H13301

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

DESCRIPTIVE REPORT

Type of Survey:	Basic Hydrographic Survey
Registry Number:	H13301

LOCALITY

State(s):	Virginia
General Locality:	Southern Chesapeake Bay
Sub-locality:	York Spit

2020

CHIEF OF PARTY
Alex T. Bernier

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13301**

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:	**Southern Chesapeake Bay**
Sub-Locality:	**York Spit**
Scale:	**10000**
Dates of Survey:	**07/07/2020 to 11/13/2020**
Instructions Dated:	**08/27/2019**
Project Number:	**OPR-E350-KR-19**
Field Unit:	**SAIC**
Chief of Party:	**Alex T. Bernier**
Soundings by:	**Multibeam 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:

Contract: EA-133C-14-CQ-0033/TO-0006. Contractor: Leidos, 221 Third Street, Newport, RI 02840 USA. Subcontractors: Divemasters, Inc., 15 Pumpshire Road, Toms River, NJ 08753; OARS, 8705 Shoal Creek Blvd, Suite 109, Austin, TX 78757. Leidos Doc. 20-TR-024. All times were recorded in UTC. Final data are corrected to North American Datum of 1983 (NAD83) 2011 realization 2010 (NAD83(2011)2010.0), UTM Zone 18N.

Any revisions to the Descriptive Report (DR) applied during office processing are shown in red italic text. The DR is maintained as a field unit product, therefore all information and recommendations within this report are considered preliminary unless otherwise noted. The final disposition of survey data is represented in the NOAA nautical chart products. All pertinent records for this survey are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via https://www.ncei.noaa.gov/. Products created during office processing were generated in WGS84 UTM 18N, MLLW. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

Table of Contents

List of Tables

List of Figures

Descriptive Report to Accompany Survey H13301

Project: OPR-E350-KR-19

Locality: Southern Chesapeake Bay

Sublocality: York Spit

Scale: 1:10000

July 2020 - November 2020

SAIC

Chief of Party: Alex T. Bernier

A. Area Surveyed

The area surveyed was a section of the Southern Chesapeake Bay York Spit (Figure 1).

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
37° 16' 21.54" N 76° 24' 54.86" W	37° 8' 11.26" N 75° 11' 27.15" W

Table 1: Survey Limits

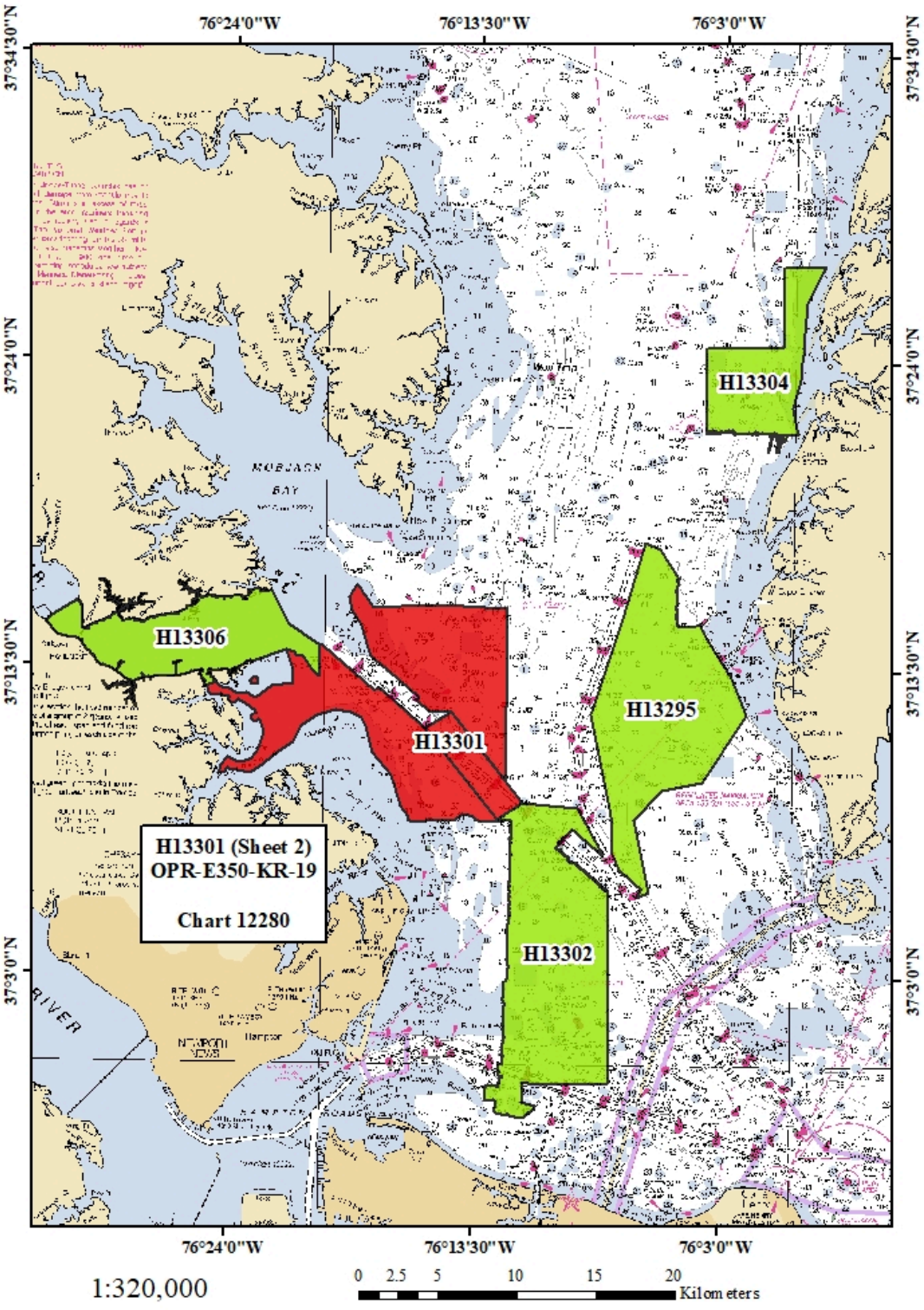

Figure 1: H13301 Survey Bounds

Survey limits were acquired in accordance with the requirements in the Project Instructions and the Hydrographic Surveys Specifications and Deliverables (HSSD), March 2019.

A.2 Survey Purpose

The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charting products. This project is located in the Chesapeake Bay in Virginia. The Chesapeake Bay is the largest of 130 estuaries in the United States. The Coast Guard is currently conducting a Waterways Assessment and Management Survey of the lower James River. This data will be used to assess if ATONs are correctly placed and help inform a comprehensive report regarding the location of shoals within the lower James River. Survey vintage in this area dates back to 1945. This project will provide critical data for the updating of National Ocean Service (NOS) nautical charting products to increase maritime safety in the region. 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.

Leidos warrants only that the survey data acquired by Leidos and delivered to NOAA under Contract EA-133C-14-CQ-0033 reflects the state of the sea floor in existence on the day and at the time the survey was conducted.

H13301 was surveyed in accordance with the following documents:
1. Project Instructions, OPR-E350-KR-19, dated 27 August 2019
2. Hydrographic Surveys Specifications and Deliverables (HSSD), March 2019
3. OPR-E350-KR-19 Statement of Work, dated 28 August 2019
4. OPR-E350-KR-19_PRF_10282019.000, received 28 October 2019
5. OPR-E350-KR-19_CSF_10282019.000, received 28 October 2019
6. OPR-E350-KR-19_Southern_Chesapeake_Bay_Questions.pdf, dated 05 November 2019
7. OPR_E350_KR_19_1305M219FNCNJ0356 Mod P20002 - No-cost Extension.pdf, dated 07 August 2020
8. OPR-E350-KR-19 Survey LNM and NALL.pdf, dated 15 October 2020

A.4 Survey Coverage

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

Water Depth	Coverage Required
H13301 (inside PRF-designated corridor)	Object Detection Coverage (Refer to HSSD Section 5.2.2.2)
H13301 (outside PRF corridor)	Complete Coverage (Refer to HSSD Section 5.2.2.2)
8 meters water depth and shoaler	Sidescan may be acquired at an altitude of 6-20% of the range scale
All waters in survey area	Complete 5,553 LNM. Transit mileage, system calibration mileage and data which do not meet HSSD specifications shall not count towards the completion of the LNM requirement. Notify the COR/Project Manager upon nearing completion of LNM requirement. The final survey area shall be squared off and ensure the full investigation of any features within the surveyed extent.

Table 2: Survey Coverage

Survey coverage achieved was in accordance with the requirements in the Project Instructions and the HSSD (Figure 2). Leidos chose to achieve the coverage requirement using Object Detection Coverage, Option B (200% side scan sonar coverage with concurrent multibeam) (Figure 3 and Figure 6) and Complete Coverage, Option B (100% side scan sonar coverage with concurrent multibeam) (Figure 4 and Figure 5), within the NOAA designated areas. The Project Instructions defined the Inshore Limit as “The Inshore Limit is the Navigable Area Limit Line (Refer to HSSD 1.3.2). Per correspondence dated 15 October 2020, referenced above, Leidos was directed to box surveys areas completed and to not survey to the NALL within remaining areas of survey.

