<b>US,US,graph,H12116</b>
<b>CSCCL</b>	
CSCALE	
SORDAT	
SORIND	

**SPECIFICATIONS**

- I. COMBINED SURFACE:
  - a. Number of ESAR Final Grids: **1**
  - b. Resolution of Combined (m): **3m**
  
- II. SURVEY SCALE SOUNDINGS (SS): **30705**
  - a. Radius
  - b. Shoal biased
  - c. Use Single-Defined Radius (mm at Map Scale): ; Radius Value = 1
  - d. Queried Depth of All Soundings
    - i. Minimum: **-2.52525**
    - ii. Maximum: **181.0000**
  
- III. INTERPOLATED TIN SURFACE:
  - a. Resolution (m): **10m**
  - b. Linear
  - c. Shifted value: **-0.229 m (-0.75 ft)** [-0.229m (feet), (≤ 10 fathoms)]  
[-1.372m (fathoms), (> 10 fathoms)]
  
- IV. CONTOURS:
  - a. Use a Depth List: **H12116\_NOAA\_depth\_curves\_list.txt**
  - b. Line Object: **DEPCNT**
  - c. Value Attribute: **VALDCO**
  
- V. FEATURES:
  - a. Total Number of Features: 43 FEATURES TOTAL: 5 charted obstruction areas retained/1 obstruction retained/10 charted seabed area characteristics retained/ 5 charted wrecks retained/1 pipeline (sewer) retained/1 pipeline (outfall pipe) retained/1 new day mark/1 new beacon/1 new light/4 new rocky seabed area features/3 new rocks
  - b. Number of Insignificant Features:
  
- VI. CHART SURVEY SOUNDINGS (CS):
  - a. Number of ENC CS Soundings: **179**
  - b. Radius 10m
  - c. Shoal biased

[Type text]

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- d. Use Single-Defined Radius: m on the ground
  - i. Radius Value (m):
  - ii. Or use a Sounding Space Range Table (if applicable): H12116\_SSR.txt
- e. Filter: Interpolated != 1
- f.* Number Survey CS Soundings: *179*

VII. Notes:

**ATLANTIC HYDROGRAPHIC BRANCH  
H-CELL REPORT to ACCOMPANY  
SURVEY H12116 (2008)**

This H-Cell Report has been written to supplement and/or clarify the original Descriptive Report. Sections in this report refer to the corresponding sections of the Descriptive Report.

**B. DATA ACQUISITION AND PROCESSING**

**B.4. Data Processing**

The following software was used to process data at the Atlantic Hydrographic Branch:

CARIS HIPS/SIPS version 6.1 SP2 HF 8  
CARIS Bathymetry Manager version 2.1 SP1 HF 1-10  
CARIS Bathymetry Manager version 2.3 Build 192 HF 1-16  
CARIS HOM version 3.3 SP3  
CARIS S57 Composer version 2.1 HF 1-3  
dKart Inspector version 5.0 Build 732 SP1

**B.4.1. H-Cell Processing**

The AHB source depth grid for the survey's nautical chart update product was a 3m resolution shoal BASE surface derived from the field's original LIDAR 3m \*.hns BASE surface. The survey scale soundings were created from the surface at single defined radius of one millimeter at chart scale of 1:40,000. A TIN was created from the survey scale soundings from which an interpolated surface was generated. The chart scale soundings were selected from the filtered interpolated surface using a single defined radius at the 40,000 chart scale. The chart scale selected soundings are a subset of the survey scale selected soundings. The surface model was referenced when selecting the chart scale soundings, to ensure that the selected soundings portrayed the bathymetry within the common area.

Depth contours were created from a shifted interpolated TIN surface of 10m resolution. The depth contours are forwarded to MCD for reference only. The contours were utilized during chart scale sounding selection and quality assurance efforts at AHB. The depth contours are incorporated into the SS H-Cell product as per 2009 H-Cell Specifications.

The pre-compilation products or components (Stand Alone HOB files (SAHOB)) are detailed in the Pre-Compile Process Log attached at the end of this document. The SAHOB files included depth contours (DEPCNT), depth area (DEPARE), sounding selections (SOUNDG), features (BCNLAT, COALNE, DAYMAR, LIGHTS, SBDARE, UWTRC), H12116\_ENC\_Features\_Retain (OBSTRN, PIPSOL, SBDARE, WRECKS), Meta objects (M\_COVR, M\_QUAL), and cartographic Blue Notes (\$CSYMB).

