

H12866

U.S. Department of Commerce  
National Oceanic and Atmospheric Administration  
National Ocean Service

**DESCRIPTIVE REPORT**

Type of Survey: Navigable Area

Registry Number: H12866

**LOCALITY**

State(s): Virginia

General Locality: Chesapeake Bay

Sub-locality: Willoughby Bank

**2016**

CHIEF OF PARTY  
Chris van Westendorp, CDR/NOAA

LIBRARY & ARCHIVES

Date:

**HYDROGRAPHIC TITLE SHEET**

**H12866**

**INSTRUCTIONS:** The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

State(s): **Virginia**

General Locality: **Chesapeake Bay**

Sub-Locality: **Willoughby Bank**

Scale: **10000**

Dates of Survey: **04/04/2016 to 08/25/2016**

Instructions Dated: **03/09/2016**

Project Number: **OPR-E350-TJ-16**

Field Unit: **NOAA Ship *Thomas Jefferson***

Chief of Party: **Chris van Westendorp, CDR/NOAA**

Soundings by: **Multibeam Echo Sounder Singlebeam Echo Sounder**

Imagery by: **Side Scan Sonar Multibeam Echo Sounder Backscatter**

Verification by: **Atlantic Hydrographic Branch**

Soundings Acquired in: **meters at Mean Lower Low Water**

Remarks:

*The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. All separates are filed with the hydrographic data. Any revisions to the Descriptive Report (DR) generated during office processing are shown in bold red italic text. The processing branch maintains the DR as a field unit product, therefore, all information and recommendations within the body of the DR are considered preliminary unless otherwise noted. The final disposition of surveyed features is represented in the OCS nautical chart update products. All pertinent records for this survey, including the DR, are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via <https://www.ncei.noaa.gov/>.*

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## Descriptive Report to Accompany Survey H12866

Project: OPR-E350-TJ-16

Locality: Chesapeake Bay

Sublocality: Willoughby Bank

Scale: 1:10000

April 2016 - August 2016

**NOAA Ship *Thomas Jefferson***

Chief of Party: Chris van Westendorp, CDR/NOAA

### A. Area Surveyed

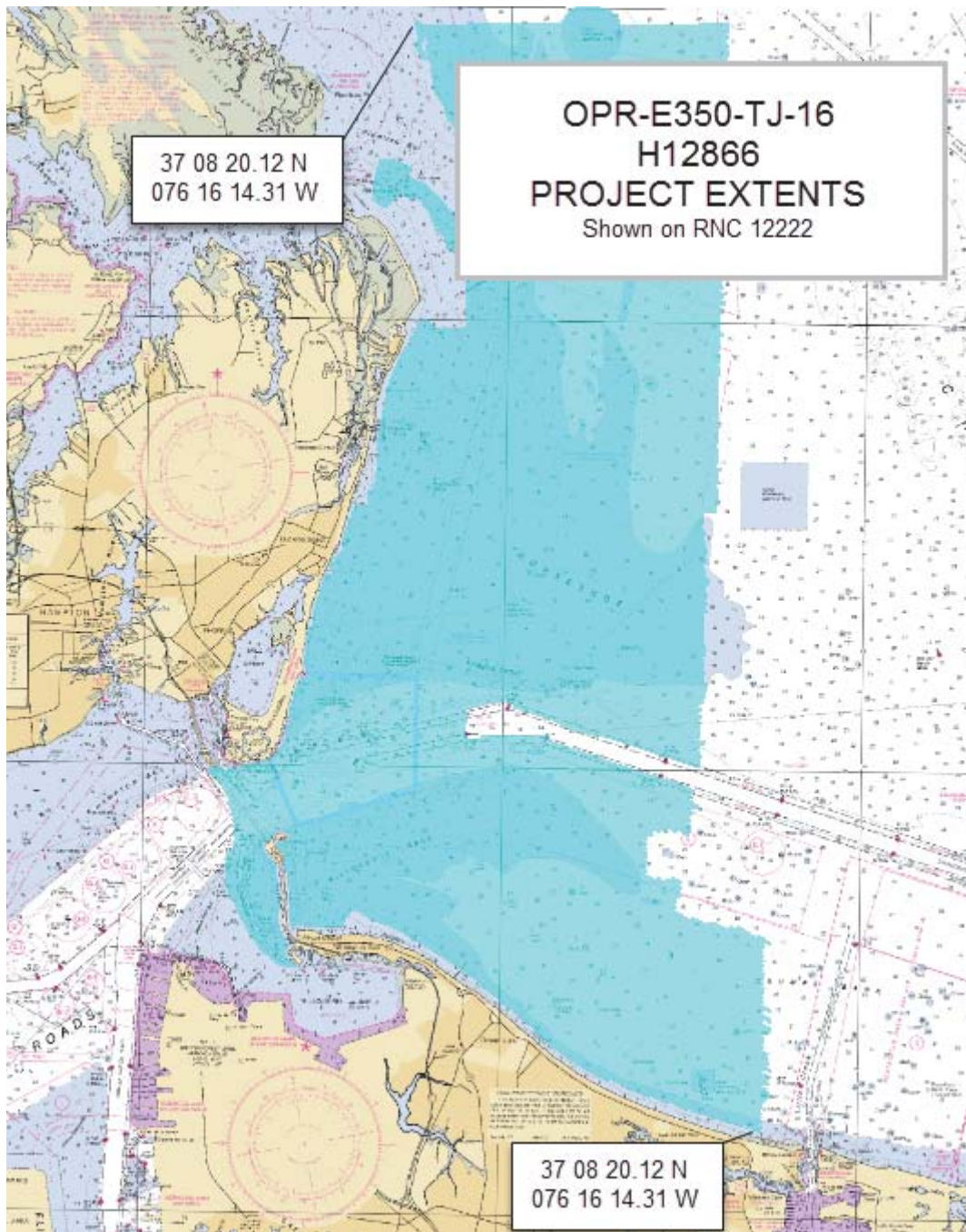
Hydrographic survey H12866 was completed as specified by hydrographic survey project instructions OPR-E350-TJ-16, signed 09 March 2016. This survey extends from Little Creek, VA to Poquoson, VA.

#### A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
37° 8' 20.12" N 76° 16' 14.31" W	36° 56' 0.97" N 76° 11' 20.77" W

*Table 1: Survey Limits*



*Figure 1: H12866 Project Extents*

Survey H12866, Sheet 1 of OPR-E350-TJ-16 extends from Little Creek in the South to Back River in the North, from Thimble Shoal Channel West to the Hampton Roads Bridge Tunnel (Figure 1).

Deviations were made to the original survey limits as assigned. The Chief of Party made the decision to extend the western perimeter of the sheet limits to include Willoughby Bay Channel and the complete extents of the Hampton Roads Bridge Tunnel based on local reports of dangers to navigation, predominantly shoaling (Figure 2). This extension was acquired using a combination of object detection multibeam

collected by hydrographic survey launches and singlebeam data collected by an autonomous Z-boat (Figure 3). Two other allowances of sheet limit deviation were made for further extensions: one obstruction on the eastern side of the project area near the entrance to Little Creek that was cut off by sheet limits (Figure 4) and one fish haven along the northernmost edge of the sheet limit (Figure 5). Both areas were fully developed with object detection multibeam data.

The project limits were not completed in the vicinity of Phoebus Channel near the northern end of the Hampton Roads Bridge Tunnel due to safety concerns (Figure 6) nor in the northwestern section into Back River due to time and schedule constraints (Figure 7). The southeasterly point of Willoughby Bank also has an area that was not covered by survey data. The area is approximately 100m by 200m (Figure 8). Two areas without data coverage exist along the northern-most limit of the project area (Figures 9 and 10). Five data coverage gaps exist along the eastern sheet limit that are small, and likely the result of early termination of logging data. The most severe of these is located at 37-08-08.835N 076-11-59.597W. The southern edge of the sheet also has some minor data gaps where the side scan sonar imagery does not meet the inshore-most multibeam data (Figure 11).

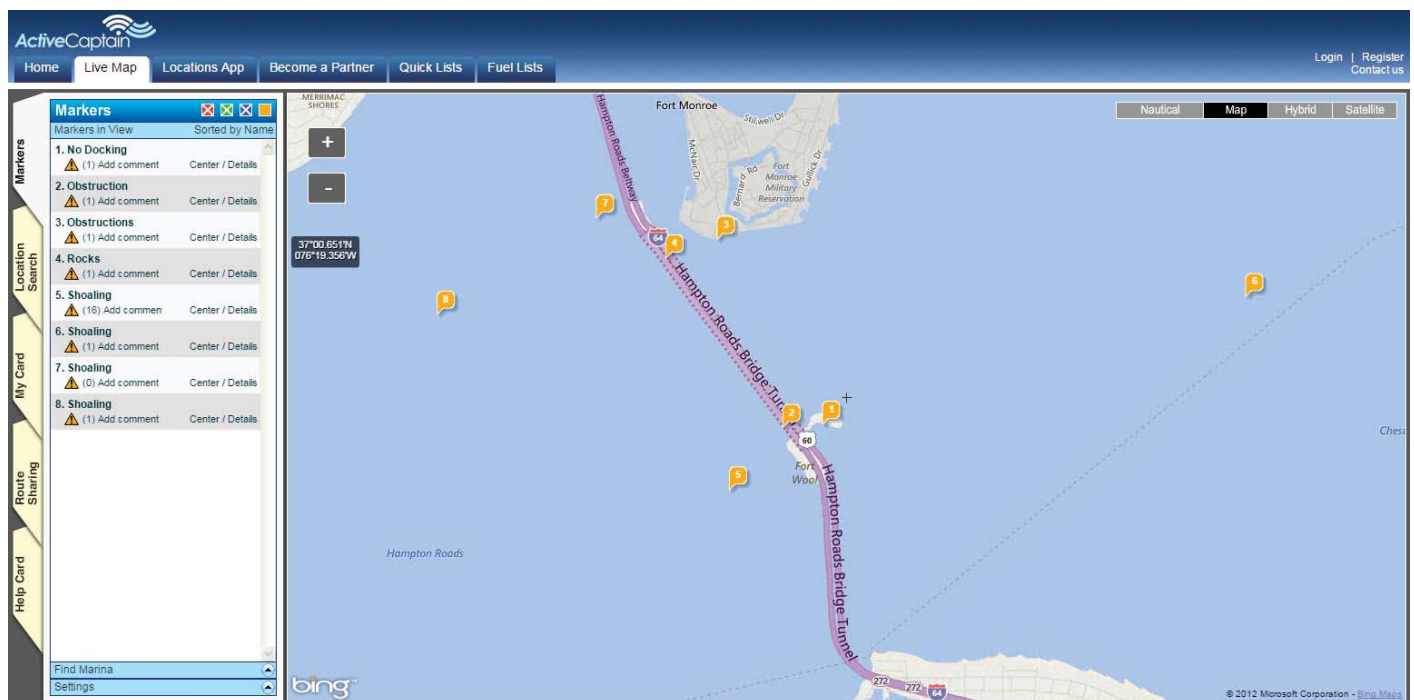


Figure 2: Active Captain markers for local concerns to safe navigation. Western survey limits were extended to include markers 4, 2, and 5.



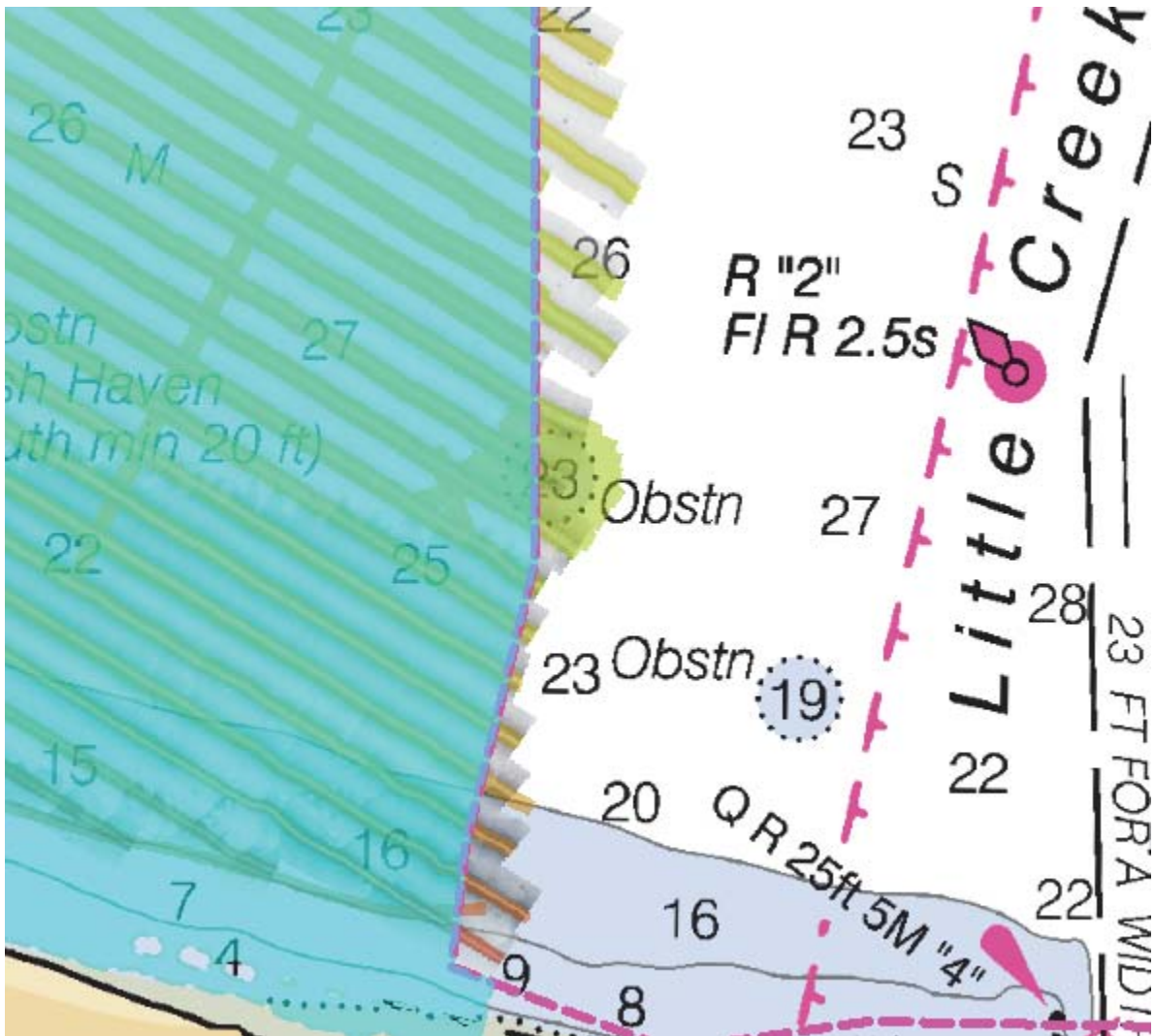


Figure 4: Data extends from sheet limits to cover obstruction.

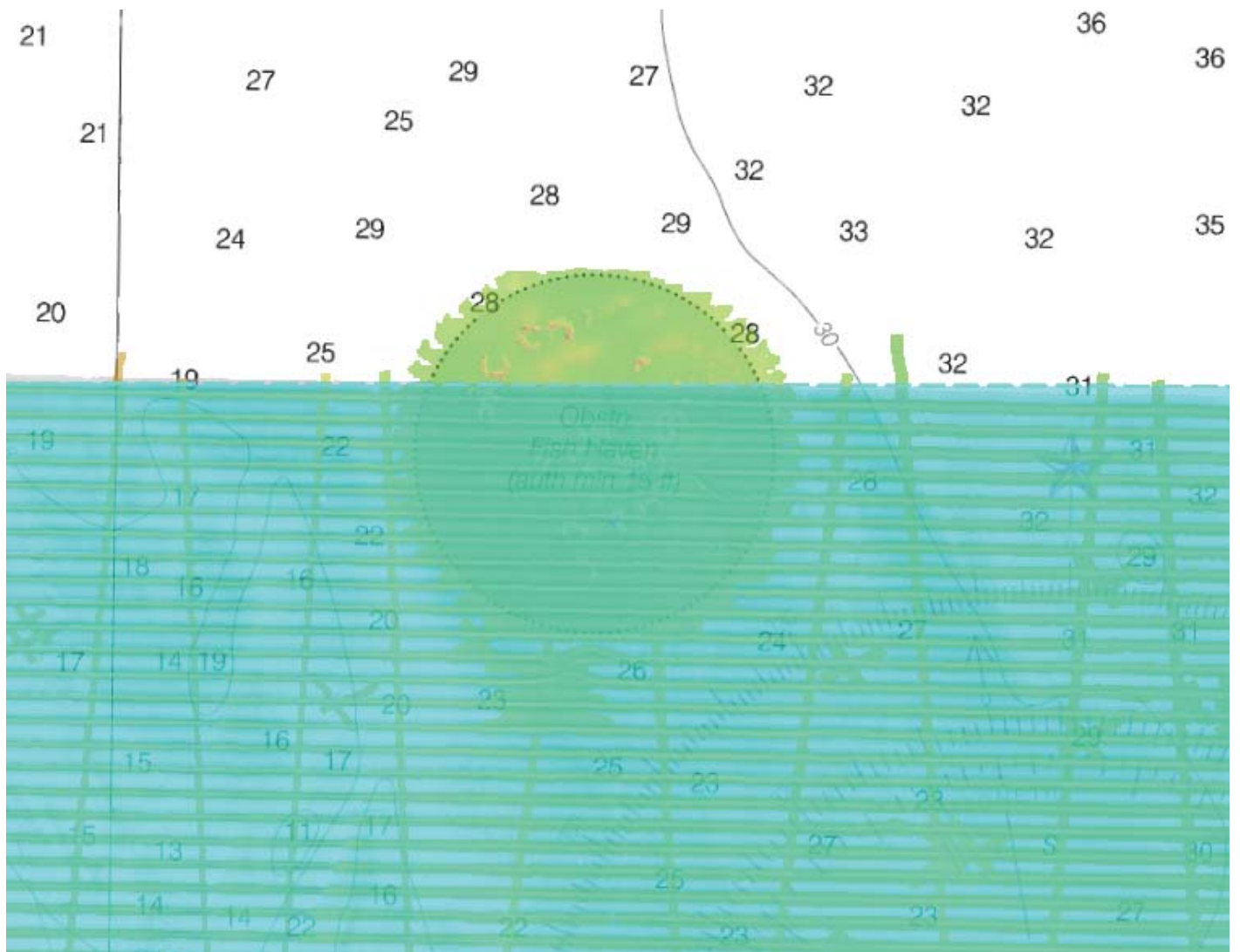
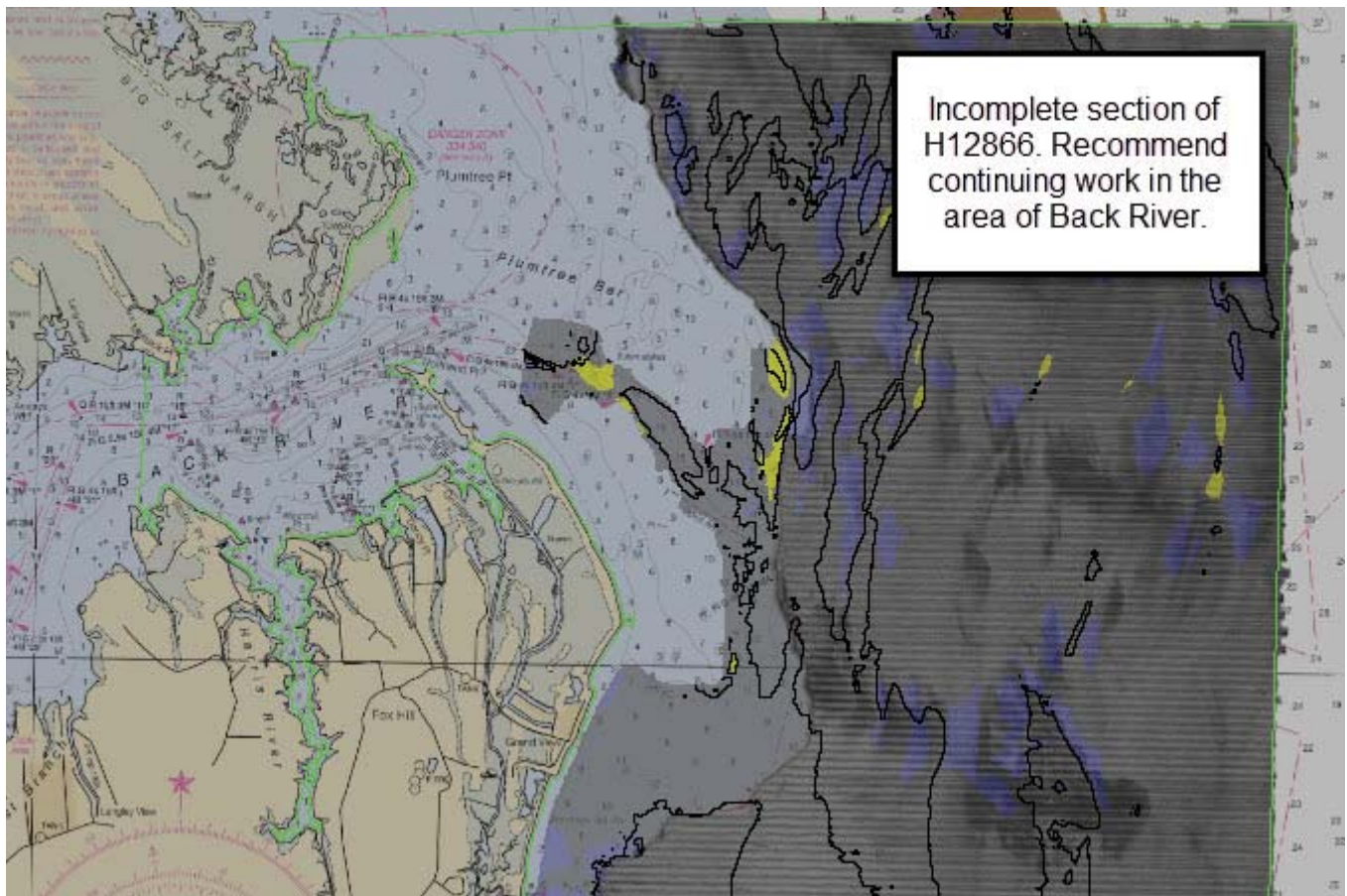


Figure 5: Data extends from sheet limits to cover fish haven.