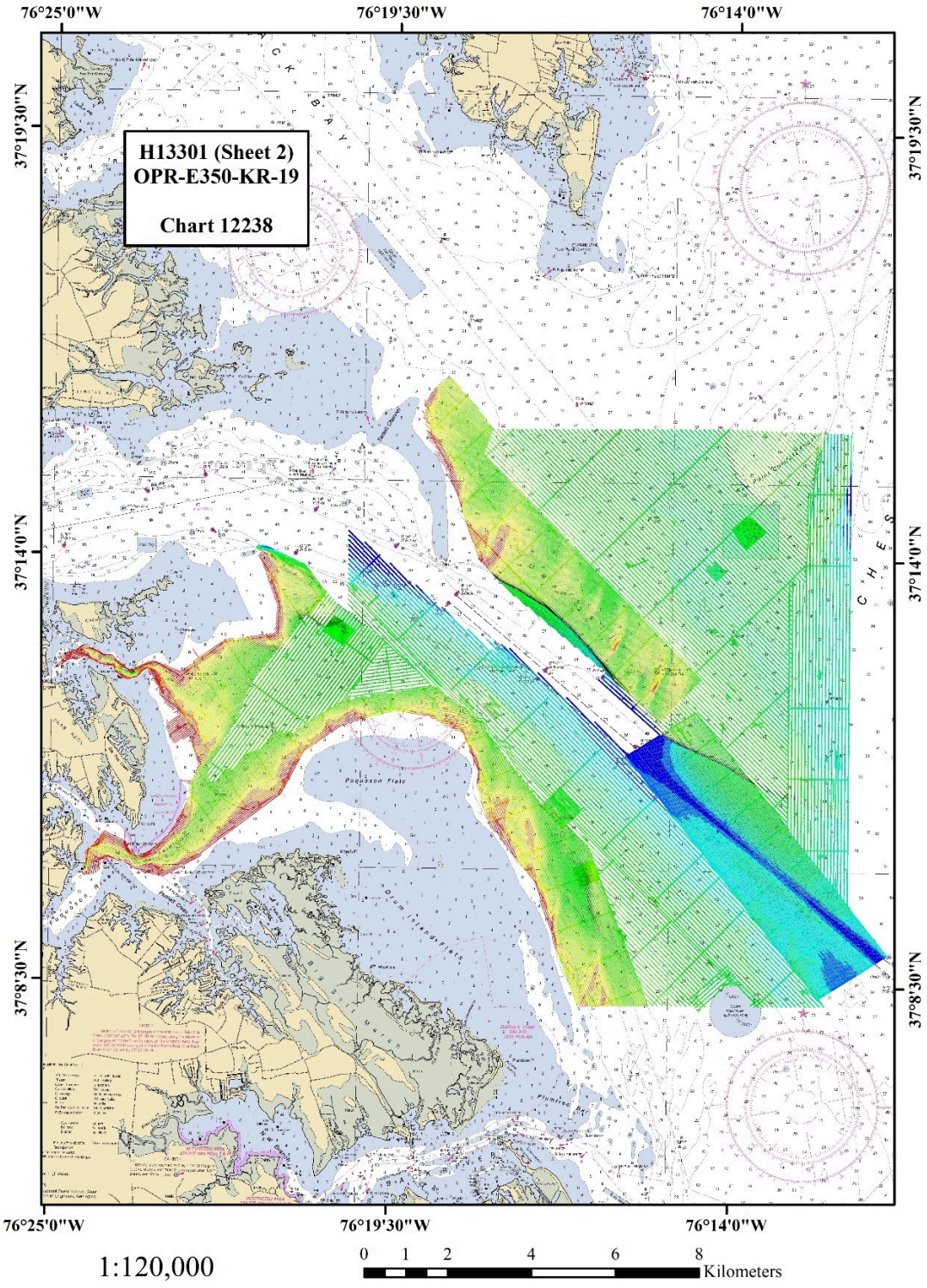

Figure 2: Final Bathymetry Coverage for H13301

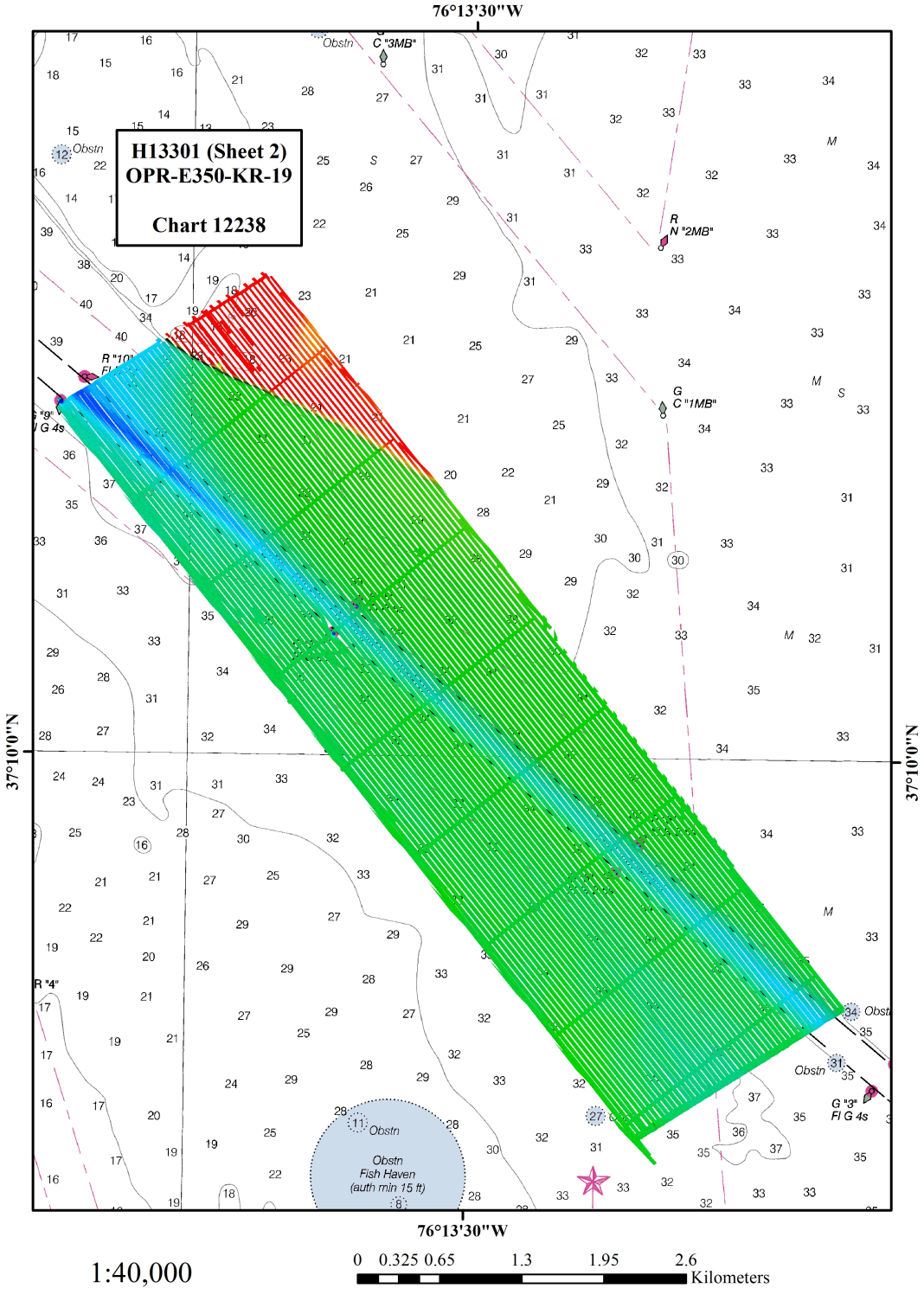

Figure 3: Final Bathymetry Coverage for H13301 Object Detection Coverage

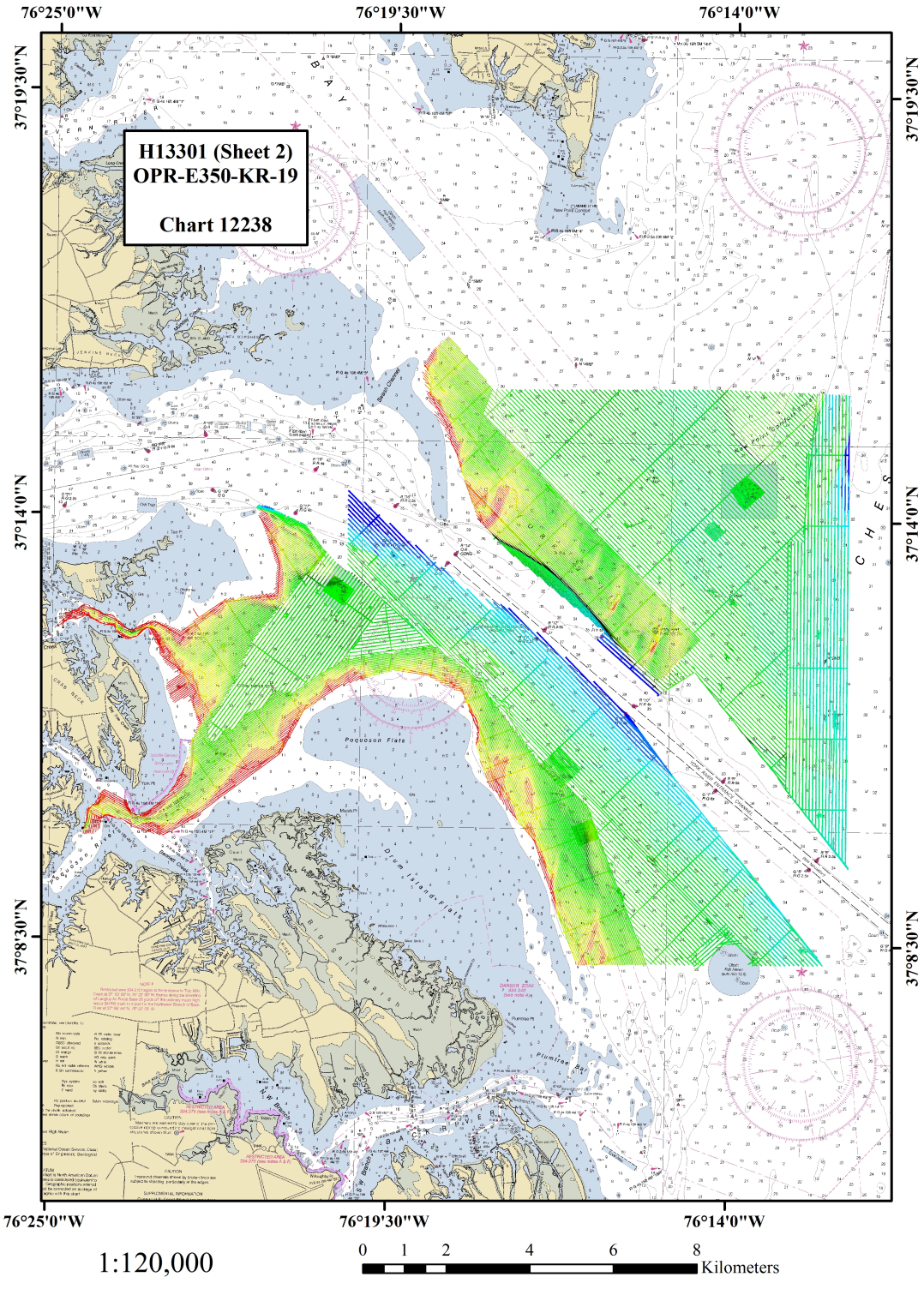

Figure 4: Final Bathymetry Coverage for H13301 Complete Coverage

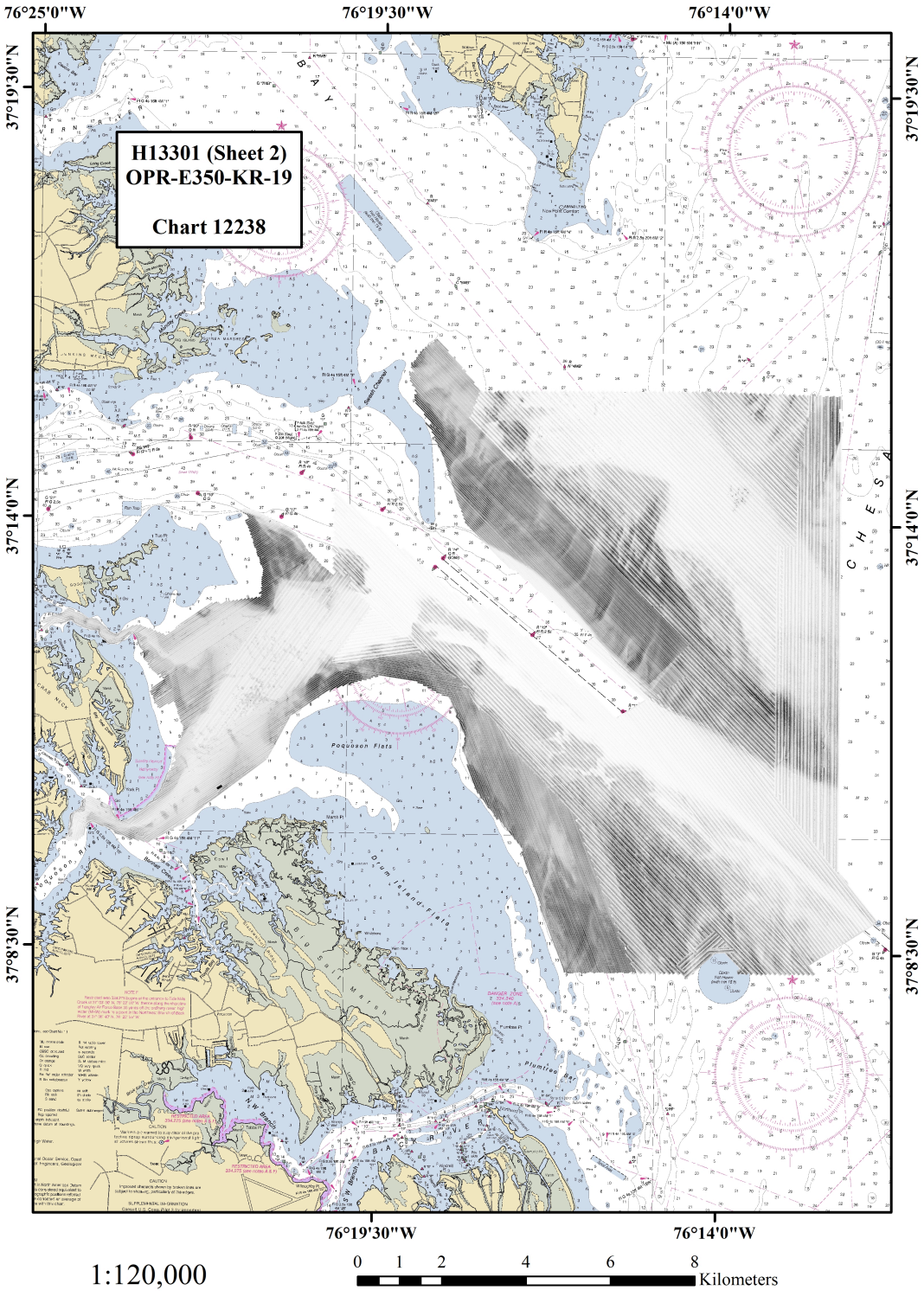

Figure 5: Final Side Scan Coverage for H13301 (First 100% coverage)