All of the components with the exception of the survey scale sounding selection and depth contours were inserted into one feature layer (including the Bluenotes and zero depth contours, as dictated by Hydrographic Technical Directive 2008-8), and this layer

was exported into S-57 format to create the H-Cell deliverable. Similarly, the survey scale sounding selection and depth contours were exported into S-57 format separately, and then both S-57 files were processed in CARIS HOM to convert the metric units to feet. The final products are two S-57 files, in Lat/Lon NAD-83, one that contains the chart soundings, all the features, Meta objects, Bluenotes, shoreline changes and zero depth contours (H12116\_CS.000), and one that contains the survey scale sounding selection and depth contours (H12116\_SS.000). Finally, quality assurance checks were made utilizing CARIS S-57 Composer version 2.1 HF 4 validation checks and DKART INSPECTOR, version 5.0 Build 732 SP1, tests.

Chart compilation was performed by Atlantic Hydrographic Branch personnel in Norfolk, Virginia. Compilation data will be forwarded to Marine Chart Division, Silver Spring, Maryland.

H12116 CARIS H-Cell final deliverables include the following products:

H12116_CS.000	1:40,000 Scale	H12116 H-Cell with Chart Scale Selected Soundings
H12116_SS.000	1:10,000 Scale	H12116 Survey Scale Soundings

### **B.5. Vertical and Horizontal**

A Horizontal and Vertical Control Report (HVCR) was submitted for OPR-H328-KRL-09, survey H12116.

Final vertical correction processing was completed by the field unit with no additional correction required by Atlantic Hydrographic Branch. The field unit personnel applied verified water levels in conjunction with the preliminary tidal zoning which was accepted as the final zoning for H12116. Sounding datum is Mean Lower Low Water (MLLW). Vertical datum is Mean High Water (MHW).

Horizontal control used for this survey during data acquisition is based upon the North American Datum of 1983 (NAD83), UTM projection zone 17 North.

## **C. RESULTS AND RECOMMENDATIONS**

### **C.1. Chart Comparison**

#### **11467-1 (41st Edition, Jun/08)**

Intracoastal Waterway  
 Lake Worth to Deerfield Beach Florida  
 Corrected through NM 07/03/2010  
 Corrected through LNM 06/29/2010  
 Scale 1:40,000

#### **11467-5 (41st Edition, Jun/08)**

Intracoastal Waterway  
 Pampano Beach to Halladale Florida  
 Corrected through NM 07/03/2010  
 Corrected through LNM 06/29/2010  
 Scale 1:40,000

## ENC Comparison

## US5FL33M

Intracoastal Waterway  
West Palm Beach to Miami  
Edition 18  
Application Date 2010-07-07  
Issue Date 2010-07-07  
Chart 11467

### Hydrography

The charted hydrography originates with prior surveys and requires no further consideration. The hydrographer makes adequate chart comparisons in section "D" and Appendix 1&2 of the Descriptive Report. The following exceptions are noted:

#### C.1.1. Danger to Navigation Reports

No Dangers to Navigation were found during processing of the survey in AHB.

#### C.1.3. Aids to Navigation

1. Of the thirteen Aids to Navigation investigated during present survey operations, only six of them are privately maintained. All of the privately maintained aids should be retained as charted except Boca Raton Inlet South Jetty Light 1 and its associated beacon and daymark. These aids are charted in Latitude 26-20-06.68N Longitude 080-04-11.24W, but the field found them in Latitude 26-20-08.02N Longitude 080-04-13.25W. It is recommended that the charted light, daymark and beacon are deleted and a light, daymark and beacon are charted in the present survey location. Final charting disposition is deferred to MCD Nautical Data Branch.

2. Of the six privately maintained Aids to Navigation investigated during present survey operations one not detected by the survey is the Deerfield Fishing Pier South Light, in Latitude 26-18-58.40N, Longitude 080-04-25.00W. This south light is not shown on the latest edition of NOS chart 11467 or the corresponding ENC of the chart. It is recommended that no changes to charting are made. Final charting disposition is deferred to MCD Nautical Data Branch.