*Figure 7: Incomplete northern section of Sheet H12866.*

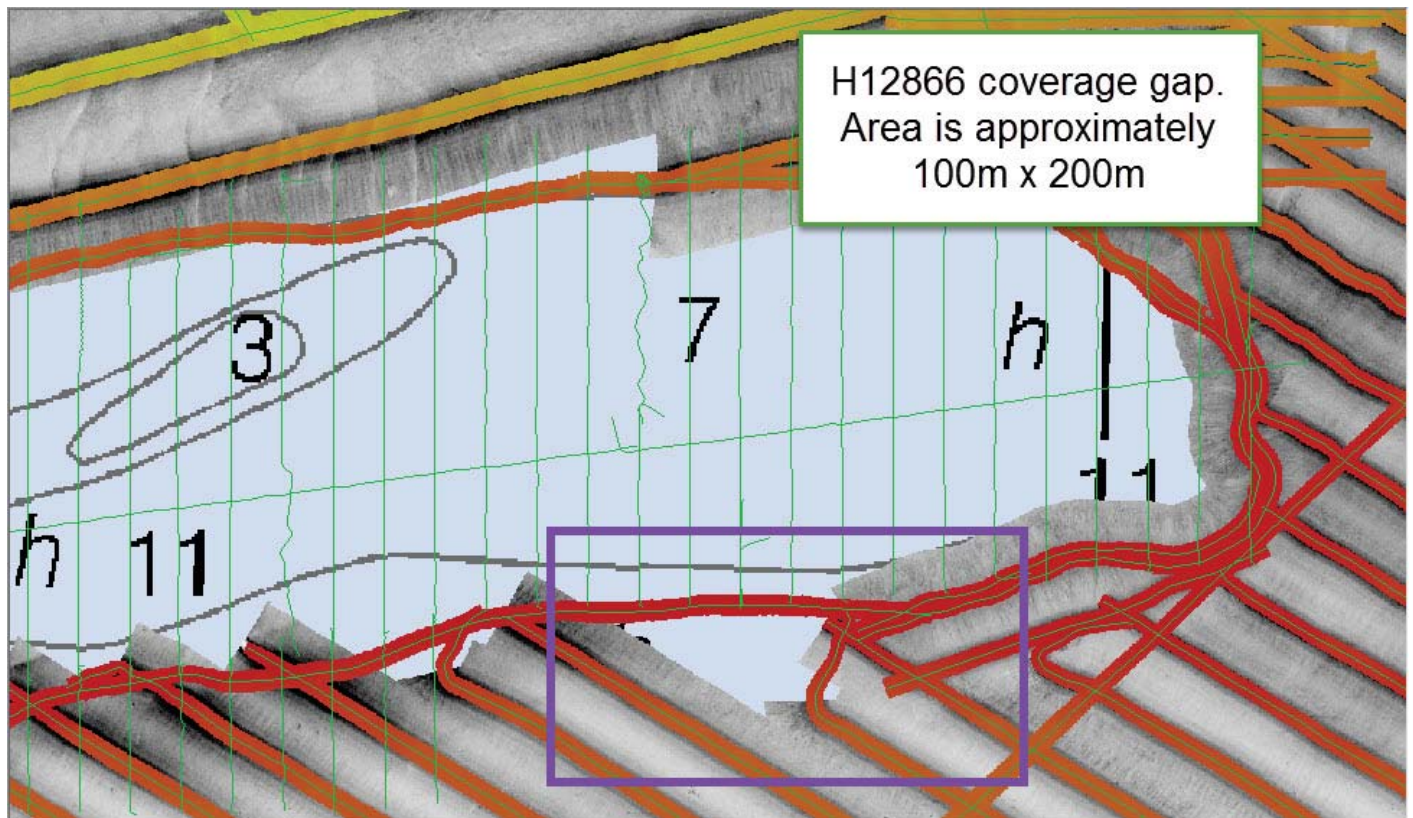


Figure 8: Data gap South of Willoughby Bank.

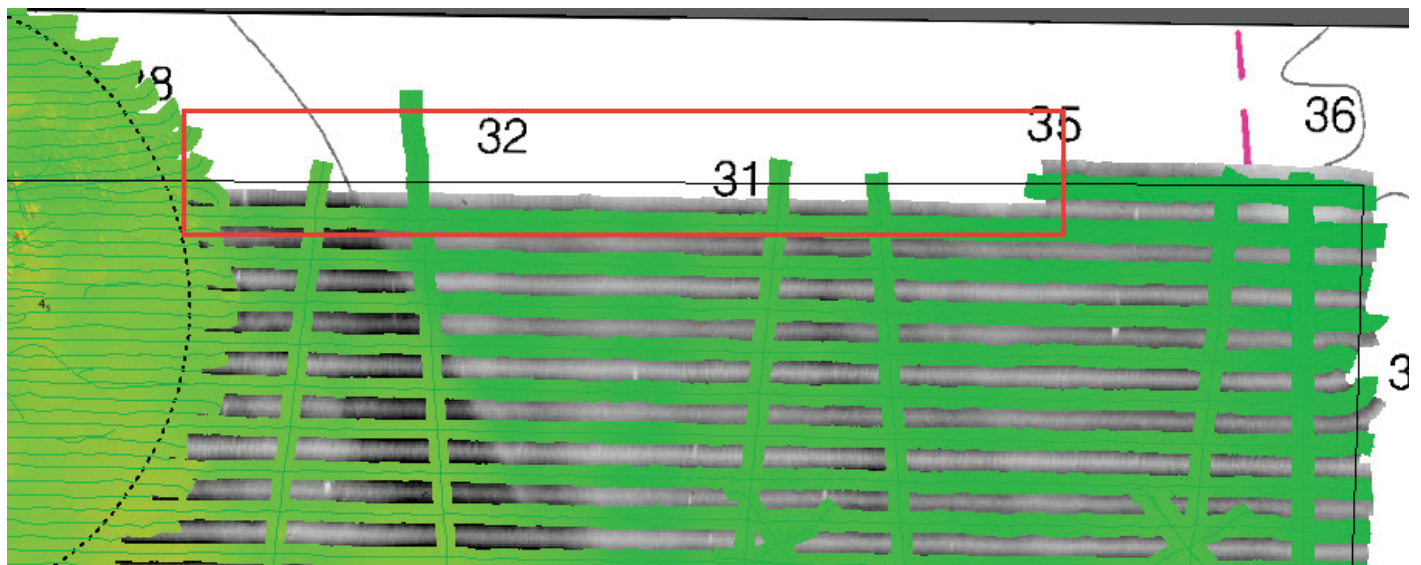


Figure 9: Data gap along northern sheet limit.

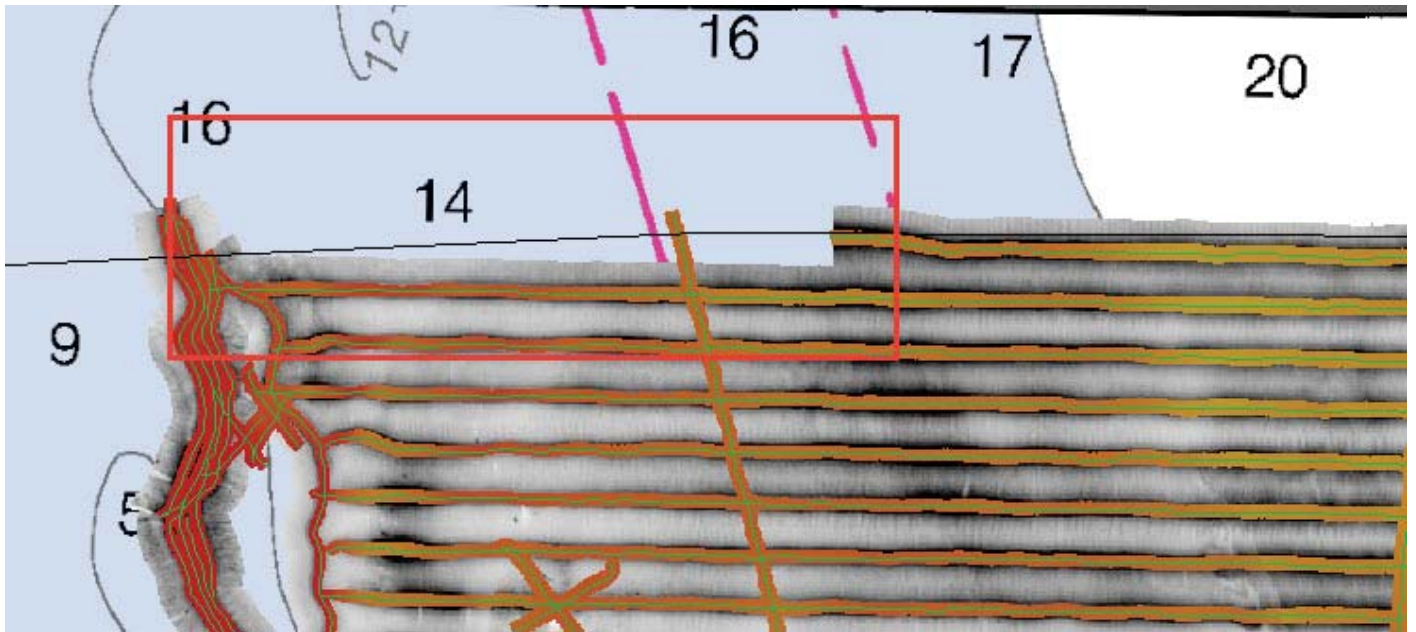


Figure 10: Data gap along northern sheet limit.

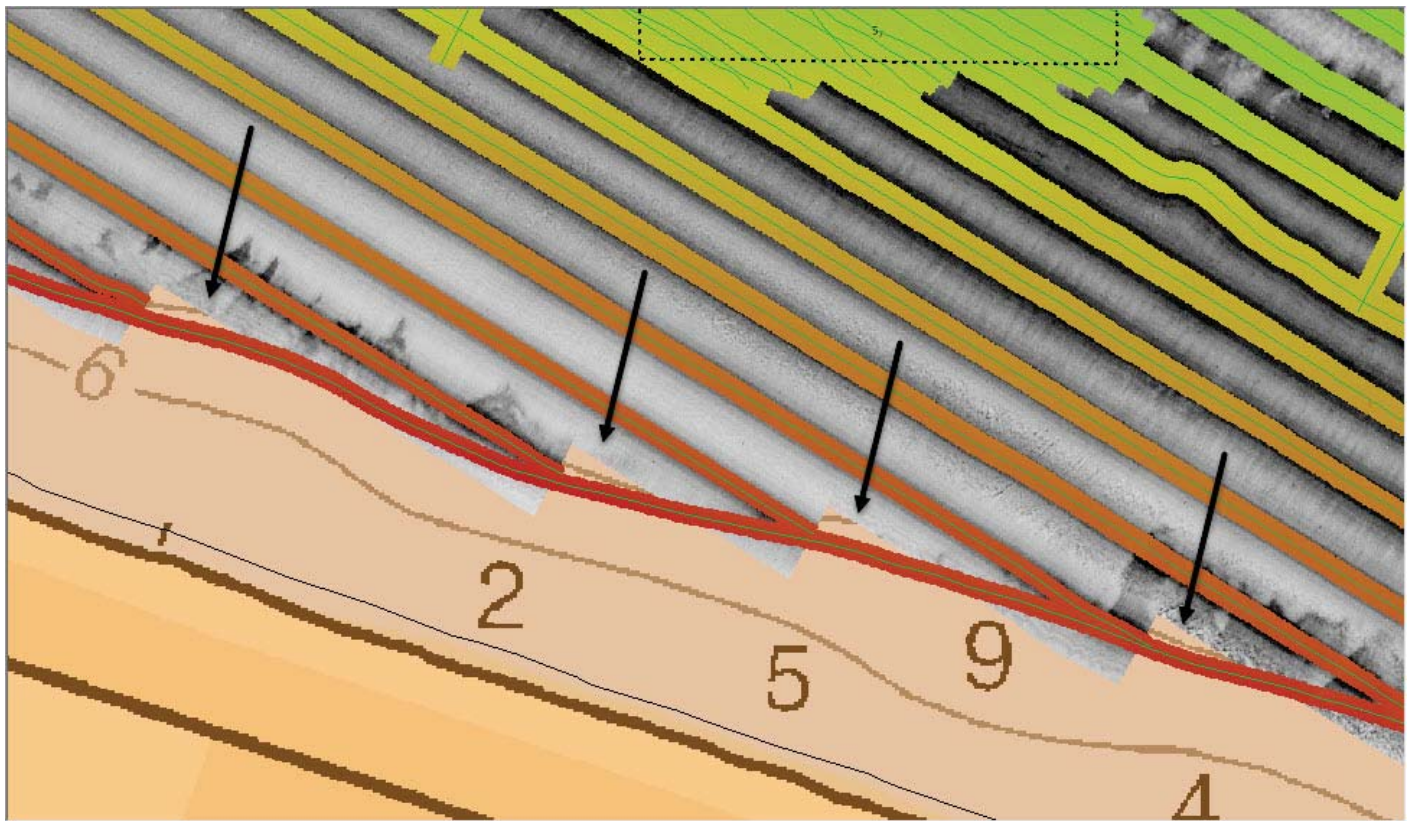


Figure 11: SSS coverage gaps.

## A.2 Survey Purpose

Local constituents have raised concerns over the accuracy of nautical charts in the area, directly affecting their ability to safely navigate. This project will cover approximately 44 square nautical miles. Survey data from this project is intended to supersede all prior survey data in the common area.

## A.3 Survey Quality

The entire survey is adequate to supersede previous data.

## A.4 Survey Coverage

The following table lists the coverage requirements for this survey as assigned in the project instructions:

<b>Water Depth</b>	<b>Coverage Required</b>
Inshore Limit to 4 meters	100 meter Set Line Spacing
Offshore Shoals of depths 1-4 meters	50 meter Set Line Spacing
All waters non-contiguous to shore	Complete Coverage

Survey H12866 deviated from the coverage requirements in the area adjacent to North of Hampton Roads Channel, South of Thimble Shoal. Coverage in this area was requested by the Chief of Party to be acquired with object detection multibeam. Survey H12866 utilized several different methods of coverage; object detection multibeam in Thimble Shoal Channel and from the channel North to the southern portion of Thimble Shoal, 50m line spaced vertical beam inshore of the 12ft depth curve (Figure 12), and 100% SSS (Figure 13) with concurrent multibeam. Multibeam data was gridded to both 1m and 50cm specifications and vertical beam was gridded to 1m specifications, as opposed to the required 4m grid. There are four occurrences of 200% side scan sonar data acquired to aid in feature disproval, but all were later reacquired with object detection multibeam (Figure 14). The HDCS data, mosaic, and geotiff are included with the submission of this project even though they were not used to prove or disprove feature occurrence.

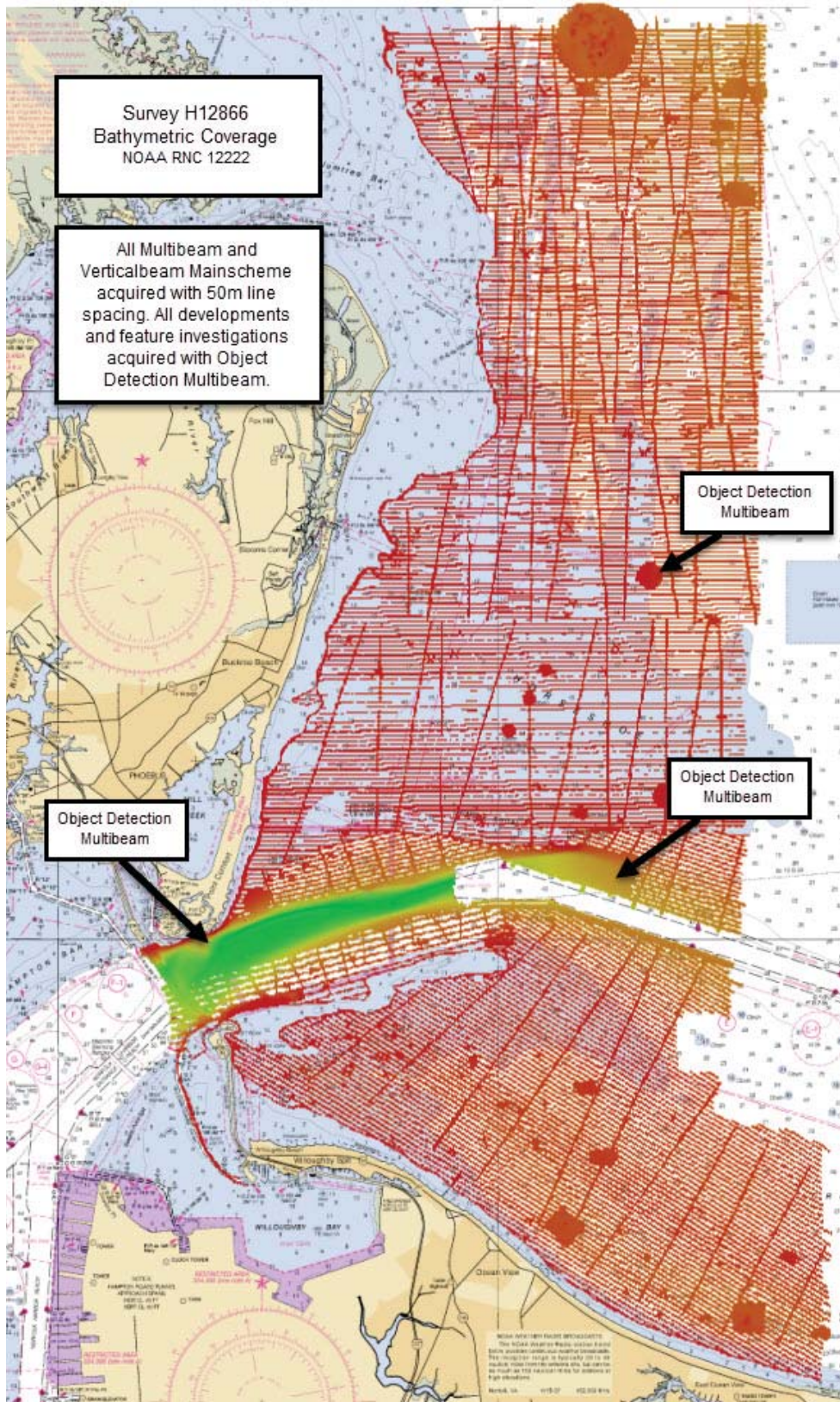


Figure 12: H12866 bathymetric coverage.

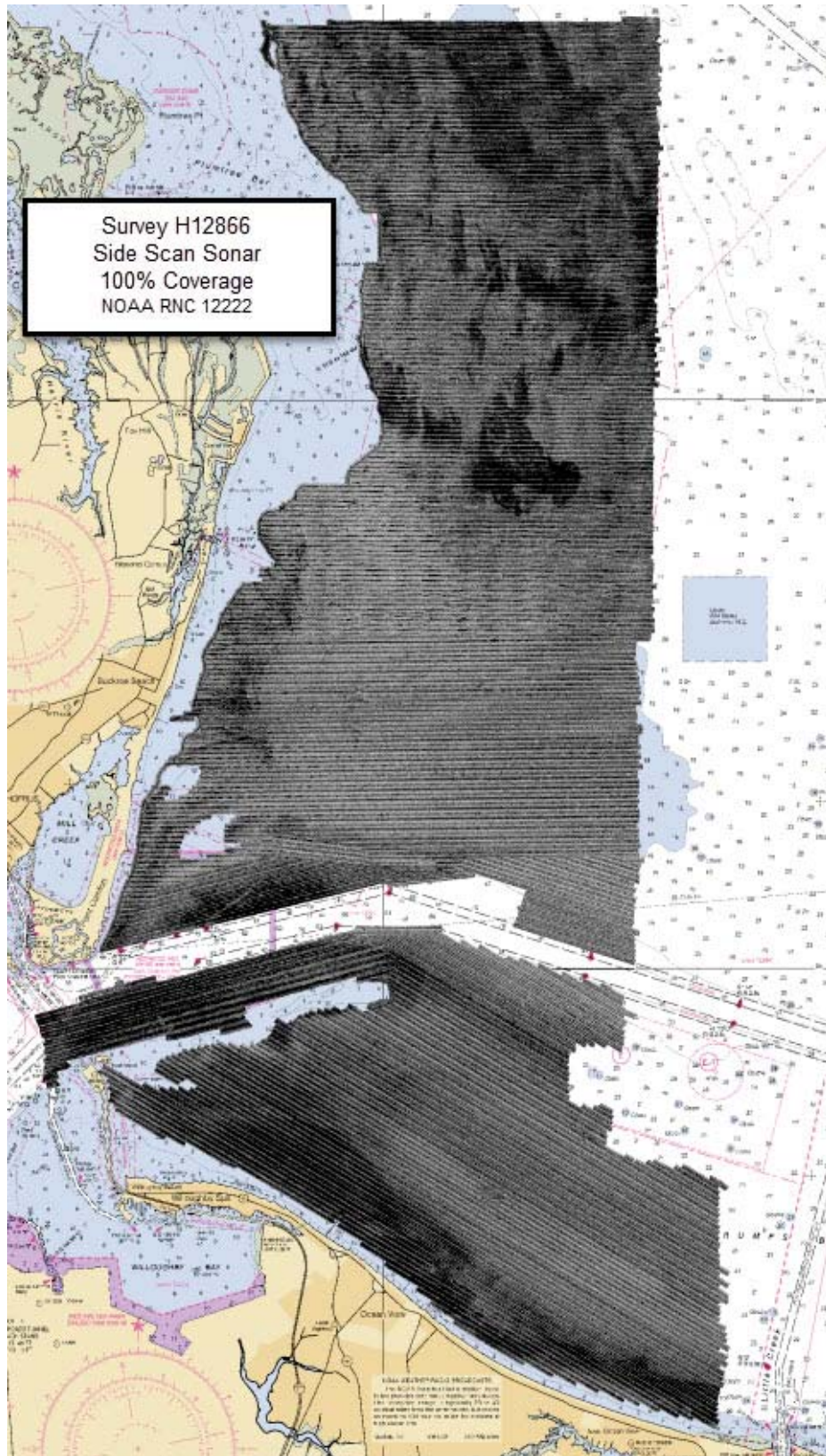


Figure 13: H12866 100% Side Scan Sonar coverage.

