H13519

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13519

LOCALITY

State(s):	Maryland
General Locality:	Patuxent River, MD
Sub-locality:	St. Leonard Creek to Town Point

2021

CHIEF OF PARTY
LTJG Jane Saunders

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13519**

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):	**Maryland**
General Locality:	**Patuxent River, MD**
Sub-Locality:	**St. Leonard Creek to Town Point**
Scale:	**5000**
Dates of Survey:	**08/03/2021 to 12/09/2021**
Instructions Dated:	**05/14/2021**
Project Number:	**S-E903-BH2-21**
Field Unit:	**NOAA R/V *Bay Hydro II***
Chief of Party:	**LTJG Jane Saunders**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Multibeam Echo Sounder Backscatter**
Verification by:	**Pacific Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**

Remarks:

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 NAD83 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.

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Descriptive Report to Accompany Survey H13519

Project: S-E903-BH2-21

Locality: Patuxent River, MD

Sublocality: St. Leonard Creek to Town Point

Scale: 1:5000

August 2021 - December 2021

NOAA R/V *Bay Hydro II*

Chief of Party: LTJG Jane Saunders

A. Area Surveyed

The survey area is located in the Patuxent River with the sub locality between St. Leonard Creek and Town Point.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
38° 23' 8.59" N 76° 31' 15.56" W	38° 17' 30.76" N 76° 23' 24.1" W

Table 1: Survey Limits

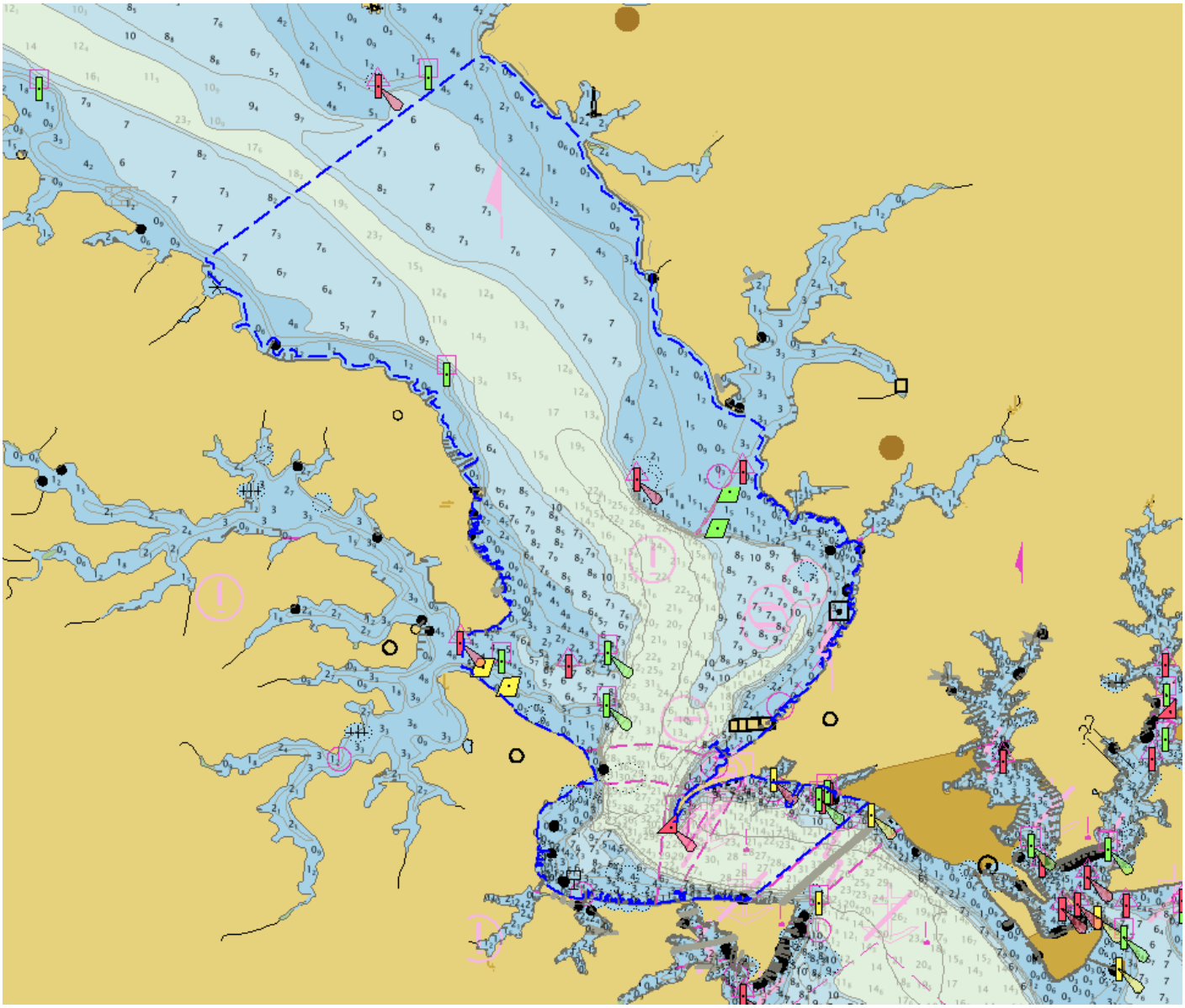


Figure 1: H13519 sheet limits (in blue) overlaid onto Charts US5MD21M and US5MD31M.

Data was acquired to the survey limits in accordance with the requirements in the Project Instructions (PIs) and the April 2021 NOS Hydrographic Surveys Specifications and Deliverables (HSSD), as shown in Figure 1. In all areas where the 4 meter depth contour or sheet limits were not met, the Navigable Area Limit Line (NALL) was defined as the inshore limit of bathymetry due to the risks of maneuvering the survey vessel in close proximity to shoal.

A.2 Survey Purpose

The area of Southern Patuxent River is in need of a contemporary hydrographic survey to update the nautical chart. 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.

Data acquired in H13519 meet multibeam echo sounder (MBES) coverage requirements for object detection, as required by the HSSD unless otherwise stated in this report. This includes crosslines (see Section B.2.1 of this document), NOAA allowable uncertainty (see Section B.2.10 of this document), and density requirements (see Section B.2.11 of this document). Additional compliance statistics can be found in the Standards and Compliance Review located in Appendix II of this report.

A.4 Survey Coverage

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

Water Depth	Coverage Required
All waters in survey area.	Object Detection Coverage

Table 2: Survey Coverage

Survey coverage was in accordance with the requirements in the PIs and the HSSD with the exception of holidays as a result of pervasive fish schools across multiple days of survey acquisition prohibiting the MBES from identifying the true seafloor. This interference resulted in artifacts in the processed data which did not accurately represent the seafloor (see Figure 2). In many cases, removal of these artifacts in the MBES surface introduced gaps in coverage. The number of areas this occurred in was extensive, therefore a Holiday Line file was created and executed. Each of these gaps in coverage were examined in CARIS HIPS and SIPS, Subset Editor and determined not to degrade the confidence in the quality of the survey. These data gaps do not limit the ability to adequately verify charted depths.

The charted shoal inside of the shore ward survey limits were not fully ensonified during acquisition. These areas was deemed too shallow to survey safely with Bay Hydro II (see Figure 2).