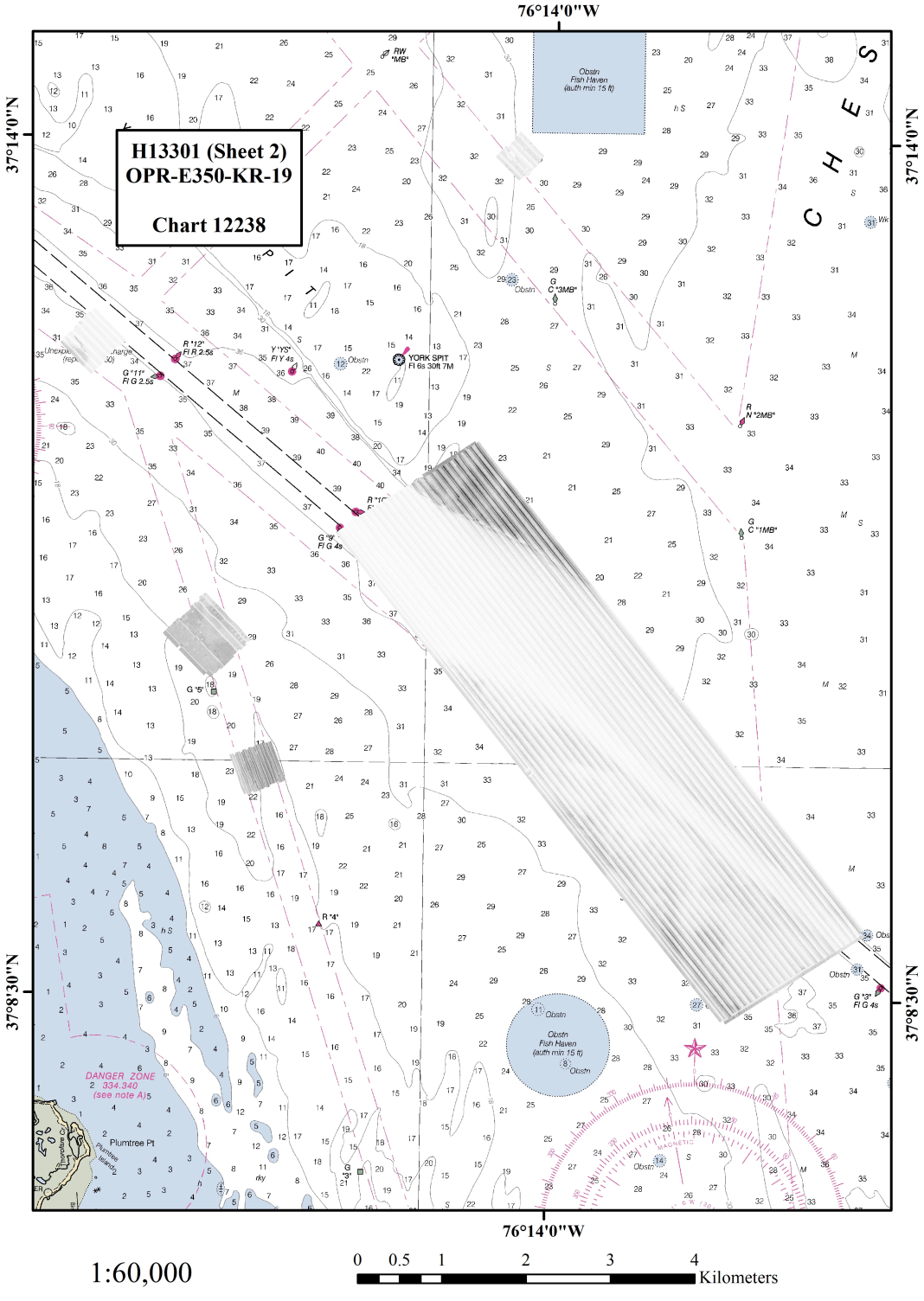

Figure 6: Final Side Scan Coverage for H13301 (Second 100% coverage)

A.6 Survey Statistics

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

	HULL ID	*M/V Atlantic Surveyor*	*R/V Oyster Bay II*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0	0.0
	MBES Mainscheme	0.0	0.0	0.0
	Lidar Mainscheme	0.0	0.0	0.0
	SSS Mainscheme	0.0	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0	0.0
	MBES/SSS Mainscheme	798.99	723.92	0.0
	SBES/MBES Crosslines	33.58	29.84	63.42
	Lidar Crosslines	0.0	0.0	0.0
Number of Bottom Samples				9
Number Maritime Boundary Points Investigated				0
Number of DPs				0
Number of Items Investigated by Dive Ops				0
Total SNM				42.56

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
07/07/2020	189
07/08/2020	190
07/09/2020	191
07/10/2020	192
07/11/2020	193
07/12/2020	194
07/13/2020	195
07/14/2020	196
07/15/2020	197
07/16/2020	198
07/17/2020	199
07/19/2020	201
07/21/2020	203
07/23/2020	205
07/24/2020	206
07/25/2020	207
07/26/2020	208
07/27/2020	209
07/28/2020	210
07/30/2020	212
07/31/2020	213
08/01/2020	214
08/02/2020	215
08/10/2020	223
08/11/2020	224
08/17/2020	230
08/18/2020	231
08/24/2020	237
08/25/2020	238
09/03/2020	247
09/04/2020	248

Survey Dates	Day of the Year
09/06/2020	250
10/09/2020	283
10/10/2020	284
10/11/2020	285
10/20/2020	294
10/21/2020	295
10/23/2020	297
10/31/2020	305
11/01/2020	306
11/13/2020	318

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Leidos used their ISS-2000 software on a Windows 7 platform to acquire these survey data. Survey planning and data analysis were conducted using the Leidos SABER software on Red Hat Enterprise 7 Linux platforms. Klein 3000 and 4900 side scan sonar (SSS) data were collected on a Windows 7 platform using Klein's SonarPro software. Subsequent processing and review of the SSS data, including the generation of coverage mosaics, were accomplished using SABER.

A detailed description of the systems and vessel used to acquire and process these data is included in the Data Acquisition and Processing Report (DAPR) rev 1 for OPR-E350-KR-19, delivered previously with the H13304 Descriptive Report (DR). There were no variations from the equipment configuration described in the DAPR rev 1.

B.1.1 Vessels

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

Hull ID	*M/V Atlantic Surveyor*	*R/V Oyster Bay II*
LOA	110.0 feet	30.0 feet
Draft	9.0 feet	3.0 feet

Table 5: Vessels Used

Figure 7: M/V Atlantic Surveyor

Figure 8: R/V Oyster Bay II

The M/V Atlantic Surveyor (Figure 7) was used to collect multibeam echo sounder (MBES) (RESON SeaBat T50), side scan sonar (SSS) (Klein 3000), and sound speed data during twenty-four hours per day survey operations. The R/V Oyster Bay II (Figure 8) was used to collected MBES (RESON SeaBat 7125 SV1), SSS (Klein 4900), and sound speed data during twelve hours per day survey operations.

A detailed description of the vessels used is included in the DAPR rev 1.

B.1.2 Equipment

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

Manufacturer	Model	Type
Teledyne RESON	SeaBat T50-R	MBES
Teledyne RESON	SeaBat 7125 SV	MBES
Klein Marine Systems	System 3000	SSS
Klein Marine Systems	System 3900	SSS
Applanix	POS MV 320 v5	Positioning and Attitude System
AML Oceanographic	MVP30	Sound Speed System
AML Oceanographic	BaseX	Sound Speed System

Table 6: Major Systems Used

A detailed description of the equipment installed is included in the DAPR rev 1.

B.2 Quality Control

B.2.1 Crosslines

Multibeam/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 4.16% of mainscheme acquisition.

Refer to Separates II for details about how the crossing analyses were performed and a complete discussion of each analysis and tabular results. Figure 9 summarizes the crossline comparison results.

Difference Grid	Minimum and Maximum CUBE Depth (meters) of Crossline Grid	IHO Order 1A Maximum Allowable Uncertainty (meters) for the Range of Depths	Percentage of Depth Differences Within IHO Order 1A Maximum Allowable Uncertainty
Mainscheme to Crossline (Class 1) (all valid multibeam) 1-meter	2.629 – 12.342	0.501 – 0.525	99.99%
M/V Atlantic Surveyor multibeam Crossline (Class 1) to Mainscheme 1-meter	5.736 – 12.342	0.506 – 0.525	100.00%
R/V Oyster Bay II multibeam Crossline (Class 1) to Mainscheme 1-meter	2.749 – 10.546	0.501– 0.518	99.99%
M/V Atlantic Surveyor RESON SeaBat T50 multibeam to R/V Oyster Bay II RESON SeaBat 7125 SV1 multibeam 1-meter	5.604 – 13.618	0.505 – 0.530	99.99%

Figure 9: Summary of Repeatability Analysis

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.15 meters	0.2 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
Atlantic Surveyor	1 meters/second	1 meters/second	N/A meters/second	1 meters/second
Oyster Bay II	1 meters/second	1 meters/second	N/A meters/second	1 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

For specific details on the use and application of the SABER Total Propagated Uncertainty (TPU) model, refer to the DAPR rev 1. Once the TPU model was applied to the GSF bathymetry data, each beam was attributed with the horizontal uncertainty and the vertical uncertainty at the 95% confidence level. The

vertical and horizontal uncertainty values, estimated by the TPU model for individual multibeam soundings, varied little across the dataset, tending to be most affected by beam angle. Individual soundings that had vertical and horizontal uncertainty values above IHO S-44 5th Edition, Order 1a were flagged as invalid during the uncertainty attribution.

As discussed in the DAPR rev 1, SABER generates two vertical uncertainty surfaces; the Hypothesis Standard Deviation (Hyp. StdDev) and the Hypothesis Average Total Propagated Uncertainty (Hyp. AvgTPU). A third vertical uncertainty surface is generated from the larger value of these two uncertainties at each node and is referred to as the Hypothesis Final Uncertainty (Hyp. Final Uncertainty).

The final H13301 50-centimeter PFM CUBE surface contained final vertical uncertainties that ranged from 0.210 meters to 0.636 meters. The IHO Order 1a maximum allowable vertical uncertainty was calculated to range between 0.505 to 0.532 meters, based on the minimum CUBE depth (5.618 meters) and maximum CUBE depth (13.904 meters). Results from the SABER Check PFM Uncertainty function identified that there were eight nodes in the final H13301 50-centimeter PFM CUBE surface with final vertical uncertainties that exceeded IHO Order 1a allowable vertical uncertainty. These nodes were associated with objects found within the survey area and the steep slopes associated with the scour surrounding an ATON buoy anchor. The SABER Frequency Distribution Tool was also used to review the Hyp. Final Uncertainty surface within the final H13301 50-centimeter CUBE PFM grid. Results showed that 99.96% of all nodes had final uncertainties less than or equal to 0.210 meters.