#### C.1.4. Charted Depths and Features

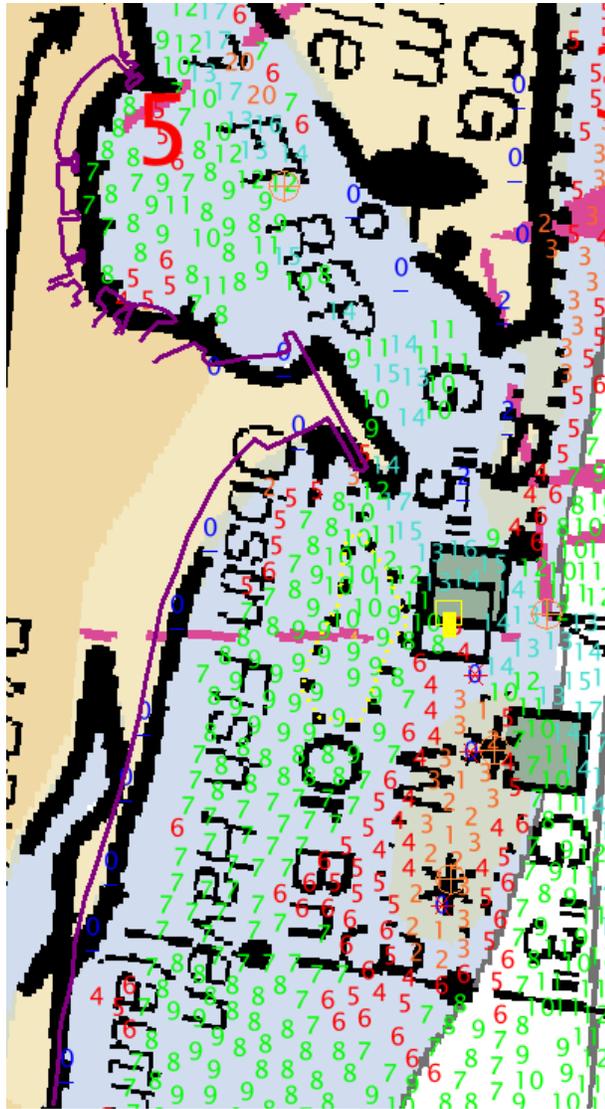
##### Contemporary Survey Junctions

Survey H12116 (2008) junctions to the south with contemporary survey H12117 (2008). Present survey soundings compare within 0 to 1 foot with the junctional survey. Present survey soundings are in harmony with charted depths to the north and west.

#### a. Coastline

1. There are numerous depths above MHW on the present survey. These depths were used to help delineate the zero depth contour and the MHW line, but the depths were not charted because this is a Lidar Survey and it was felt that they were usable only in the capacity of reference depths. These negative depths are located around the shoreline areas. The negative depths are included in the survey scale data set but they are not in the chart scale data set. The zero depth contours were well defined by the present survey and the charted low water limits should be updated based on present survey findings.

2. According to the latest orthoimagery of the survey area as well as the present survey data, the charted coastline in Hillsboro Inlet in the vicinity of Latitude  $26^{\circ} 15' 39.2725''\text{N}$ , Longitude  $80^{\circ} 05' 02.5279''\text{W}$  within the limits of the survey and north of Hillsboro Inlet from Latitude  $26^{\circ} 15' 31.9572''\text{N}$ , Longitude  $80^{\circ} 04' 49.76364''\text{W}$  to Latitude  $26^{\circ} 17' 42.73368''\text{N}$ , Longitude  $80^{\circ} 04' 39.17316''\text{W}$  has changed. In these areas, the shoreline has migrated to the west, away from seaward. The grid and present survey negative depths were used with the orthoimagery to delineate the MHW limits. Update the MHW limits based on the orthoimagery and present survey findings.



3. Unless specifically denoted, the charted shoreline features; piers, wharfs and jetties should be retained as charted.

c. Rocks

1. The underwater/awash rock charted in Latitude  $26^{\circ} 15' 15.9624''\text{N}$ , Longitude  $80^{\circ} 04' 51.0348''\text{W}$  originates with prior survey information. The present survey found the rock with a depth of 0.3937 ft in Latitude  $26^{\circ} 15' 15.3587''\text{N}$ , Longitude  $80^{\circ} 04' 51.1187''\text{W}$ . It is recommended that the charted underwater/awash rock is removed and a underwater/awash rock is charted in the present survey location with the above characteristics.

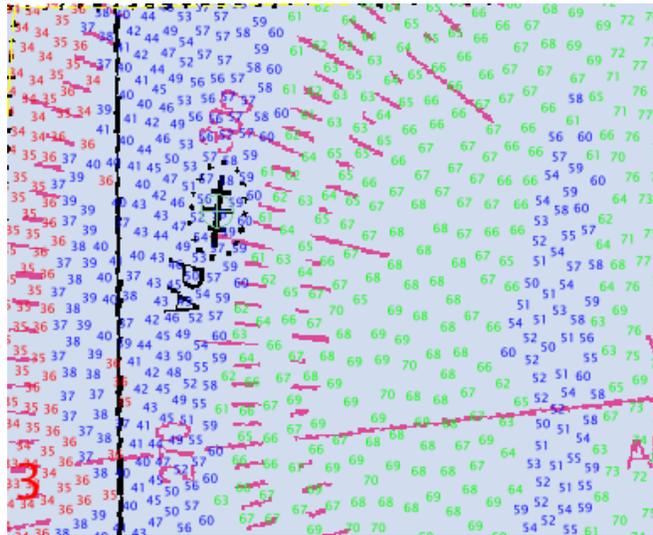
2. The underwater/awash rock charted in Latitude  $26^{\circ} 15' 19.7244''\text{N}$ , Longitude  $80^{\circ} 04' 49.6920''\text{W}$  originates with prior survey information. The present survey found the underwater/awash rock with a depth of 0.6234 ft in Latitude  $26^{\circ} 15' 19.4324''\text{N}$ , Longitude  $80^{\circ} 04' 50.2428''\text{W}$ . It is recommended that the charted underwater/awash rock is removed and a underwater/awash rock is charted in the present survey location with the above characteristics.

d. Wrecks

1. The following charted dangerous wrecks and wrecks PA, depth unknown; symbols were not verified, disproved or discussed by the field. It is recommended that they are retained as charted.