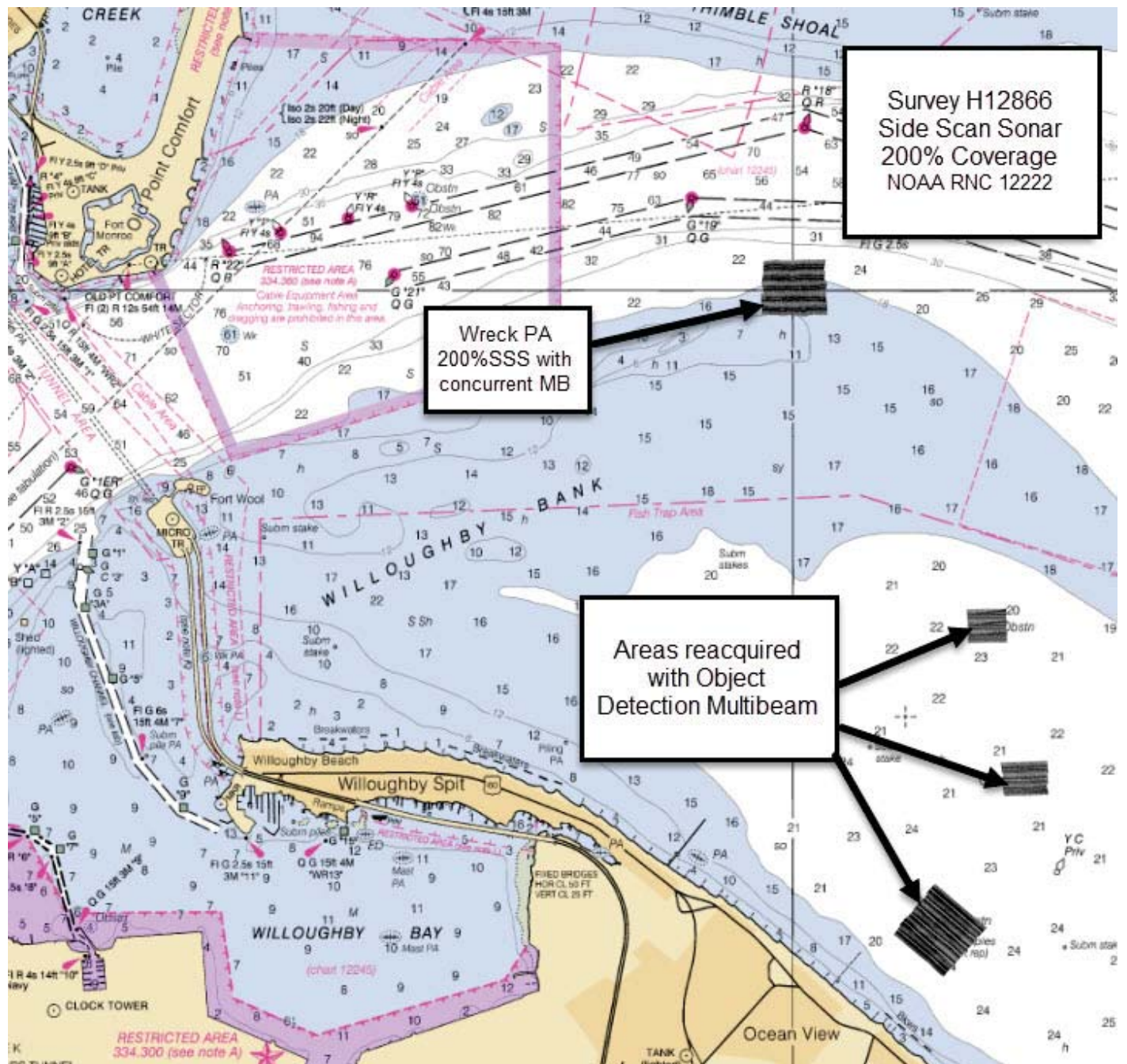


Figure 14: H12866 200% Side Scan Sonar coverage.

### A.5 Survey Statistics

The following table lists the mainscheme and crossline acquisition mileage for this survey:

	<b>HULL ID</b>	<i>3101</i>	<i>3102</i>	<i>Z-1</i>	<i>Z-2</i>	<b><i>Total</i></b>
<b>LNM</b>	<b>SBES Mainscheme</b>	0	0	7.08	193.64	200.72
	<b>MBES Mainscheme</b>	92.19	621.98	0	0	714.17
	<b>Lidar Mainscheme</b>	0	0	0	0	0
	<b>SSS Mainscheme</b>	0	0	0	0	0
	<b>SBES/SSS Mainscheme</b>	0	0	0	0	0
	<b>MBES/SSS Mainscheme</b>	282.28	616.73	0	0	899.01
	<b>SBES/MBES Crosslines</b>	95.38	33.97	0.48	9.98	139.81
	<b>Lidar Crosslines</b>	0	0	0	0	0
<b>Number of Bottom Samples</b>						0
<b>Number Maritime Boundary Points Investigated</b>						0
<b>Number of DPs</b>						0
<b>Number of Items Investigated by Dive Ops</b>						0
<b>Total SNM</b>						44.74

*Table 2: Hydrographic Survey Statistics*

The following table lists the specific dates of data acquisition for this survey:

<b>Survey Dates</b>	<b>Day of the Year</b>
04/04/2016	95
04/06/2016	97

<b>Survey Dates</b>	<b>Day of the Year</b>
04/07/2016	98
04/08/2016	99
04/11/2016	102
04/12/2016	103
04/15/2016	106
04/18/2016	109
04/19/2016	110
04/21/2016	112
04/22/2016	113
04/25/2016	116
04/26/2016	117
04/27/2016	118
04/29/2016	120
05/02/2016	123
05/03/2016	124
05/06/2016	127
05/09/2016	130
05/10/2016	131
05/11/2016	132
05/12/2016	133
05/13/2016	134
05/16/2016	137
05/17/2016	138
05/20/2016	141
05/24/2016	145
05/25/2016	146
05/26/2016	147
05/27/2016	148
05/31/2016	152
06/02/2016	154
06/03/2016	155
06/07/2016	159

<b>Survey Dates</b>	<b>Day of the Year</b>
06/09/2016	161
06/14/2016	166
06/15/2016	167
06/16/2016	168
06/20/2016	172
06/21/2016	173
06/24/2016	176
07/27/2016	209
07/29/2016	211
08/04/2016	217
08/10/2016	223
08/11/2016	224
08/15/2016	228
08/16/2016	229
08/17/2016	230
08/18/2016	231
08/23/2016	236
08/24/2016	237
08/25/2016	238

*Table 3: Dates of Hydrography*

## **B. Data Acquisition and Processing**

### **B.1 Equipment and Vessels**

Refer to the Data Acquisition and Processing Report (DAPR) for a complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods. Additional information to supplement sounding and survey data, and any deviations from the DAPR are discussed in the following sections.

### B.1.1 Vessels

The following vessels were used for data acquisition during this survey:

<b>Hull ID</b>	<b><i>HSL 3101</i></b>	<b><i>HSL 3102</i></b>	<b><i>Z-1</i></b>	<b><i>Z-2</i></b>
<b>LOA</b>	31 feet	31 feet	5.5 feet	5.5 feet
<b>Draft</b>	5.2 feet	5.2 feet	1 feet	1 feet

*Table 4: Vessels Used*

Data was acquired by 3101, 3102, Z1, and Z2. The four platforms collected Reson multibeam echosounder soundings, singlebeam echosounder soundings, multibeam backscatter data, side scan sonar imagery, sound velocity profiles, surface sound speed readings, and position and attitude data.

### B.1.2 Equipment

The following major systems were used for data acquisition during this survey:

<b>Manufacturer</b>	<b>Model</b>	<b>Type</b>
Reson	7125 SV2	MBES
Klein	5000 V1	SSS
Odom	Echotrac CV100	SBES
Applanix	Applanix M/V v4	Positioning and Attitude System
Seabird	Seacat 19+	Conductivity, Temperature, and Depth Sensor
Trimble	SPS461	Positioning System
Reson	SV-70	Sound Speed System

*Table 5: Major Systems Used*

## B.2 Quality Control

### B.2.1 Crosslines

Crosslines acquired for this survey totaled 7.71% of mainscheme acquisition.

The Thomas Jefferson hydrographic survey launches and autonomous survey vessels collected 139.81 linear nautical miles of MBES and VBES crosslines, equating to 7.71% of mainscheme MBES and VBES data. As section 5.2.4.3 of the 2016 HSSD outlines, combined vertical beam and multibeam crossline mileage for mixed echosounder set line spacing surveys must meet the minimum requirement of 8% of mainscheme mileage. Survey H12866 does not meet this specification. Crosslines were compared to mainscheme by differencing a 1m resolution mainscheme surface to a 1m resolution crossline surface in CARIS BASE Editor 4.2. 99.97% of differenced nodes agree within 0.5m. The mean was 0.0m and the standard deviation was 0.1m (Figure 15). The large values of minimum and maximum differences of -3.2m and 2.9m respectively, stem from areas of high relief such as the northern fish haven. The difference surface was filtered to specifically examine the locations of values from -3.2m to -0.49m and 0.49m to 2.9m. No outstanding or systemic errors were noted in the data.

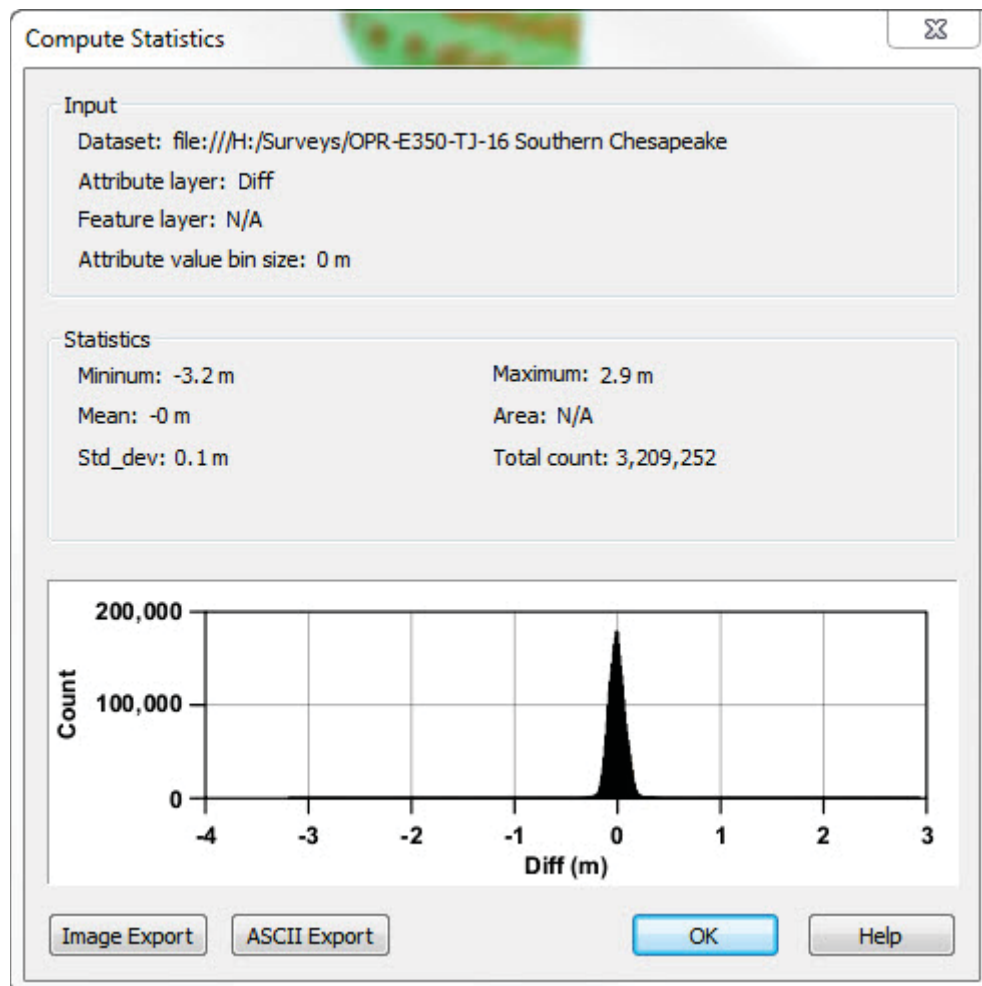


Figure 15: Results of surface differencing between mainscheme and crossline surfaces.

### B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning	Method
0 meters	0.092 meters	ERS via VDATUM

*Table 6: Survey Specific Tide TPU Values.*

Hull ID	Measured - CTD	Measured - MVP	Surface
3101	4 meters/second	0 meters/second	0.2 meters/second
3102	4 meters/second	0 meters/second	0.2 meters/second
Z-1	4 meters/second	0 meters/second	0.2 meters/second
Z-2	4 meters/second	0 meters/second	0.2 meters/second

*Table 7: Survey Specific Sound Speed TPU Values.*

Total Propagated Uncertainty values for survey H12866 were derived using a combination of: real time uncertainties for vessel motion; a priori values for equipment and vessel characteristics; an a priori value for the separation model used to reduce soundings to chart datum; and field assigned values for sound speed uncertainties. The realtime uncertainties for vessel motion include roll, pitch, gyro, navigation, and elevation. The uncertainties in these measurements were recorded as part of the POSpac Real Time Kinematic position solution, as well as the POSpac smartbase IAPPK solution, and were applied to the soundings via an SBET RMS file generated by Applanix POSpac 7.2. Uncertainties for sonar mounting and vessel speed were based on Appendix 4, table 4.9 of the NOAA Field Procedures Manual (ed 2014). These uncertainties were applied to the data via the CARIS HIPS Vessel File. The uncertainty associated with the VDatum separation model was supplied by the Hydrographic Surveys Division's Operations Branch, and is listed under Zoning (Table 6). Finally, the uncertainty associated with sound speed measurements was based on the frequency and location of CTD casts, in accordance with the guidance set by Appendix 4 of the FPM (ed2014) (Table 7).

Total Propagated Uncertainty was then evaluated to ensure compliance with section 5.1.3 of NOAA's Hydrographic Surveys Specifications and Deliverables. First, the maximum allowable uncertainty for each node was calculated using the equation:  $-\text{Uncertainty}/((0.5^2 + ((\text{Depth} * 0.013)^2))^0.5)$ . Second, the ratio between actual uncertainty and maximum allowed uncertainty was found for each node. The resulting 'TVU\_QC' layer was filtered using a color map to show any areas where actual uncertainty exceeded the maximum allowed uncertainty. Additionally the Pydro CSAR QA tool was utilized for each surface to be submitted.

For grid H12866\_MB\_50cm\_MLLW\_Final.csar, 99.9% of nodes passed uncertainty standards (Figure 16). 15 nodes out of 222,903,224 exceed allowable TVU tolerances. All nodes out of TVU allowance are confined to an area around the Hampton Roads Bridge Tunnel at 36-59-35.584 N and 076-18-39.893 W

(Figure 17). These were reviewed, and the excessive uncertainty appears to be associated mainly with the slopes of 1-2m bedforms in that locale. Refraction error associated with sound velocity profiles may also be a minor contributor. The 50cm gridded surface appears to be unaffected and shows no sign of honoring the outlying nodes.

For grid H12866\_MB\_1m\_MLLW\_Final.csar, 99.9% of nodes passed uncertainty standards (Figure 18). 2,663 nodes out of 3,122,257 million exceed allowable TVU tolerances. Most of these nodes are confined to the area south of Old Point Comfort in and along the periphery of Thimble Shoal Channel. These were reviewed, and the excessive uncertainty appears to be associated mainly with refraction error associated with sound velocity profiles. As seen in Figures 19 and 20, sound velocity profile depths for this day did not extend to the deepest bathymetry collected and is at the root of the TVU bust.

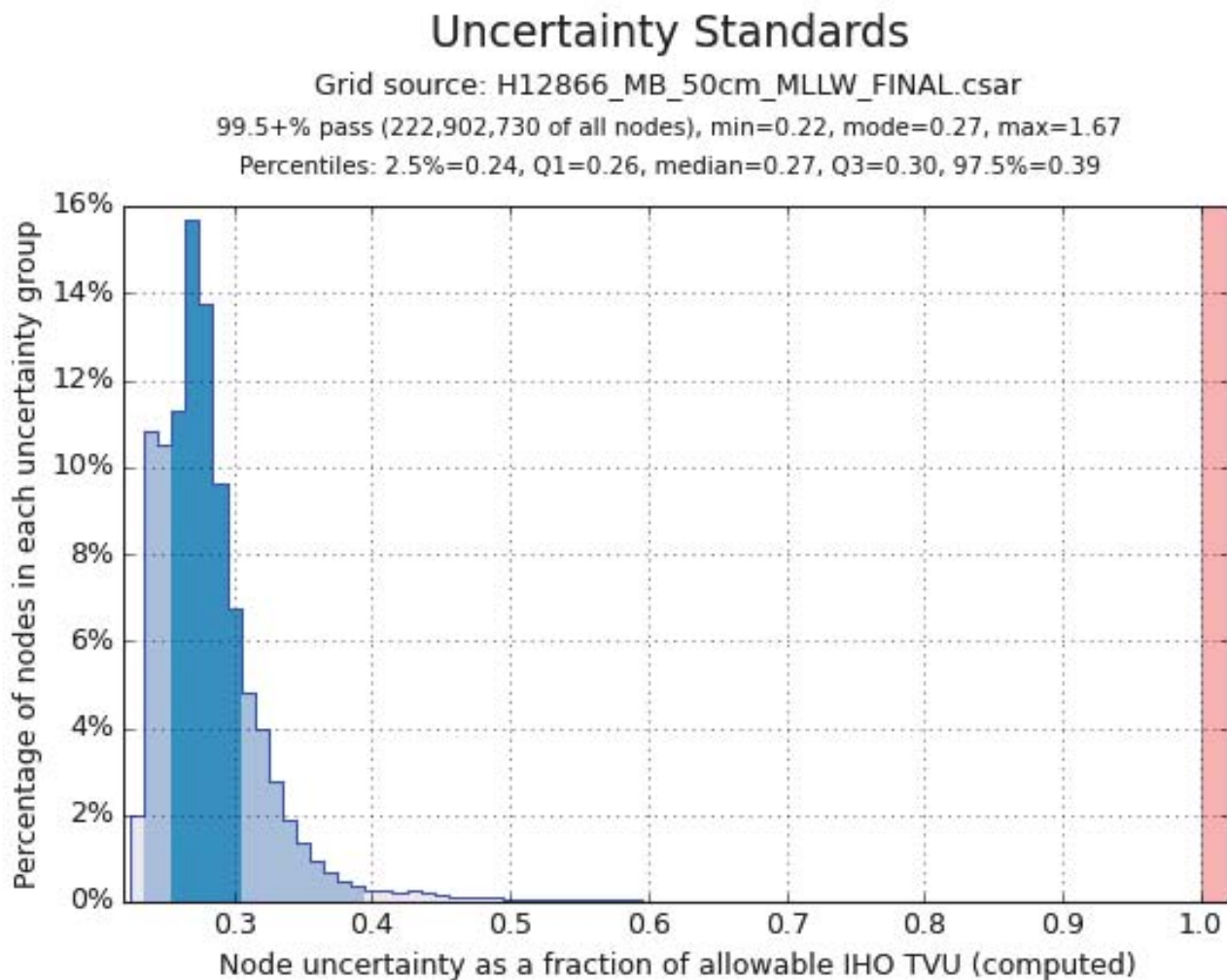


Figure 16: H12866\_MB\_50cm\_MLLW\_Final Uncertainty Standards statistics utilizing Pydro CSAR QA.

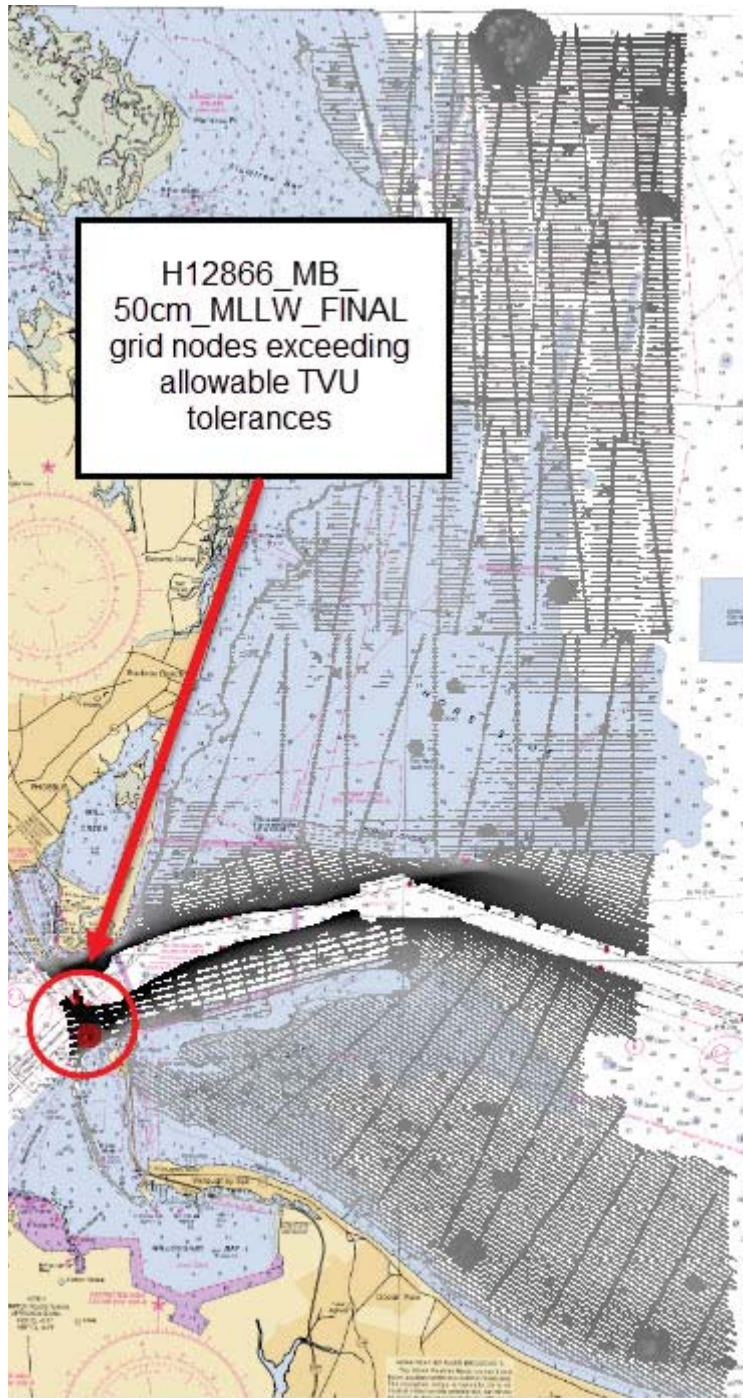


Figure 17: Area of grid nodes exceeding allowable TVU for H12866\_MB\_50cm\_MLLW.