The final H13301 1-meter PFM CUBE surface contained final vertical uncertainties that ranged from 0.210 meters to 0.614 meters. The IHO Order 1a maximum allowable vertical uncertainty was calculated to range between 0.500 to 0.533 meters, based on the minimum CUBE depth (0.718 meters) and maximum CUBE depth (14.175 meters). Results from the SABER Check PFM Uncertainty function identified that there were three nodes in the final H13301 1-meter PFM CUBE surface with final vertical uncertainties that exceeded IHO Order 1a allowable vertical uncertainty. These nodes were associated with objects within the charted fish haven, and the steep slopes associated with the scour surrounding an ATON buoy anchor. The SABER Frequency Distribution Tool was also used to review the Hyp. Final Uncertainty surface within the final H13301 1-meter CUBE PFM grid. Results showed that 99.84% of all nodes had final uncertainties less than or equal to 0.210 meters.

B.2.3 Junctions

Per the Project Instructions, analyses of the H13301 junctions with adjacent surveys were performed between the survey listed in Table 7. Figure 10 shows the general locality of H13301 as it relates to the sheet to which junctions were performed. Refer to Separates II for details about how junction analyses were performed and a complete discussion of the analysis and tabular results.

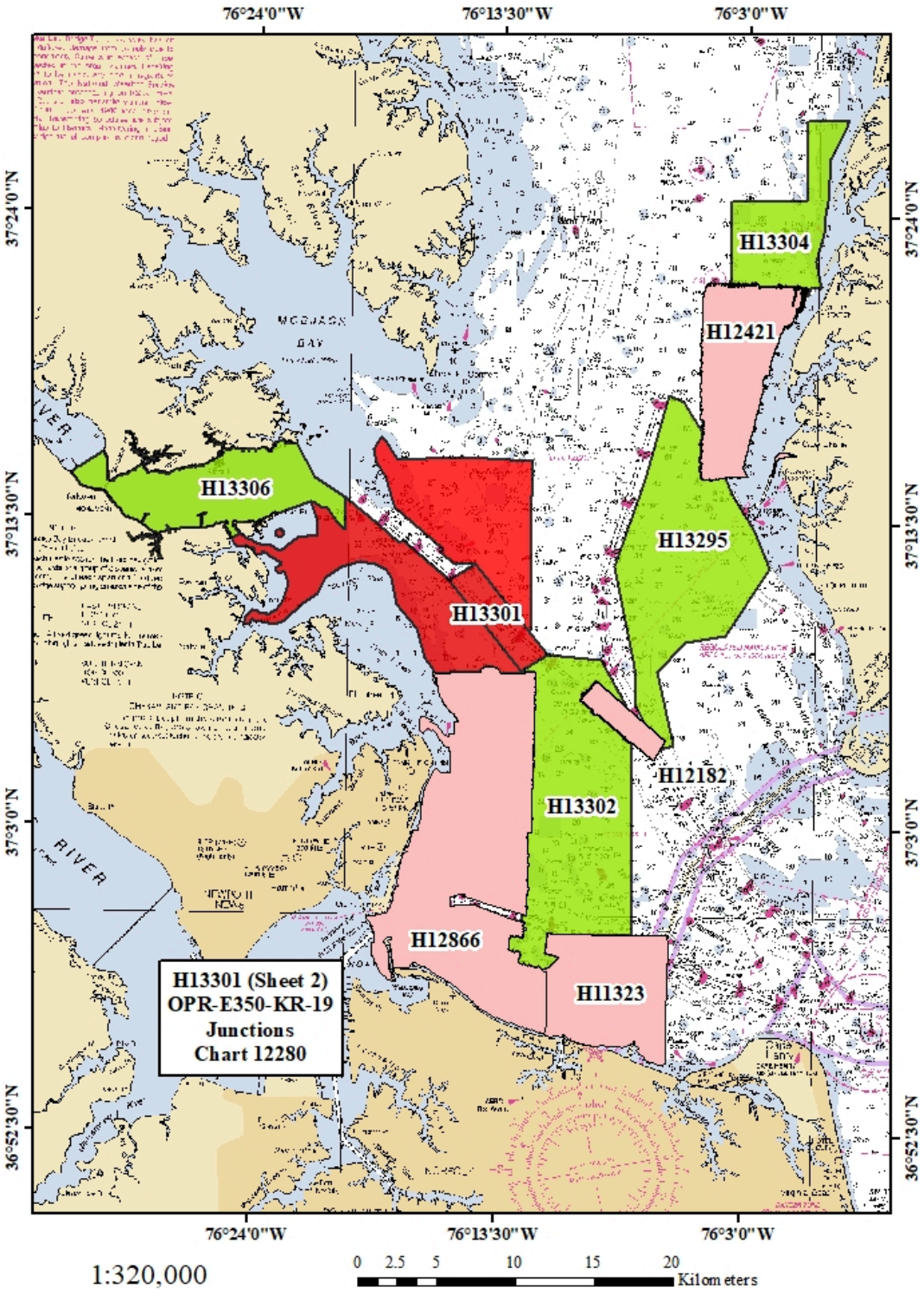

Figure 10: General Locality of H13301 with Junctioning Surveys

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13302	1:10000	2020	Leidos	SE
H12866	1:10000	2016	NOAA Ship Thomas Jefferson	S

Table 9: Junctioning Surveys

H13302

H13302 junctions with H13301 to the southeast; 100% of the comparisons agreed within ±0.18 meters, below the calculated maximum allowable TVU of 0.524 meters.

H12866

H12866 junctions with H13301 to the south; 100% of the comparisons agreed within ±1.420 meters while 99.77% of the comparison results fell within the calculated maximum allowable TVU of 0.52 meters.

B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the DAPR rev 1; quality control checks conducted during H13301 are reported in Separates I.

B.2.5 Equipment Effectiveness

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

B.2.6 Factors Affecting Soundings

R/V Oyster Bay II

The R/V Oyster Bay II MBES data occasionally exhibited an artifact due to minor vibrations in the pole mount setup; attributed to sea state, currents, and vessel speed. The artifact was observed in the outer beams and when present it was generally within 2 to 3 centimeters and occasionally was observed in the range of 10

centimeters. The outer beam artifact had no significant impact on the final CUBE surface. When observed, these artifacts were within the IHO Order 1a allowable uncertainty standards as described in Section B.2.2.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: On the M/V Atlantic Surveyor, the MVP30 was the primary system used to collect sound speed profile (SSP) data, refer to the DAPR rev 1 for additional details. On the R/V Oyster Bay II, the BASE-X2 was the primary system used to collect SSP data, refer to the DAPR rev 1 for additional details. SSP data were obtained at intervals frequent enough to meet depth accuracy requirements as specified in Section 5.2.3.3 of the HSSD.

All sound speed profiles applied for online bathymetry data collection were acquired within 500 meters of the bounds of the survey area as specified in Section 5.2.3.3 of the HSSD.

Confidence checks of the sound speed profile casts were conducted by comparing at least two consecutive casts taken with different SSP sensors. Results from conducting the sound speed confidence checks conducted during H13301 acquisition period can be found in Separates II within the “Comparison Cast Log” section.

All individual SSP files are delivered with the H13301 data and are broken out into sub-folders, which correspond to the purpose of each cast. Also, all individual SSP files for H13301 have been concatenated into four separate files based on the purpose of the cast, provided in CARIS format files (.svp), and delivered under (H13301/Processed/SVP/CARIS_SSP) on the delivery drive. In accordance with HSSD Section 8.3.6, H13301 NCEI data were submitted prior to the delivery of the last sheet for OPR-E350-KR-19. Refer to Separates II for additional details.

B.2.8 Coverage Equipment and Methods

All equipment and survey methods are detailed in the DAPR rev 1.

B.2.9 Multibeam Coverage Analysis

Leidos chose to achieve the coverage requirement using 100% or 200% side scan sonar coverage with concurrent multibeam bathymetry. To achieve this coverage, the SSS was set to 25-meter and 50-meter range scale, and main scheme survey lines were collected between 40-meter and 80-meters, based on range scale, to ensure 100% or 200% SSS coverage was achieved.

The SABER Gapchecker program was used to flag MBES data gaps within the CUBE surface. Additionally, the entire surface was visually scanned for holidays at various points during the data processing effort. Additional survey lines were run to fill any holidays that were detected.

A final review of the CUBE Depth surface of the H13301 50-centimeter PFM and 1-meter PFM showed that there were no holidays as defined for complete coverage surveys in Section 5.2.2.2 of the HSSD. Any three by three or three by one node gaps were along the outer swath data beyond side scan nadir coverage.

The final CUBE PFM grids were examined for the number of soundings contributing to the chosen CUBE hypotheses for each node by running SABER's Frequency Distribution Tool on the Hypothesis Number of Soundings (Hyp. # Soundings) surface. The Hyp. # Soundings surface reports the number of soundings that were used to compute the chosen hypothesis. Analysis was conducted on the Hyp. # Soundings surface of the PFM grid to ensure that the requirements for Object Detection Coverage surveys (HSSD Section 5.2.2.2) and Complete Coverage surveys (HSSD Section 5.2.2.3) were met. Within the final 50-centimeter CUBE PFM grid 99.06% of all nodes contained five or more soundings. Within the final 1-meter CUBE PFM grid 99.49% of all nodes contained five or more soundings.

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

All data reduction procedures conform to those detailed in the DAPR rev 1.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR rev1. Multibeam files associated with calibration were previously delivered under OPR-E350-KR-19 H13295 and H13304. No additional files contributed to the calibration than were previously delivered, therefore no additional files are provided with H13301 per HSSD Section 8.3.2.

B.4 Backscatter

Side Scan Sonar (SSS) Coverage Analysis: For all details regarding SSS data processing, see the DAPR rev 1. Leidos chose to adhere to the coverage requirements in the Project Instructions using Object Detection Coverage, Option B (200% side scan sonar coverage with concurrent multibeam) and Complete Coverage Option B (100% side scan sonar coverage with concurrent multibeam). As referenced in Section A.4, the Project Instructions provided a waiver to HSSD Section 6.1.2.3 for side scan towfish height. In waters less

than 8 meters the towfish height above the bottom could be 6% of the range scale. Mosaics were analyzed for coverage at both 8% and 6% of range based on water depths greater or less than 8 meters.

Leidos generated each SSS coverage mosaic at 1-meter cell size resolution as specified in Section 8.2.1 of the HSSD. Each 100% coverage mosaic was independently reviewed using tools in SABER to verify data quality and swath coverage. The SABER Gapchecker routine was used to flag data gaps within the 100% SSS coverage mosaic. Additionally, the entirety of the SSS surface was visually scanned for holidays at various points during the data processing effort. Additional survey lines were run to fill any holidays that were detected. The coverage mosaics are determined to be complete and sufficient to meet the requirements contained within the Project Instructions and HSSD. Each mosaic is delivered as a single georeferenced raster file (datum of NAD83) in floating point GeoTIFF format, as specified in Sections 8.2.1 and 8.3.3 in the HSSD.

Multibeam Echo Sounder Seafloor Backscatter: Leidos collected MBES backscatter data with all GSF data acquired, in accordance with HSSD Section 6.2. The MBES settings used were checked to ensure acceptable quality standards were met and to mitigate acoustic saturation of the backscatter data. The MBES backscatter data acquired were written to the GSF in real-time by ISS-2000 and are delivered in the final GSF files for this sheet. Evaluation of backscatter data and processing were not required for OPR-E350-KR-19 and therefore no additional processing was performed by Leidos and no additional products were produced.

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
Leidos	SABER	5.4.0.30.4

Table 10: Primary bathymetric data processing software

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

Manufacturer	Name	Version
Leidos	SABER	5.4.0.30.4

Table 11: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Profile Version 2019.

The primary data processing software used for both bathymetry and imagery was SABER. Subsequent to the delivery of the OPR-E350-KR-19 DAPR rev 1 (submitted 2020-12-04), the SABER version was upgraded from 5.4.0.30.1 to 5.4.0.30.4 as captured in Table 8 and Table 9. There were no other changes from the software configuration as detailed in the DAPR rev 1.