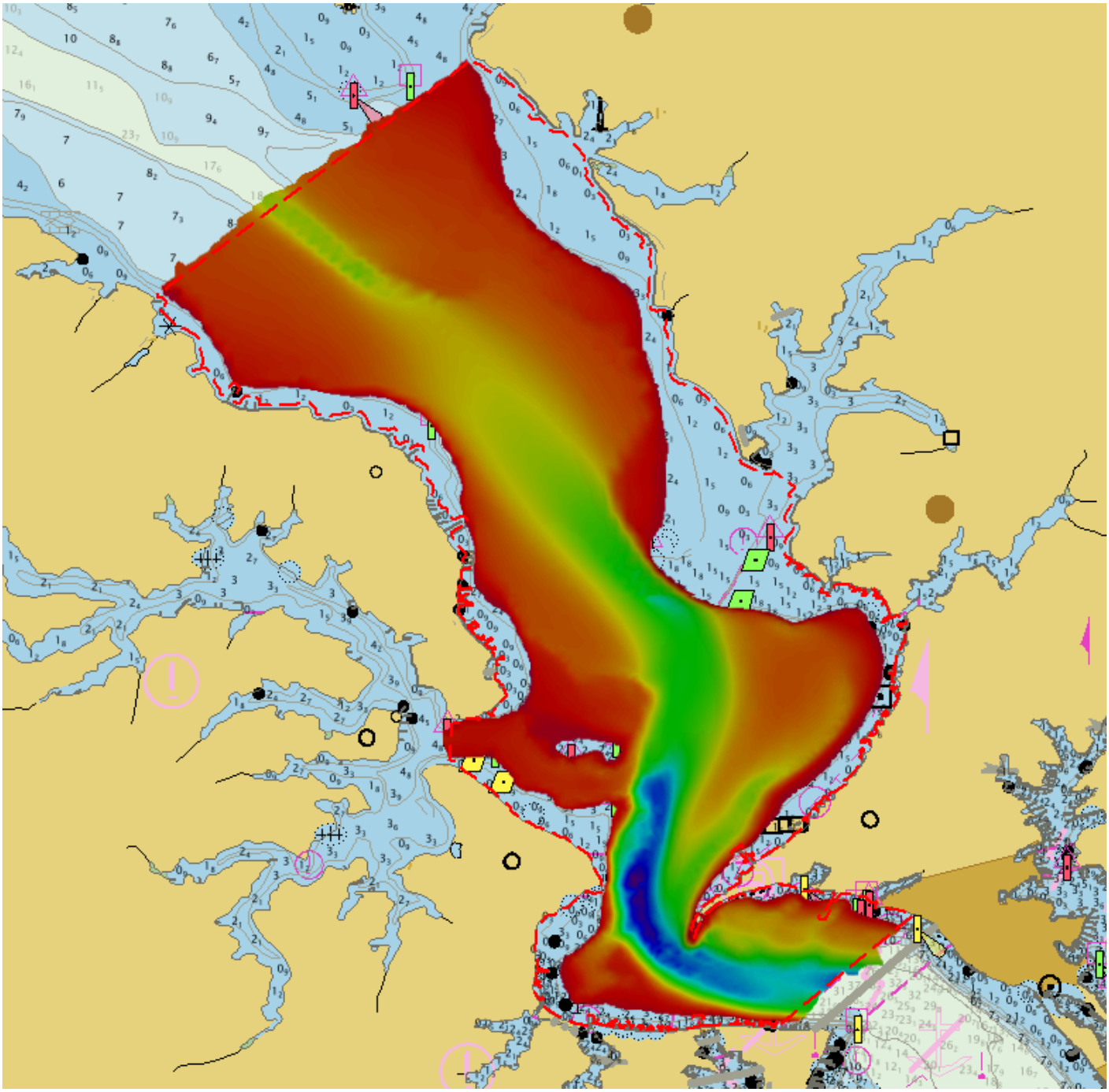


Figure 2: H13519 survey coverage overlaid onto Chart US5MD21M and US5MD31M.

A.6 Survey Statistics

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

	HULL ID	*S5401*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0
	MBES Mainscheme	170.25	170.25
	Lidar Mainscheme	0.0	0.0
	SSS Mainscheme	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0
	MBES/SSS Mainscheme	0.0	0.0
	SBES/MBES Crosslines	7.77	7.77
	Lidar Crosslines	0.0	0.0
Number of Bottom Samples			3
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			3.06

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
08/03/2021	215
08/04/2021	216

Survey Dates	Day of the Year
08/06/2021	218
08/09/2021	221
08/11/2021	223
08/12/2021	224
08/16/2021	228
08/24/2021	236
09/09/2021	252
09/13/2021	256
12/09/2021	343

Table 4: Dates of Hydrography

No multibeam data was acquired between 16 September 2021 and 05 December 2021 due to mechanical issues with Bay Hydro II and previously scheduled obligations of the crew.

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the S-E903-BH2-21 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:

Hull ID	***S5401***
LOA	17.3 meters
Draft	1.8 meters

Table 5: Vessels Used

B.1.2 Equipment

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

Manufacturer	Model	Type
Kongsberg Maritime	EM 2040CD	MBES
Valeport	MiniSVS	Sound Speed System
SonTek	CastAway-CTD	Conductivity, Temperature, and Depth Sensor
Applanix	POS MV 320 v5	Positioning and Attitude System

Table 6: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Multibeam/Single Beam Echo Sounder/Side Scan Sonar crosslines acquired for this survey totaled 4.56% of mainscheme acquisition.

Crosslines were collected, processed, and compared in accordance with Section 5.2.4.2 of the HSSD. To evaluate crosslines, a 0.10 m Variable Resolution (VR) CUBE surface using strictly mainscheme lines, and a 0.10 m Variable Resolution (VR) CUBE surface using strictly crosslines were created. From these two surfaces, a difference surface (mainscheme - crosslines = difference surface) was generated at a 0.10 m resolution (See Figure 3), and is submitted in the Separates II Digital Data folder. Statistics show the mean difference between the depths derived from mainscheme and crosslines was 0.54 meters (Figure 4) with mainscheme being deeper and 95% of nodes falling within +/- 0.30 (Figure 4). For the respective depths, the difference surface was compared to the allowable NOAA uncertainty standards using Pydro's Compare Surfaces tool. In total, 99.00% of the depth differences between H13519 mainscheme and crossline data were within allowable NOAA uncertainties (Figure 5).