## Uncertainty Standards

Grid source: H12866\_MB\_1m\_MLLW\_FINAL.csar

99.5+% pass (3,119,430 of all nodes), min=0.26, mode=0.30, max=1.65

Percentiles: 2.5%=0.28, Q1=0.33, median=0.42, Q3=0.56, 97.5%=0.83

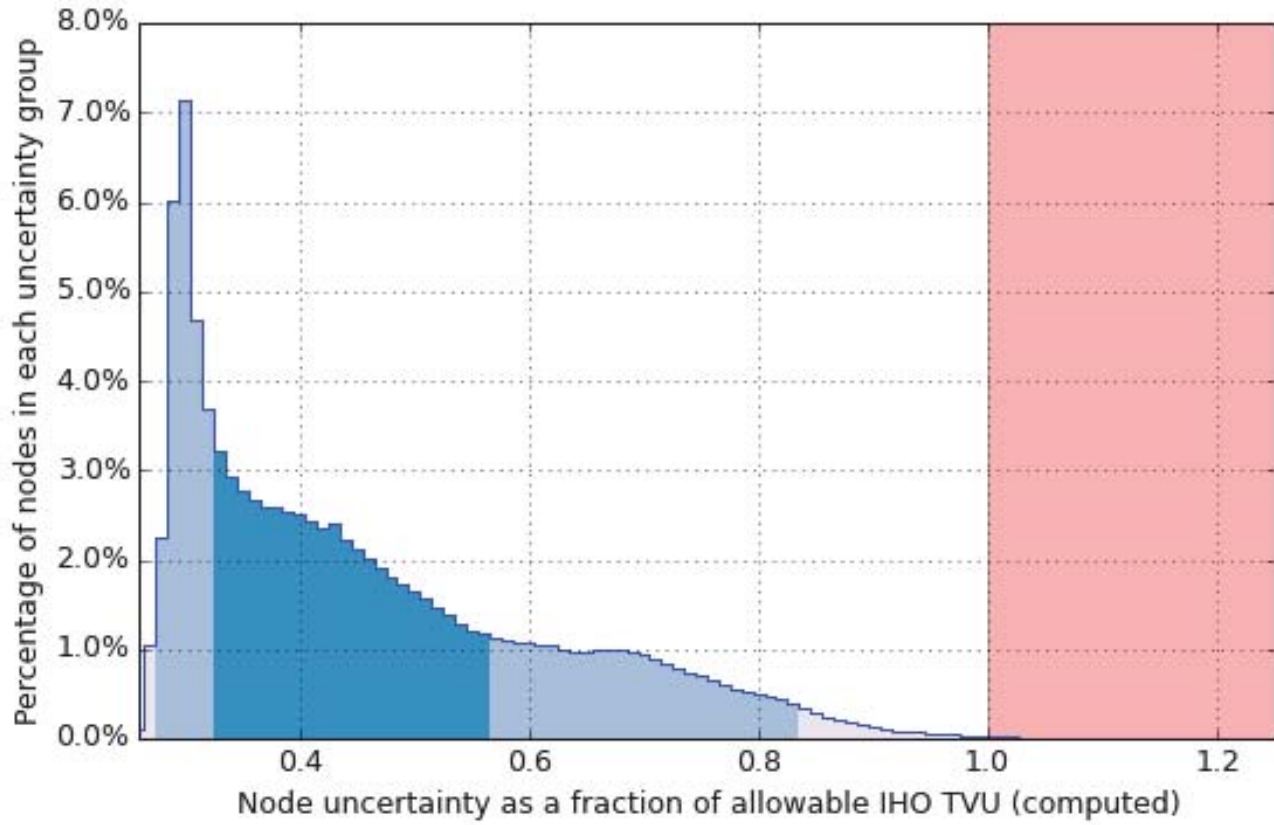


Figure 18: H12866\_MB\_1m\_MLLW\_Final Uncertainty Standards statistics utilizing Pydro CSAR QA.

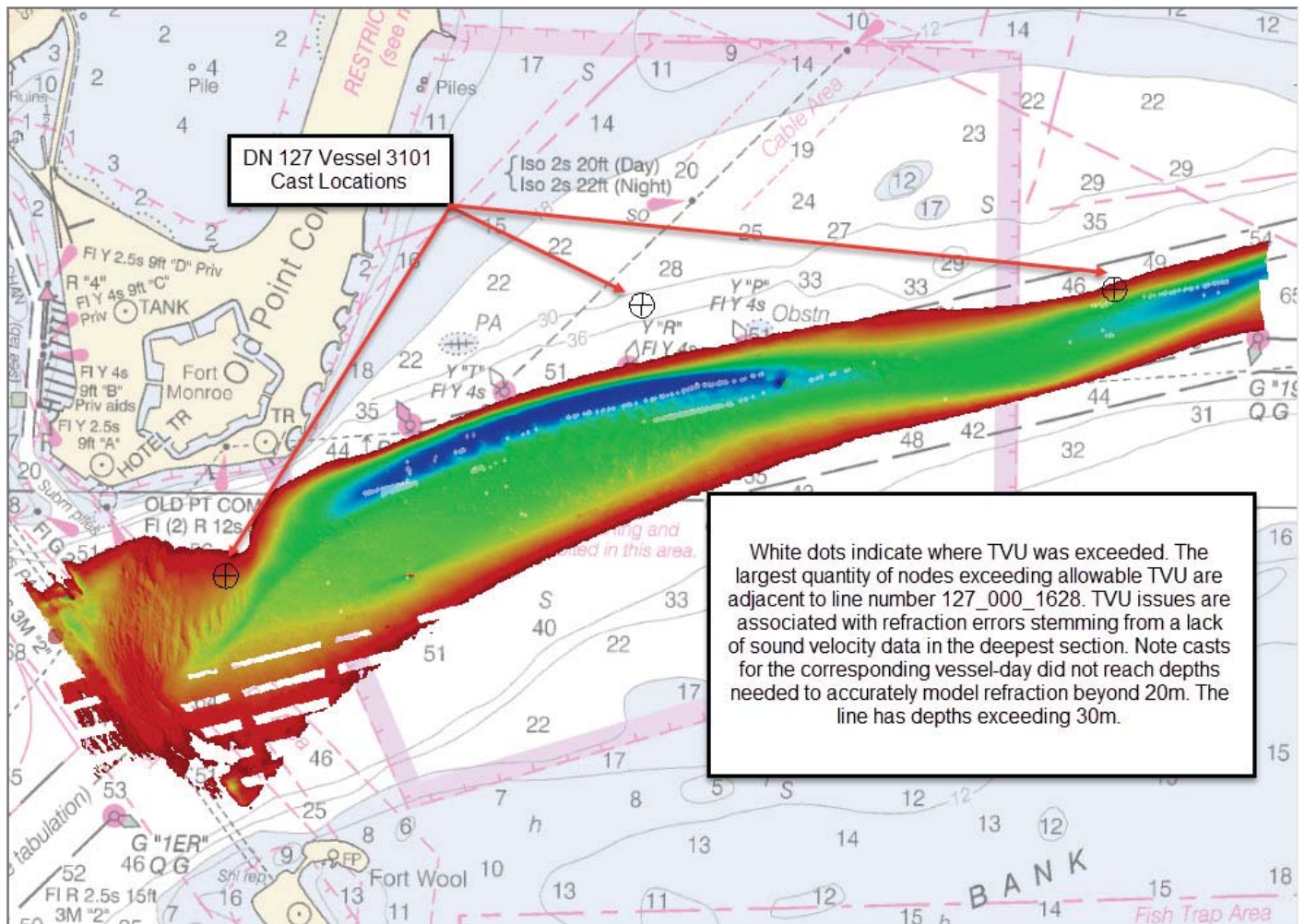
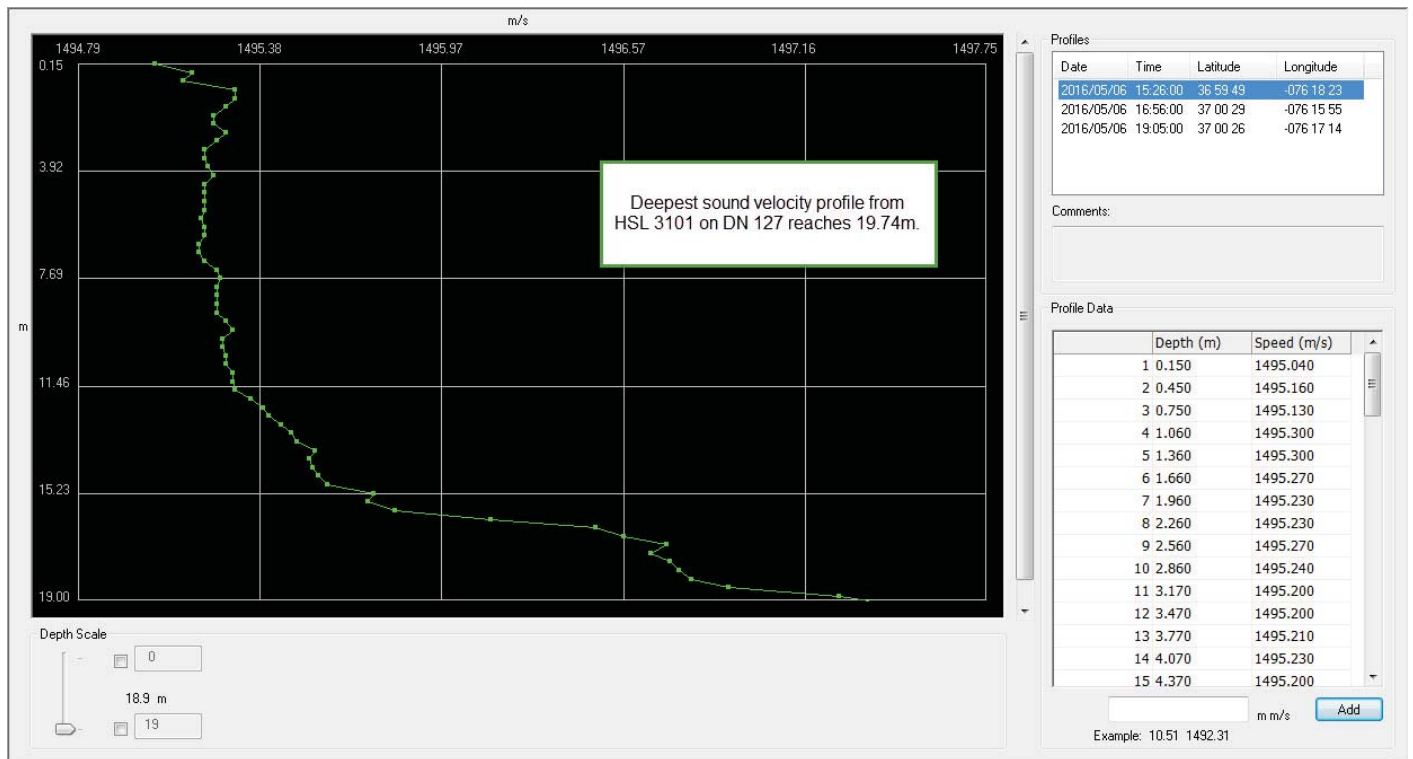


Figure 19: Area of grid nodes exceeding allowable TVU for H12866\_MB\_1m\_MLLW.



*Figure 20: Deepest sound velocity profile from HSL 3101 on DN127 (<20m) applied to data with depths greater than 30m.*

### B.2.3 Junctions

No contemporary junction surveys exist in the area of H12866.

There are no contemporary surveys that junction with this survey.

### B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the quality control section of the DAPR.

### B.2.5 Equipment Effectiveness

There were no conditions or deficiencies that affected equipment operational effectiveness.

### B.2.6 Factors Affecting Soundings

There were no other factors that affected corrections to soundings.

### B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Approximately every 4 hours

CTD casts performed by launches 3101 & 3102 were taken at a maximum of 4 hour intervals; or more frequently in areas where sound speed changed by greater than 2m/sec. If 3101 or 3102 was tending either Z-1 or Z-2, the launch would take a singlebeam specific cast and apply it to the proper ASV's master sound velocity file. Figure 21 shows acquired data colored by sound velocity cast.



*Figure 21: H12866 geographic distribution of sound velocity casts from 3101 and 3102.*

## B.2.8 Coverage Equipment and Methods

Refer to section A.4 and B.1.2 of this report for survey equipment and methods used to meet coverage requirements for this project.

## B.2.9 Outer Beam Filtering

Hydrographic Survey Launch 3101 data exhibited high uncertainty in the outer beams, as data was collected at maximum swath angle. A filter was created in CARIS 9.1 HIPS to reject all data greater than 65 degrees from nadir for both port and starboard beams in the bulk of the multibeam data collected by 3101. Ultimately, the overall mean uncertainty values for the survey were lowered by a significant amount after filtering was applied.

## B.3 Echo Sounding Corrections

### B.3.1 Corrections to Echo Soundings

All data reduction procedures conform to those detailed in the DAPR.

### B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

## B.4 Backscatter

Raw backscatter was logged as a 7k file and was processed by the field unit. A backscatter project was created for each vessel and will be submitted as a deliverable with this report.

## B.5 Data Processing

### B.5.1 Primary Data Processing Software

The following software program was the primary program used for bathymetric data processing:

Manufacturer	Name	Version
Caris	HIPS and SIPS	9.1.2

*Table 8: Primary bathymetric data processing software*

The following software program was the primary program used for imagery data processing:

Manufacturer	Name	Version
Fledermaus	FMGT	7.6.4

*Table 9: Primary imagery data processing software*

The following Feature Object Catalog was used: NOAA Profile V\_5\_4

### B.5.2 Surfaces

The following surfaces and/or BAGs were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12866_MB_50cm_MLLW_FINAL	CUBE	0.5 meters	0.81 meters - 20.00 meters	NOAA_0.5m	Complete MBES
H12866_MB_1m_MLLW_FINAL	CUBE	1 meters	17.59 meters - 31.26 meters	NOAA_1m	Object Detection
H12866_VB_1m_MLLW_FINAL	CUBE	1 meters	-0.80 meters - 16.58 meters	NOAA_1m	MBES TracklineSBES Set Line Spacing
H12866_SSS_100_1m	SSS Mosaic	1 meters	0 meters - 0 meters	N/A	100% SSS
H12866_SSS_200_1m	SSS Mosaic	1 meters	0 meters - 0 meters	N/A	200% SSS

*Table 10: Submitted Surfaces*

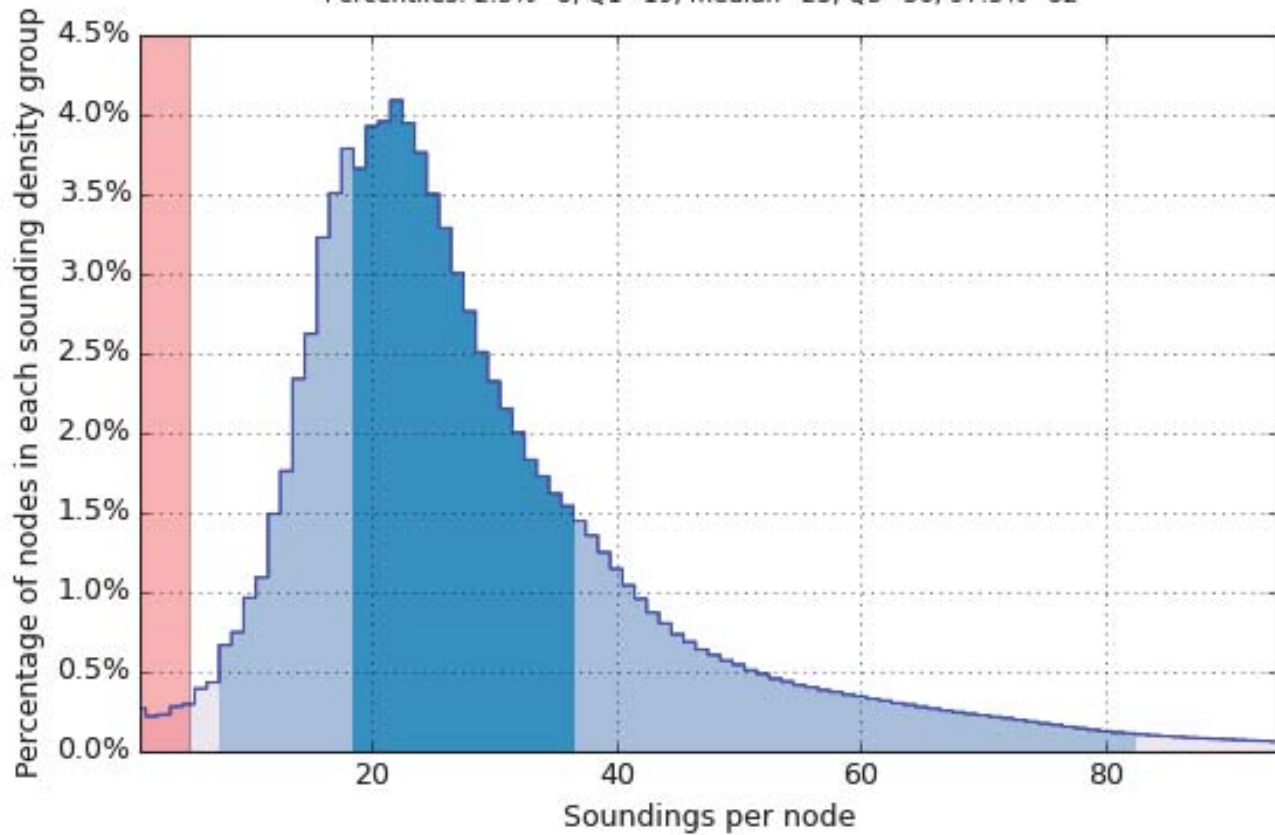
Submitted multibeam grids for survey H12866 exceed the full coverage requirements assigned by the project instructions. Both the 1m and 50cm surfaces meet object detection requirements for density as described in section 5.2.2.2 of the HSSD 2016 (Figures 22 and 23). For further discussion, see section A.4 of this report.

## Object Detection Coverage

Grid source: H12866\_MB\_50cm\_MLLW\_FINAL.csar

99% pass (220,667,051 of all nodes), min=1.0, mode=22, max=3301.0

Percentiles: 2.5%=8, Q1=19, median=25, Q3=36, 97.5%=82



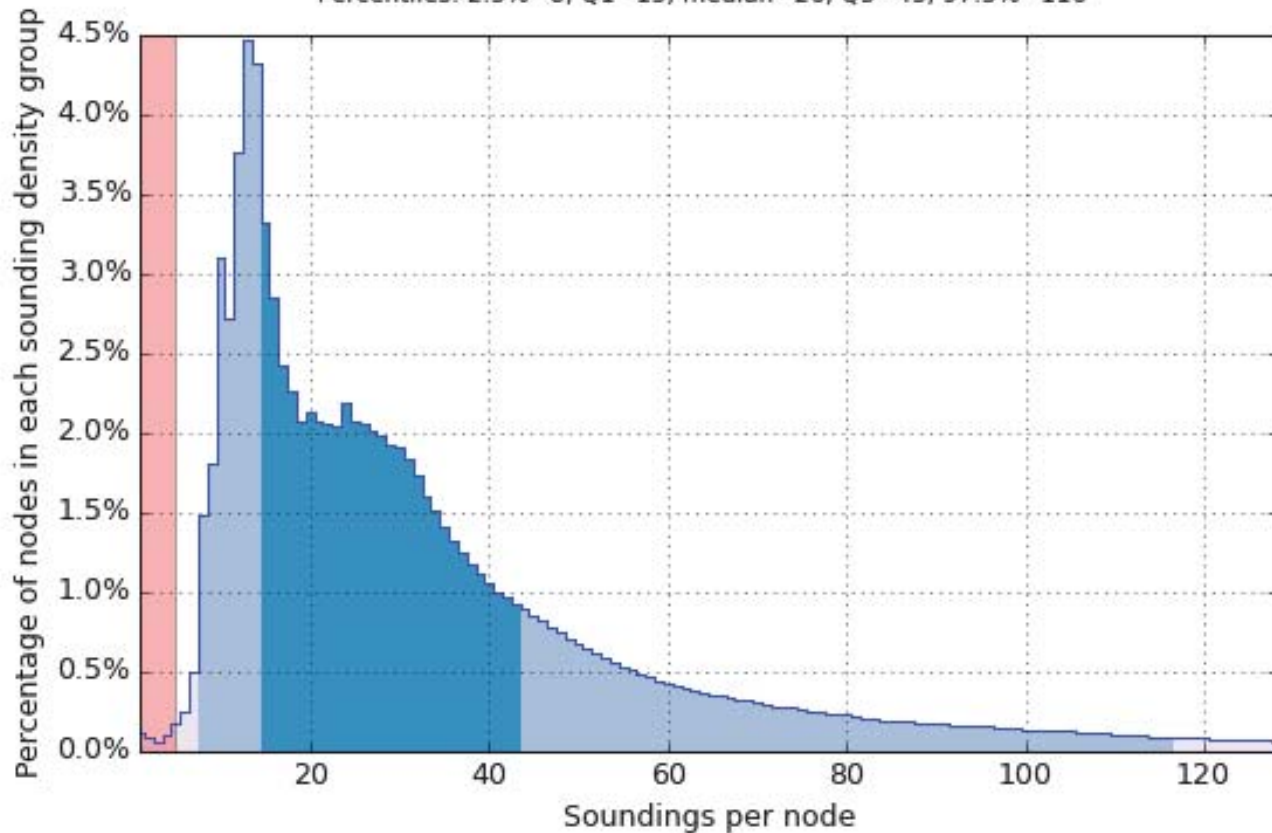
*Figure 22: 98.7% of H12866\_MB\_50cm\_MLLW\_FINAL passes density requirements for object detection multibeam.*

## Object Detection Coverage

Grid source: H12866\_MB\_1m\_MLLW\_FINAL.csar

99.5+% pass (3,111,167 of all nodes), min=1.0, mode=13, max=507.0

Percentiles: 2.5%=8, Q1=15, median=26, Q3=43, 97.5%=116



*Figure 23: 99.5% of H12866\_MB\_1m\_MLLW\_FINAL passes density requirements for object detection multibeam.*

### B.5.3 Survey Lines With No Delayed Heave

Several lines of multibeam data exist within survey H12866 that have no associated delayed heave.