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
H13301_MB_50cm_MLLW_Final-1_of_2	BAG	50 centimeters	9.643 meters - 12.308 meters	N/A	Object Detection Coverage, Option B (200% side scan sonar coverage with concurrent multibeam)
H13301_MB_50cm_MLLW_Final-2_of_2	BAG	50 centimeters	5.618 meters - 13.904 meters	N/A	Object Detection Coverage, Option B (200% side scan sonar coverage with concurrent multibeam)
H13301_MB_1m_MLLW_Final-1_of_2	BAG	1 meters	0.749 meters - 13.832 meters	N/A	Complete coverage, Option B (100% side scan sonar coverage with concurrent multibeam)
H13301_MB_1m_MLLW_Final-2_of_2	BAG	1 meters	0.718 meters - 14.175 meters	N/A	Complete coverage, Option B (100% side scan sonar coverage with

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
					concurrent multibeam)
H13301_SSSAB_1m_500kHz_900kHz_1of2	SSS Mosaic (.tif)	1 meters	0.0 meters - 0.0 meters	N/A	First 100% SSS
H13301_SSSAB_1m_500kHz_900kHz_2of2	SSS Mosaic (.tif)	1 meters	0.0 meters - 0.0 meters	N/A	Second 100% SSS

Table 12: Submitted Surfaces

Object Detection Coverage Section 5.2.2.2 of the HSSD requires 50-centimeter node resolution for depths ranging from zero meters to 20 meters. Leidos generated a CUBE PFM grid for H13301 at 50-centimeter resolution, of the corridor designated as Object Detection Coverage from the PRF (Figure 3).

Complete Coverage Section 5.2.2.2 of the HSSD requires 1-meter node resolution for depths ranging from zero meters to 20 meters. Leidos generated a CUBE PFM grid for H13301 at 1-meter resolution. Data within the 1-meter were outside of the corridor designated as Object Detection Coverage from the PRF (Figure 4).

The CUBE Depth surface of the final H13301 50-centimeter PFM was used to assess and document multibeam survey coverage. SABER populates the CUBE depth with either the node’s chosen hypothesis or the depth of a feature or designated sounding set by the hydrographer, which overrides the chosen hypothesis. The range of CUBE depths of the H13301 50-centimeter PFM was from 5.618 meters (18.432 feet; 0.210 meters Total Vertical Uncertainty [TVU]) to 13.904 meters (45.617 feet; 0.210 meters TVU).

The CUBE Depth surface of the final H13301 1-meter PFM was used to assess and document multibeam survey coverage. SABER populates the CUBE depth with either the node’s chosen hypothesis or the depth of a feature or designated sounding set by the hydrographer, which overrides the chosen hypothesis. The range of CUBE depths of the H13301 1-meter PFM was from 0.718 meters (2.356 feet; 0.210 meters Total Vertical Uncertainty [TVU]) to 14.175 meters (46.506 feet; 0.210 meters TVU).

The final gridded bathymetry data are delivered as a Bathymetric Attributed Grid (BAG). The BAG files were exported from the CUBE PFM grid as detailed in the DAPR rev 1.

C. Vertical and Horizontal Control

Additional information discussing the vertical and horizontal control for this survey can be found in the DAPR rev 1.

C.1 Vertical Control

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

ERS Datum Transformation

The following ellipsoid-to-chart vertical datum transformation was used:

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	OPR-E350-KR-19_NAD83_VDatum_MLLW.cov

Table 13: ERS method and SEP file

Refer to the DAPR rev 1 for details regarding the application of VDatum to the MBES data files. No final tide note was provided from NOAA Center for Operational Oceanographic Products and Services (CO-OPS). While a final tide note was not required, a final tide note has been provided by Leidos in Appendix I.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD 83).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 18.

PPP

The vessel kinematic data (POS/MV files) were post-processed in Applanix POSPac software using the Applanix PP-RTX solution to generate the Smoothed Best Estimate of Trajectory (SBET) solutions which were applied through SABER to the multibeam data. Refer to the DAPR rev 1 for additional information and for details regarding all antenna and transducer offsets. Any soundings with total horizontal uncertainties exceeding the maximum allowable IHO S-44 5th Edition Order 1a specifications were flagged as invalid and therefore were not used in the CUBE depth calculations.

D. Results and Recommendations

D.1 Chart Comparison

The chart comparisons were conducted using a combination of SABER and CARIS' HIPS and SIPS.

United States Coast Guard (USCG) District 5 Local Notice to Mariners (LNM) publications were reviewed for changes subsequent to the date of the Project Instructions and before the end of survey (as specified in Section 8.1.4 of the HSSD). The LNM reviewed were from week 42/19 (15 October 2019) until week 46/20

(17 November 2020). The H13301 survey limits covered the position ATON Back Creek Daybeacon 4, and at the time of survey acquisition over this area this ATON was observed on station and serving it's intended purpose, as documented in the H13301 S-57 FFF. Subsequent review of the LNM publications listed this ATON as "DAYMK MISSING" starting on publications 45/20. Additionally, while the unassigned NOAA Lighted Data Buoy YS was charted slightly outside the H13301 SOW, its charted position was covered within the achieved survey limits of this sheet. During the time of survey acquisition over this area this ODAS buoy was not found in its charted location, but was observed off station further to the southeast as documented in the H13301 S-57 FFF. Subsequent review of the LNM publications listed this buoy as "OFF STA" starting on publications 08/19.

H13301 data met data accuracy standards and bottom coverage requirements. Leidos recommends updating the common areas of all charts using data from this survey. Charting recommendations for new features, and updates to charted features, are documented in the H13301 S-57 FFF. Additional charted objects are discussed in later sections.

D.1.1 Electronic Navigational Charts

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

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US5VA13M	1:40000	41	10/24/2019	08/21/2020	NO
US5VA24M	1:40000	29	03/24/2020	10/23/2020	NO
US5VA60M	1:20000	20	05/29/2018	11/10/2020	NO

Table 14: Largest Scale ENCs

US5VA13M

ENC US5VA13M covers the H13301 survey limit from 37° 08' 30.60"N southward.

CUBE depths within H13301 agreed well with the charted depths across the contemporaneous survey area; observed depths were primarily within ±0.5 meters of charted depths. There was greater variability along the western extent of H13301 with observed depths deeper than charted depths (Figure 11). The depth contours on ENC US5VA13M generally agreed with depths that fell within the H13301 survey area with the exception of the 3.6-meter contour which has migrated west (Figure 12, Figure 13, and Figure 14).

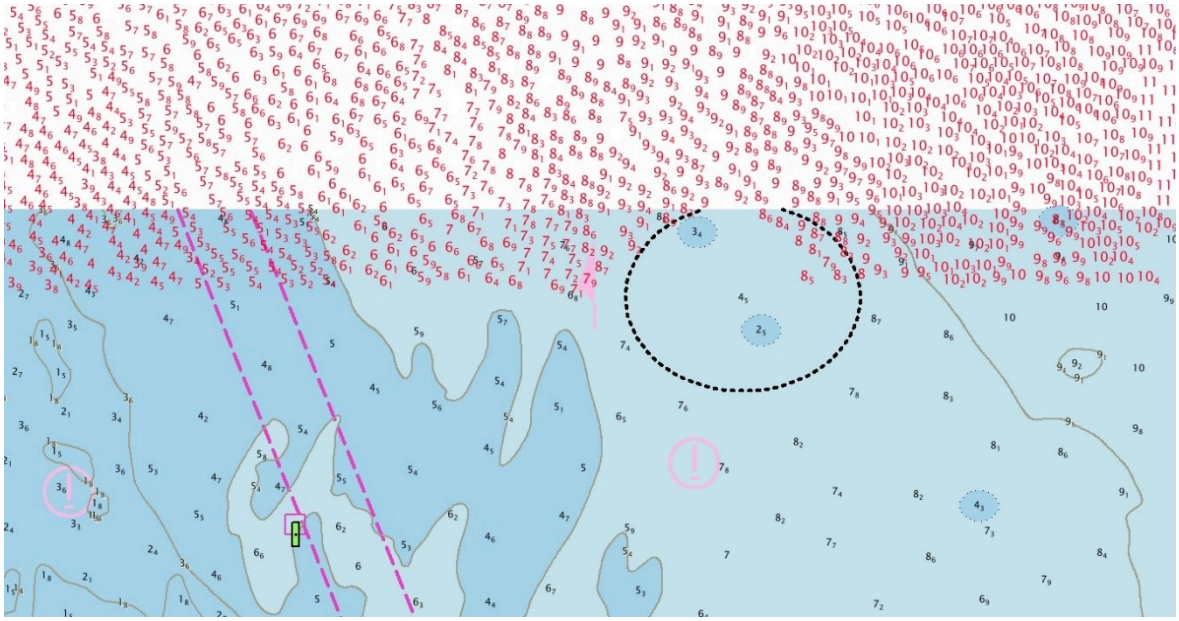

Figure 11: ENC US5VA13M Charted Soundings (black) with H13301 CUBE Depth Selected Soundings (red)

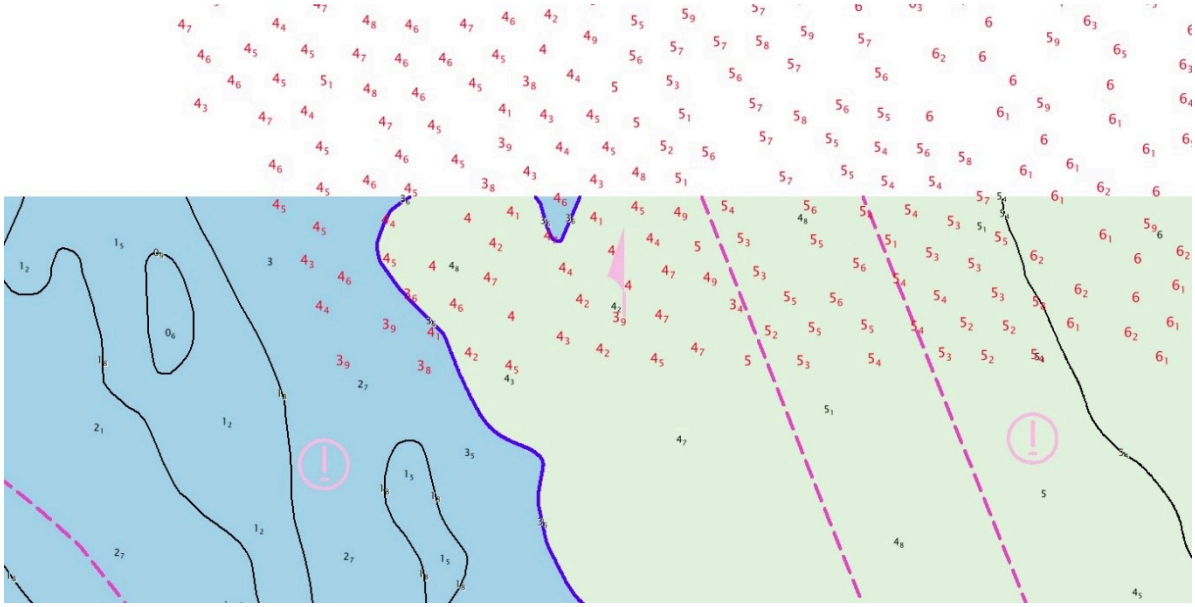

Figure 12: ENC US5VA13M Charted 3.6-meter contour (blue), Charted Soundings (black), H13301 CUBE Depth Selected Soundings (red)

