H13414

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13414

LOCALITY

State(s):	Washington
General Locality:	Approaches to Puget Sound
Sub-locality:	West Twin River to Sekiu Pt

2021

CHIEF OF PARTY
CDR John Lomnicky

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13414**

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):	**Washington**
General Locality:	**Approaches to Puget Sound**
Sub-Locality:	**West Twin River to Sekiu Pt**
Scale:	**20000**
Dates of Survey:	**11/22/2020 to 12/02/2020**
Instructions Dated:	**10/20/2020**
Project Number:	**OPR-N305-FA-20**
Field Unit:	**NOAA Ship *Fairweather***
Chief of Party:	**CDR John Lomnicky**
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 10N, 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 H13414

Project: OPR-N305-FA-20

Locality: Approaches to Puget Sound

Sublocality: West Twin River to Sekiu Pt

Scale: 1:20000

November 2020 - December 2020

NOAA Ship *Fairweather*

Chief of Party: CDR John Lomnicky

A. Area Surveyed

The survey area is located in Strait of Juan de Fuca, WA.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
48° 18' 52.15" N 124° 19' 36.68" W	48° 9' 38.84" N 123° 57' 15.47" W

Table 1: Survey Limits

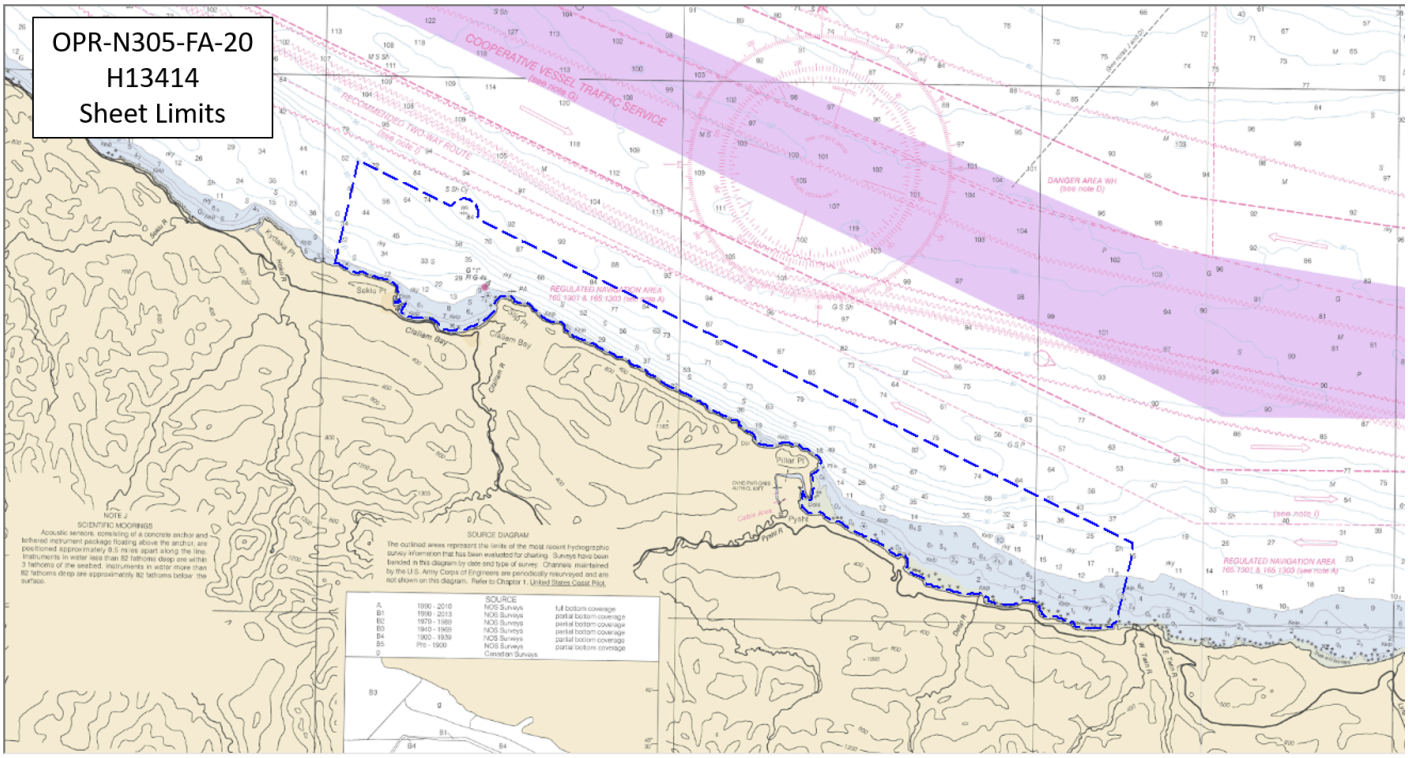


Figure 1: H13414 sheet limits overlaid onto Chart 18460

Data were acquired to the survey limits in accordance with the requirements in the Project Instructions and the 2020 NOS Hydrographic Surveys Specifications and Deliverables (HSSD). Coverage acquired in H13414 is shown in Figure 1. In all areas where the 3.5 meter depth contour or the 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 boulders and kelp on the shoreline. An example of such an area is shown in Figures 2 and 3.