Lines from launch 3101 missing delayed heave are: 118\_138\_1459, 161\_388\_1429, 209\_301\_1734, 209\_347\_1835, and 228\_316\_1632. Lines from launch 3102 missing delayed heave are: 145\_319\_1337, 145\_322\_1426, 145\_320\_1408, 145\_318\_1320, 145\_321\_1352, 172\_224\_1823, and 166\_401\_1405.

Hypothetically, there is a correlation between line length and the ability to incorporate delayed heave data into the line information. Message from CARIS: "WARNING: Delayed heave was selected for the above lines, but no data was found. Only heave has been applied". The Hydrographer assesses the effect on data collected for which there is no delayed heave applied appears to be negligible.

The autonomous survey vessels used to acquire vertical beam data have no heave sensor, and therefore, no heave data. Positioning correctors applied to vertical beam data are derived from a Real Time Kinematic solution.

#### **B.5.4 Surface Fliers**

H12866\_MB\_1m\_MLLW\_FINAL grid scanned for fliers at 50cm tolerance yielded 18 potential fliers. After review and directed editing, remaining flagged nodes were determined to be valid objects.

H12866\_MB\_50cm\_MLLW\_FINAL grid scanned for fliers at 50cm tolerance yielded 2526 potential fliers. 2475 of these exist within two fish havens expected to have significant relief. 2381 are located within the northernmost fish haven, 76 are located in the southern fish haven. The remaining 69 flagged fliers were reviewed and deemed valid objects.

H12866\_VB\_1m\_MLLW\_FINAL grid scanned for fliers at 50cm tolerance yielded 0 potential fliers.

Several of the initially flagged fliers were particularly difficult to identify as the flier itself could only be observed in the 3-D subset view and not 2-D subset. CARIS HIPS 9.1.2 is unable to resolve some isolated surface areas in 2-D subset and reviewers should be aware of this bug.

## **C. Vertical and Horizontal Control**

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying HVCR.

### **C.1 Vertical Control**

The vertical datum for this project is Mean Lower Low Water.

#### Traditional Methods Used:

TCARI

The following National Water Level Observation Network (NWLON) stations served as datum control for this survey:

<b>Station Name</b>	<b>Station ID</b>
Kiptopeke	8632200
Yorktown	8637689
Sewells Point	8638610
Chesapeake Bay Bridge Tunnel	8638863

*Table 11: NWLON Tide Stations*

<b>File Name</b>	<b>Status</b>
8662200.tid	Final Approved
8637689.tid	Final Approved
8638610.tid	Final Approved
8638863.tid	Final Approved

*Table 12: Water Level Files (.tid)*

<b>File Name</b>	<b>Status</b>
E350TJ2016.tc	Final

*Table 13: Tide Correctors (.zdf or .tc)*

A request for final approved tides was sent to N/OPS1 on 08/30/2016. The final tide note was received on 09/13/2016.

ERS Methods Used:

ERS via VDATUM

Ellipsoid to Chart Datum Separation File:

OPR-E350-TJ-16\_ExtendedSEP

## C.2 Horizontal Control

The horizontal datum for this project is WGS84.

The projection used for this project is 18N.

The following PPK methods were used for horizontal control:

Smart Base

A RTK base station was installed on top of the Atlantic Hydrographic Branch in Norfolk, VA. For further information, reference the accompanying HVCR with this report.

## D. Results and Recommendations

### D.1 Chart Comparison

Surveyed soundings were compared to existing charted soundings by two separate methods to ensure agreement in results. The first method differenced surveyed soundings to an interpolated grid of existing ENC soundings in BASE Editor 4.2. The second method utilized exported ASCII data, both surveyed soundings and ENC soundings, from BASE Editor 4.2 and assessed comparison of surveyed soundings to charted soundings. The areas of greatest change were then flagged in a feature layer populated with cartographic symbols. The resultant generalized cartographic symbol layer accurately portrayed areas of shoaling and significant change, while the most significant difference points and areas (most likely to be dangers to navigation, or DtoNs) were flagged in a separate layer. The area encompassed within survey H12866 showed relative stability to previously charted data. However, areas of shifting shoals pose dangers throughout, as noted in the Danger to Navigation Reports located in Appendix II and submitted with this report. Both methods of assessing changes to charted bathymetry resulted in a good visual representation of change.

In the area immediately South of Thimble Shoal Light, a shoal has developed with depths ranging up to 9m shoal to charted soundings. It appears a south easterly shift in Thimble Shoal is the primary contributor to this accretion (Figure 24). The United States Army Corps of Engineers, Norfolk District has scheduled dredging this area for early 2017 and will be using the removed material to renourish the beach along bay-side sections of Willoughby Spit (ref Appendix II of this report).

The easternmost reach of Willoughby Bank has shifted southeast by approximately 140m, taking along with it the shoalest of the charted soundings (Figure 25). This shift resulted in the submission of DtoN Report 1,

which can be found in Appendix II of this report. At the time this report was submitted, the effected charts have been updated with the instance of shoaling described in DtoN Report 1.

Another significant occurrence of shoaling has developed in the vicinity of 36-59-27.525N 076-17-38.990W. A surveyed sounding of 15ft was found in the vicinity of a 22ft charted sounding (Figure 26). This was determined not to be a danger to navigation.

Other significant areas of shoaling have occurred along the southern portion of the Hampton Roads Bridge Tunnel in the vicinity of Fort Wool. Willoughby Channel, to the West, is known to have dangerous shoaling around 36-58-52.166N 076-18-38.438W (Figure 27). Shoaling was reported in DtoN Report 1 found in Appendix II of this report. A supplementary Aid to Navigation had been placed prior to this survey, and the charted depth curve has been updated to reflect this change, but danger of grounding still exists. At the time this report was submitted, the effected charts have been updated with the instance of shoaling described in DtoN Report 1.

On the North end of the Hampton Roads Bridge Tunnel and along the shoreline of Old Point Comfort, surveyed depths are shoal to charted soundings on the magnitude of 2-5m (Figure 28).

In the northern section of the survey, shoals have shown general eastward movement on the magnitude of 75m to 140m from charted positions (Figure 29). Two dangers to navigation were submitted in this area: DtoN Report 3 and DtoN Report 5 (Appendix II). DtoN 3 exists at 57-06-14.186N 076-15-12.590W where a 2ft sounding was surveyed 120m outside of the charted 6ft contour, in between a 19ft and 18ft charted sounding (Figure 30). DtoN 5 is within the Back River Channel where shoaling is threatening the safe passage of the channel (Figure 31). At the time this report was submitted, the effected charts have been updated with the instances of shoaling described in both DtoN Report 3 and DtoN Report 5.

Both large fish havens within the survey limits have depths shoal to charted authorized minimum depths. Two DtoNs were submitted from surveyed depths within the northern fish haven: DtoN 2 and DtoN 4. DtoN 2 is a pile of debris with a least depth of 8ft; DtoN 4 is a pile of debris with a least depth of 11ft (Figure 32). At the time this report was submitted, the effected charts have been updated with the instances of shoaling described in both DtoN Report 2 and DtoN Report 4. In the southern fish haven, one debris pile exceeds authorized minimum by less than 0.5ft. An uncharted shipwreck with a least depth of 21.59ft exists along the northern border of the fish haven (Figure 33).

As the shoals have shifted, so too have the deeps. In general, as the faces of the shoals have shifted eastward the surveyed depths behind them now read deep to the charted soundings. Two areas found to be deeper than charted are: an area of scour under the Hampton Roads Bridge Tunnel (possibly due to construction work on the tunnel) and an area where sand has been physically removed for beach renourishment 3km East of Buckroe Beach.

With the exception of the shoaling and other objects noted above, the bathymetry of survey H12866 agrees well with existing charted information. For further analysis of charted and new features, refer to the Final Feature File submitted with this report.

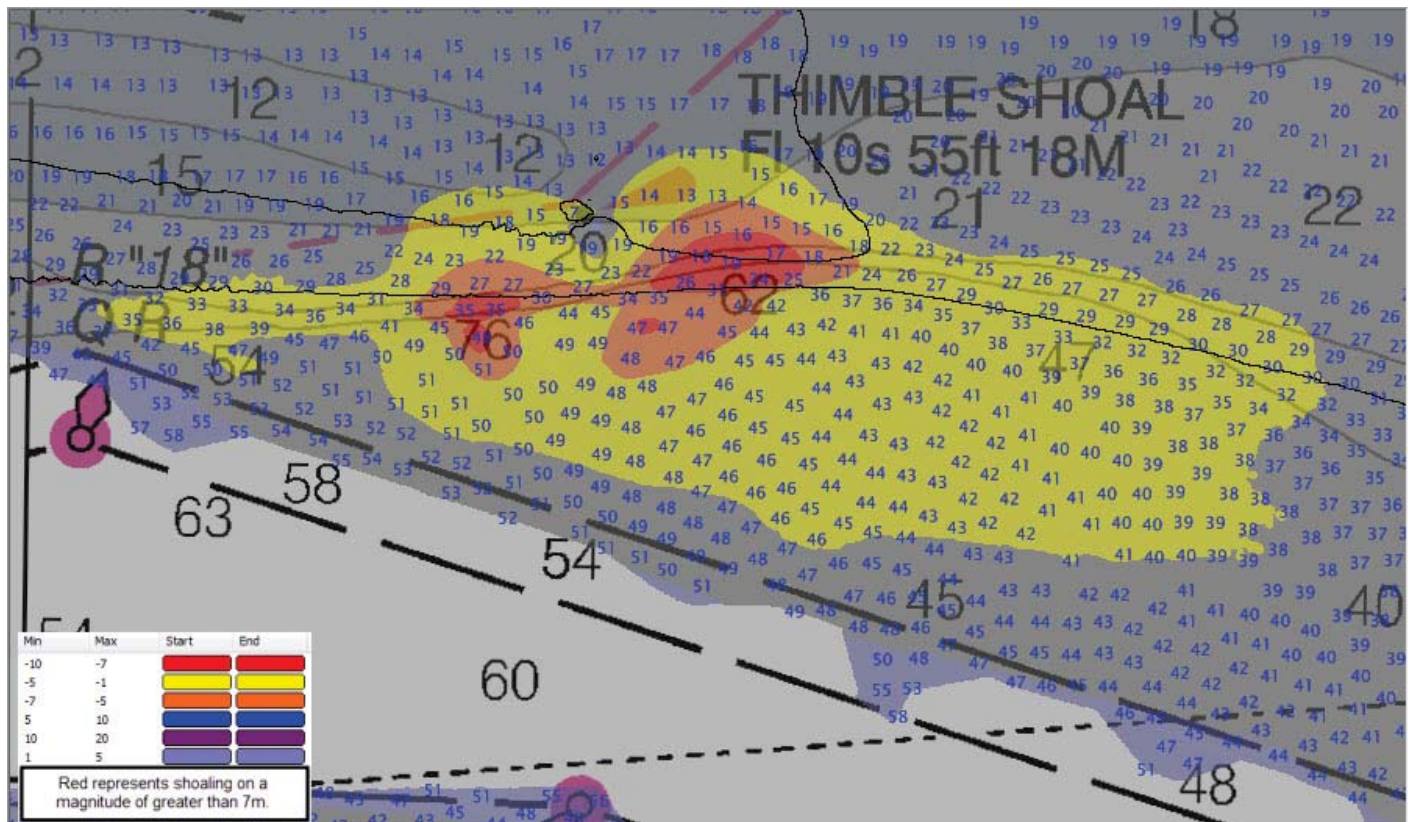


Figure 24: Thimble Shoal has shifted in a southeasterly direction causing a mass of sand to accrete in the vicinity of Thimble Shoal Light. This area will be a material source for a beach renourishment project undertaken by the USACE in early 2017.

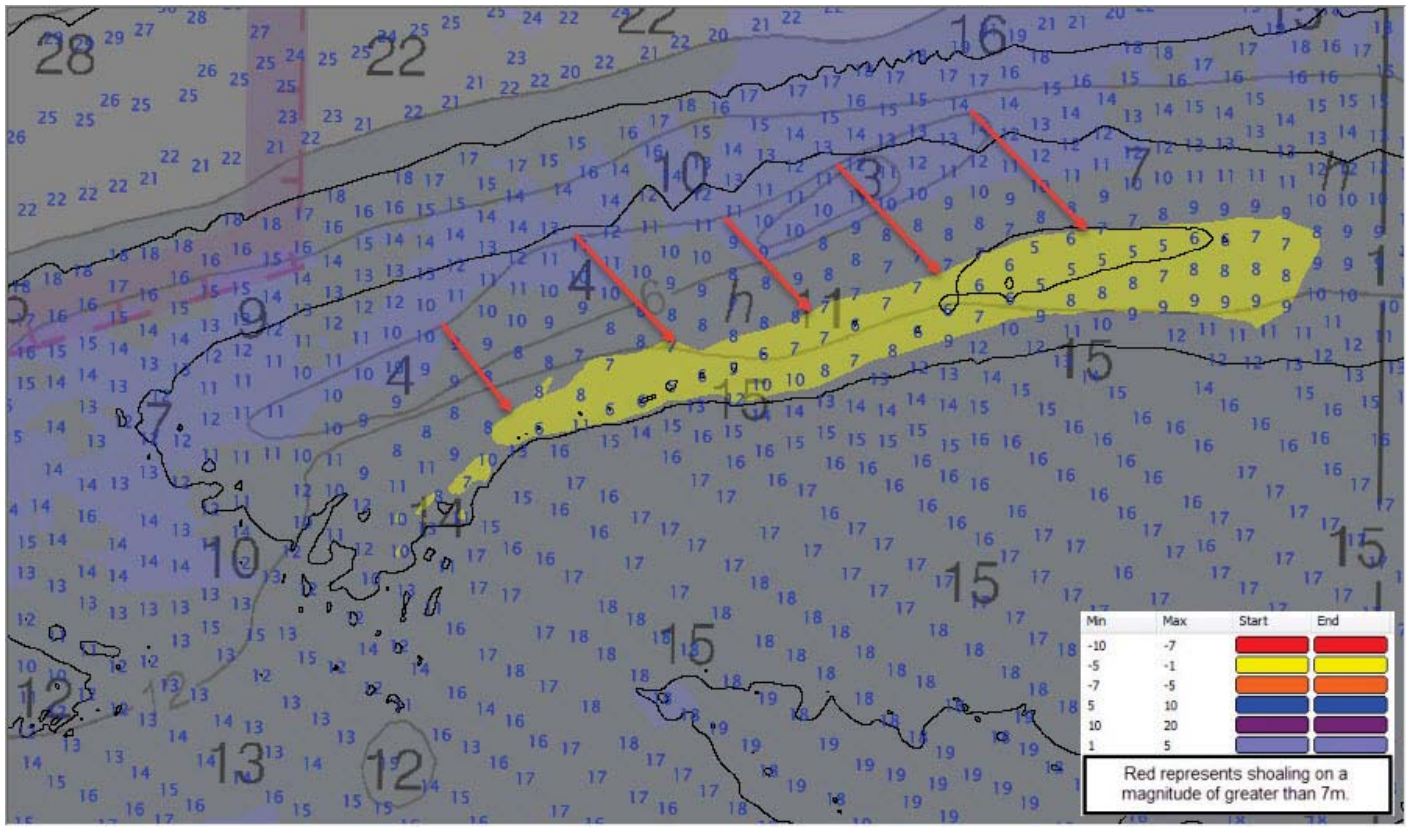


Figure 25: Shifting shoal of Willoughby Bank.

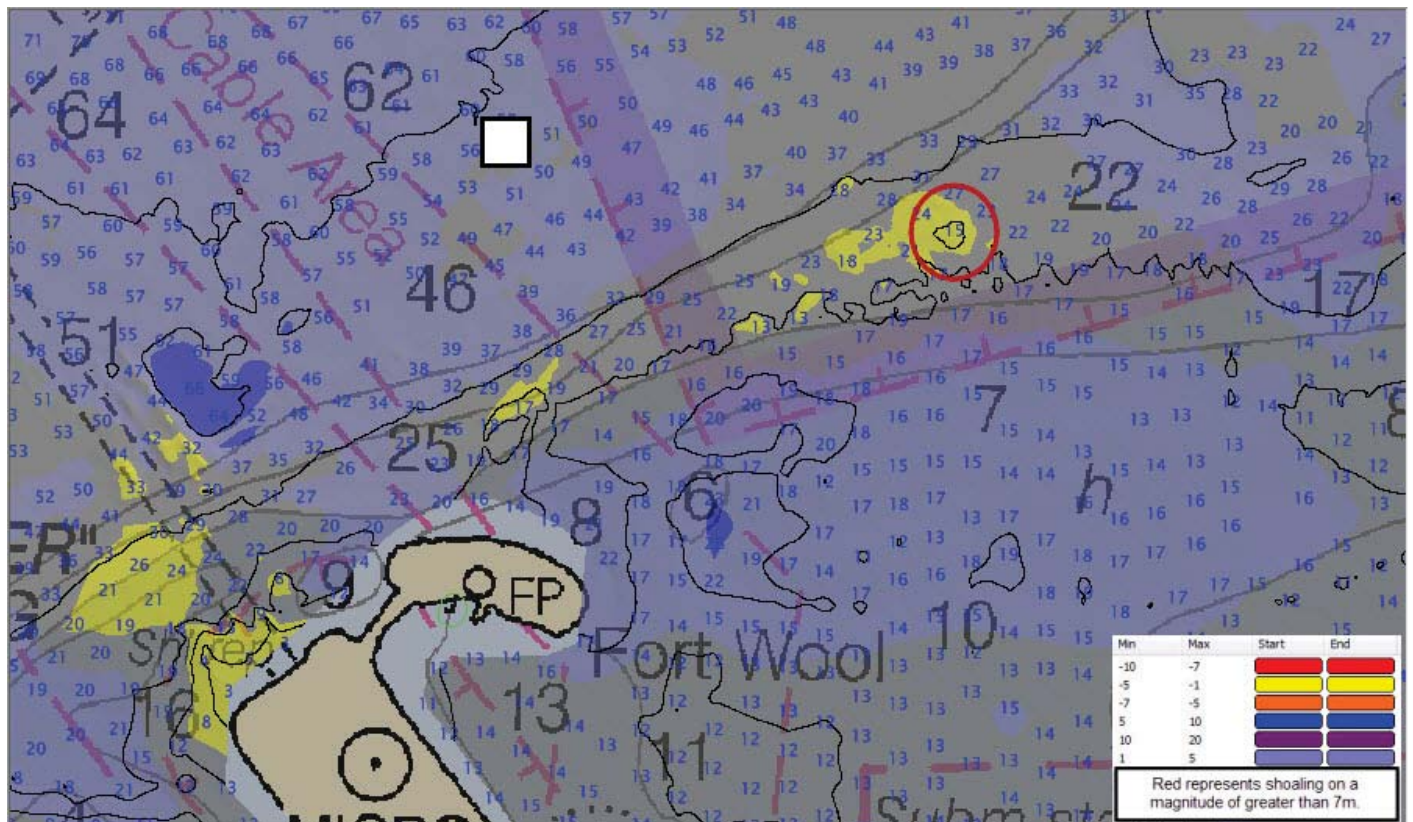
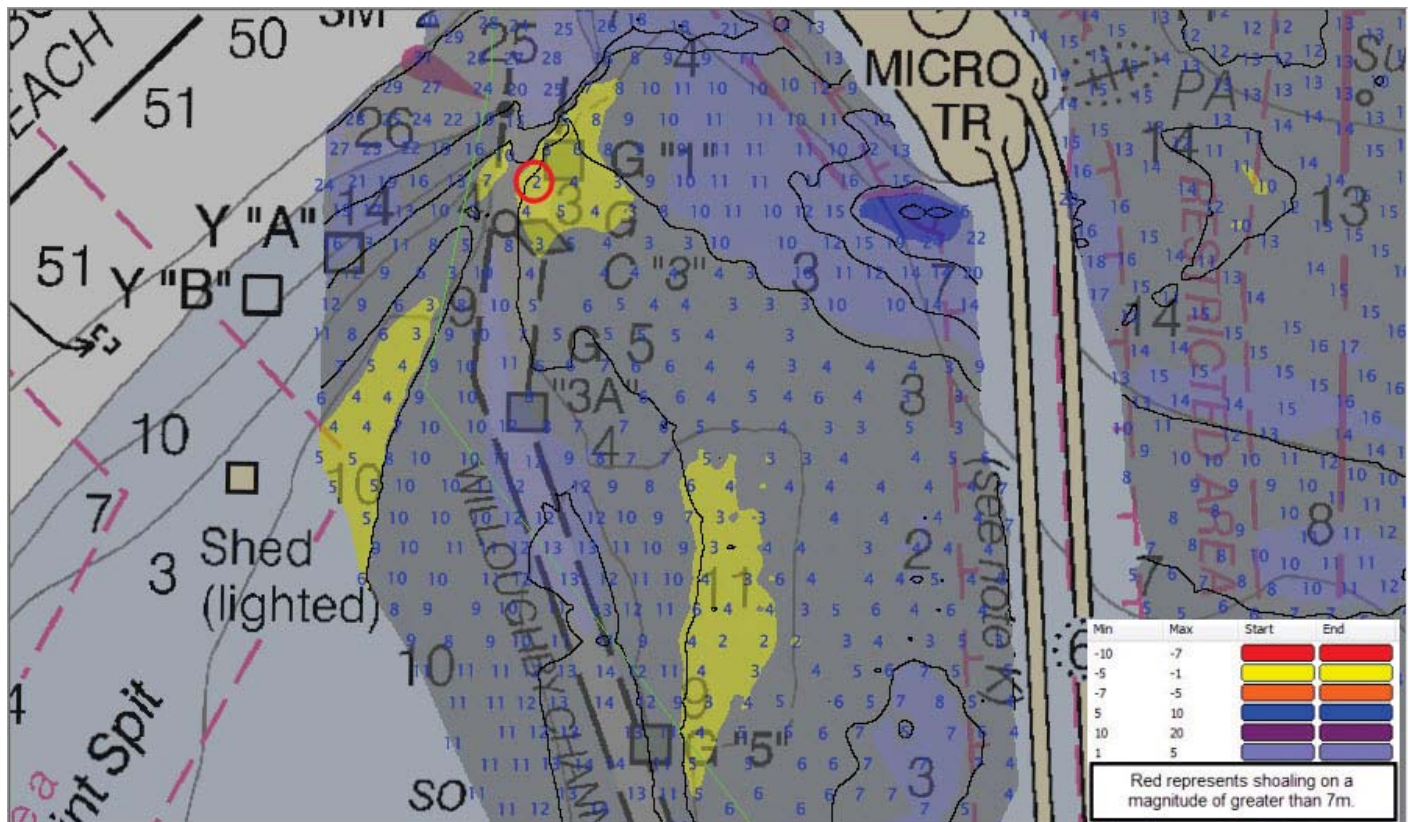


Figure 26: Shoaling along northern Willoughby Bank and the southern section of the Hampton Roads Bridge Tunnel.