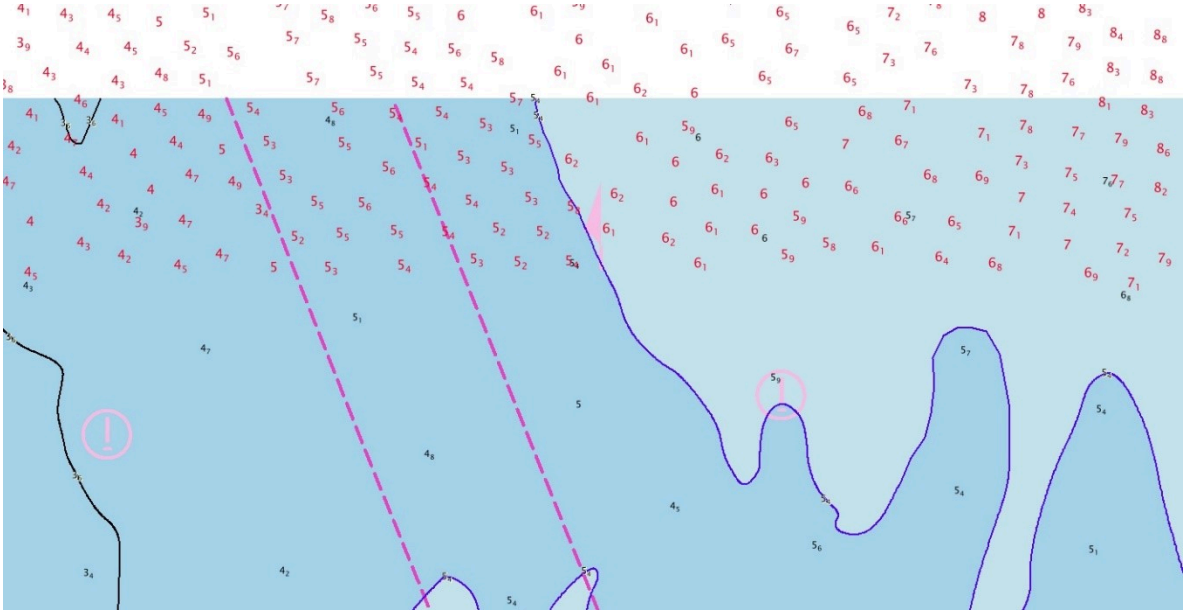

Figure 13: ENC US5VA13M Charted 5.4-meter contour (blue), Charted Soundings (black), H13301 CUBE Depth Selected Soundings (red)

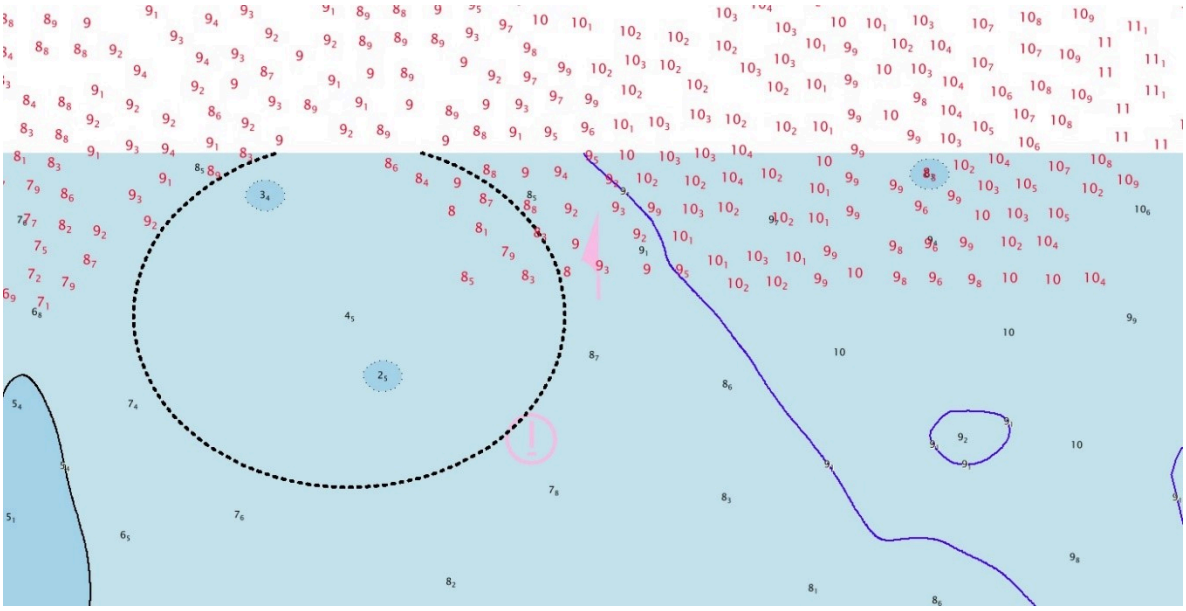

Figure 14: ENC US5VA13M Charted 9.6-meter contour (blue), Charted Soundings (black), H13301 CUBE Depth Selected Soundings (red)

US5VA24M

ENC US5VA24M covers the H13301 survey limit from 37° 08’ 30.60”N northward and from 076° 20’ 15.00”W eastward and 37° 11’ 29.90”N south.

CUBE depths within H13301 agreed well with the charted depths across the contemporaneous survey area; observed depths were primarily within ±0.5 meters of charted depths (Figure 15, Figure 16, and Figure 17). The depth contours on ENC US5VA13M generally agreed with depths that fell within the H13301 survey area with the exception of the 3.6-meter contour in the southern part of the survey area where the 3.6-meter depth contour has migrated west and were not present on York Spit (Figure 18 and Figure 19). The 5.4-meter depth contours within the northeast survey area have diminished in size (Figure 20).

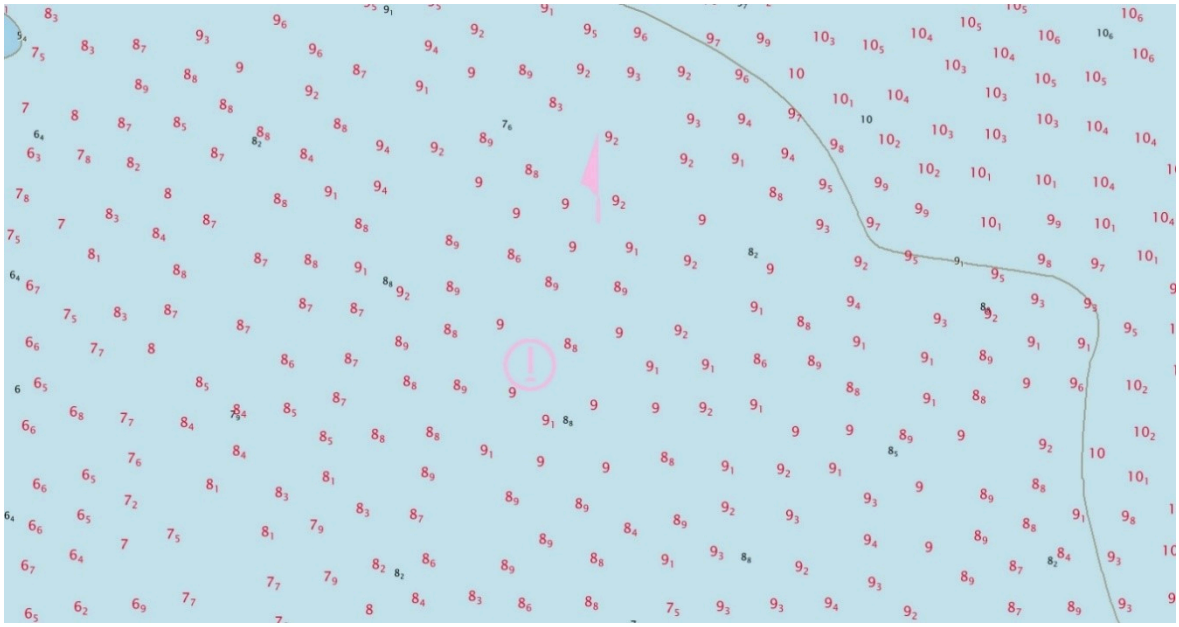

Figure 15: ENC US5VA24M Charted Soundings (black) with H13301 CUBE Depth Selected Soundings (red)

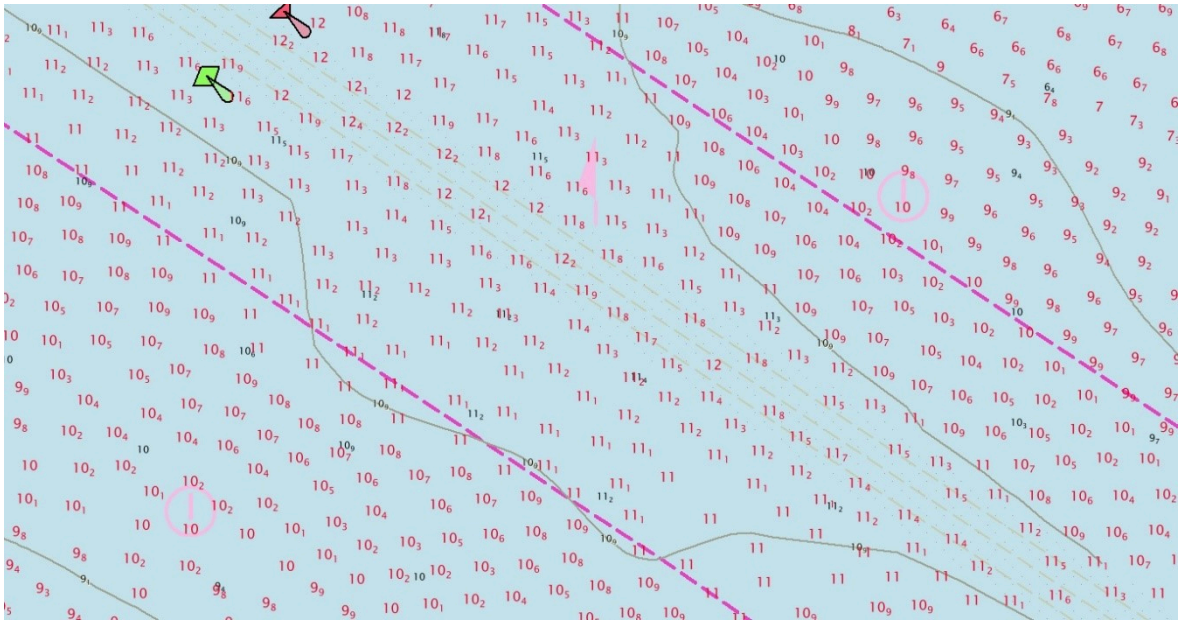

Figure 16: ENC US5VA24M Charted Soundings (black)
with H13301 CUBE Depth Selected Soundings (red)