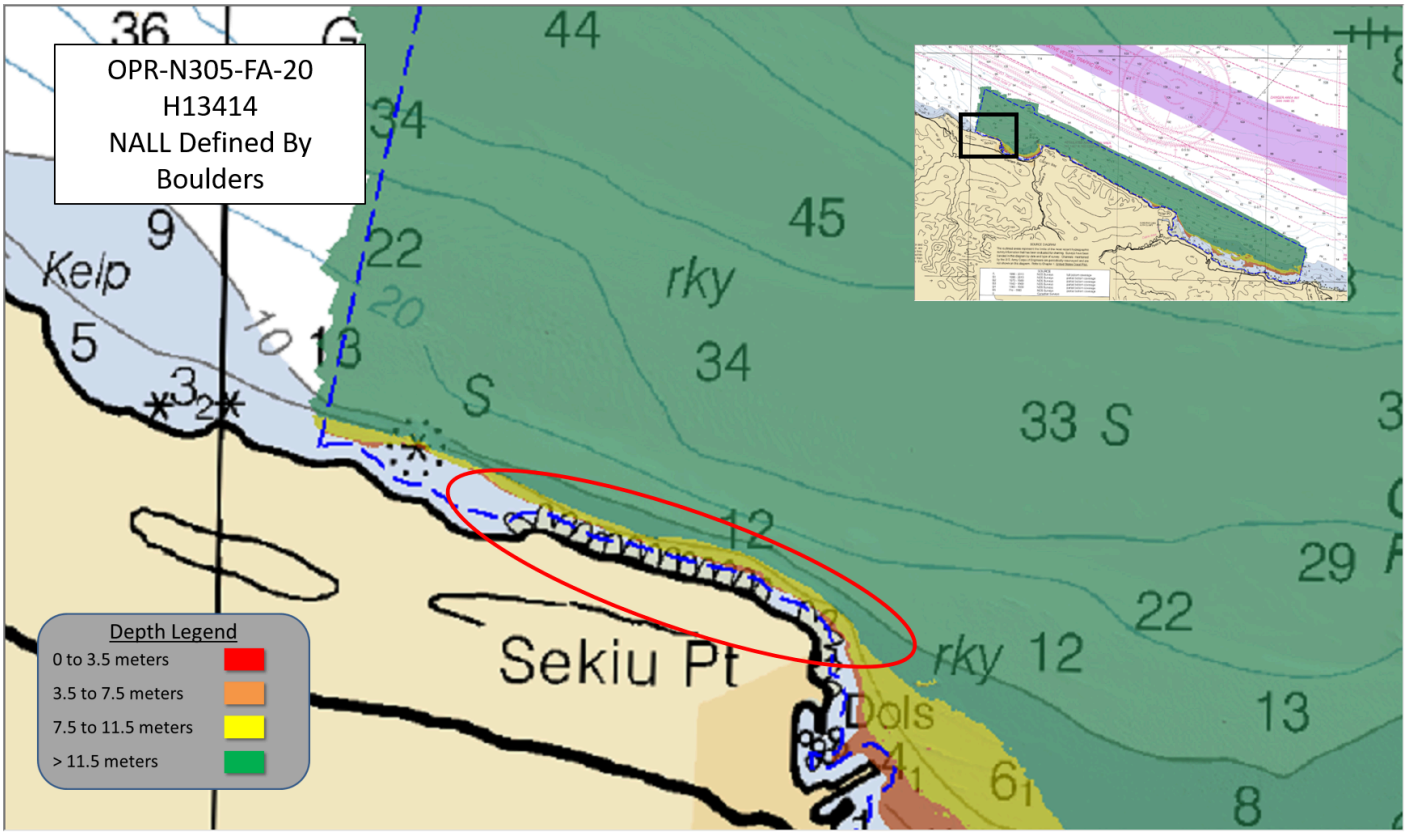


Figure 2: Area where the NALL was defined by the presence of boulders along shoreline