<u>Latitude</u>	<u>Longitude</u>
26-12-22.032N	080-05-06.364W
26-15-48.840N	080-03-53.462W
26-16-01.596N	080-04-27.962W
26-19-25.406N	080-04-04.541W
26-19-41.243N	080-04-18.948W

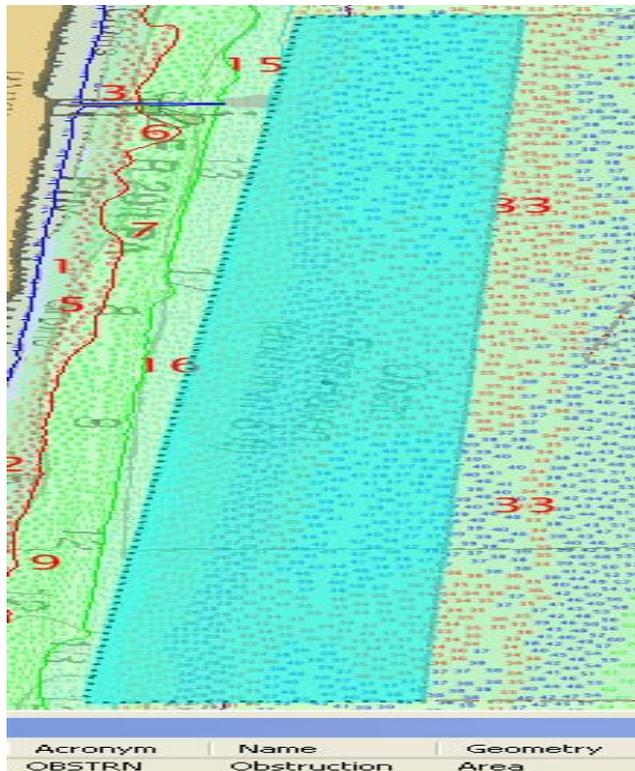
2. A dangerous wreck PA, depth unknown; symbol charted in Latitude 26°19'00.041"N, Longitude 080°03'54.155"W was not verified, disproved or discussed by the field. This wreck falls within the limits of a charted obstruction (fish haven) (auth min 35 ft) whose center is charted in Latitude 26° 18' 30.3326"N, Longitude 80° 03' 17.7075"W. Present survey depths in the area are 47 to 61 feet. It is recommended that the dangerous wreck PA, depth unknown symbol is deleted because it is redundant inside the obstruction (fish haven).



C.1.5. Detailed Chart Comparison

1. There are five obstructions (fish haven) within the limits of the present survey. The auth min depths were accurate in three of the fish havens.

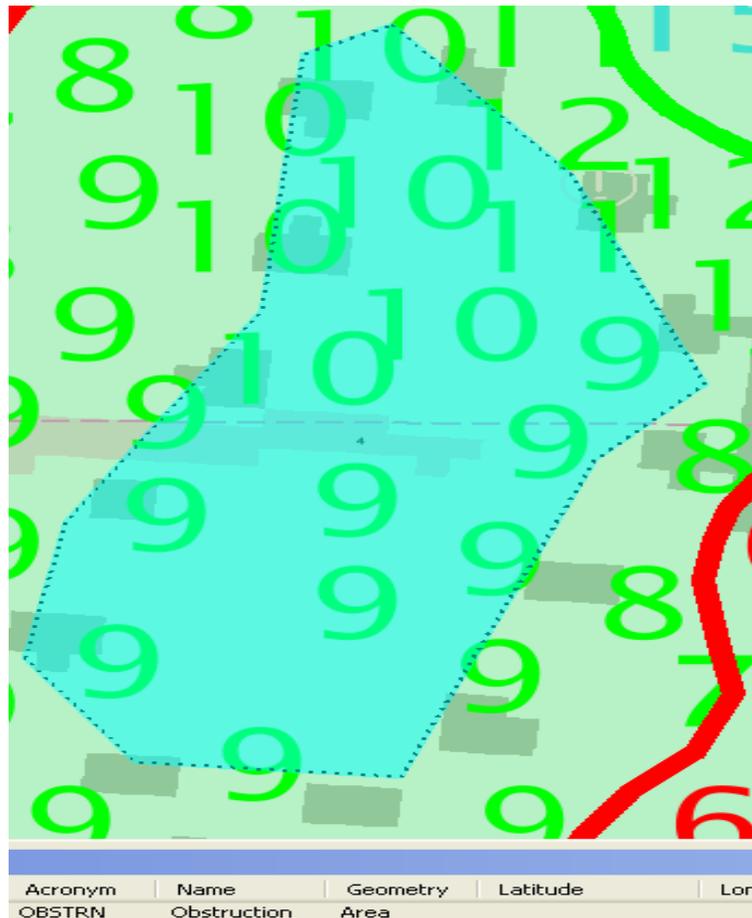
a. The obstruction Fish Haven (auth min 6 ft) whose center is charted in Latitude 26° 18' 25.80"N, Longitude 80° 04' 16.742"W originates with prior survey information and was totally covered by the present survey. The least depth found during the present survey was 15.945 ft in Latitude 26° 17' 39.81"N, Longitude 80° 04' 29.123"W. No changes to charting are necessary.