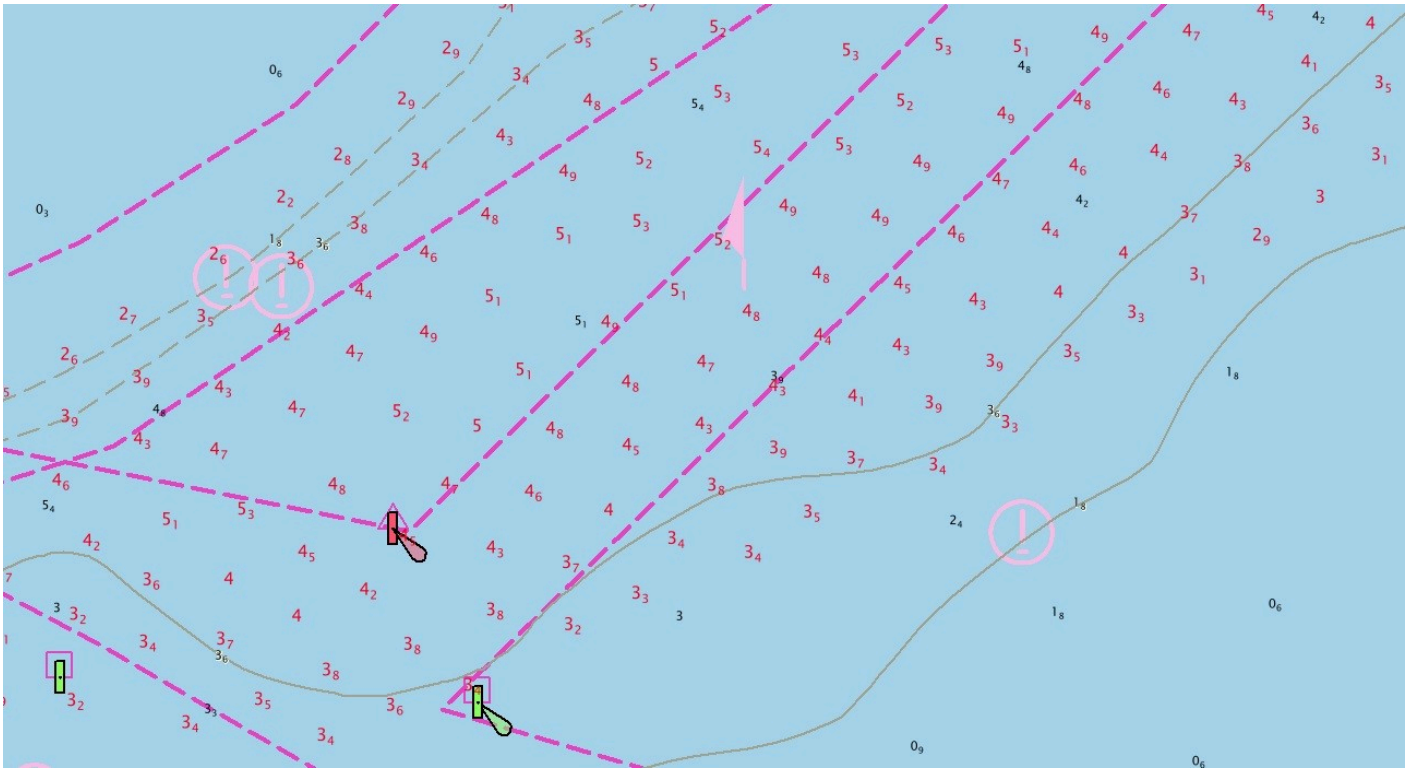

Figure 17: ENC US5VA24M Charted Soundings (black)
with H13301 CUBE Depth Selected Soundings (red)

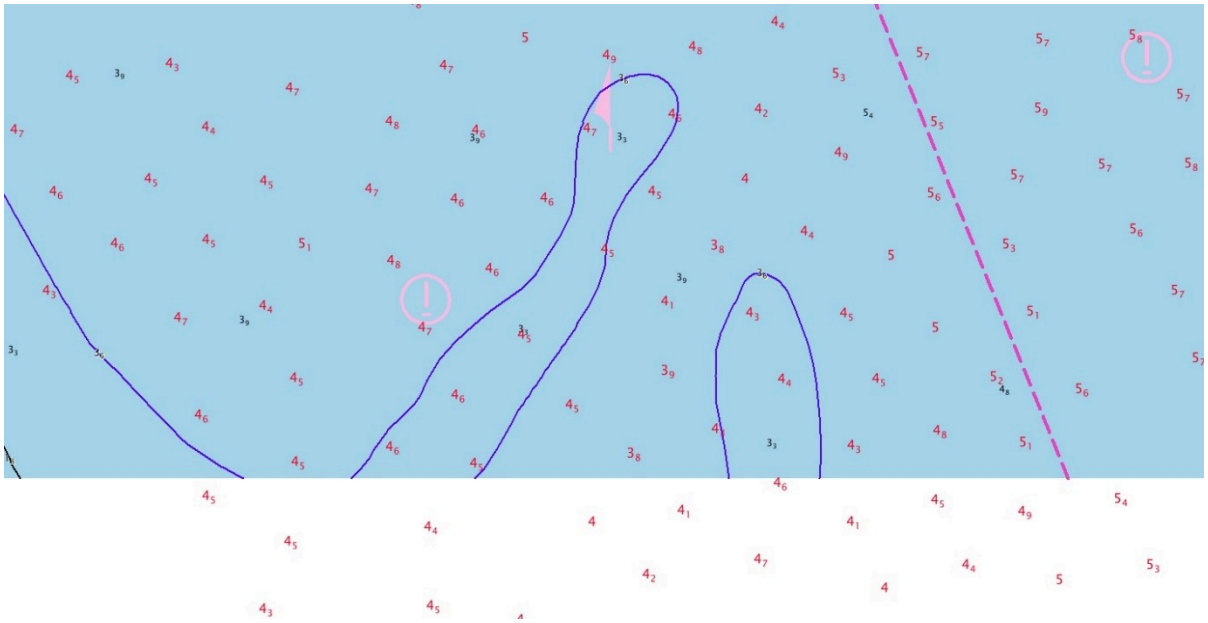

Figure 18: ENC US5VA24M Charted 3.6-meter contour (blue), Charted Soundings (black), H13301 CUBE Depth Selected Soundings (red)

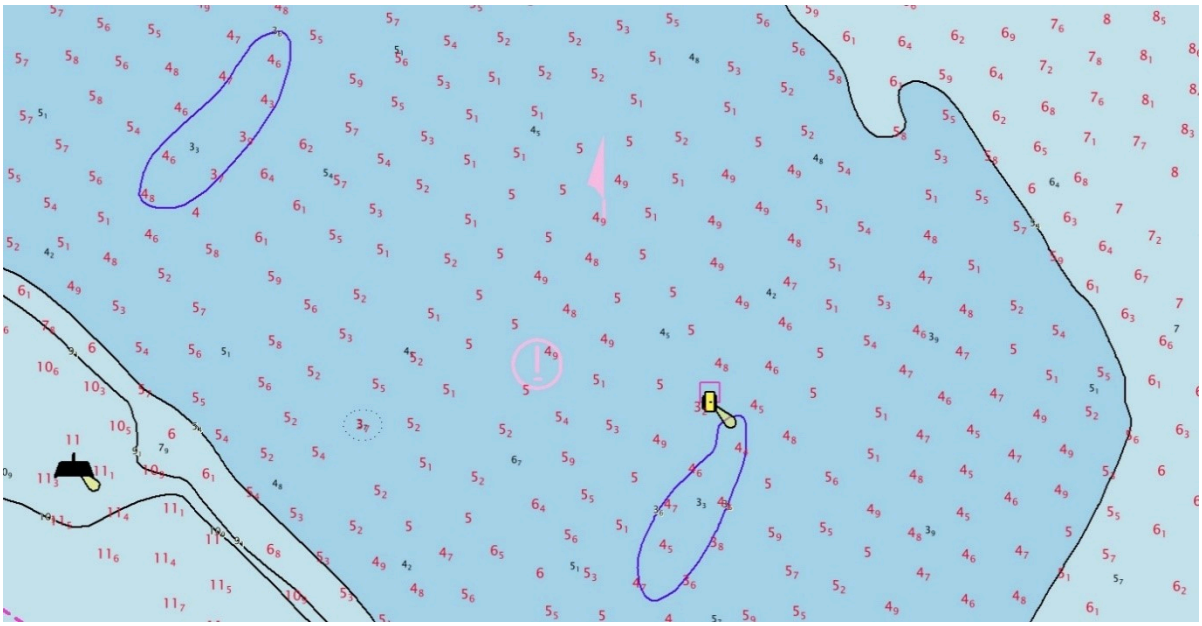

Figure 19: ENC US5VA24M Charted 3.6-meter contour (blue), Charted Soundings (black), H13301 CUBE Depth Selected Soundings (red)

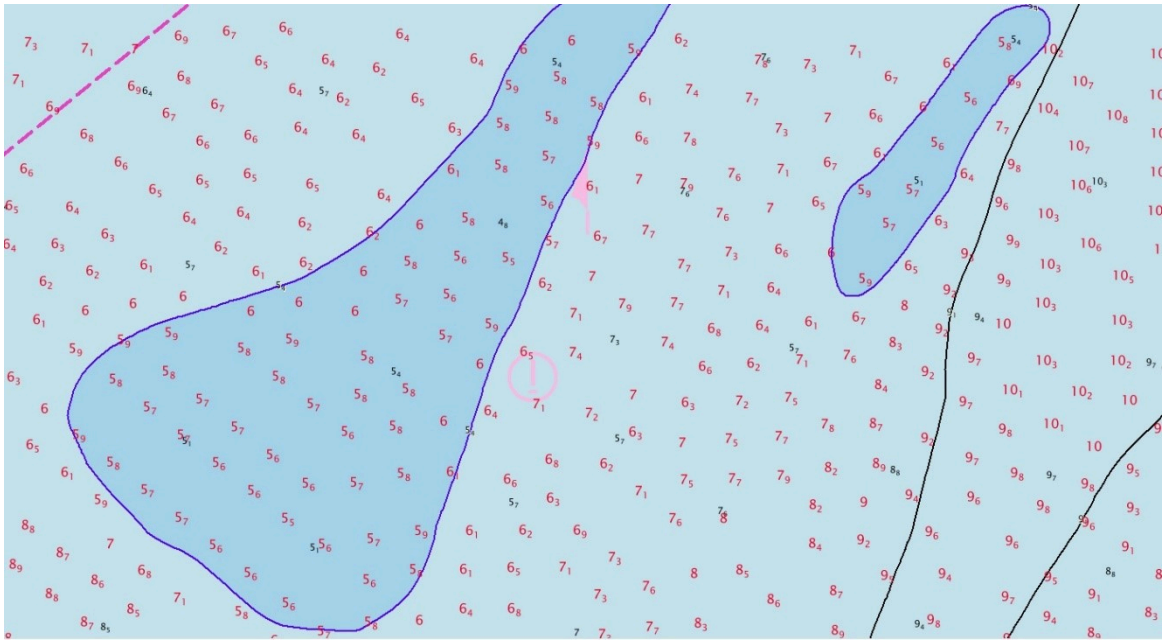

Figure 20: ENC US5VA24M Charted 5.4-meter contour (blue), Charted Soundings (black), H13301 CUBE Depth Selected Soundings (red)

US5VA60M

ENC US5VA60M covers the H13301 survey limit from 076° 20’ 15.00”W westward and 37° 11’ 29.90”N north.

CUBE depths within H13301 agreed well with the charted depths across the contemporaneous survey area; observed depths were primarily within ±0.5 meters of charted depths (Figure 21). The depth contours on ENC US5VA60M generally agreed with depths that fell within the H13301 survey area. Isolated 5.4-meter contours are no longer present (Figure 22).