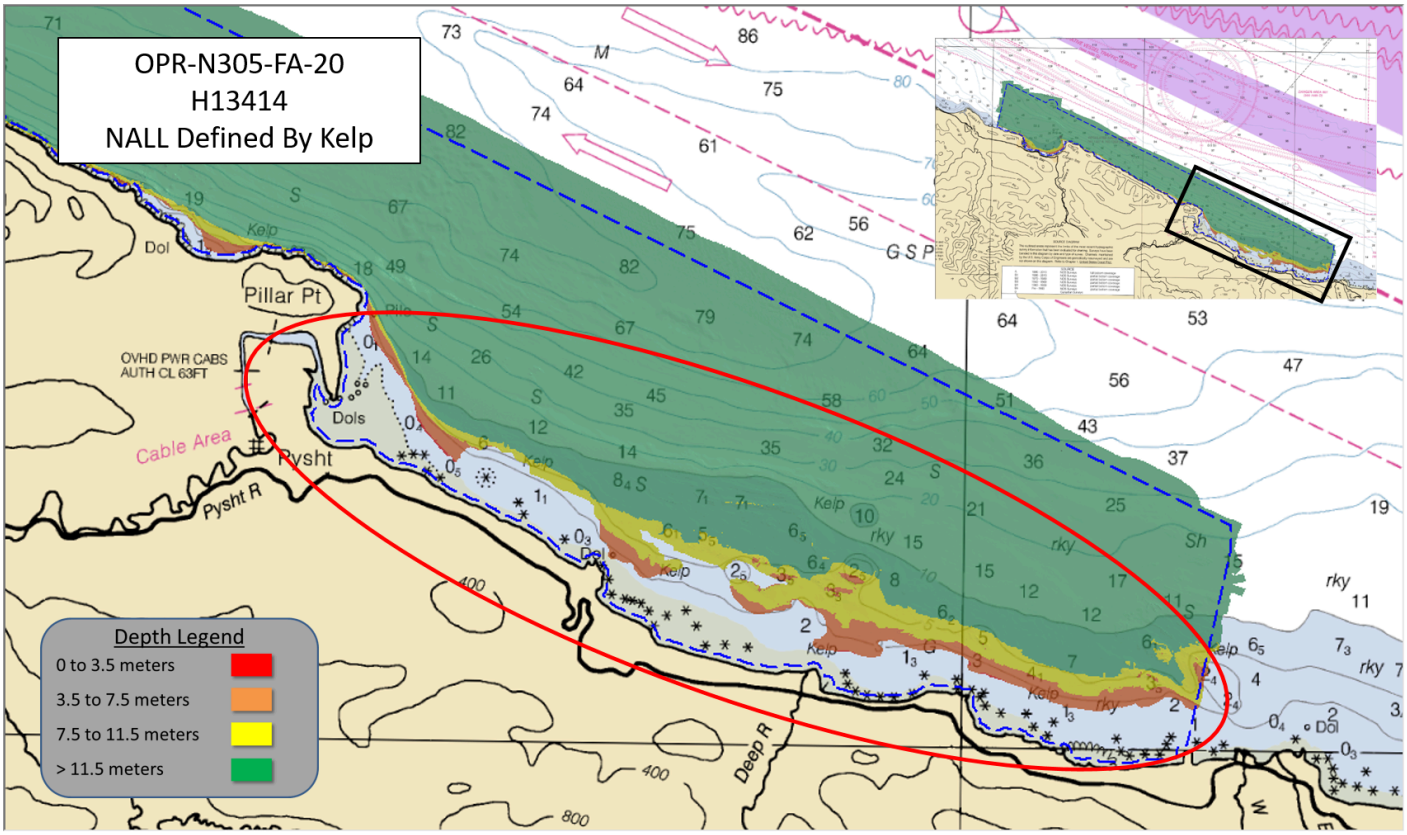


Figure 3: Area where the NALL was defined by the presence of kelp

A.2 Survey Purpose

This survey provides modern bathymetry for updating National Ocean Service nautical charting products in the Strait of Juan De Fuca, improving maritime safety as well as supporting the Seabed 2030 global mapping initiative. This area is a navigationally significant waterway within the Salish Sea, which supports transits of deep-draft container ships, cargo and chemical carriers, oil tankers, fuel and coal barges arriving and departing from Puget Sound and Vancouver, Canada along with fishing, recreational, tug and barge vessels, and Washington State Ferries. Furthermore, the region is home to 8 million people including fifty First Nation communities with centuries old cultural ties to traditional fishing.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired in H13414 meet multibeam echo sounder (MBES) coverage requirements for complete coverage, as required by the HSSD. This includes crosslines (see Section B.2.1), NOAA allowable uncertainty (see Section B.2.10), and density requirements (see Section B.2.11).

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	Complete Coverage

Table 2: Survey Coverage

The entirety of H13414 was acquired with complete coverage, meeting the requirements listed above and in the HSSD. See Figure 4 for an overview of coverage.