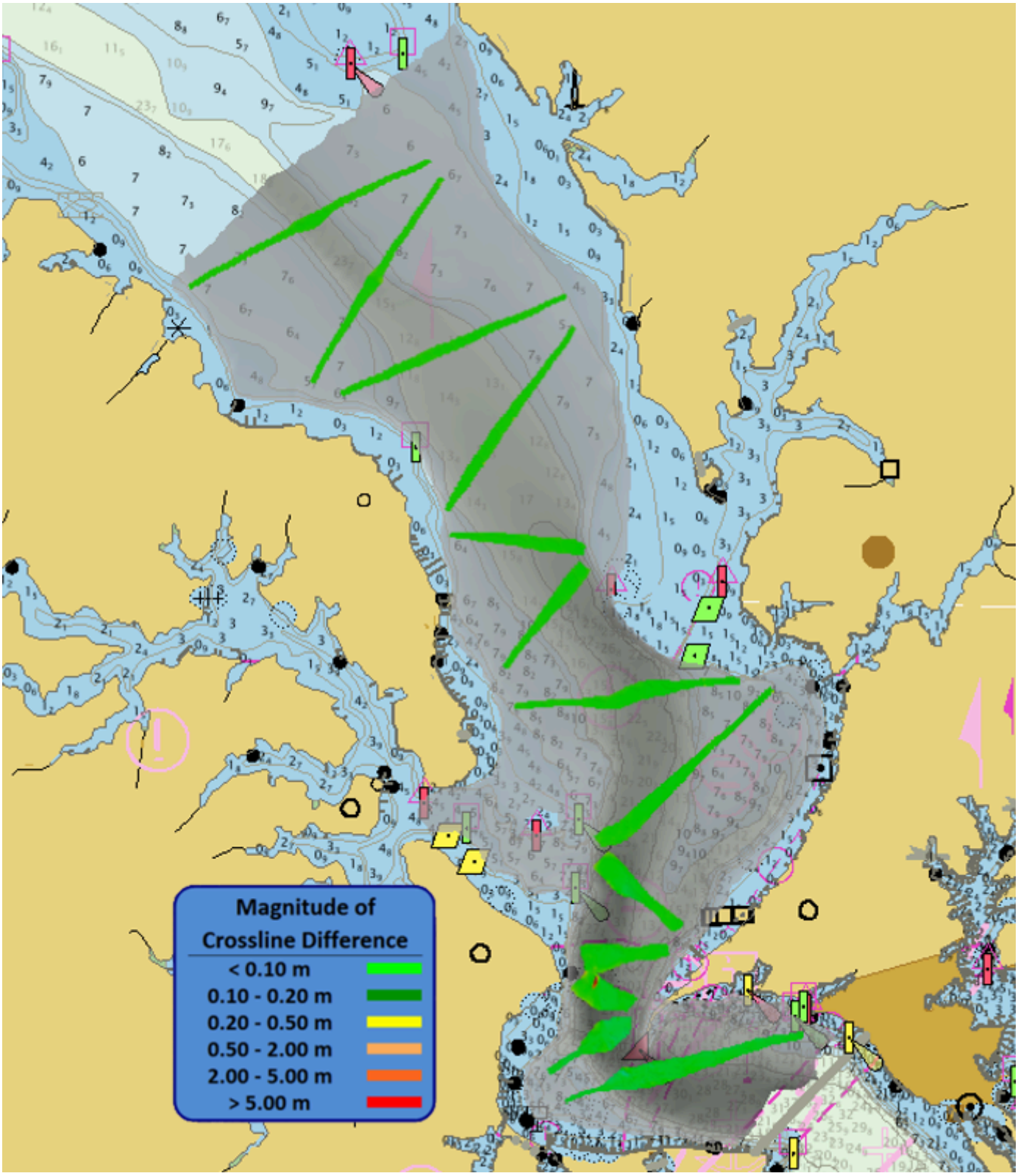
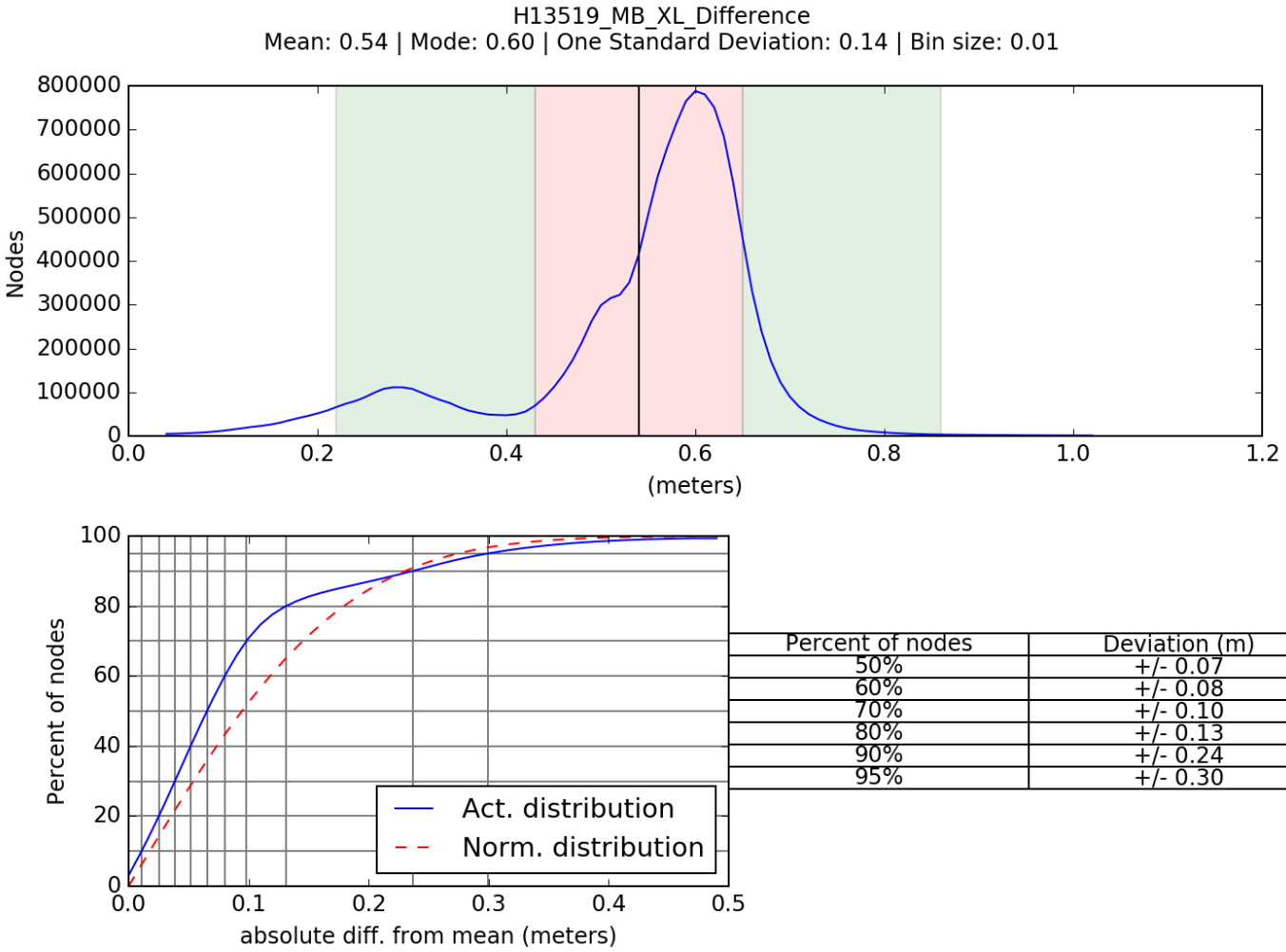


Figure 3: Overview of H13519 crosslines.



Percent of nodes	Deviation (m)
50%	+/- 0.07
60%	+/- 0.08
70%	+/- 0.10
80%	+/- 0.13
90%	+/- 0.24
95%	+/- 0.30

Figure 4: H13519 crossline and mainscheme difference statistics.