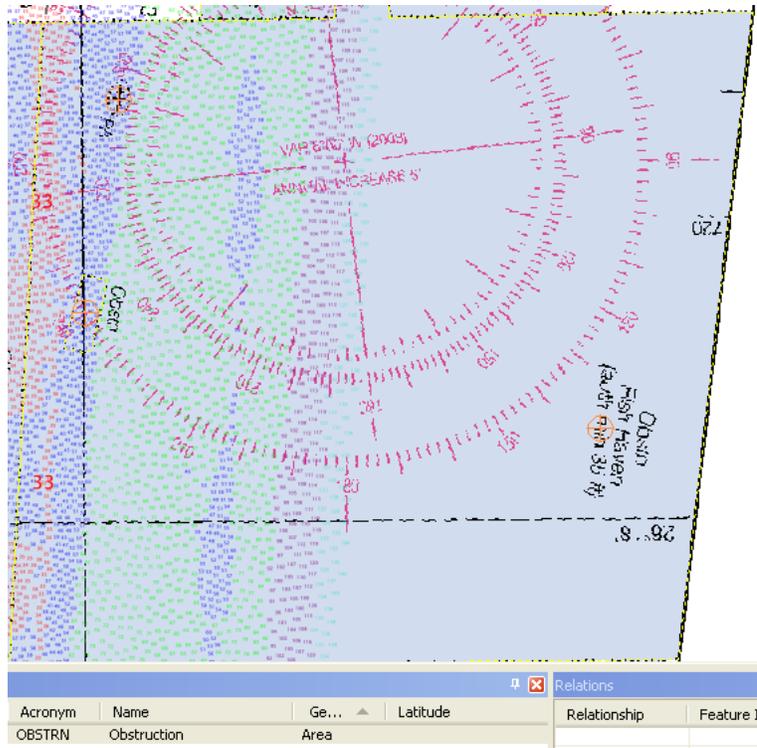
b. The obstruction Fish Haven (auth min 40 ft) whose center is charted in Latitude  $26^{\circ} 13' 19.6728''\text{N}$ , Longitude  $80^{\circ} 03' 33.7155''\text{W}$  originates with prior survey information and was partially covered by the present survey. The least depth found during the present survey was 72.146 ft in Latitude  $26^{\circ} 13' 07.4579''\text{N}$ , Longitude  $80^{\circ} 03' 58.4158''\text{W}$ . No changes to charting are necessary.



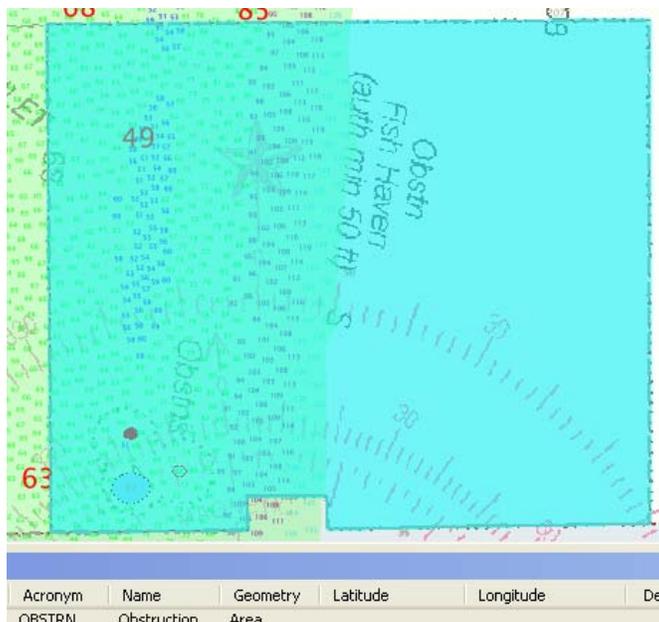
c. The obstruction Fish Haven (auth min 4 ft) whose center is charted in Latitude  $26^{\circ} 15' 22.5403''\text{N}$ , Longitude  $80^{\circ} 04' 53.631''\text{W}$  originates with prior survey information and was partially covered by the present survey. The least depth found during the present survey was 9.1863 ft in Latitude  $26^{\circ} 15' 20.3350''\text{N}$ , Longitude  $80^{\circ} 04' 54.1286''\text{W}$ . No changes to charting are necessary.