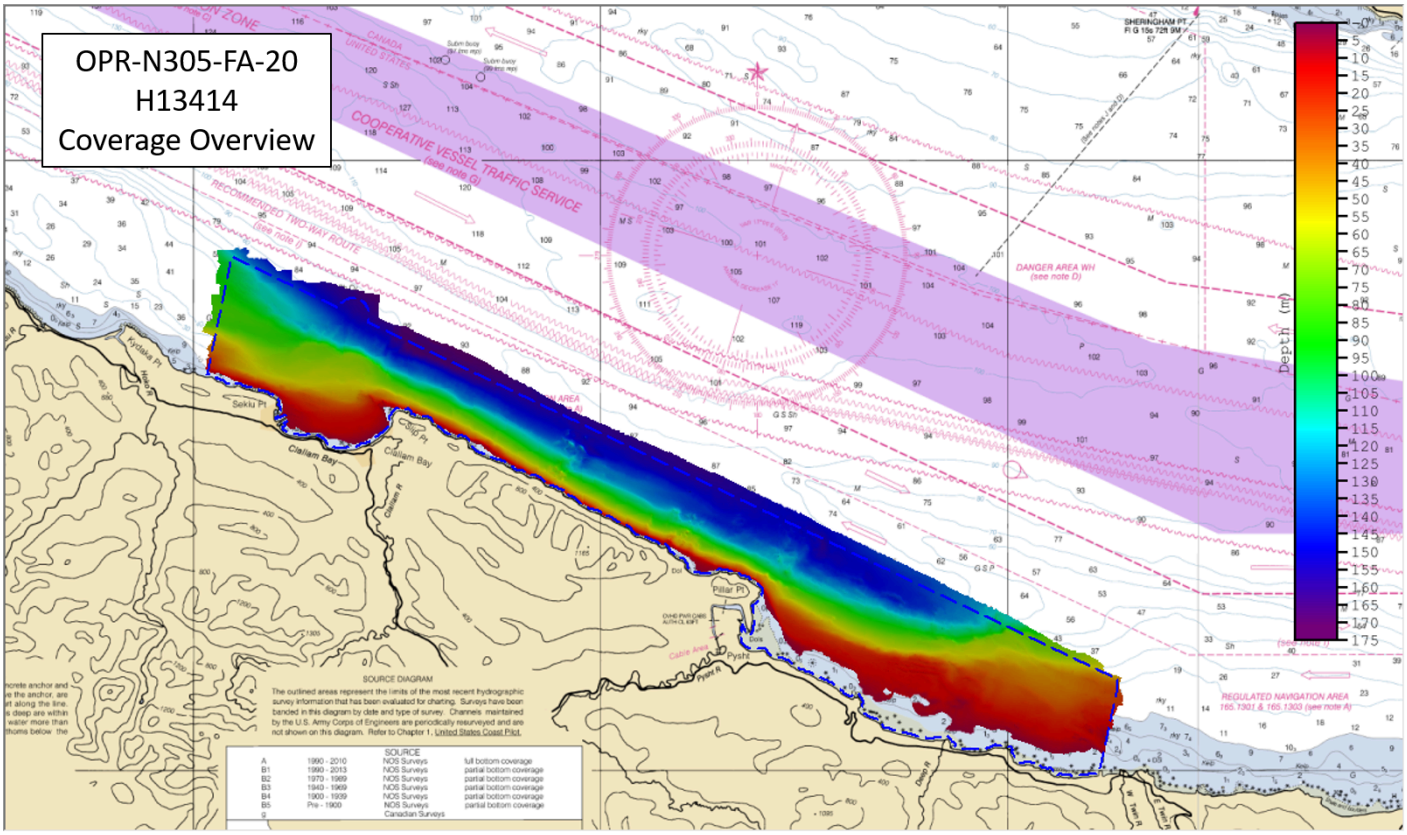


Figure 4: H13414 survey coverage overlaid onto Chart 18460

A.6 Survey Statistics

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

	HULL ID	*S220*	*2805*	*2807*	*2808*	*Total*
LNM	SBES Mainscheme	0	0	0	0	0
	MBES Mainscheme	88.08	99.09	168.05	85.51	440.73
	Lidar Mainscheme	0	0	0	0	0
	SSS Mainscheme	0	0	0	0	0
	SBES/SSS Mainscheme	0	0	0	0	0
	MBES/SSS Mainscheme	0	0	0	0	0
	SBES/MBES Crosslines	0	21.07	5.01	0	26.08
	Lidar Crosslines	0	0	0	0	0
Number of Bottom Samples						7
Number Maritime Boundary Points Investigated						0
Number of DPs						0
Number of Items Investigated by Dive Ops						0
Total SNM						27.45

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
11/22/2020	327
11/23/2020	328

Survey Dates	Day of the Year
11/24/2020	329
11/25/2020	330
11/26/2020	331
11/28/2020	333
12/02/2020	337

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the OPR-N305-FA-20 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	*S220*	*2805*	*2807*	*2808*
LOA	70.4 meters	8.6 meters	8.6 meters	8.6 meters
Draft	4.8 meters	1.1 meters	1.1 meters	1.1 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 2040	MBES
AML Oceanographic	MVP200	Conductivity, Temperature, and Depth Sensor
Kongsberg Maritime	EM 710	MBES
Sea-Bird Scientific	SBE 19plus V2	Conductivity, Temperature, and Depth Sensor
Teledyne RESON	SVP 70	Sound Speed System
Teledyne RESON	SVP 71	Sound Speed System
Applanix	POS MV 320 v5	Positioning and Attitude System

Table 6: Major Systems Used

The equipment was installed on the survey platform as follows: S220 utilizes the Kongsberg EM 710 MBES, a POS M/V v5 system for position and attitude, SVP 70 surface sound speed sensors, and AML Oceanographic MVP 200 for conductivity, temperature, and depth (CTD) casts. All launches utilize the Kongsberg EM 2040 MBES, a POS M/V v5 system for position and attitude, SVP 71 surface sound speed sensors, and Sea-Bird SBE 19plus v2 CTDs for conductivity, temperature, and depth casts.

B.2 Quality Control

B.2.1 Crosslines

Multibeam crosslines were collected, processed and compared in accordance with Section 5.2.4.2 of the HSSD. Crosslines for H13414 totaled 5.9% of mainscheme acquisition. To evaluate crosslines, a surface generated via data strictly from mainscheme lines and a surface generated via data strictly from crosslines were created. From these two surfaces, a difference surface (mainscheme - crosslines = difference surface) was generated (Figure 5), and is submitted in the Separates II Digital Data folder. Statistics show the mean difference between the depths derived from mainscheme data and crossline data was 0.01 meters (with mainscheme being deeper) and 95% of nodes falling within 0.25 meters (Figure 6). For the respective depths, the difference surface was compared to the allowable NOAA uncertainty standards. In total, 99.98% of the depth differences between H13414 mainscheme and crossline data were within allowable NOAA uncertainties.