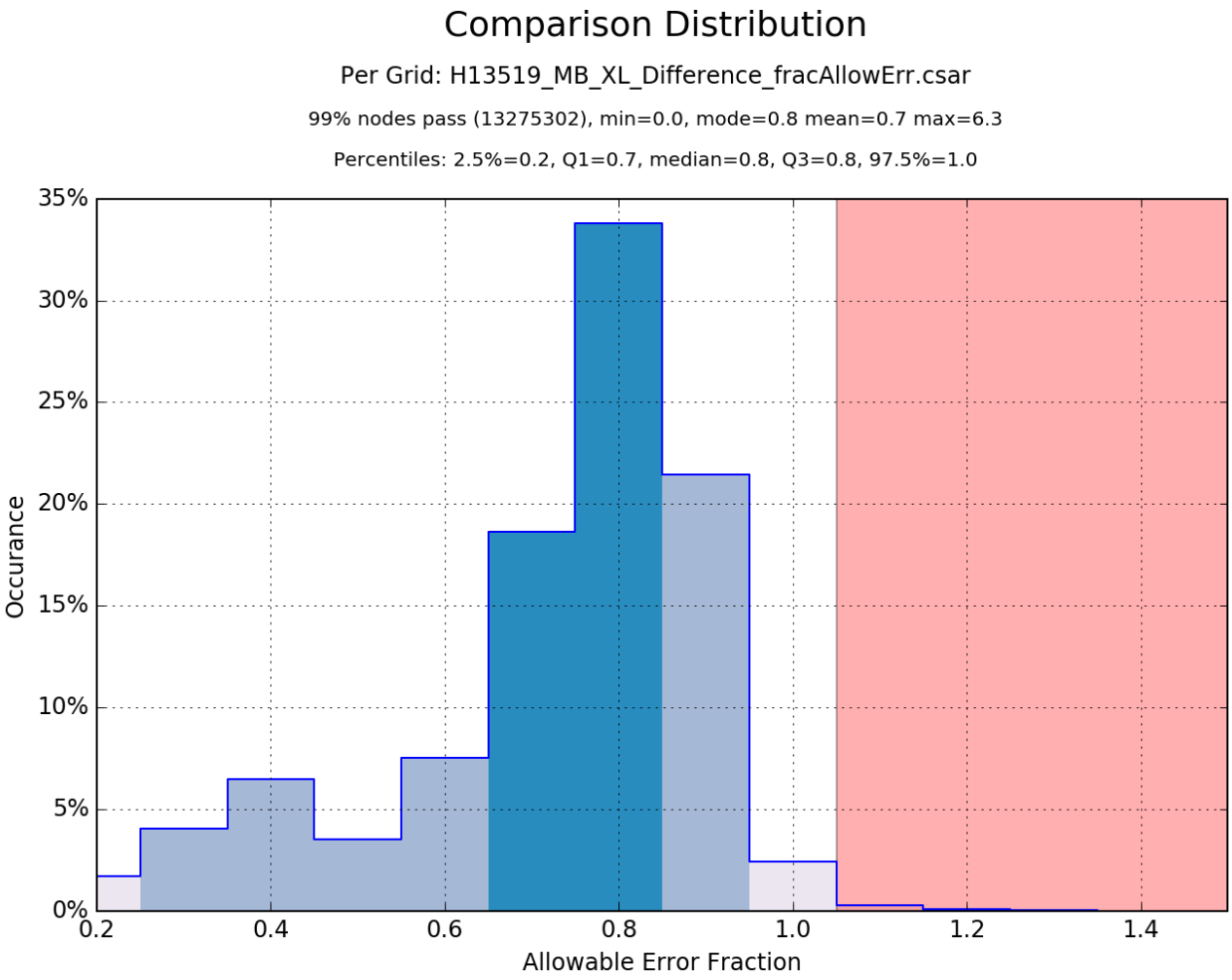


Figure 5: H13519 crossline and mainscheme NOAA allowable uncertainty statistics.

Concur with clarification, the crosslines were acquired only by MBES.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.0 meters	0.09 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
S5401	4.0 meters/second	0.0 meters/second	0.0 meters/second	1 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

In addition to the usual a priori estimates of uncertainty provided via device models for vessel motion and VDATUM, real-time and post processed uncertainty sources were also incorporated into the depth estimates of survey H13519. Real-time uncertainties were provided via EM 2040 CH MBES data and Applanix Delayed Heave RMS. Following post-processing of the real-time vessel motion, recomputed uncertainties of vessel roll, pitch, gyro, and navigation were applied in CARIS HIPS and SIPS via a Smoothed Best Estimate of Trajectory (SBET) RMS file generated in Applanix POSPac.

Conclur with clarification. The uncertanty values described in table 8 above and in the DAPR are incorrect. The CTD uncertainty values that were applied to the HDCS were at 2.0 m/s and SV uncertainty values appled to the HDCS data weres at 0.5 m/s. The applied values are acceptable values and the data is within the TVU for that water depth.

B.2.3 Junctions

H13519 junctions with one surveys from prior projects, H13518.

H13519 junctions H13518 along the southern edge of the survey, just north of the Governor Thomas Johnson Bridge (See Figure 6). Data overlap between H13519 and H13518 was achieved. To evaluate this junction area, a 0.10 m CUBE surface was created using only the H13519 data then differenced with the data from Survey H13518, using the CARIS Difference tool (see Figure 7). H13519 and H13518 were then compared using Pydro's Compare Grids sub-program. Statistics show the data from H13519 and Junction Survey H13518 had good depth agreement with the mean difference being 0.09m with H13519 being deeper and 95% of nodes falling within +/- 0.29m, see Figure 8. The junction with H13518 are generally within the NOAA Allowable uncertainty in the area of overlap, with 99.50% of nodes passing, see Figure 9.

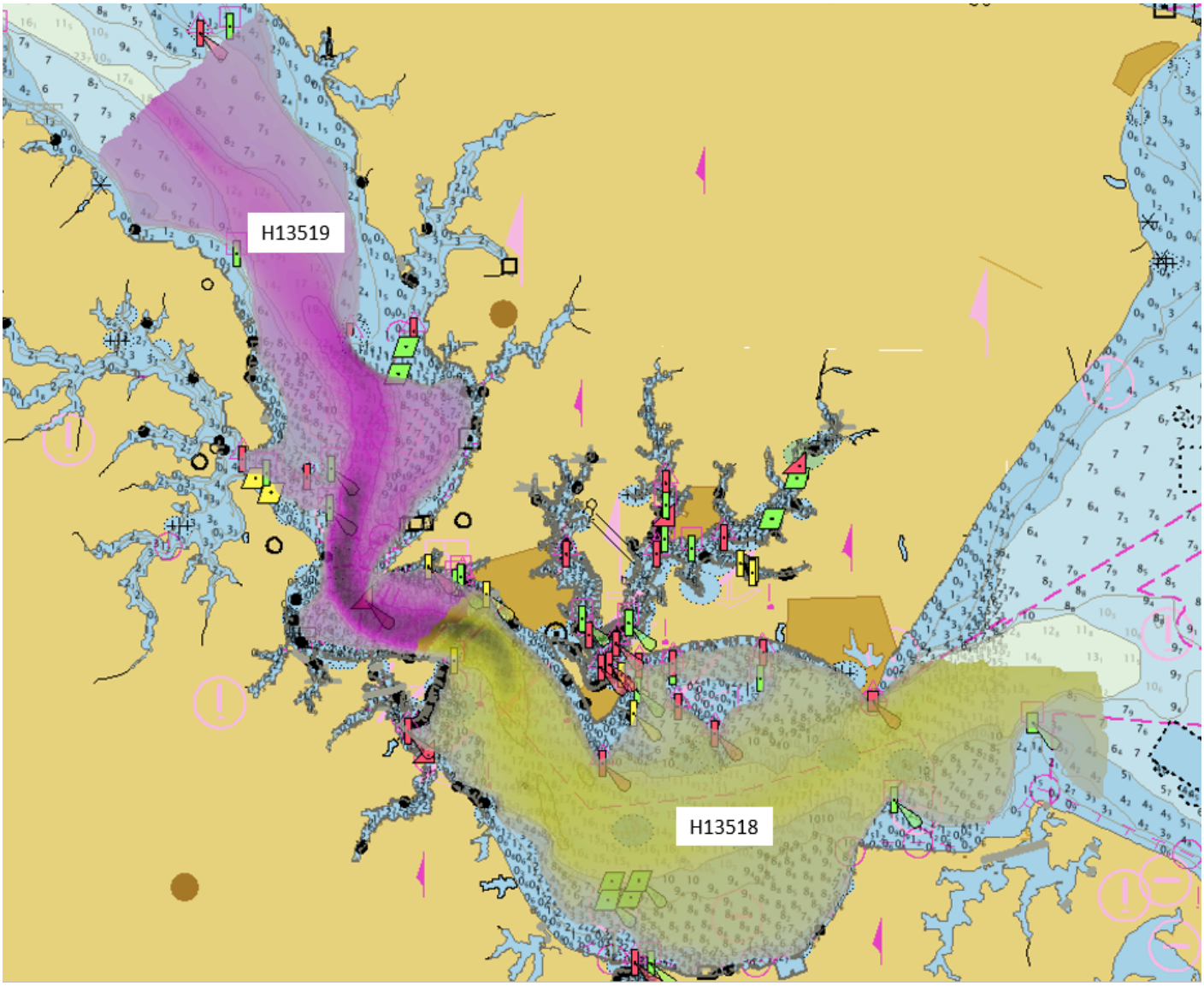


Figure 6: Overview of H13519 junction surveys.