*Figure 27: Shoaling in Willoughby Channel. Dangerous encroachment of sediment into channel is highlighted in red circle. Aid to Navigation was placed before current survey and is on station serving its intended purpose.*

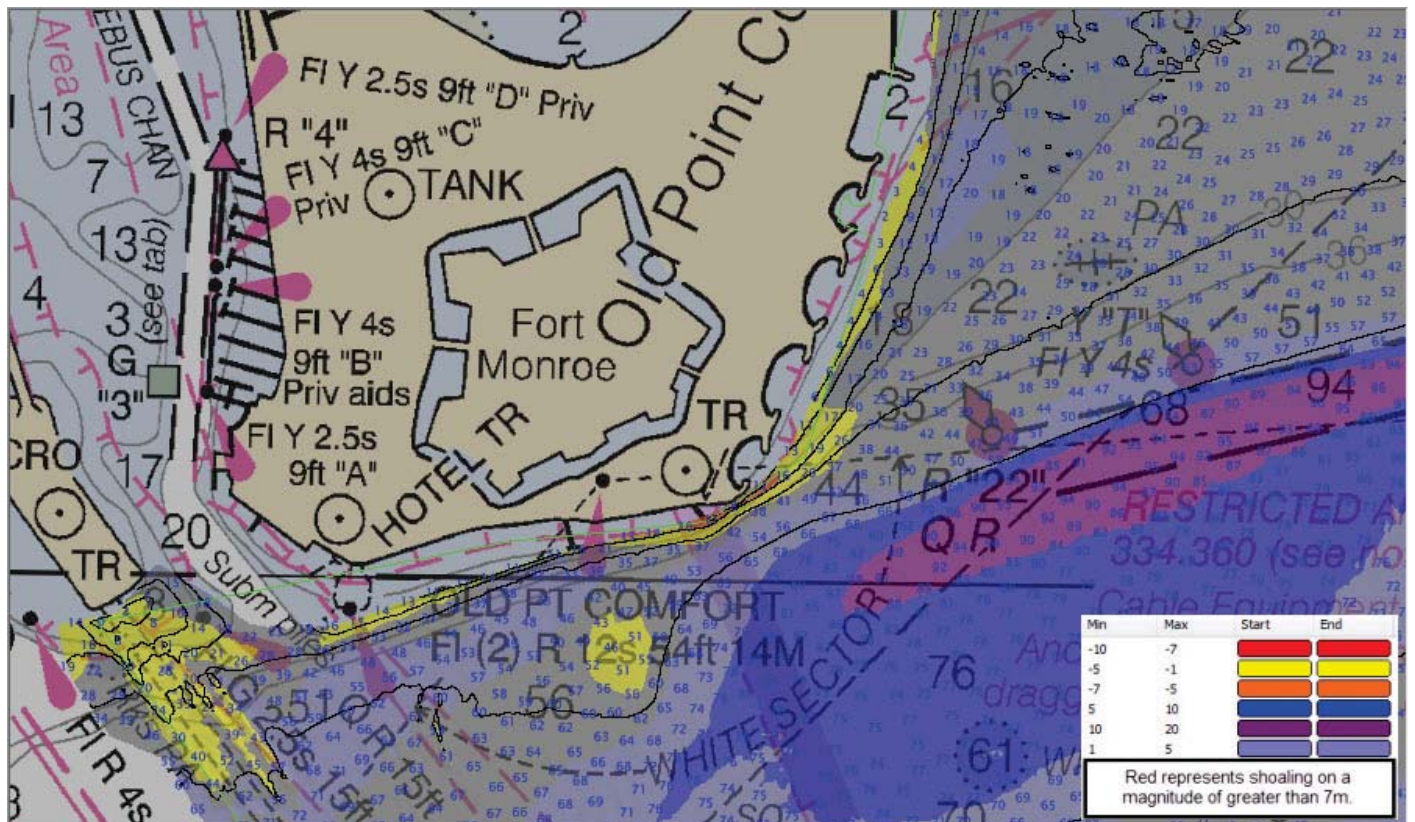


Figure 28: Shoaling noted along the North end of the Hampton Roads Bridge Tunnel and along the southern edge of Old Point Comfort.

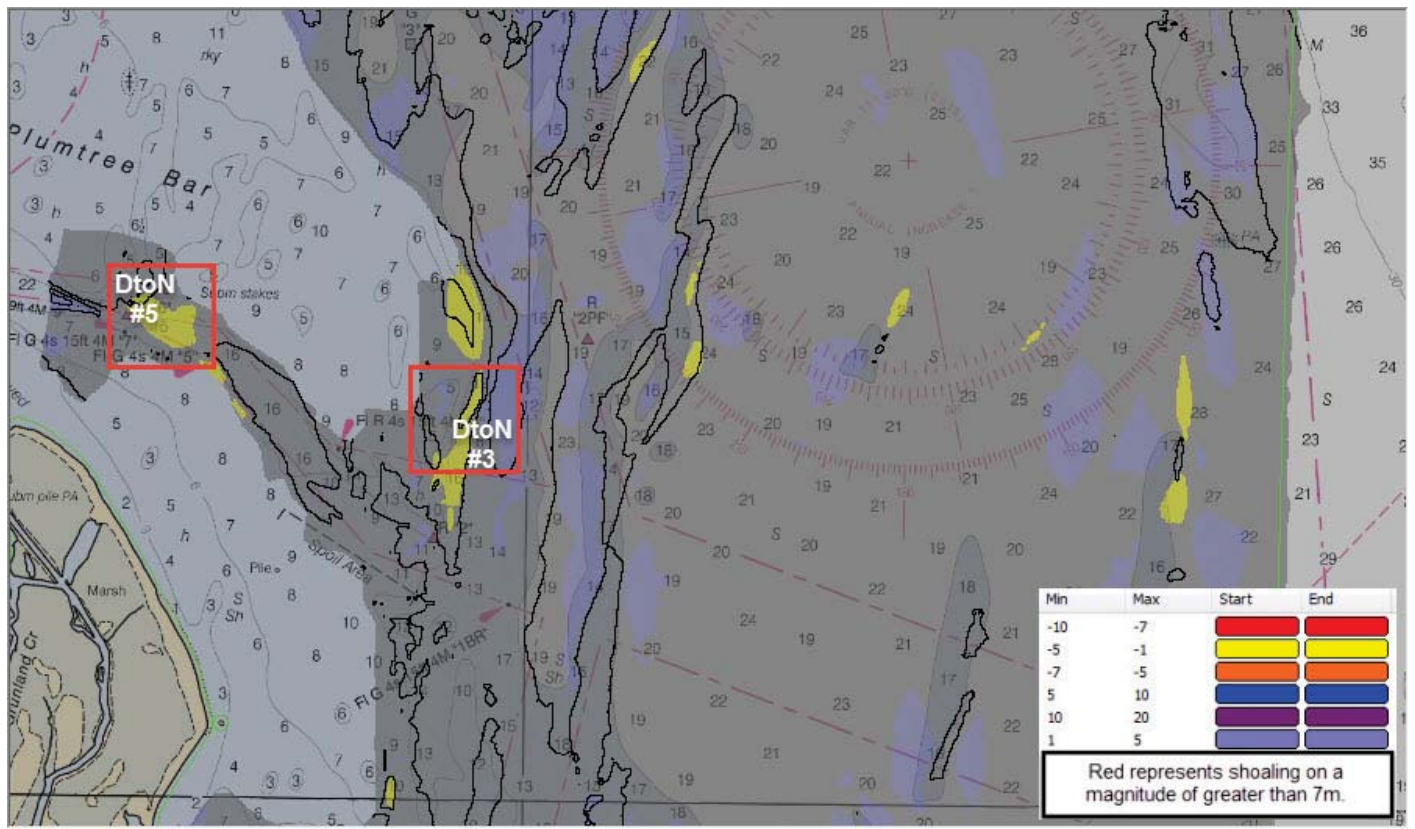


Figure 29: General eastward movement of charted shoals in the vicinity of Back River including 2 DtoNs.

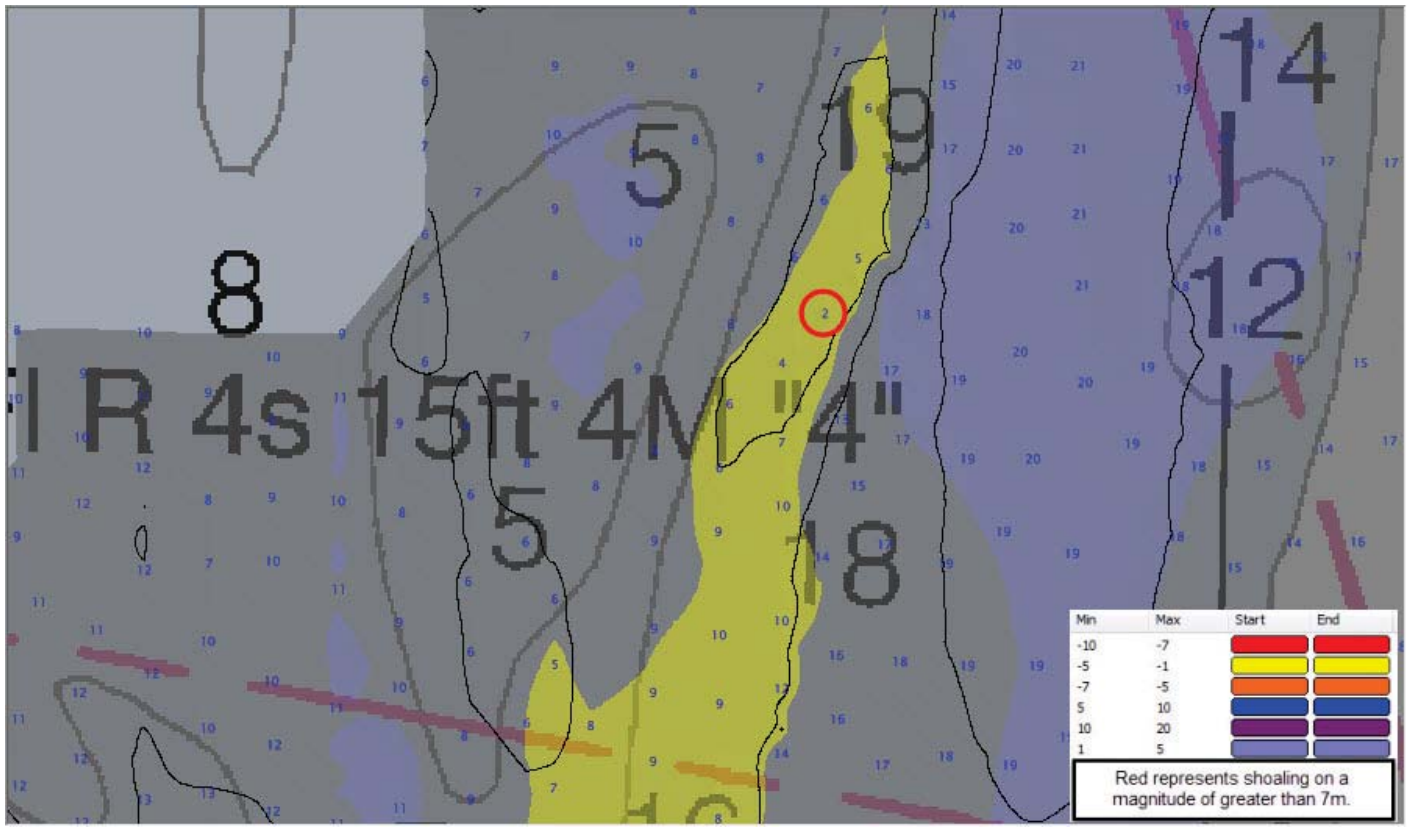


Figure 30: Danger to Navigation number 3. Surveyed 2ft sounding 120m East of nearest 5ft contour.

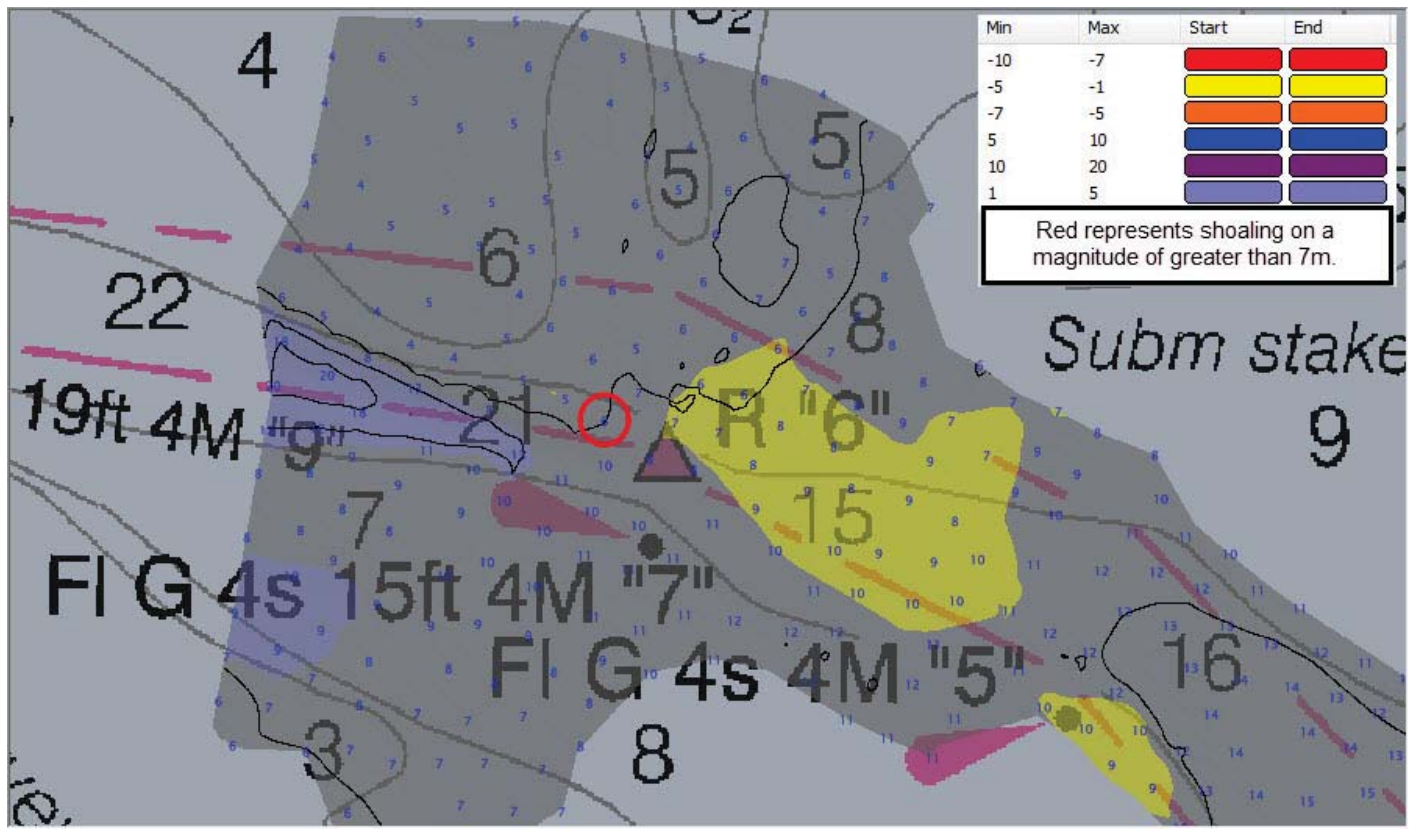


Figure 31: Danger to Navigation number 5. Shoaling is encroaching into Back River Channel.

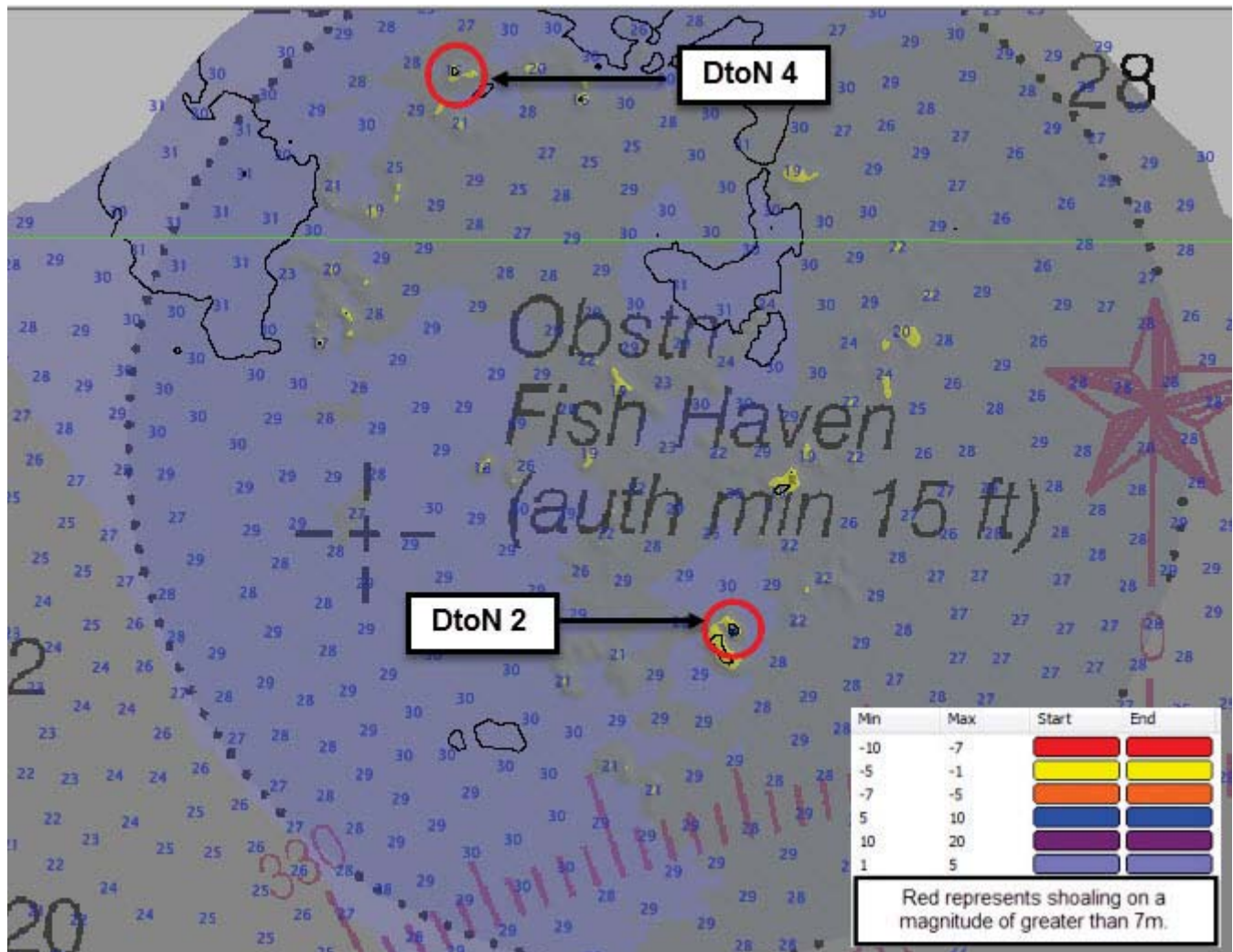


Figure 32: Northern fish haven with authorized minimum of 15ft. Current survey found 3 soundings shoal to authorized minimum, 2 of which were reported as DtoNs.

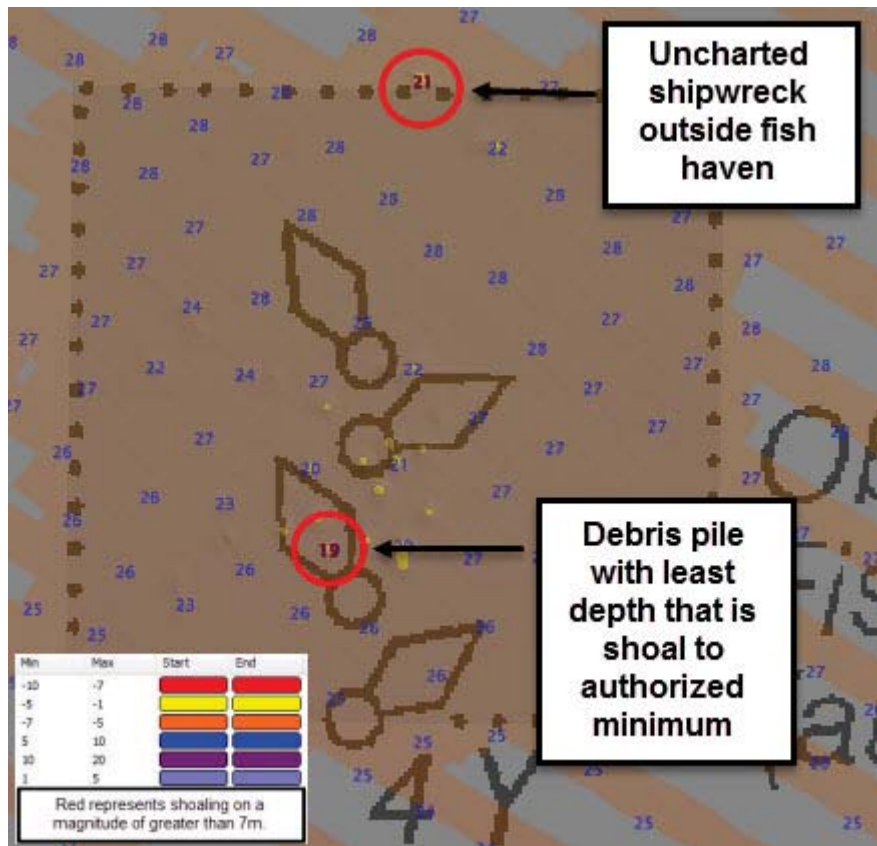


Figure 33: The southern fish haven has one debris pile with a least depth of 19.69ft. There is also an uncharted ship wreck just beyond the northern boundary of the fish haven with a least depth of 21.59ft.