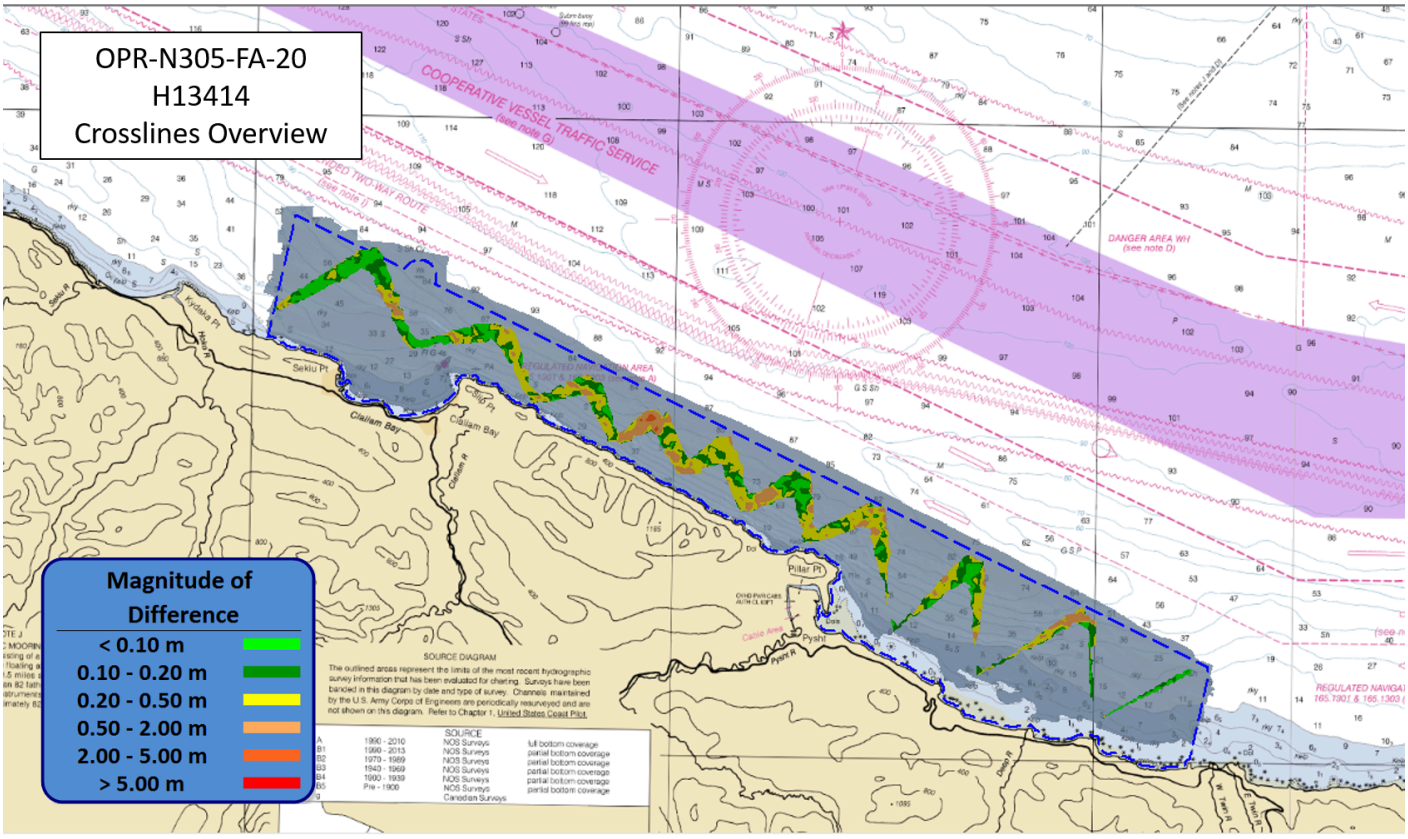
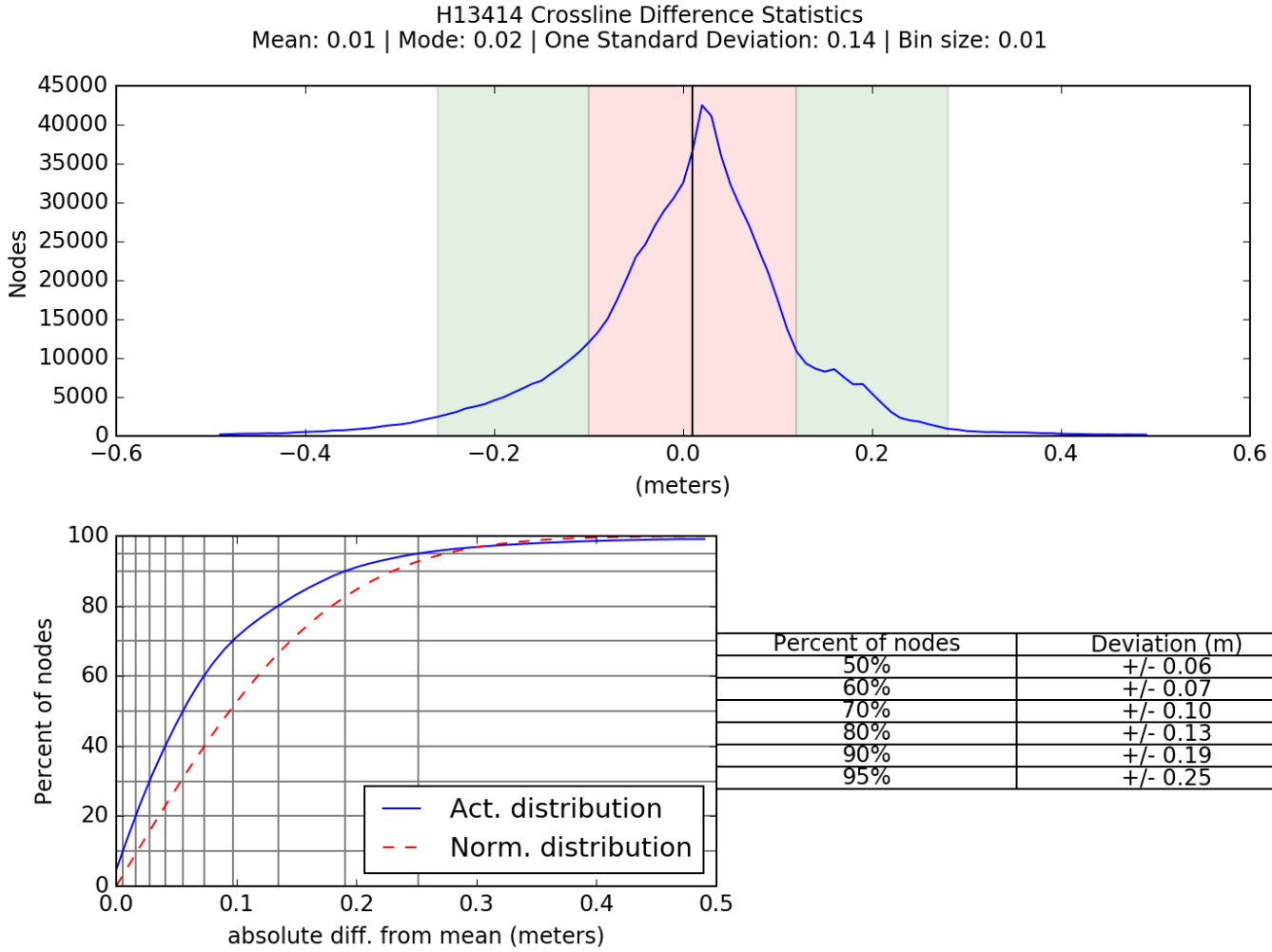


Figure 5: Overview of H13414 crosslines



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.07
70%	+/- 0.10
80%	+/- 0.13
90%	+/- 0.19
95%	+/- 0.25

Figure 6: H13414 crossline and mainscheme difference statistics

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	N/A	0.132 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
S220	N/A	1 meters/second	N/A	0.5 meters/second
2805	2 meters/second	N/A	N/A	0.5 meters/second
2807	2 meters/second	N/A	N/A	0.5 meters/second
2808	2 meters/second	N/A	N/A	0.5 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

In addition to the usual a priori estimates of uncertainty via device models for vessel motion and VDATUM, real-time and post-processed uncertainty sources were also incorporated into the depth estimates of survey H13414. Real-time uncertainties were provided via EM 740 and EM 2040 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.