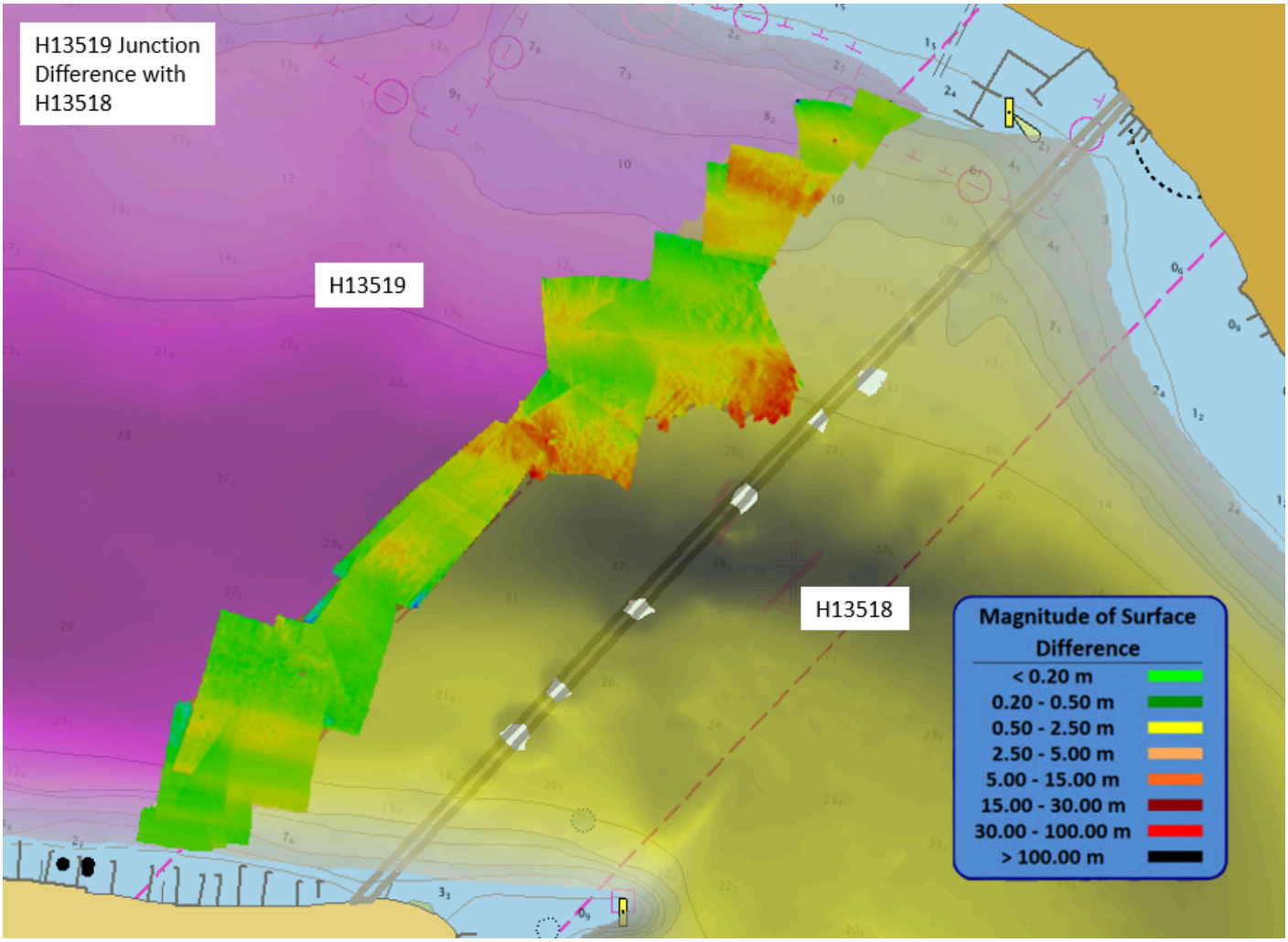
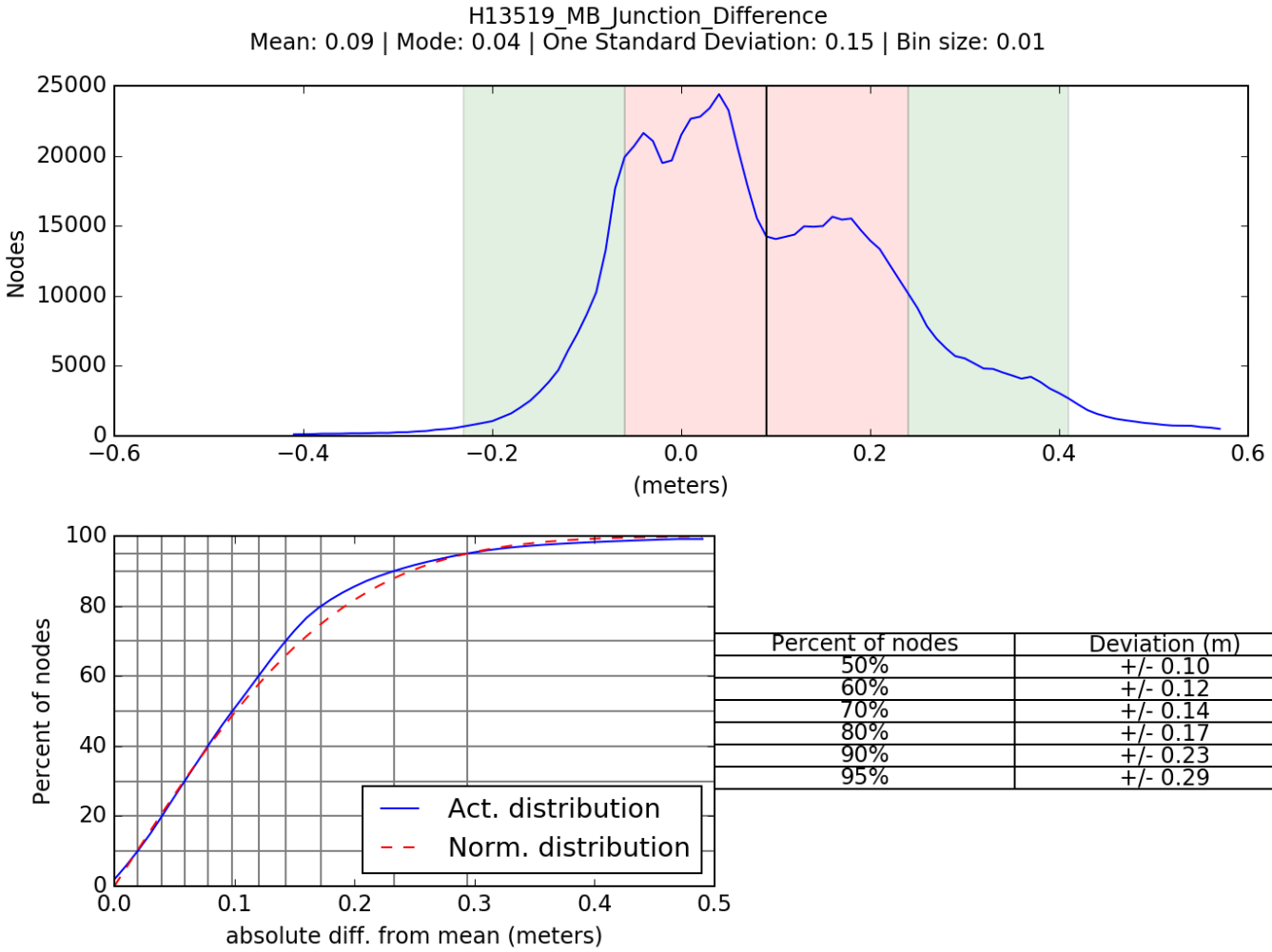


Figure 7: Difference surface between H13519 (magenta) and junctioning survey H13518 (yellow).