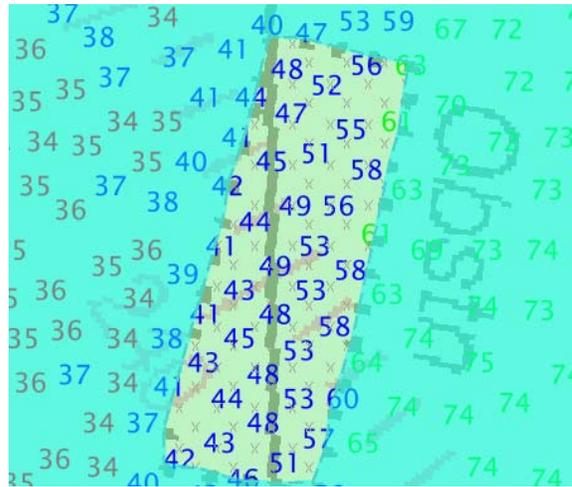
2. The obstruction Fish Haven (auth min 35 ft) whose center is charted in Latitude  $26^{\circ} 18' 30.3326''\text{N}$ , Longitude  $80^{\circ} 03' 17.7075''\text{W}$  originates with prior survey information and was partially covered by the present survey. The present survey found several 33 foot depths; the least of which is 33.038 ft in Latitude  $26^{\circ} 18' 05.6012''\text{N}$ , Longitude  $80^{\circ} 04' 06.4160''\text{W}$ . It is recommended that the charted obstruction Fish Haven (auth min 35 ft) is retained as charted. It is further recommended that the auth min depth is revised to 33 ft. See also Section C.1.6. of the Descriptive Report.



3. The obstruction Fish Haven (auth min 50 ft) whose center is charted in Latitude  $26^{\circ} 19' 34.0142''N$ , Longitude  $80^{\circ} 03' 09.3417''W$  originates with prior survey information and was partially covered by the present survey. The present survey found a depth of 48.884 ft in Latitude  $29^{\circ} 19' 48.9284''N$ , Longitude  $80^{\circ} 03' 31.3945''W$  but there is a 42 ft dangerous obstruction charted inside the limits of this fish haven in Latitude  $26^{\circ} 19' 15.3948''N$ , Longitude  $80^{\circ} 03' 32.4396''W$ . It is recommended that the charted obstruction Fish Haven (auth min 50 ft) is retained as charted. It is further recommended that the auth min depth is revised to 42 ft. See also Section C.1.6. of the Descriptive Report. Also see Section 1.4.6 of this report.



4. A dangerous obstruction (foul area), least depth unknown, charted in Latitude  $26^{\circ}18'12.5800''\text{N}$ , Longitude  $080^{\circ}03'59.6678''\text{W}$ , is charted inside the limits of an obstruction (fish haven). The present survey depths within the limits of the foul area are 41 to 61 feet and the auth min depth of the fish haven is 35 ft. This obstruction (foul area) is on the raster chart (RNC) and electronic charts (ENC). It is recommended that this obstruction (foul area) is deleted from the chart and ENC. An obstruction inside and obstruction is redundant and unnecessary.



5. There is a cluster of three dangerous obstructions charted inside the limits of an obstruction Fish Haven (auth min 50 ft) whose center is charted in Latitude  $26^{\circ}19'34.0142''\text{N}$ , Longitude  $80^{\circ}03'09.3417''\text{W}$ . The obstructions are charted in Latitude  $26^{\circ}19'15.3948''\text{N}$ , Longitude  $80^{\circ}03'32.4396''\text{W}$ , Latitude  $26^{\circ}19'16.8761''\text{N}$ , Longitude  $80^{\circ}03'26.6292''\text{W}$ , and Latitude  $26^{\circ}19'20.1647''\text{N}$ , Longitude  $80^{\circ}03'33.0555''\text{W}$ . They originate with prior survey information.