### D.1.1 Raster Charts

The following are the largest scale raster charts, which cover the survey area:

Chart	Scale	Edition	Edition Date	LNM Date	NM Date
12222	1:40000	55	02/2015	11/10/2016	11/10/2016
12254	1:20000	50	05/2016	11/12/2016	11/12/2016
12245	1:20000	68	05/2013	11/12/2016	11/12/2016

Table 14: Largest Scale Raster Charts

12222

NOAA RNC 12222 covers the entire area of survey H12866 at a scale of 1:40000. Any changes to assigned features derived from the ENC can be found in the Final Feature File included with this report. For a general description of bathymetric changes, refer to section D.1 of this report.

### 12254

NOAA RNC 12254 covers the southeastern area of survey H12866 at a scale of 1:20000. Any changes to assigned features derived from the ENC can be found in the Final Feature File included with this report. For a general description of bathymetric changes, refer to section D.1 of this report.

### 12245

NOAA RNC 12245 covers the southwestern area of survey H12866 at a scale of 1:20000. Any changes to assigned features derived from the ENC can be found in the Final Feature File included with this report. For a general description of bathymetric changes, refer to section D.1 of this report.

## **D.1.2 Electronic Navigational Charts**

The following are the largest scale ENCs, which cover the survey area:

<b>ENC</b>	<b>Scale</b>	<b>Edition</b>	<b>Update Application Date</b>	<b>Issue Date</b>	<b>Preliminary?</b>
US5VA13M	1:40000	35	09/27/2016	11/27/2016	NO
US5VA15M	1:20000	45	08/11/2016	08/11/2016	NO
US5VA18M	1:5000	15	07/20/2016	07/20/2016	NO
US5VA20M	1:20000	14	07/20/2016	07/20/2016	NO
US5VA24M	1:40000	25	11/07/2016	11/07/2016	NO

*Table 15: Largest Scale ENCs*

### US5VA13M

NOAA ENC US5VA13M covers the northern area of survey H12866 from Buckroe Beach to Back River at a scale of 1:40000. Any changes to assigned features derived from the ENC can be found in the Final Feature File included with this report. For a general description of bathymetric changes, refer to section D.1 of this report.

### US5VA15M

NOAA ENC US5VA15M covers the southwestern area of survey H12866 at a scale of 1:20000. Any changes to assigned features derived from the ENC can be found in the Final Feature File included with this report. For a general description of bathymetric changes, refer to section D.1 of this report.

#### US5VA18M

NOAA ENC US5VA18M covers a small area of survey H12866 in the vicinity of Little Creek at a scale of 1:5000. Any changes to assigned features derived from the ENC can be found in the Final Feature File included with this report. For a general description of bathymetric changes, refer to section D.1 of this report.

#### US5VA20M

NOAA ENC US5VA20M covers the southeastern area of survey H12866 at a scale of 1:20000. Any changes to assigned features derived from the ENC can be found in the Final Feature File included with this report. For a general description of bathymetric changes, refer to section D.1 of this report.

#### US5VA24M

### **D.1.3 Maritime Boundary Points**

No Maritime Boundary Points were assigned for this survey.

### **D.1.4 Charted Features**

Survey H12866 encompassed several obstructions and wrecks with the designation of PA, ED, PD, or Rep. For full details, see the Final Feature File submitted with this report.

### **D.1.5 Uncharted Features**

For full details, see the Final Feature File submitted with this report.

### **D.1.6 Dangers to Navigation**

Danger to Navigation Reports are included in Appendix II of this report.

### **D.1.7 Shoal and Hazardous Features**

For full details, see the Final Feature File submitted with this report.

**D.1.8 Channels**

For full details, see the Final Feature File submitted with this report.

**D.1.9 Bottom Samples**

No bottom samples were required for this survey.

**D.2 Additional Results****D.2.1 Shoreline**

Shoreline was not assigned in the Hydrographic Survey Project Instructions or Statement of Work.

**D.2.2 Prior Surveys**

Prior survey comparisons exist for this survey, but were not investigated.

**D.2.3 Aids to Navigation**

All Aids to Navigation within the sheet limits of survey H12866 were found to be on station and serving their intended purpose.

**D.2.4 Overhead Features**

No overhead features exist for this survey.

**D.2.5 Submarine Features**

For full details, see the Final Feature File submitted with this report.

**D.2.6 Ferry Routes and Terminals**

No ferry routes or terminals exist for this survey.

**D.2.7 Platforms**

No platforms exist for this survey.

### **D.2.8 Significant Features**

For full details, see the Final Feature File submitted with this report.

### **D.2.9 Construction and Dredging**

Present and/or planned construction or dredging exists within the survey limits. The easternmost point of Thimble Shoal will be dredged in early 2017 by the USACE and material used to renourish Willoughby beaches. There is on-going construction and maintenance on the HRBT.

### **D.2.10 New Survey Recommendation**

The area of Back River that was not completed during this survey should be prioritized for placement in the assignment queue.

### **D.2.11 Inset Recommendation**




No new insets are recommended for this area.

## E. Approval Sheet

As Chief of Party, field operations for this hydrographic survey were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports.

All field sheets, this Descriptive Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys and Specifications Deliverables Manual, Field Procedures Manual, Letter Instructions, and all HSD Technical Directives. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required with the exception of deficiencies noted in the Descriptive Report.

Approver Name	Approver Title	Approval Date	Signature
Chris van Westendorp, CDR/NOAA	Chief of Party	12/13/2016	 <small>VAN WESTENDORP.CHRISTIAAN.HENRY.1012828175 c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=NOAA, cn=VAN WESTENDORP.CHRISTIAAN.HENRY.1012828175 2016.12.13 14:56:53 -05'00'</small>
Matthew Forrest, LT/NOAA	Field Operations Officer	12/13/2016	 <small>Digitally signed by FORREST.MATTHEW.ROBERT.136273100 DN: cn=US, o=U.S. Government, ou=DoD, ou=PKI, ou=NOAA, c=FORREST.MATTHEW.ROBERT.136273100 Date: 2016.12.13 19:48:41 Z</small>
Allison C Stone	Senior Survey Technician	12/13/2016	

## F. Table of Acronyms

<b>Acronym</b>	<b>Definition</b>
<b>AHB</b>	Atlantic Hydrographic Branch
<b>AST</b>	Assistant Survey Technician
<b>ATON</b>	Aid to Navigation
<b>AWOIS</b>	Automated Wreck and Obstruction Information System
<b>BAG</b>	Bathymetric Attributed Grid
<b>BASE</b>	Bathymetry Associated with Statistical Error
<b>CO</b>	Commanding Officer
<b>CO-OPS</b>	Center for Operational Products and Services
<b>CORS</b>	Continually Operating Reference Station
<b>CTD</b>	Conductivity Temperature Depth
<b>CEF</b>	Chart Evaluation File
<b>CSF</b>	Composite Source File
<b>CST</b>	Chief Survey Technician
<b>CUBE</b>	Combined Uncertainty and Bathymetry Estimator
<b>DAPR</b>	Data Acquisition and Processing Report
<b>DGPS</b>	Differential Global Positioning System
<b>DP</b>	Detached Position
<b>DR</b>	Descriptive Report
<b>DTON</b>	Danger to Navigation
<b>ENC</b>	Electronic Navigational Chart
<b>ERS</b>	Ellipsoidal Referenced Survey
<b>ERZT</b>	Ellipsoidally Referenced Zoned Tides
<b>FFF</b>	Final Feature File
<b>FOO</b>	Field Operations Officer
<b>FPM</b>	Field Procedures Manual
<b>GAMS</b>	GPS Azimuth Measurement Subsystem
<b>GC</b>	Geographic Cell
<b>GPS</b>	Global Positioning System
<b>HIPS</b>	Hydrographic Information Processing System
<b>HSD</b>	Hydrographic Surveys Division
<b>HSSD</b>	Hydrographic Surveys Specifications and Deliverables

<b>Acronym</b>	<b>Definition</b>
<b>HSTP</b>	Hydrographic Systems Technology Programs
<b>HSX</b>	Hypack Hysweep File Format
<b>HTD</b>	Hydrographic Surveys Technical Directive
<b>HVCR</b>	Horizontal and Vertical Control Report
<b>HVF</b>	HIPS Vessel File
<b>IHO</b>	International Hydrographic Organization
<b>IMU</b>	Inertial Motion Unit
<b>ITRF</b>	International Terrestrial Reference Frame
<b>LNM</b>	Local Notice to Mariners
<b>LNM</b>	Linear Nautical Miles
<b>MCD</b>	Marine Chart Division
<b>MHW</b>	Mean High Water
<b>MLLW</b>	Mean Lower Low Water
<b>NAD 83</b>	North American Datum of 1983
<b>NAIP</b>	National Agriculture and Imagery Program
<b>NALL</b>	Navigable Area Limit Line
<b>NM</b>	Notice to Mariners
<b>NMEA</b>	National Marine Electronics Association
<b>NOAA</b>	National Oceanic and Atmospheric Administration
<b>NOS</b>	National Ocean Service
<b>NRT</b>	Navigation Response Team
<b>NSD</b>	Navigation Services Division
<b>OCS</b>	Office of Coast Survey
<b>OMAO</b>	Office of Marine and Aviation Operations (NOAA)
<b>OPS</b>	Operations Branch
<b>MBES</b>	Multibeam Echosounder
<b>NWLON</b>	National Water Level Observation Network
<b>PDBS</b>	Phase Differencing Bathymetric Sonar
<b>PHB</b>	Pacific Hydrographic Branch
<b>POS/MV</b>	Position and Orientation System for Marine Vessels
<b>PPK</b>	Post Processed Kinematic
<b>PPP</b>	Precise Point Positioning
<b>PPS</b>	Pulse per second

<b>Acronym</b>	<b>Definition</b>
<b>PRF</b>	Project Reference File
<b>PS</b>	Physical Scientist
<b>PST</b>	Physical Science Technician
<b>RNC</b>	Raster Navigational Chart
<b>RTK</b>	Real Time Kinematic
<b>SBES</b>	Singlebeam Echosounder
<b>SBET</b>	Smooth Best Estimate and Trajectory
<b>SNM</b>	Square Nautical Miles
<b>SSS</b>	Side Scan Sonar
<b>ST</b>	Survey Technician
<b>SVP</b>	Sound Velocity Profiler
<b>TCARI</b>	Tidal Constituent And Residual Interpolation
<b>TPE</b>	Total Propagated Error
<b>TPU</b>	Topside Processing Unit
<b>USACE</b>	United States Army Corps of Engineers
<b>USCG</b>	United States Coast Guard
<b>UTM</b>	Universal Transverse Mercator
<b>XO</b>	Executive Officer
<b>ZDA</b>	Global Positioning System timing message
<b>ZDF</b>	Zone Definition File

APPENDIX I  
TIDES AND WATER LEVELS



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
National Ocean Service  
Silver Spring, Maryland 20910

**PROVISIONAL TIDE NOTE FOR HYDROGRAPHIC SURVEY**

**DATE :** September 13, 2016

**HYDROGRAPHIC BRANCH:** Atlantic  
**HYDROGRAPHIC PROJECT:** OPR-E350-TJ-2016  
**HYDROGRAPHIC SHEET:** H12866

**LOCALITY:** Willoughby Bank, Chesapeake Bay, VA  
**TIME PERIOD:** April 06 - August 25, 2016

**TIDE STATION USED:** Kiptopeke, VA 8632200  
Lat. 37° 09.9' N Long. 75° 59.3' W

**PLANE OF REFERENCE (MEAN LOWER LOW WATER):** 0.000 meters  
**HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE:** 0.827 meters

**TIDE STATION USED:** Yorktown, VA 8637689  
Lat. 37° 13.6' N Long. 76° 28.7' W

**PLANE OF REFERENCE (MEAN LOWER LOW WATER):** 0.000 meters  
**HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE:** 1.319 meters

**TIDE STATION USED:** Sewells Point, VA 8638610  
Lat. \_\_\_\_\_ N Long. 76° 19.8' W

**PLANE OF REFERENCE (MEAN LOWER LOW WATER):** 0.000 meters  
**HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE:** 0.778 meters

**TIDE STATION USED:** Chesapeake Bay Bridge Tunnel, VA 8638863  
Lat. 36° 58.0' N Long. 76° 06.8' W

**PLANE OF REFERENCE (MEAN LOWER LOW WATER):** 0.000 meters  
**HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE:** 0.814 meters

**REMARKS: Recommended Grid**

Please use the TCARI grid "E350TJ2016.tc" as the final grid for project OPR-E350-TJ-2016, H12866, during the time period between April 06 - August 25.

**Refer to attachments for grid information.**

**Note 1:** Provided time series data are tabulated in metric units (meters), relative to MLLW and on Greenwich Mean Time on the 1983-2001 National Tidal Datum Epoch (NTDE).

**Note 2:** Survey tracklines fall outside of the TCARI grid boundaries in some areas due to inaccurate shoreline. TCARI will extrapolate the tide corrector to cover these soundings.

**Note 3:** Annual leveling for Sewells Point (8638610) was not completed in FY16. A review of the verified leveling records from October 2005 - 2015 shows the tide station benchmark network to be stable within an allowable 0.009 m tolerance. This Tide Note may be used as final stability verification for survey OPR-E350-TJ-2016, H12866. CO-OPS will immediately provide a revised Tide Note should subsequent leveling records indicate any benchmark network stability movement beyond the allowable 0.009 m tolerance.

**HOVIS.GERALD.THOMAS.JR.1365860250**

Digitally signed by  
HOVIS.GERALD.THOMAS.JR.1365860250  
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI,  
ou=OTHER,  
cn=HOVIS.GERALD.THOMAS.JR.1365860250  
Date: 2016.09.13 11:09:29 -04'00'



CHIEF, PRODUCTS AND SERVICES BRANCH

**Preliminary as Final TCARI Grid for  
OPR-E350-TJ-2016, H12866  
Willoughby Bank, Chesapeake Bay, VA**

**8637689 YORKTOWN**

**8632200 KIPTOPEKE BEACH**

**8638863 CHESAPEAKE  
BAY BRIDGE TUNNEL**

**8638610 SEWELLS POINT**



## APPENDIX II

# SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE



---

## Ongoing dredging within TJ's Hampton Roads Survey

3 messages

---

**Allison Stone - NOAA Federal** <allison.c.stone@noaa.gov>

Thu, Nov 10, 2016 at 7:31 PM

To: Ryan Wartick - NOAA Federal <ryan.wartick@noaa.gov>

Hi Ryan!

I was just wondering if you know of any ongoing dredging or construction projects within the area pictured in the attached PDF.

Thank you!


--


**Allison C. Stone**  
Hydrographic Senior Survey Technician  
NOAA Ship *Thomas Jefferson*

*"The sea, once it casts its spell, holds one in its net of wonder forever" Jacques Cousteau*

---

### 2 attachments

 **H12866\_Outline\_TESARE\_Polygon.shp**  
106K

 **TJ\_HSL\_2016\_Survey.pdf**  
245K

---

**Ryan Wartick - NOAA Federal** <ryan.wartick@noaa.gov>

Thu, Nov 10, 2016 at 8:07 PM

To: Allison Stone - NOAA Federal <allison.c.stone@noaa.gov>

FYI  
V/R

Ryan Wartick LT/NOAA  
Navigation Services Division  
Mid-Atlantic Navigation Manager  
(757) 441-6746 x116 (office)  
(571) 305-0995 (work cell)  
(757) 268-8164 (cell)

<http://www.nauticalcharts.noaa.gov/>

----- Forwarded message -----

From: **Swallow, Jeffrey A CIV USARMY CENAO (US)** <Jeffrey.A.Swallow@usace.army.mil>

Date: Thu, Nov 10, 2016 at 2:54 PM

Subject: RE: [EXTERNAL] Fwd: Ongoing dredging within TJ's Hampton Roads Survey

To: Ryan Wartick - NOAA Federal <ryan.wartick@noaa.gov>

Hey Ryan,  
Yes, Thimble Shoal Channel is on to begin dredging this FY, I believe in February. In addition, the beach placement at Willoughby will begin around the same time, using material from the outside portion of Thimble Shoal Channel and auxiliary channel.

Let me know if you have questions.  
Jeff

-----Original Message-----

From: Ryan Wartick - NOAA Federal [mailto:[ryan.wartick@noaa.gov](mailto:ryan.wartick@noaa.gov)]  
Sent: Thursday, November 10, 2016 2:40 PM  
To: Swallow, Jeffrey A CIV USARMY CENAO (US) <[Jeffrey.A.Swallow@usace.army.mil](mailto:Jeffrey.A.Swallow@usace.army.mil)>  
Subject: [EXTERNAL] Fwd: Ongoing dredging within TJ's Hampton Roads Survey

Jeff,

Can you let me know if there are any dredging projects in this area (see attached) either ongoing or planned in the near future? Thanks

V/R

Ryan Wartick LT/NOAA  
Navigation Services Division

Mid-Atlantic Navigation Manager  
(757) 441-6746 x116 (office)  
(571) 305-0995 (work cell)

(757) 268-8164 (cell)

Blocked<http://www.nauticalcharts.noaa.gov/>

----- Forwarded message -----

From: Allison Stone - NOAA Federal <[allison.c.stone@noaa.gov](mailto:allison.c.stone@noaa.gov)> <<mailto:allison.c.stone@noaa.gov>> >  
Date: Thu, Nov 10, 2016 at 2:31 PM  
Subject: Ongoing dredging within TJ's Hampton Roads Survey  
To: Ryan Wartick - NOAA Federal <[ryan.wartick@noaa.gov](mailto:ryan.wartick@noaa.gov)> <<mailto:ryan.wartick@noaa.gov>> >

Hi Ryan!

I was just wondering if you know of any ongoing dredging or construction projects within the area pictured in the attached PDF.

Thank you!

--

Allison C. Stone

Hydrographic Senior Survey Technician  
NOAA Ship Thomas Jefferson

"The sea, once it casts its spell, holds one in its net of wonder forever" Jacques Cousteau

Thu, Nov 10, 2016 at 8:57 PM

**Allison Stone - NOAA Federal** <allison.c.stone@noaa.gov>

To: Ryan Wartick - NOAA Federal <ryan.wartick@noaa.gov>

Awesome. Thank you!

On Thu, Nov 10, 2016 at 8:07 PM, Ryan Wartick - NOAA Federal <ryan.wartick@noaa.gov> wrote:

FYI

V/R

Ryan Wartick LT/NOAA  
Navigation Services Division  
Mid-Atlantic Navigation Manager  
(757) 441-6746 x116 (office)  
(571) 305-0995 (work cell)  
(757) 268-8164 (cell)

<http://www.nauticalcharts.noaa.gov/>

----- Forwarded message -----

From: **Swallow, Jeffrey A CIV USARMY CENAO (US)** <Jeffrey.A.Swallow@usace.army.mil>

Date: Thu, Nov 10, 2016 at 2:54 PM

Subject: RE: [EXTERNAL] Fwd: Ongoing dredging within TJ's Hampton Roads Survey

To: Ryan Wartick - NOAA Federal <ryan.wartick@noaa.gov>

Hey Ryan,  
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Let me know if you have questions.  
Jeff

-----Original Message-----

From: Ryan Wartick - NOAA Federal [mailto:[ryan.wartick@noaa.gov](mailto:ryan.wartick@noaa.gov)]

Sent: Thursday, November 10, 2016 2:40 PM

To: Swallow, Jeffrey A CIV USARMY CENAO (US) <Jeffrey.A.Swallow@usace.army.mil>

Subject: [EXTERNAL] Fwd: Ongoing dredging within TJ's Hampton Roads Survey

Jeff,

Can you let me know if there are any dredging projects in this area (see attached) either ongoing or planned in the near future? Thanks

V/R

Ryan Wartick LT/NOAA

Navigation Services Division

Mid-Atlantic Navigation Manager

(757) 441-6746 x116 (office)

(571) 305-0995 (work cell)

(757) 268-8164 (cell)

Blocked <http://www.nauticalcharts.noaa.gov/>

----- Forwarded message -----

From: Allison Stone - NOAA Federal <[allison.c.stone@noaa.gov](mailto:allison.c.stone@noaa.gov) <<mailto:allison.c.stone@noaa.gov>> >

Date: Thu, Nov 10, 2016 at 2:31 PM

Subject: Ongoing dredging within TJ's Hampton Roads Survey

To: Ryan Wartick - NOAA Federal <[ryan.wartick@noaa.gov](mailto:ryan.wartick@noaa.gov) <<mailto:ryan.wartick@noaa.gov>> >

Hi Ryan!

I was just wondering if you know of any ongoing dredging or construction projects within the area pictured in the attached PDF.

Thank you!

--

Allison C. Stone

Hydrographic Senior Survey Technician

NOAA Ship Thomas Jefferson

"The sea, once it casts its spell, holds one in its net of wonder forever" Jacques Cousteau

--  
**Allison C. Stone**  
**Hydrographic Senior Survey Technician**  
**NOAA Ship *Thomas Jefferson***

***"The sea, once it casts its spell, holds one in its net of wonder forever" Jacques Cousteau***





Allison Stone - NOAA Federal <allison.c.stone@noaa.gov>

---

## Deliverable Folder Structure

2 messages

---

**Matthew Forrest - NOAA Federal** <matthew.r.forrest@noaa.gov>

Wed, Dec 7, 2016 at 2:49 PM

To: Castle Parker - NOAA Federal <castle.e.parker@noaa.gov>

Cc: \_OMAO MOA OPS Thomas Jefferson <ops.thomas.jefferson@noaa.gov>, \_OMAO MOA ChiefST Thomas Jefferson <chiefst.thomas.jefferson@noaa.gov>

Gene,

Had a question about our folder structure. HSSD 2016 dictates the following structure:

- NOAA and Contractor Data Directory Structure
- OPR-X###-XX-##
    - HXXXXX
      - Data
        - Preprocess
          - Backscatter
          - Bathymetry
            - MBES
            - SBES
          - Features
          - Positioning
          - SSS
          - SVP
        - Processed
          - Bathymetry\_&\_SSS
          - GNSS\_Data
            - SBET
          - Multimedia
          - S-57 Files
            - Final\_Feature\_File
            - Side\_Scan\_Sonar\_Contacts
          - SVP
          - Tide
        - Separates
          - I\_Acquisition\_&\_Processing\_Logs
            - Acquisition\_Logs
            - Detached\_Positions
            - Processing\_Logs
          - II\_Digital\_Data
            - Checkpoint\_Summary\_&\_Crossline\_Comparisons
            - Sound\_Speed\_Data\_Summary
        - Descriptive\_Report
          - Report
          - Appendices
            - I\_Tides\_&\_Water\_Levels
            - II\_Supplemental\_Survey\_Records\_&\_Correspondence
        - Public\_Relations\_&\_Constituent\_Products
      - Project\_Reports
        - Data\_Acquisition\_&\_Processing\_Report
          - Report
          - Appendices
        - Horizontal\_&\_Vertical\_Control\_Report
          - Digital\_A-Vertical\_Control\_Report
          - Digital\_B-Horizontal\_Control\_Data
            - ATON\_Data
            - Base\_Station\_Data
        - Project\_Correspondence

Figure J.2: Data Directory Structure for NOAA and Contractors

187

This leaves a few blanks on our end. Specifically, there is no designated spot for surfaces and mosaics. Section 8.3.3 states that "Field units shall deliver all grids in the Bathymetry and SSS folder." Does this mean that we should simply put our grids in that folder with no further breakdown? Also, where should we put HDCS data? Thanks!