Percent of nodes	Deviation (m)
50%	+/- 0.10
60%	+/- 0.12
70%	+/- 0.14
80%	+/- 0.17
90%	+/- 0.23
95%	+/- 0.29

Figure 8: Difference surface statistics between H13519 and H13518.

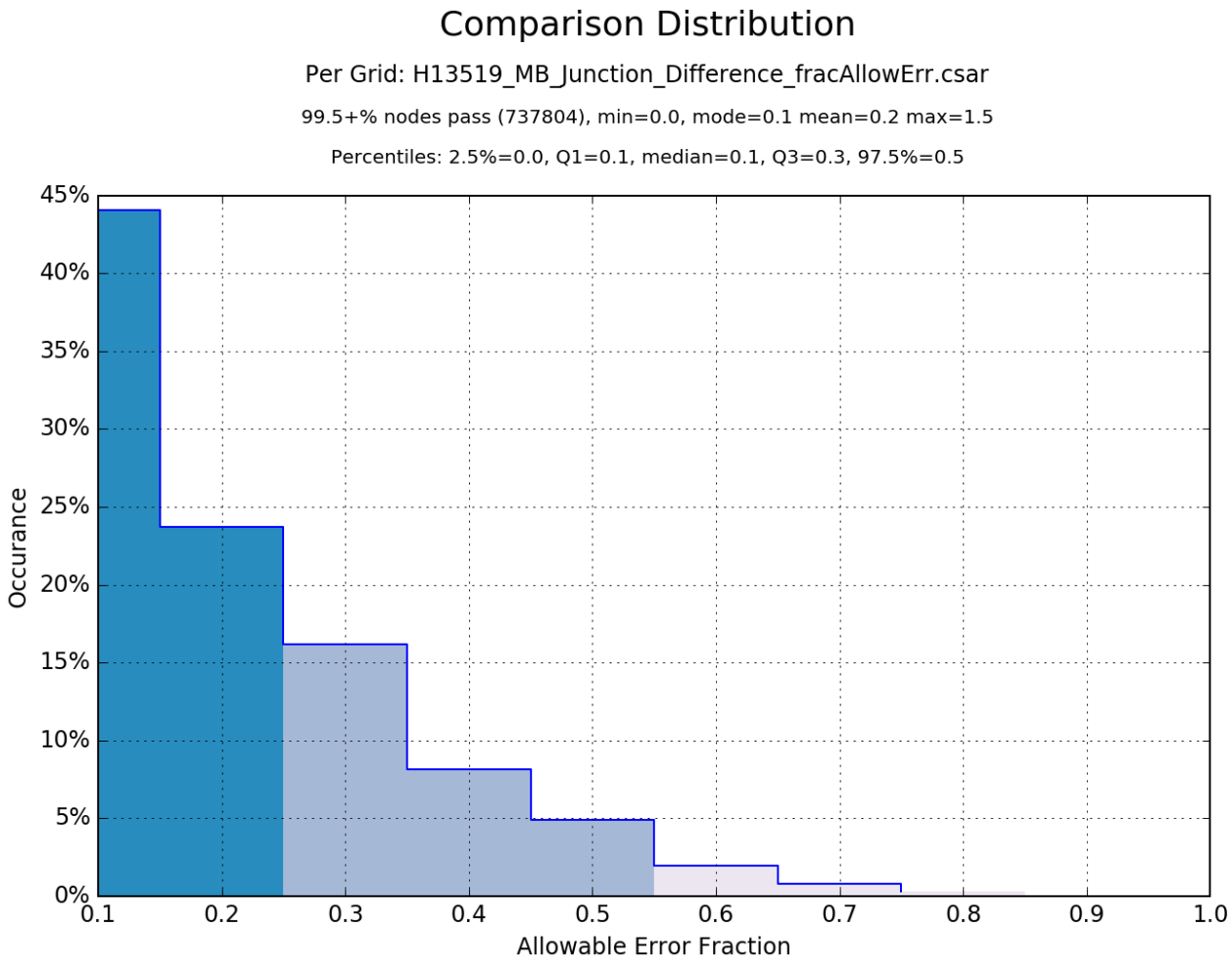


Figure 9: NOAA Allowable statistics between H13519 and H13518.

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: Casts were conducted at a minimum of one every four hours during acquisition.

Casts were conducted more frequently in area where tidal shifts caused variations in the make up of the water column or when there was a change in surface sound speed greater than two meters per second. All sound speed methods were used a detailed in the DAPR.

B.2.8 Coverage Equipment and Methods

All equipment and survey methods were used as detailed in the DAPR.

B.2.9 Holidays

On several occasions, a large school of fish and/or other marine life prohibited the MBES from identifying the true seafloor. This interference resulted in artifacts in the processed data which did not accurately represent the seafloor. In some cases, removal of these artifacts in the MBES surface introduced gaps in coverage. Each of these gaps in coverage were examined in CARIS HIPS and SIPS, Subset Editor and determined not to degrade the confidence in the quality of the survey. These data gaps do not limit the ability of adequately verify charted depths.

B.2.10 NOAA Allowable Uncertainty

To verify that all data meets the accuracy specifications as stated in HSSD Section 5.1.3, the finalized surface was analyzed using the Pydro QC Tools Grid QA feature to determine what percentage of the surface meets specifications. Figure 10 shows an overview of the NOAA Allowable Uncertainty. Overall, 99.73% of nodes within the surface meet or exceed NOAA Allowable Uncertainty specifications for H13519.