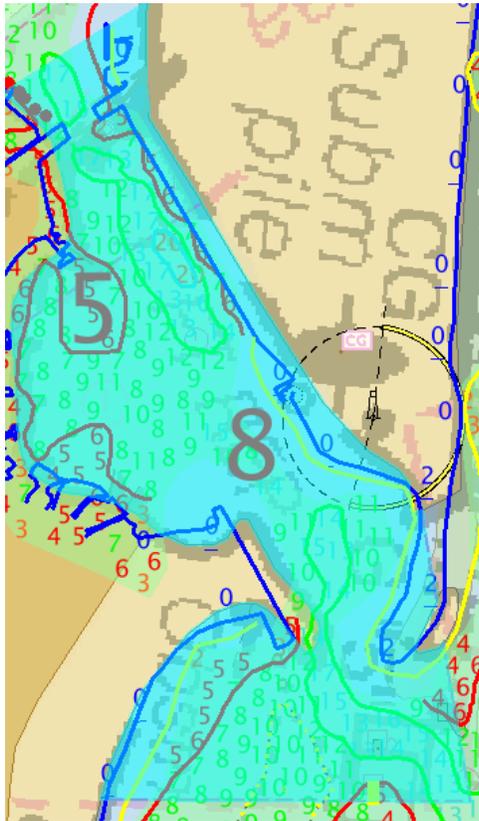
a. The 42 ft dangerous obstruction in Latitude  $26^{\circ}19'15.3948''\text{N}$ , Longitude  $80^{\circ}03'32.4396''\text{W}$  is on the ENC and the raster. Since this depth is shoaler than the fish haven min depth, it should be retained until the auth min depth of the fish haven is revised to 42 ft.

b. The dangerous obstruction, depth unknown in Latitude  $26^{\circ}19'16.8761''\text{N}$ , Longitude  $80^{\circ}03'26.6292''\text{W}$  is not in the ENC but it is on the raster chart. The present survey found a non-dangerous sunken wreck with a depth of 66 ft. in Latitude  $26^{\circ}19'16.950''\text{N}$ , Longitude  $80^{\circ}03'27.1803''\text{W}$ . It is recommended that the dangerous obstruction, depth unknown is deleted. Do not chart the 66 ft non-dangerous sunken wreck because the obstruction (fish haven) min depth takes care of it.

c. The dangerous obstruction, depth unknown in Latitude  $26^{\circ}19'20.1647''\text{N}$ , Longitude  $80^{\circ}03'33.0555''\text{W}$  is not in the ENC but it is on the raster chart. The present survey found a dangerous sunken wreck with a depth of 50 ft. in Latitude  $26^{\circ}19'20.6263''\text{N}$ , Longitude  $80^{\circ}03'32.4245''\text{W}$ . It is recommended that the dangerous obstruction, depth unknown is deleted. Do not chart the 50 ft dangerous sunken wreck because the obstruction (fish haven) min depth takes care of it.



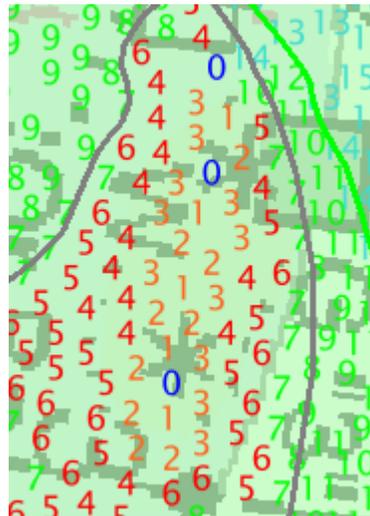
6. The 7 FT REP note charted in Latitude  $26^{\circ} 15' 35.0711''N$ , Longitude  $80^{\circ} 04' 56.3085''W$  originates with prior survey information. The present survey depths in this area range from 2 ft to 20 ft. It is recommended that the note is retained as charted.



7. The Shl to 2 ½ ft rep (1987) notation charted in Latitude 26° 15' 23.1797"N, Longitude 80° 04' 48.0274"W originates with prior survey information. The present survey depths in this area range from 12 ft to 14 ft. It is recommended that the note is deleted and the area is updated with present survey data.



8. An uncharted rock awash with a depth of 0.4921 ft was found by the present survey, just north of two charted rocks awash, in Latitude 26° 15' 21.4794"N, Longitude 80° 04' 50.1182"W. It is recommended that a rock awash symbol is added to the charts in the above present survey position.