V/r,

Forrest

--

LT Matthew Forrest, NOAA  
 Operations Officer  
 NOAA Ship Thomas Jefferson  
 439 W York St  
 Norfolk, VA 23510

Tel: (757) 647-0187  
Iridium: (808) 434-2706

---

**Castle Parker - NOAA Federal** <castle.e.parker@noaa.gov>

Thu, Dec 8, 2016 at 1:03 PM

To: Matthew Forrest - NOAA Federal <matthew.r.forrest@noaa.gov>

Cc: "OPS.Thomas Jefferson - NOAA Service Account" <ops.thomas.jefferson@noaa.gov>, "ChiefST.Thomas Jefferson - NOAA Service Account" <chiefst.thomas.jefferson@noaa.gov>, Briana Welton - NOAA Federal <briana.welton@noaa.gov>

Good day Matt,

Yep, there are gaps in the directory structure as listed in HSSD 2016. AHB will forward a change for the directory structure for 2017 HSSD.

In my opinion, I would continue to submit the directory structure as you did with 2015 surveys. Add a Fieldsheet or Grids and HDCS\_DATA directory under the Bathymetry\_&\_SSS folder. The TJ would be following specs if as long as the Bathymetry\_&\_SSS folder was included. Adding additional directories would be OK rather than dumping all in one directory. There is nothing mentioned in specs that indicates not creating a separate directory for the required content. I feel that 2015 HSSD directory structure is a better example.

The following directory structure is my recommendation:

OPR-X###-XX-XX\Data\Processed\Bathymetry\_&\_SSS\Grids\

OPR-X###-XX-XX\Data\Processed\Bathymetry\_&\_SSS\HDCS\_DATA\

OPR-X###-XX-XX\Data\Processed\Bathymetry\_&\_SSS\SSS Mosaic\

We don't have many 2016 surveys currently in our inventory. But what we do has similar structure as listed above. Contract field units are doing the same thing. There has to be some common sense with the structure as HSSD does not define the product levels.

Regards,

Gene

*Castle Eugene Parker*

*NOAA Office of Coast Survey*

*Atlantic Hydrographic Branch*

*Hydrographic Team Lead / Physical Scientist*

[castle.e.parker@noaa.gov](mailto:castle.e.parker@noaa.gov)

*office (757) 441-6746 x115*

**From:** Matthew Forrest - NOAA Federal [mailto:[matthew.r.forrest@noaa.gov](mailto:matthew.r.forrest@noaa.gov)]

**Sent:** Wednesday, December 07, 2016 9:50 AM

**To:** Castle Parker - NOAA Federal <[castle.e.parker@noaa.gov](mailto:castle.e.parker@noaa.gov)>

**Cc:** \_OMAO MOA OPS Thomas Jefferson <[ops.thomas.jefferson@noaa.gov](mailto:ops.thomas.jefferson@noaa.gov)>; \_OMAO MOA ChiefST Thomas Jefferson <[chiefst.thomas.jefferson@noaa.gov](mailto:chiefst.thomas.jefferson@noaa.gov)>

**Subject:** Deliverable Folder Structure

[Quoted text hidden]



Allison Stone - NOAA Federal <allison.c.stone@noaa.gov>

---

## Fwd: HRBT work and Maintenance

3 messages

---

**Ryan Wartick - NOAA Federal** <ryan.wartick@noaa.gov>

Tue, Apr 12, 2016 at 12:49 PM

To: Allison Stone - NOAA Federal <allison.c.stone@noaa.gov>, Peter Lewit <peter.lewit@noaa.gov>, "ops.fairweather" <ops.fairweather@noaa.gov>

When I spoke with the HRBT maintenance supervisor he said that dive ops were part of a project that will be on-going during the TJs survey. He did not have specific dates. I passed along the supervisors contact information to the TJ and recommended they contact HRBT on days when they plan on working near the HRBT just to check.

See attached email

V/R

Ryan Wartick LT/NOAA  
Navigation Services Division  
Mid-Atlantic Navigation Manager  
(757) 441-6746 x116 (office)  
(571) 305-0995 (work cell)  
(757) 268-8164 (cell)

<http://www.nauticalcharts.noaa.gov/>

----- Forwarded message -----

From: **Ryan Wartick - NOAA Federal** <ryan.wartick@noaa.gov>

Date: Tue, Mar 1, 2016 at 5:45 PM

Subject: HRBT work and Maintenance

To: Jacklyn James - NOAA Federal <jacklyn.c.james@noaa.gov>, "OPS.Thomas Jefferson - NOAA Service Account" <ops.thomas.jefferson@noaa.gov>, "CO.Thomas Jefferson - NOAA Service Account" <co.thomas.jefferson@noaa.gov>

I was able to talk to a supervisor with VDOT (HRBT) and they do have scheduled work on the bridge. They are going to be installing/replacing some cables in addition to some other stuff. They will occasionally have divers in the water as part of the work. We will have to stay clear on those days. There is no scheduled work for the tunnel. One days when you will be working near the bridge you can call the HRBT supervisor to ensure they are not diving. (757) 727-4832

V/R

Ryan Wartick LT/NOAA  
Navigation Services Division  
Mid-Atlantic Navigation Manager  
(757) 441-6746 x116 (office)  
(571) 305-0995 (work cell)  
(757) 268-8164 (cell)

<http://www.nauticalcharts.noaa.gov/>

---

**Allison Stone - NOAA Federal** <allison.c.stone@noaa.gov>

Tue, Apr 12, 2016 at 1:19 PM

To: "OPS.Thomas Jefferson - NOAA Service Account" <OPS.Thomas.Jefferson@noaa.gov>

Please add the HRBT phone # to the POD

----- Forwarded message -----

From: **Ryan Wartick - NOAA Federal** <[ryan.wartick@noaa.gov](mailto:ryan.wartick@noaa.gov)>

[Quoted text hidden]

--

**Allison C. Stone**  
Hydrographic Senior Survey Technician  
NOAA Ship *Thomas Jefferson*

*"The sea, once it casts its spell, holds one in its net of wonder forever" Jacques Cousteau*

---

**LT Matthew Forrest, NOAA** <[matthew.r.forrest@noaa.gov](mailto:matthew.r.forrest@noaa.gov)>

Tue, Apr 12, 2016 at 1:28 PM

To: Allison Stone - NOAA Federal <[allison.c.stone@noaa.gov](mailto:allison.c.stone@noaa.gov)>

Cc: "OPS.Thomas Jefferson - NOAA Service Account" <[OPS.Thomas.Jefferson@noaa.gov](mailto:OPS.Thomas.Jefferson@noaa.gov)>

It's in the Project Parameters.

[Quoted text hidden]

Matthew,

Please include this email in the DR supplemental correspondence indicating OPR-E350-TJ-16 shall follow HSSD March 2016. The SEP model from WGS84 to MLLW is attached. If you have further questions regarding the updates in the 2016 HSSD, please do not hesitate to ask.

---

On Wed, Mar 23, 2016 at 3:43 PM, Matthew Forrest - NOAA Federal <[matthew.r.forrest@noaa.gov](mailto:matthew.r.forrest@noaa.gov)> wrote:  
Jacklyn,

We are going to go with the 2016 HSSD requirements. We'll be up to speed on them in short order. Recognizing that part of the new requirements is a transition to WGS84 as the vertical and horizontal datum, we would like to ask for a new SEP model to allow us to translate from WGS84 to MLLW. Thank you!

V/r,

Forrest

On Wed, Mar 23, 2016 at 7:33 PM, Joseph Carrier - NOAA Federal <[joseph.carrier@noaa.gov](mailto:joseph.carrier@noaa.gov)> wrote:  
Thanks Jacklyn,

Joe's fine. I'll let Matt Forrest decide on the HSSD version since he's going to be leading this project.

V/R,  
Joe

---

Joseph K. Carrier III, LT/NOAA  
Field Operation's Officer Officer, NOAA Ship *Thomas Jefferson*

439 West York Street  
Norfolk, VA 23510  
cell: [\(757\) 647-0187](tel:(757)647-0187)  
voip: [\(541\) 867-8927](tel:(541)867-8927)  
fax: [\(757\) 512-8295](tel:(757)512-8295)  
<http://www.moc.noaa.gov/tj/>

On Wed, Mar 23, 2016 at 7:05 PM, Jacklyn <[jacklyn.c.james@noaa.gov](mailto:jacklyn.c.james@noaa.gov)> wrote:  
Joseph,

Please see attached. Also, if you decide to use 2016 specs I will need to send you another VDatum SEP model so let me know your plans as soon as you decide. Thanks

On Wed, Mar 23, 2016 at 11:56 AM, Joseph Carrier - NOAA Federal <[joseph.carrier@noaa.gov](mailto:joseph.carrier@noaa.gov)> wrote:  
Is the ESRI shp file in there? I couldn't find it.

---

Joseph K. Carrier III, LT/NOAA  
Field Operation's Officer Officer, NOAA Ship *Thomas Jefferson*

439 West York Street  
Norfolk, VA 23510  
cell: [\(757\) 647-0187](tel:(757)647-0187)  
voip: [\(541\) 867-8927](tel:(541)867-8927)  
fax: [\(757\) 512-8295](tel:(757)512-8295)  
<http://www.moc.noaa.gov/tj/>

On Wed, Mar 23, 2016 at 2:38 PM, Jacklyn <[jacklyn.c.james@noaa.gov](mailto:jacklyn.c.james@noaa.gov)> wrote:  
Joseph,

You should be able to access the files you need by accessing the FTP site by clicking [here](#) If you find there are other files you need after accessing the site please let me know.

On Wed, Mar 23, 2016 at 10:36 AM, Jacklyn <[jacklyn.c.james@noaa.gov](mailto:jacklyn.c.james@noaa.gov)> wrote:  
Hi Joseph,

Are you requesting a ESRI shapefile or are you talking about csf and prf?

On Wed, Mar 23, 2016 at 10:10 AM, Joseph Carrier - NOAA Federal <[joseph.carrier@noaa.gov](mailto:joseph.carrier@noaa.gov)> wrote:  
Jacklyn,

For some reason, I'm not seeing the shape files for the project area. Please email the most recent and up to date sheet limits so we can get some line plans going this week.

V/R,  
Joe

---

Joseph K. Carrier III, LT/NOAA  
Field Operation's Officer Officer, NOAA Ship *Thomas Jefferson*

439 West York Street  
Norfolk, VA 23510  
cell: [\(757\) 647-0187](tel:(757)647-0187)  
voip: [\(541\) 867-8927](tel:(541)867-8927)  
fax: [\(757\) 512-8295](tel:(757)512-8295)  
<http://www.moc.noaa.gov/tj/>

On Tue, Mar 22, 2016 at 7:58 PM, Jacklyn <[jacklyn.c.james@noaa.gov](mailto:jacklyn.c.james@noaa.gov)> wrote:  
Awesome! Always happy to help.

On Tue, Mar 22, 2016 at 3:50 PM, Joseph Carrier - NOAA Federal <[joseph.carrier@noaa.gov](mailto:joseph.carrier@noaa.gov)> wrote:  
Jacklyn,

That's what I was looking for, thanks for pointing me in the right direction. I appreciate the quick turnaround on the SEP models too.

V/R,  
Joe

---

Joseph K. Carrier III, LT/NOAA  
Field Operation's Officer Officer, NOAA Ship *Thomas Jefferson*

439 West York Street  
Norfolk, VA 23510  
cell: [\(757\) 647-0187](tel:(757)647-0187)  
voip: [\(541\) 867-8927](tel:(541)867-8927)  
fax: [\(757\) 512-8295](tel:(757)512-8295)  
<http://www.moc.noaa.gov/tj/>

On Tue, Mar 22, 2016 at 6:37 PM, Jacklyn <[jacklyn.c.james@noaa.gov](mailto:jacklyn.c.james@noaa.gov)> wrote:  
Hey Joseph,

I'm not sure what you mean by uncertainty but the SEP model uncertainty was included in the project instructions. Could you provide more detail so I can better assist you.

On Mon, Mar 21, 2016 at 9:30 AM, Joseph Carrier - NOAA Federal <[joseph.carrier@noaa.gov](mailto:joseph.carrier@noaa.gov)> wrote:  
Jacklyn,

Thanks for the reply. I'll take that to mean we don't need to apply final tides to the data if we meet full ERS requirements.

On that note, I didn't receive a SEP model. There was a Pydro info file but no SEP or uncertainty for willoughby. Can you point me in the right direction?

Vr,  
Joe

On Monday, March 21, 2016, Jacklyn <[jacklyn.c.james@noaa.gov](mailto:jacklyn.c.james@noaa.gov)> wrote:  
If you are able to get to the ellipse okay there is no point in requesting final tides.

On Fri, Mar 18, 2016 at 1:59 PM, Joseph Carrier - NOAA Federal <[joseph.carrier@noaa.gov](mailto:joseph.carrier@noaa.gov)> wrote:  
Jacklyn,

What value is the in having us apply final tides to the survey after we've done everything to the ellipse? The value added to the project compared to the risk of what could go wrong with reprocessing the data in Caris has the potential of adding weeks to processing and rework of data.

Can we submit these surveys without final tides.

V/R,  
Joe

---

Joseph K. Carrier III, LT/NOAA  
Field Operation's Officer Officer, NOAA Ship *Thomas Jefferson*

439 West York Street  
Norfolk, VA 23510  
cell: [\(757\) 647-0187](tel:(757)647-0187)  
voip: [\(541\) 867-8927](tel:(541)867-8927)  
fax: [\(757\) 512-8295](tel:(757)512-8295)  
<http://www.moc.noaa.gov/tj/>

On Thu, Mar 10, 2016 at 9:15 PM, Jacklyn <[jacklyn.c.james@noaa.gov](mailto:jacklyn.c.james@noaa.gov)> wrote:  
Signed version attached

On Thu, Mar 10, 2016 at 3:58 PM, Jacklyn <[jacklyn.c.james@noaa.gov](mailto:jacklyn.c.james@noaa.gov)> wrote:  
All,

The final project instructions are attached to this email and a ZIP file containing all pertinent project files is posted to the FTP site under the project name OPR-E350-TJ-16 Southern Chesapeake Bay. You can access the FTP site by clicking [here](#).

--

Jacklyn James  
Physical Scientist, Hydrographic Surveys Division  
1315 East-West Highway SSMC3 Room 6745  
Silver Springs, MD 20910  
(o) [301-713-2702 ext. 120](tel:301-713-2702)  
(m) [301-221-7055](tel:301-221-7055)  
jacklyn.c.james@noaa.gov

To see live feeds from the NOAA Ship Okeanos Explorer go to the web site below.  
<http://oceanexplorer.noaa.gov/okeanos/welcome.html#>

--

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Please excuse the brevity, this email was sent from my phone.

--

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LT Matthew Forrest, NOAA  
Operations Officer in Training  
NOAA Ship Thomas Jefferson  
439 W York St  
Norfolk, VA 23510  
Tel: [\(757\) 647-0187](tel:757-647-0187)  
Iridium: [\(808\) 434-2706](tel:808-434-2706)

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<b>Name</b>	<b>Date Completed</b>
ENS Marybeth Head	3/21/2016
Kimberly Glomb	3/28/2016
Anthony Teele	3/29/2016
ENS Peter Gleichauf	3/29/2016
Francine Grains	3/29/2016
ENS Kaitlyn Seberger	3/29/2016
Chris Marcum	3/29/2016
ENS Max Andersen	3/30/2016
Rita Bowker	4/1/2016
LCDR Olivia Hauser	4/1/2016
LTJG Eileen Pye	4/1/2016
LT Matthew Forrest	4/1/2016
CAPT Shephard Smith	4/1/2016
LT Joseph Carrier	4/1/2016
Todd Walsh	4/1/2016
Alex Ligon	4/1/2016
Robert Bayliss	4/1/2016



Allison Stone - NOAA Federal <allison.c.stone@noaa.gov>

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## Re: TPU Value for WGS84-MLLW vDatum Model

5 messages

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**Jacklyn** <jacklyn.c.james@noaa.gov>

Thu, Apr 7, 2016 at 6:48 PM

To: Matthew Forrest - NOAA Federal <matthew.r.forrest@noaa.gov>

Cc: "OPS.Thomas Jefferson - NOAA Service Account" <ops.thomas.jefferson@noaa.gov>, "ChiefST.Thomas Jefferson - NOAA Service Account" <chiefst.thomas.jefferson@noaa.gov>, Allison Stone - NOAA Federal <allison.c.stone@noaa.gov>, Max Andersen - NOAA Federal <max.andersen@noaa.gov>

Hi Matthew,

The separation uncertainty is 9.2 cm for the WGS84-MLLW separation model provided. Kindly let me know if you have further questions.

On Thu, Apr 7, 2016 at 10:37 AM, Matthew Forrest - NOAA Federal <matthew.r.forrest@noaa.gov> wrote:

Jacklyn,

Our PIs state that our vDatum model for E350 is 9.2cm; I believe that number refers to the model for NAD83-MLLW. Can you confirm that this value holds true for the WGS84-MLLW model, or if the change in original datum has changed that at all? Thank you!

V/r,

LT Forrest

--

LT Matthew Forrest, NOAA  
Operations Officer  
NOAA Ship Thomas Jefferson  
439 W York St  
Norfolk, VA 23510  
Tel: (757) 647-0187  
Iridium: (808) 434-2706

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**Matthew Forrest - NOAA Federal** <matthew.r.forrest@noaa.gov>

Thu, Apr 7, 2016 at 6:57 PM

To: Jacklyn <jacklyn.c.james@noaa.gov>

Cc: "OPS.Thomas Jefferson - NOAA Service Account" <ops.thomas.jefferson@noaa.gov>, "ChiefST.Thomas Jefferson - NOAA Service Account" <chiefst.thomas.jefferson@noaa.gov>, Allison Stone - NOAA Federal

<allison.c.stone@noaa.gov>, Max Andersen - NOAA Federal <max.andersen@noaa.gov>

Jacklyn,

Thanks! I appreciate you looking into this. There is one other thing I was just about to email you about. Would it be possible to have our vDatum model expanded a little bit? We'd like to have it cover to the extents of Willoughby Bay. Thanks!

V/r,

LT Forrest

[Quoted text hidden]

---

**Jacklyn** <jacklyn.c.james@noaa.gov>

Thu, Apr 7, 2016 at 7:16 PM

To: Matthew Forrest - NOAA Federal <matthew.r.forrest@noaa.gov>

Cc: "OPS.Thomas Jefferson - NOAA Service Account" <ops.thomas.jefferson@noaa.gov>, "ChiefST.Thomas Jefferson - NOAA Service Account" <chiefst.thomas.jefferson@noaa.gov>, Allison Stone - NOAA Federal <allison.c.stone@noaa.gov>, Max Andersen - NOAA Federal <max.andersen@noaa.gov>

You want it to include the area attached?

[Quoted text hidden]



**willoughby bay.png**  
89K

---

**LT Matthew Forrest, NOAA** <matthew.r.forrest@noaa.gov>

Thu, Apr 7, 2016 at 7:19 PM

To: Jacklyn <jacklyn.c.james@noaa.gov>

Cc: "OPS.Thomas Jefferson - NOAA Service Account" <ops.thomas.jefferson@noaa.gov>, "ChiefST.Thomas Jefferson - NOAA Service Account" <chiefst.thomas.jefferson@noaa.gov>, Allison Stone - NOAA Federal <allison.c.stone@noaa.gov>, Max Andersen - NOAA Federal <max.andersen@noaa.gov>

Jacklyn,

That's the area. Thanks!

V/r,

Forrest

[Quoted text hidden]

<willoughby bay.png>

---

**Jacklyn** <jacklyn.c.james@noaa.gov>

Thu, Apr 7, 2016 at 8:22 PM

To: "LT Matthew Forrest, NOAA" <matthew.r.forrest@noaa.gov>

Cc: "OPS.Thomas Jefferson - NOAA Service Account" <ops.thomas.jefferson@noaa.gov>, "ChiefST.Thomas Jefferson - NOAA Service Account" <chiefst.thomas.jefferson@noaa.gov>, Allison Stone - NOAA Federal <allison.c.stone@noaa.gov>, Max Andersen - NOAA Federal <max.andersen@noaa.gov>, Michael Gonsalves - NOAA Federal <michael.gonsalves@noaa.gov>, Corey Allen - NOAA Federal <corey.allen@noaa.gov>

Matthew,

The requested model is attached. Feel free to reach out with additional questions.

[Quoted text hidden]

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**2 attachments**

 **OPR-E350-TJ-VDatum\_Shapefile\_WGS84-MLLW\_WilloughbyBay.csar0**  
129K

 **OPR-E350-TJ-VDatum\_Shapefile\_WGS84-MLLW\_WilloughbyBay.csar**  
83K





APPROVAL PAGE

H12866

Data meet or exceed current specifications as certified by the OCS survey acceptance review process. Descriptive Report and survey data except where noted are adequate to supersede prior surveys and nautical charts in the common area.

The following products will be sent to NCEI for archive

- H12866\_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12866\_GeoImage.pdf

The survey evaluation and verification has been conducted according current OCS Specifications, and the survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.

Approved: \_\_\_\_\_

**Lieutenant Commander Briana W. Hillstrom, NOAA**  
Chief, Atlantic Hydrographic Branch