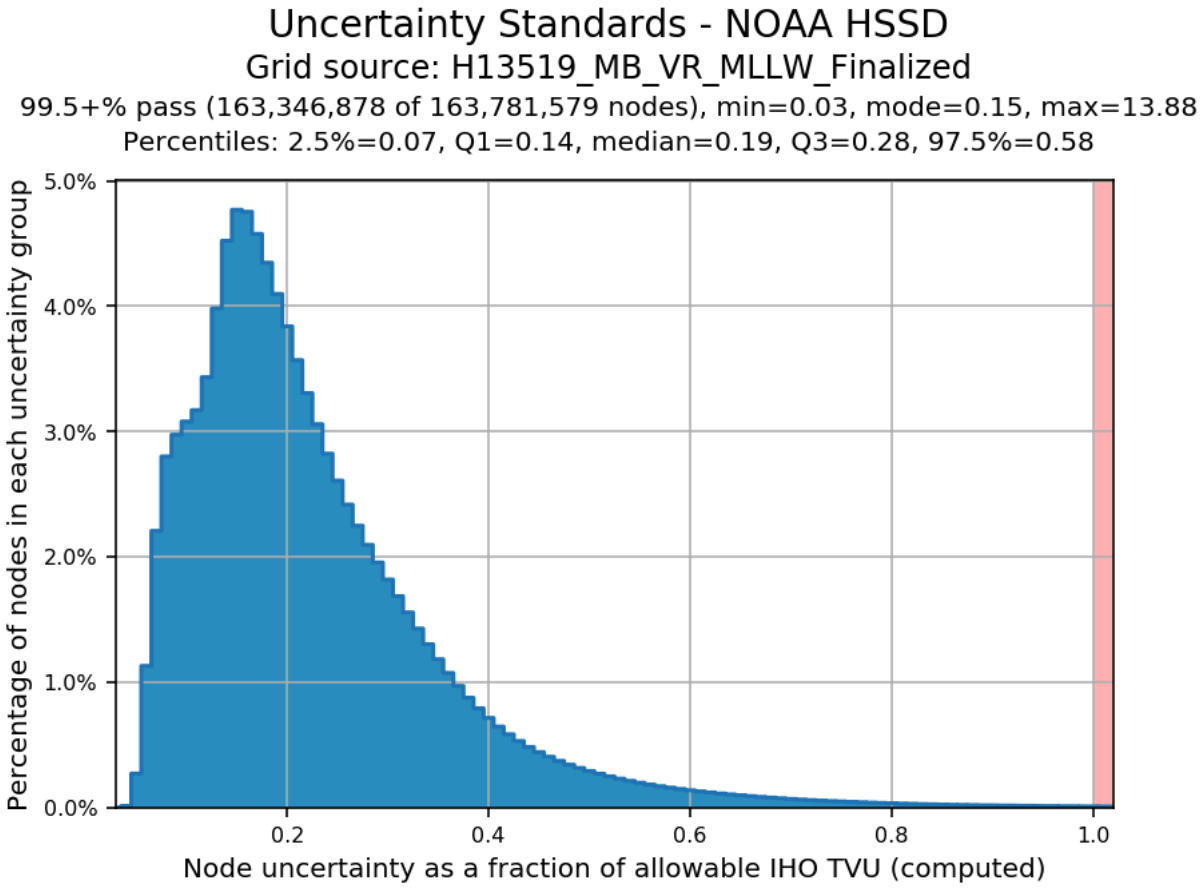


Figure 10: H13519 NOAA Allowable Uncertainty statistics.

B.2.11 Density

The finalized surface was analyzed using the Pydro QC Tools Grid QA feature and the results are shown in Figure 11 below. Density requirements for H13519 were achieved with at least 99.73% of finalized surface nodes containing five or more soundings as required by HSSD Section 5.2.2.3.

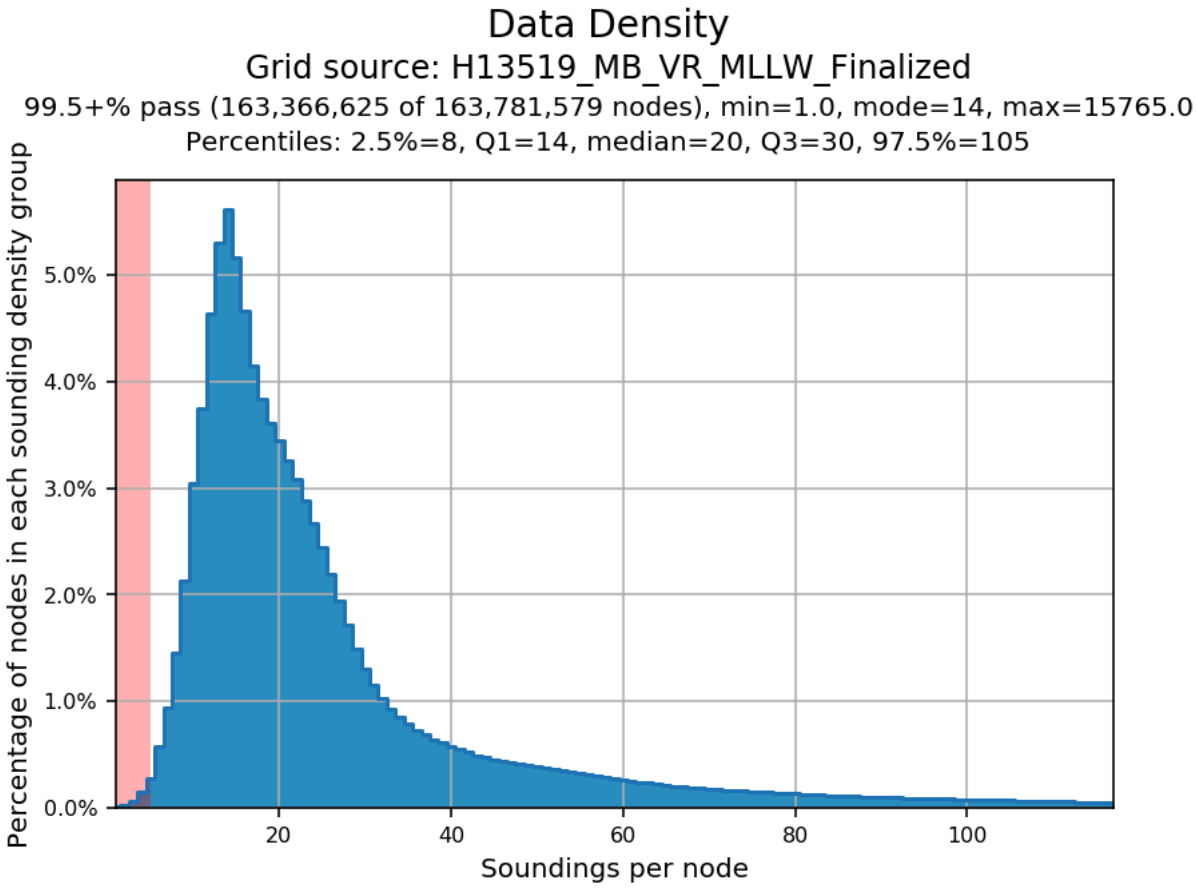


Figure 11: H13519 density statistics.

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

Backscatter was acquired within the Kongsberg.all file and is being submitted for processing by the branch. All equipment and survey methods were used as detailed in the DAPR.

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	11.3.17
CARIS	BASE Editor	5.5.14

Table 9: Primary bathymetric data processing software

The following Feature Object Catalog was used: NOAA Profile Version 2021.

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
H13519_MB_VR_MLLW_Finalized	CARIS VR Surface (CUBE)	Variable Resolution	1.41 meters - 41.04 meters	NOAA_VR	Complete MBES

Table 10: Submitted Surfaces

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surfaces in Survey H13519. The surfaces have been reviewed where noisy data, or "fliers," are incorporated into the gridded solutions causing the surface to be shoaler or deeper than the true sea floor. Where these spurious soundings cause the gridded surface to be shoaler or deeper than the reliably measured seabed by greater than the maximum allowable Total Vertical Uncertainty at that depth, the noisy data have been rejected by the hydrographer and the surface recomputed.

Flier Finder v8, part of the QC Tools package within Pydro, was used to assist the search for spurious soundings following gross cleaning. Flier Finder was run multiple times for the surface, reducing the flier height value for each consecutive run. This allowed Flier Finder to accurately and quickly identify gross fliers, but as the flier height was reduced the effectiveness of the tool diminished. With smaller heights, Flier Finder began to incorrectly flag dynamic aspects of the seafloor such as steep drop offs resulting in hundreds of false positives. At this point, the hydrographer ceased using the tool and returned to manual cleaning for these dynamic regions of the seafloor.

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.

ERS Datum Transformation

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

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	S-E903-BH2-21_VDatumLimits_100m_NAD83-MLLW_geoid12b.csar

Table 11: ERS method and SEP file

Following the successful application of SBETs, ERS methods using VDATUM were used for reducing data to MLLW. ERS methods were used as the final means of reducing H13519 to MLLW for submission.

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.

The following PPK methods were used for horizontal control:

- RTX

Vessel kinematic data were post-processed using Applanix POSPac processing software and Smart Base Positioning methods using Charlene as described in the DAPR. Smoothed Best Estimate of Trajectory (SBET) and associated error (RMS) data were applied to all MBES data in CARIS HIPS and SIPS. For further details regarding the processing and quality control checks performed, see the H13519 POSPAC Processing Logs located in the Separates folder.