B.2.3 Junctions

H13414 junctions with one adjacent survey from this project, H13412, as shown in Figure 7. Sufficient data overlap between H13414 and the adjacent survey was achieved for junction analysis. These areas of overlap between surveys were reviewed in CARIS HIPS and SIPS by surface differencing (at equal resolutions) to assess surface agreement. The multibeam data were also examined in CARIS Subset Editor for consistency and agreement. The junction with H13414 is generally within the NOAA allowable uncertainty in their areas of overlap. A negative difference indicates H13414 was shoaler and a positive difference indicates H13414 was deeper.

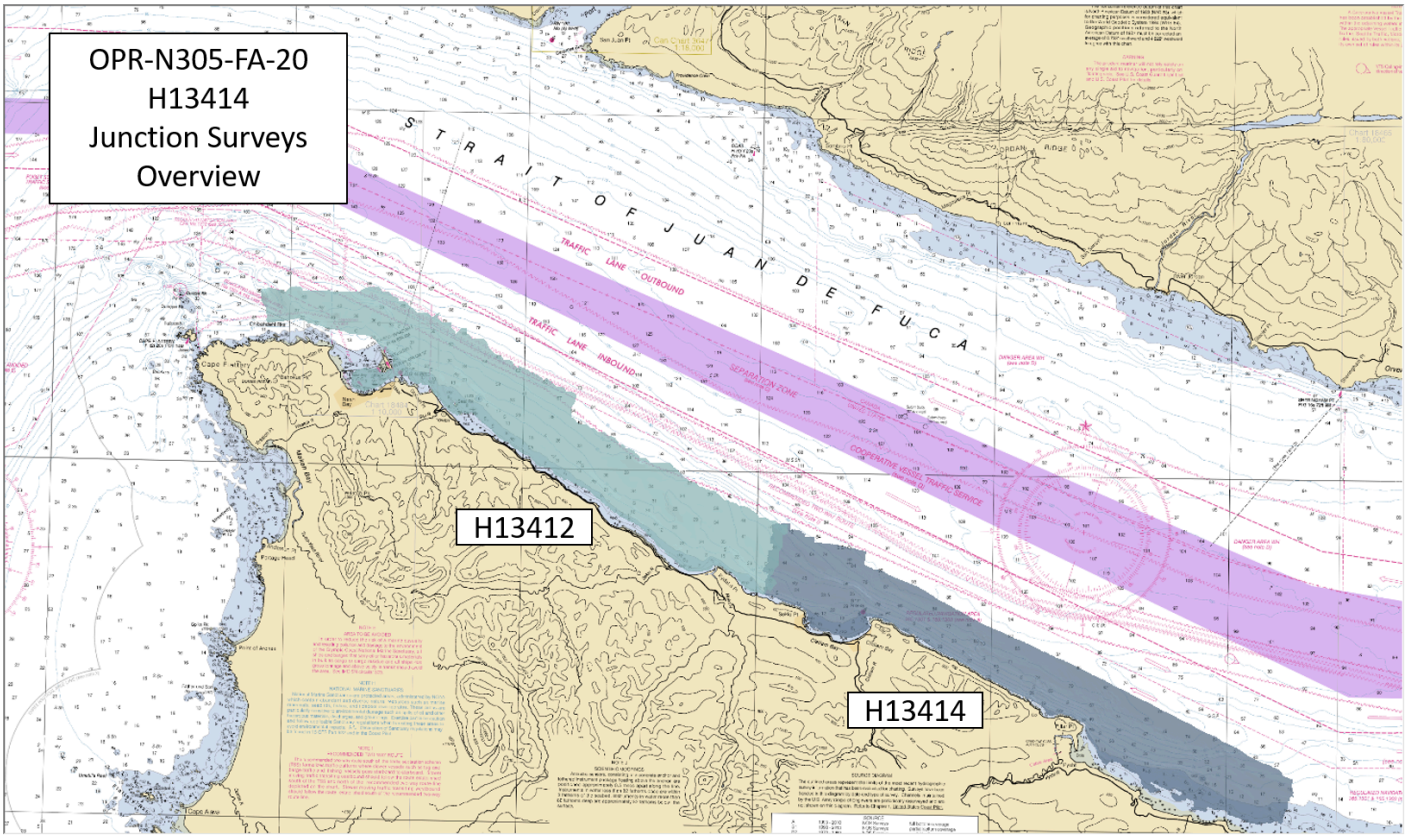


Figure 7: Overview of H13414 junction surveys

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H13412	1:5000	2020	S220	W

Table 9: Junctioning Surveys

H13412

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface from H13414 and the surface from H13412 (Figure 8). The statistical analysis of the difference surface shows a mean of -0.02 meters with 95% of the nodes having a maximum deviation of +/- 0.16 meters, as seen in Figure 9. It was found that 99.99% of nodes are within NOAA allowable uncertainty.