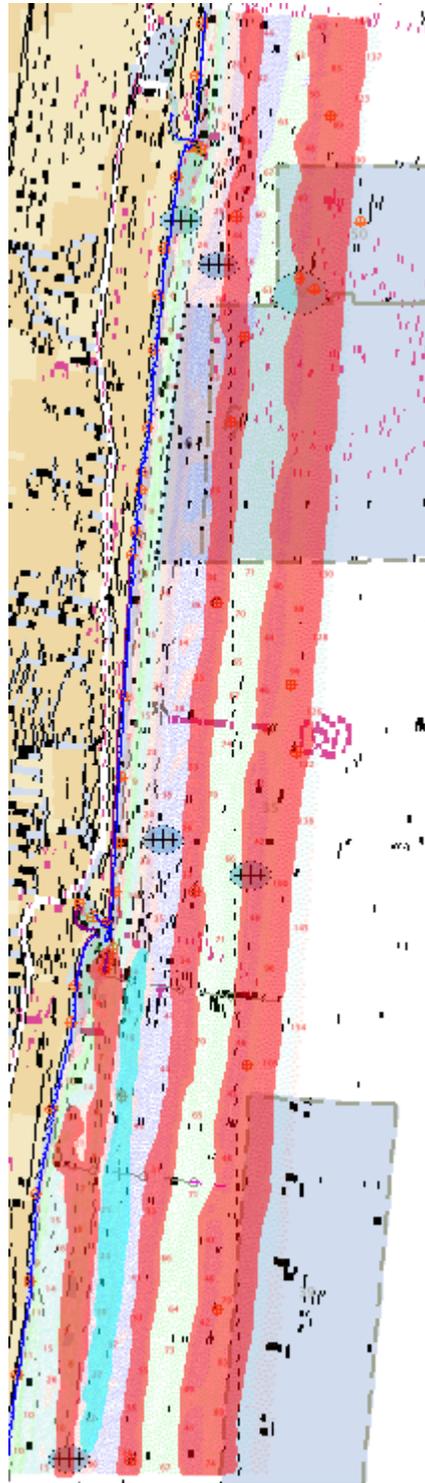
9. Three intertidal area were found by the present survey in the vicinity of Boca Raton Inlet southern jetty (pier), in Latitude 26° 20' 07.6416"N, Longitude 80° 04' 15.2252"W, Latitude 26° 20' 08.2738"N, Longitude 80° 04' 14.6762"W, and Latitude 26° 20' 08.2766"N, Longitude 80° 04' 17.1314"W. Only the one in Latitude 26° 20' 07.6416"N, Longitude 80° 04' 15.2252"W should be charted because the other two are under the pier. It is recommended that the new intertidal area is charted according to the present survey data.



12. The pipeline (sewer) charted within the present survey limits with its eastern limit in Latitude 26° 14' 07.0286"N, Longitude 80° 05' 16.0985"W and its western limit in Latitude 26° 13' 58.1863"N, Longitude 80° 03' 59.0978"W was detected during present survey operations and should be retained as charted.



13. During the present survey, there was no collection of bottom samples (SBDARE) but four new seabed area features were digitized to delineated areas of coral seafloor. These were attributed with a NATSUR of "Coral" and a NATQUA of "Calcareous". These coral seafloor areas extend the entire length of the present survey. In areas covered by the new coral seafloor areas, where the charted characteristic is CO (coral) it is recommended that the charted coral characteristic is deleted. Of the twenty charted seabed characteristics within present survey limits, ten have been retained as charted and the other ten were coral characteristics inside the new coral seafloor areas. Those have been recommended for deletion.



### **C.3. MISCELLANEOUS**

Chart compilation was done by Atlantic Hydrographic Branch personnel, in Norfolk, Virginia. Compilation data will be forwarded to Marine Chart Division, Silver Spring, Maryland. See Section C.1. of this report for a list of the Raster Chart and Electronic Navigation Chart (ENC) used for compiling the present survey.

#### **C.4. ADEQUACY OF SURVEY**

The present survey is adequate to supersede the charted bathymetry within the common area. Any features not specifically addressed either in the H-Cell, the Blue Notes, or the H-Cell Report, should be retained as charted. Refer to the Descriptive Report for further recommendations by the hydrographer.

**APPROVAL SHEET**  
**H12116**

**Initial Approvals:**

The completed survey has been inspected with regard to survey coverage, delineation of depth contours, disposition of critical depths, cartographic symbolization, and verification or disproof of charted data. All revisions and additions made to the H-Cell files during survey processing have been entered in the digital data for this survey. The survey records and digital data comply with National Ocean Service and Office of Coast Survey requirements except where noted in the Descriptive Report and the H-Cell Report.

All final products have undergone a comprehensive reviews per the Hydrographic surveys Division Office Processing Manual and are verified to be accurate and complete except where noted.

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**Deborah A. Bland**  
Cartographer  
Atlantic Hydrographic Branch

I have reviewed the H-Cell files, accompanying data, and reports. This survey and accompanying Marine Chart Division deliverables meet National Ocean Service requirements and standards for products in support of nautical charting except where noted.

Approved: \_\_\_\_\_  
**Richard Brennan**  
Commander, NOAA  
Chief, Atlantic Hydrographic Branch