WAAS

During real-time acquisition, S5401 received correctors from the Wide Area Augmentation System (WAAS) for increased accuracies similar to USCG DGPS stations. WAAS and SBETs were the sole methods of positioning for H13519 as no DGPS stations were available for realtime horizontal control.

D. Results and Recommendations

D.1 Chart Comparison

Two ENCs covered survey H13519; US5MD21M and US5MD31M, with US5MD31M being a small scale, cutout ENC of US5MD21M. These two ENCs were TINed using the TINing tool in CARIS Base Editor 5.5.14, interpolated, and then Warped using the same program's Warping Tool. Since ENC US5MD21M covers the southern part of the survey area, as well as up river of the survey area, but not cover the majority of the survey area, the TINing process incorrectly interpolated the area of the survey area around Solomons, MD that is not covered by the ENC. Therefore, two separate 0.5M surfaces were created from H13519, one surface to complete a chart comparison with each of the two ENCs.

A sounding set was then created for each of the two surfaces, so that a visual comparison could be made between the ENC and it's corresponding 0.5M surface. Then a difference surface was made, comparing the ENC and the corresponding H13519 survey data.

All data from H13519 should supersede charted data. In general, surveyed soundings agree with the majority of charted depths. A full discussion of the disagreements follows below.

Sounding from H13519 are in a general agreement with charted depths on ENC US5MD21M, with all depths agreeing to 1 meter with the survey data being deeper than the charted depths on the ENC (See Figure 12).

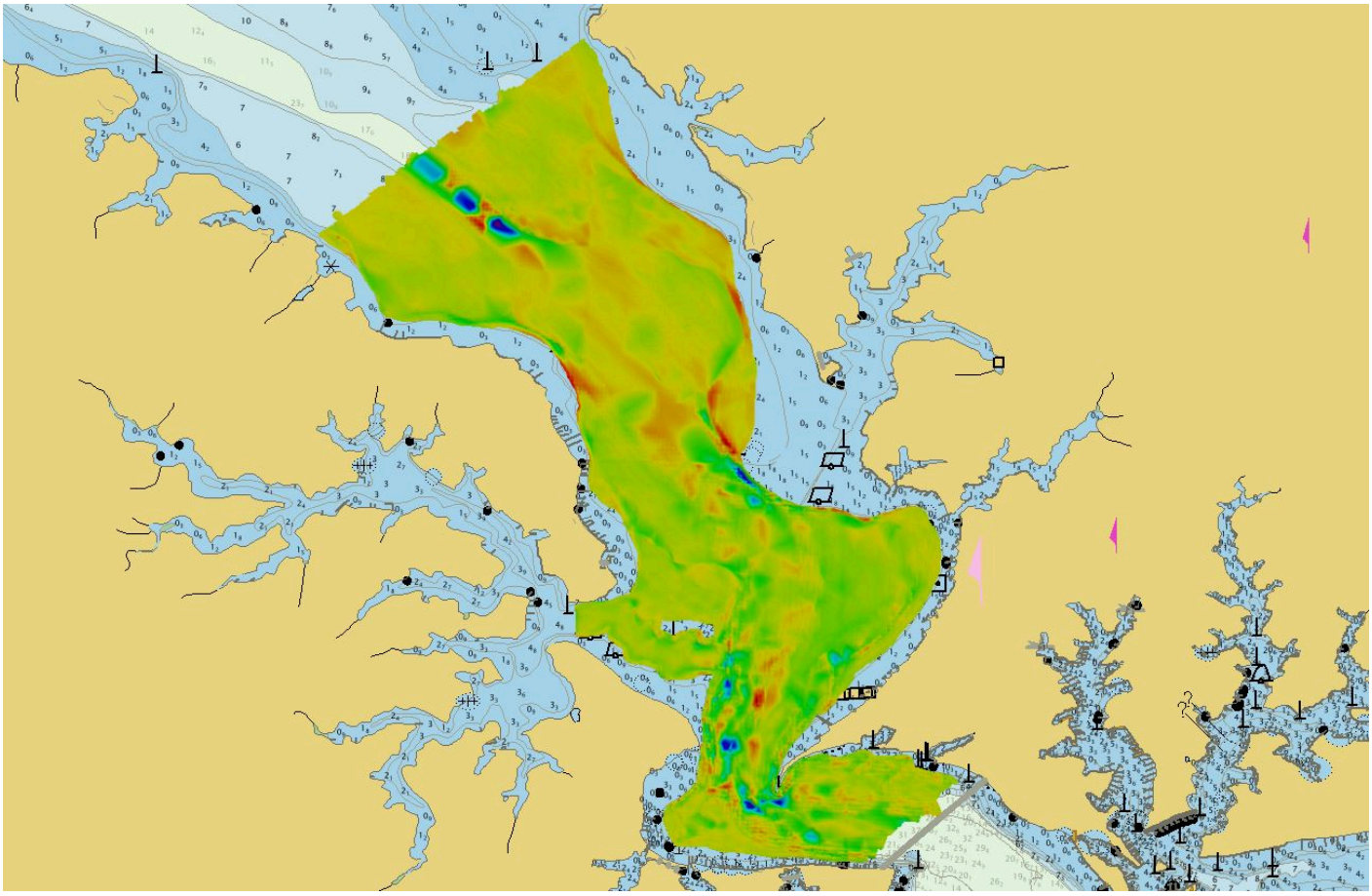


Figure 12: H13519 survey data differenced with US5MD21M overlayed on ENC US5MD21M.

Sounding from H13519 are in a general agreement with charted depths on ENC US5MD31M, with all depths agreeing to 1 meter with the survey data being deeper than the charted depths on the ENC (See Figure 12).

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
US5MD21M	1:40000	25	05/14/2018	03/17/2021
US5MD31M	1:10000	11	04/30/2018	05/11/2020

Table 12: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

The majority of this charted shoal was too shallow to survey with the R/V Bay Hydro II, however as much of the shoal was surveyed as safety would allow. This shoal is delineated by ATONS which were found to be on station and survey their intended purpose, see H13519_FFF.000.

D.1.3 Charted Features

There are multiple features assigned to H13519, see H13519_FFF.000 for descriptions, remarks, and recommendation.

D.1.4 Uncharted Features

All uncharted features have been address in the Final Feature File (H13519_FFF.000).

D.1.5 Channels

No channels exist for this survey. There are no designated anchorages, precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas, or channel and range lines within the survey limits.

D.2 Additional Results

D.2.1 Aids to Navigation

ATONS were investigated to the best of the field unit's ability to determine proper placement and to confirm they are serving their intended purpose, see the Final Feature File (H13519_FFF.000) for more detail.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

Five bottom samples were assigned with H13519, however, only three bottom samples were acquired in accordance with the Project Instructions for Survey H13519; three unsuccessful attempts were made to collect the seventh and eighth bottom sample. All bottom samples were entered into the H13519 Final Feature File.

Concur with clarification, only two bottom samples were included in the submitted FFF.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

No submarine features exist for this survey.

D.2.6 Platforms

No platforms exist for this survey.

D.2.7 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.8 Abnormal Seafloor or Environmental Conditions

No abnormal seafloor or environmental conditions exist for this survey.

D.2.9 Construction and Dredging

No present or planned construction or dredging exist within the survey limits.

D.2.10 New Survey Recommendations

No new surveys or further investigations are recommended for this area.

D.2.11 ENC Scale Recommendations

No new ENC scales 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 Specifications and Deliverables, Field Procedures Manual, Project Instructions, and all HSD Technical Directives, except as noted in this Descriptive Report. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required unless otherwise noted herein.

Approver Name	Approver Title	Approval Date	Signature
LTJG Jane Saunders	Chief of Party	12/16/2022	SAUNDERS.JANE.DEVEREAUX.1087825414 Digitally signed by SAUNDERS.JANE.DEVEREAUX.1087825414 Date: 2022.12.20 11:25:35 -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