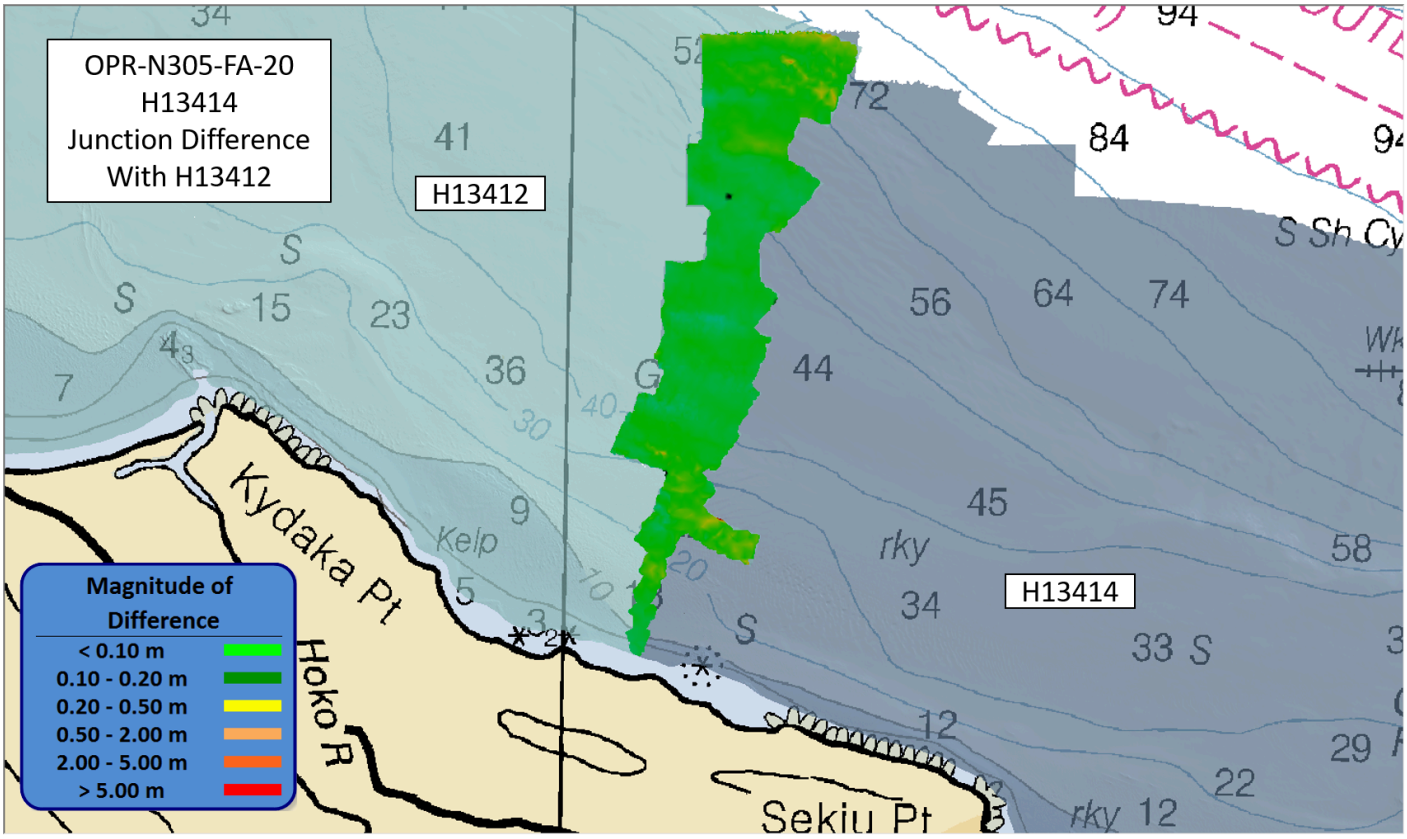
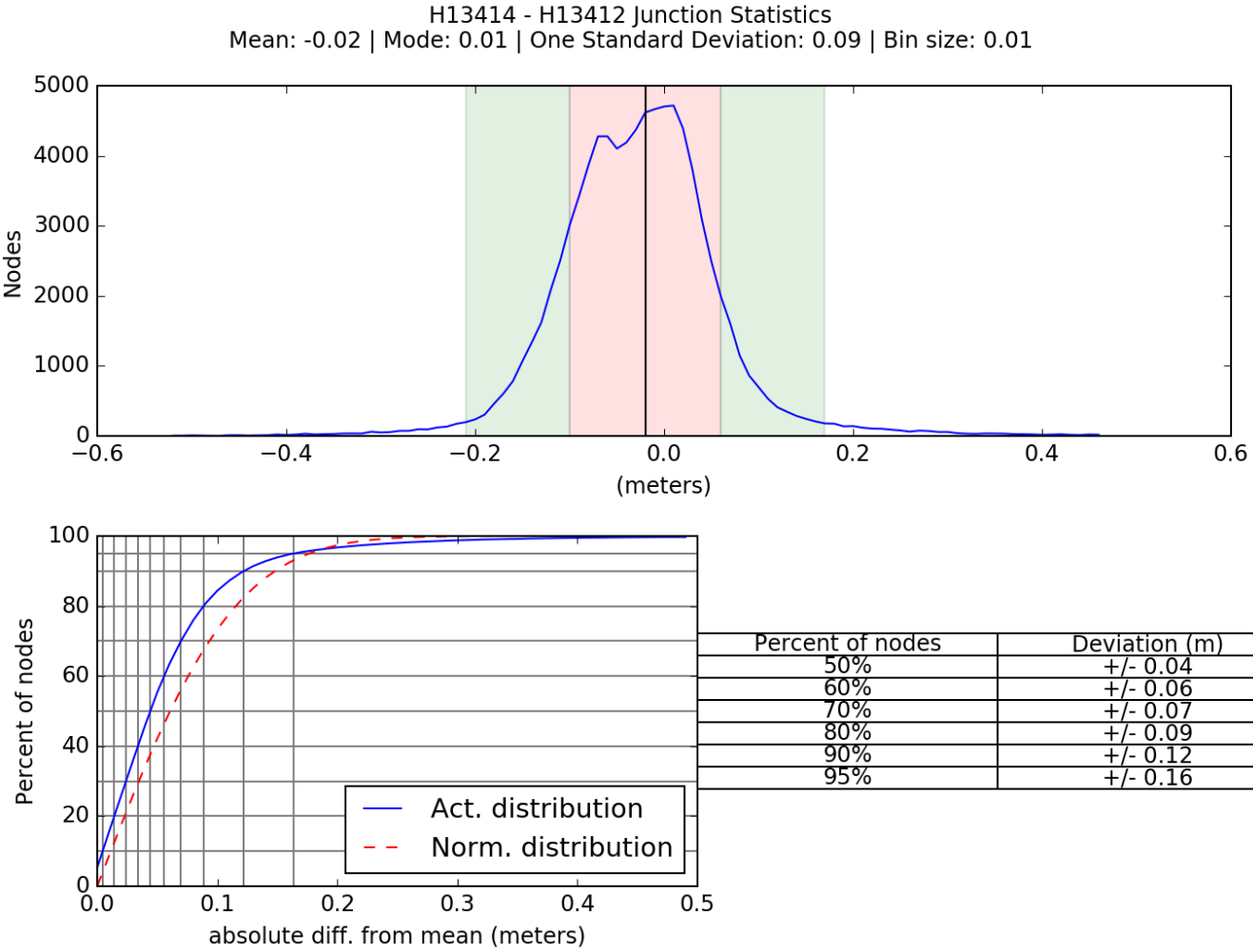