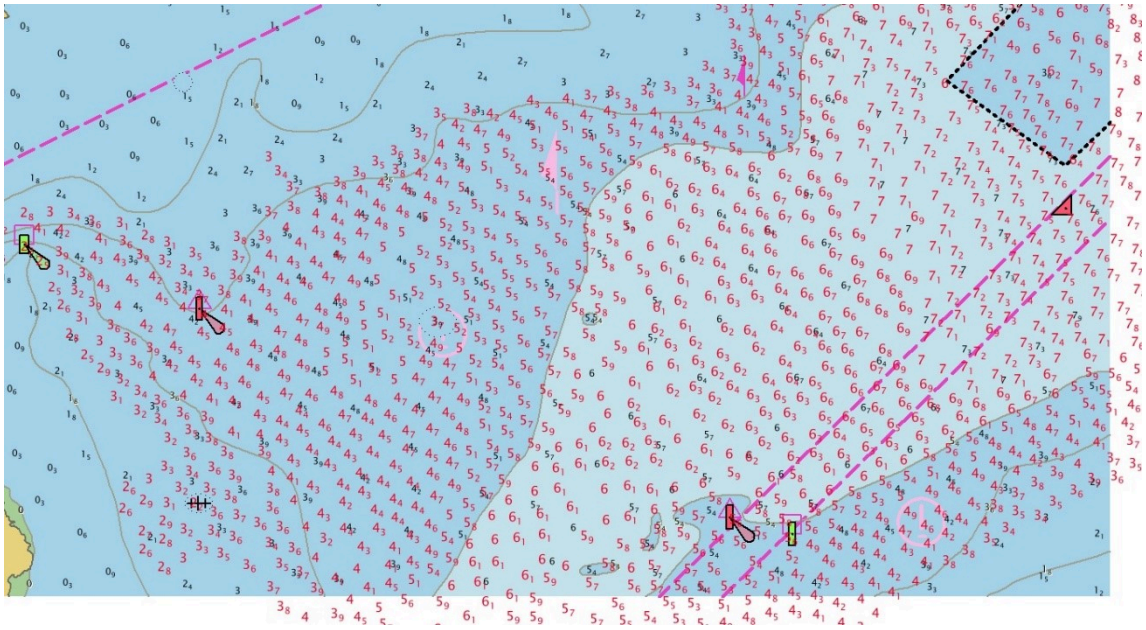

Figure 21: ENC US5VA60M Charted Soundings (black) with H13301 CUBE Depth Selected Soundings (red)

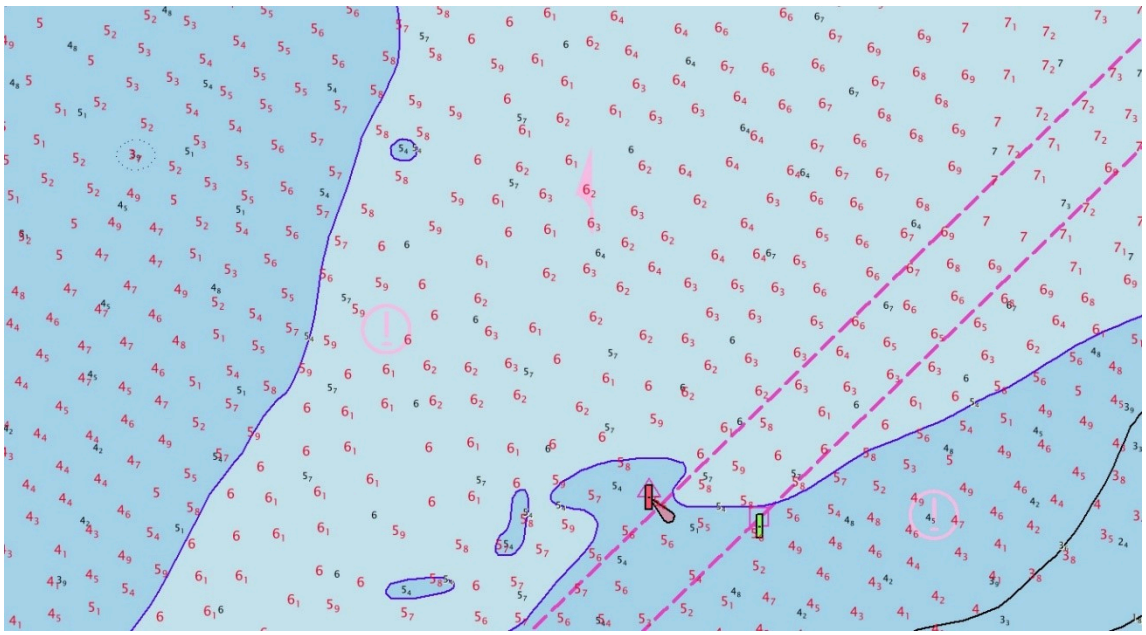

Figure 22: ENC US5VA60M Charted 5.4-meter contour (blue), Charted Soundings (black), H13301 CUBE Depth Selected Soundings (red)

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

There were numerous assigned charted features in the final CSF (OPR-E350-KR-19_CSF_10282019.000) within the SOW of H13301; however none of these features contained the label PA, ED, PD, or Rep. Per HSSD Section 8.1.4, these charted features are not addressed in this section, refer to the H13301 S-57 Final Feature File (H13301_FFF.000) for all the details and recommendations regarding charted features.

D.1.4 Uncharted Features

See the H13301 S-57 FFF for all the details and recommendations regarding new uncharted features investigated. During the course of H13301 survey operations, various bamboo and PVC pipe markers were observed within the survey limits (Figure 23). These were determined to be temporary in nature as over the course of survey operations it was observed that several of the markers would no longer be present or moved. Due to their temporary nature, there are no features associated with these markers within the H13301 S-57 FFF.

Figure 23: Example of PVC and Broken Bamboo Markers

D.1.5 Shoal and Hazardous Features

There were no significant shoals or hazardous features within the area covered by this survey other than those referenced in Section D.1.4. and the DTON reports described below.

Leidos submitted ten DTONs for H13301 in S-57 format to the Atlantic Hydrographic Branch (AHB).

Copies of the email correspondence for Leidos' submissions of H13302 DTON Report, as well as the DTON recommendation file, are included within Appendix II of this Descriptive Report. Refer to the S-57 FFF for details.

D.1.6 Channels

The York River Entrance Channel and the Poquoson River Channel were covered by H13301. CUBE depths from the H13301 survey agreed with or were deeper than the charted depths for each channel.

D.1.7 Bottom Samples

In accordance with both the Project Instructions and Section 7.2.3 of the HSSD, bottom characteristics were obtained for H13301. Bottom characteristics were acquired at the nine locations assigned in the final PRF (OPR-E350-KR-19_PRF_10282019.000). Leidos did not modify the bottom sample locations from the location proposed by NOAA in the PRF. Bottom characteristics are included in the S-57 FFF. In addition, images of the sediment obtained for each bottom sample are referenced in the S-57 FFF and are included on the delivery drive under the folder H13301/Processed/Multimedia.

D.2 Additional Results

D.2.1 Shoreline

All features in the CSF within the assigned Survey Limits of H13301 were resolved. Additional assigned features inshore of the survey limits were not addressed; refer to the H13301 FFF.

D.2.2 Aids to Navigation

There were assigned aid to navigations (ATON) within the SOW of H13301 from the final CSF. ATONs within the survey limits were observed on station and serving their intended purpose. Per the investigation requirements from the CSF, as they were on station and serving intended purpose, they are included in the H13301 FFF with description of retain.

D.2.3 Overhead Features

There were no overhead features within this survey area.

D.2.4 Submarine Features

There were no submarine features charted or identified within this survey area.

D.2.5 Platforms

One platform, a stationary Duck Blind, exists within the survey limits of this survey; refer to the H13301 FFF.

D.2.6 Ferry Routes and Terminals

No ferry routes or terminals exist within this survey area.

D.2.7 Abnormal Seafloor and/or Environmental Conditions

No abnormal seafloor or environmental conditions, as defined in Section 8.1.3 of the HSSD, exist within this survey area other than those discussed in Section B.2.6.

D.2.8 Construction and Dredging

No construction or dredging exists for this survey area.

D.2.9 New Survey Recommendation

No new survey recommendations are made for the area surrounding this survey area.

D.2.10 Designated Soundings

As discussed in the DAPR rev 1 within Generic Sensor Format (GSF) there are separate flags for a designated sounding of a feature. During data analysis, these flags are used to preserve the shoalest sounding relative to the computed depth surface. All depths flagged as a feature or designated sounding in GSF override the CUBE best estimate of the depth in the final BAG files. GSF feature flags were set on significant features within H13301, and all information is contained in the H13301 S-57 FFF.

D.2.11 Final Feature S-57 File

Included with the H13301 delivery is the S-57 FFF, H13301_FFF.000. Details on how this file was generated and quality controlled can be found in the DAPR rev 1. The S-57 FFF delivered for H13301 contains millimeter precision for the value of sounding (VALSOU) attribute. As specified in Section 2.2 of the HSSD, the S-57 FFF is in the WGS84 datum and is unprojected with all depth units in meters. Per HSSD Section 2.2 bathymetry data were positioned to NAD83. All significant and recommended for charting features found in H13301 are included within the S-57 FFF.

In accordance with the HSSD, Leidos addressed assigned objects from the provided CSF S-57 file that fell within the surveyed bounds of H13301 in the S-57 FFF. Assigned objects from the CSF which were not surveyed due to being inshore of the NALL are provided in the H13301 S-57 FFF.

D.2.12 Side Scan Sonar Contacts S-57 File

Included with the H13301 delivery is the Side Scan Sonar Contact S-57 File, H13301_SSCon.000. Details on how this file was generated and quality controlled can be found in the DAPR rev 1. As specified in Section 2.2 of the HSSD, the S-57 file is in the WGS84 datum and is unprojected with all depth units in meters. Per HSSD Section 2.2 side scan data were positioned to NAD83.

Side scan sonar contacts were investigated and confirmed using SABER Contact Review. All side scan contacts are retained within the Side Scan Sonar Contact S-57 File. For each contact included in this S-57 file, a JPEG image of the side scan contact is included under the NOAA Extended Attribute field “images”.

D.2.13 Coast Pilot Review Report

In accordance with the Project Instructions and HSSD Section 8.1.3, a Coast Pilot Review was performed for OPR-E350-KR-19. Within the Coast Pilot Field Report (OPR-E350-KR-19CoastPilotReport.docx) provided by NOAA to Leidos on 28 October 2019, there were assigned investigation items and inquiries from the Nautical Publications Branch. During survey, Leidos reviewed and updated the assigned and additional Coast Pilot paragraphs as possible for the survey area, port of call, and areas frequently transited. Recommendations were documented using the text from the 53rd Edition (19 July 2020) and are marked following the HSSD Section 8.1.3. Leidos followed NOAA’s strategy for designating omitted paragraphs as provided in the delivered Coast Pilot Field Report (OPR-E350-KR-19CoastPilotReport.docx). Leidos submitted the Coast Pilot Field Report on 26 July 2020. The email correspondence for Leidos’ submission of the Coast Pilot Review Report is included within the Project Correspondence. A Coast Pilot Field Report rev 1 was submitted on 01 December 2020 as new areas were navigated since the original submission as survey effort were on-going at time of original delivery.

D.2.14 Inset Recommendation

No inset recommendations are made for the area covered by this survey.

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.

This Descriptive Report, all BAG files, 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 Hydrographic Surveys Specifications and Deliverables, Project Instructions, and Statement of Work. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required. Previously, or concurrently, submitted deliverables for OPR-E350-KR-19 are provided in the table below.

Report Name	Report Date Sent
OPR-E350-KR-19_Marine_Species_Awareness_Training_Record.pdf	2020-07-20
OPR-E350-KR-19_20200724.zip (NCEI Sound Speed Data 2019 data only)	2020-07-24
OPR-E350-KR-19_Coast Pilot Review Report.pdf	2020-07-26
OPR-E350-KR-19_DAPR.pdf	2020-07-29
H13295_DR.pdf	2020-07-29
H13302_DR.pdf	2020-07-30
OPR-E350-KR-19_Coast Pilot Review Report_rev1.pdf	2020-12-01
OPR-E350-KR-19_Marine_Species_Awareness_Training_Record_rev1.pdf	2020-12-02
OPR-E350-KR-19_DAPR_rev1.pdf	2020-12-04
H13304_DR.pdf	2020-12-04
H13306_DR.pdf	2020-12-23
OPR-E350-KR-19_20201207.zip (NCEI Sound Speed Data 2020 data only)	2020-12-28
OPR-E350-KR-19_Marine_Mammal_Observation_Logs_1of3.pdf OPR-E350-KR-19_Marine_Mammal_Observation_Logs_2of3.pdf OPR-E350-KR-19_Marine_Mammal_Observation_Logs_3of3.pdf	2020-12-29
OPR-E350-KR-19_Sea_Turtle_Observation_Log.pdf	2020-12-29

Approver Name	Approver Title	Approval Date	Signature
Alex T. Bernier	Lead Hydrographer	12/30/2020	Alex T Bernier Digitally signed by: Alex T Bernier DN: CN = Alex T Bernier C = US O = Leidos OU = A01410D00000171F4D884FE0000D620 Date: 2020.12.30 16:13:56 -05'00'

F. Table of Acronyms

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

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

Acronym	Definition
PRF	Project Reference File
PS	Physical Scientist
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
RTX	Real Time Extended
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
SSSAB	Side Scan Sonar Acoustic Backscatter
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPU	Total Propagated Uncertainty
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDF	Zone Definition File