Figure 8: Difference surface between H13414 (grey) and junctioning survey H13412 (blue)



Percent of nodes	Deviation (m)
50%	+/- 0.04
60%	+/- 0.06
70%	+/- 0.07
80%	+/- 0.09
90%	+/- 0.12
95%	+/- 0.16

Figure 9: Difference surface statistics between H13414 and H13412

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

Kelp

Kelp was present throughout the survey area, though most abundant east of Pillar Point. In some areas, patches of dense kelp prohibited safe navigation of the survey vessels. The limits of these areas were then used to define the NALL (Figure 10). Documentation can be found in the vessel boat sheets, which are located in the Separates I Digital Data folder.

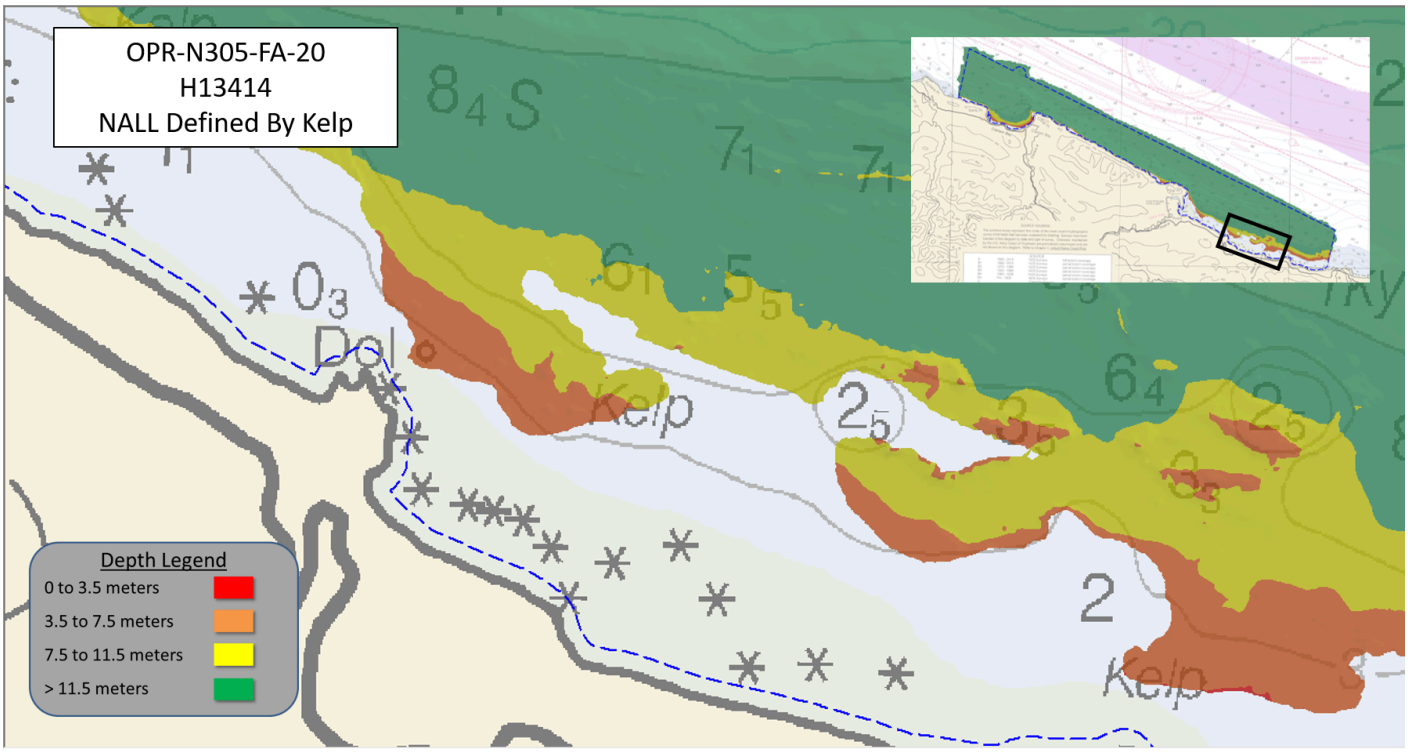


Figure 10: Area east of Pillar Point where dense kelp defined the NALL

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Casts were conducted at a minimum of one every four hours during launch acquisition. Casts were conducted more frequently in areas where the influx of freshwater had an effect on the speed of sound in the water column and when there was a change in surface sound speed greater than two meters per second. MVP casts on S220 were conducted at an average interval of 120 minutes, guided by observation of the surface sound speed and targeted to deeper areas. All sound speed methods were used as 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

H14314 data were reviewed in CARIS HIPS and SIPS for holidays in accordance with Section 5.2.2.3 of the HSSD. One holiday which meets the definition described in the HSSD for complete coverage were identified via HydrOffice QC Tools Holiday Finder tool. This tool automatically scans the surface for holidays as defined in the HSSD and was run in conjunction with a visual inspection of the surface by the hydrographer.

The holiday is due to acoustic shadowing in steep, rocky areas as seen in Figure 11. This shadow is formed due to lack of coverage on the “back” side of a feature, usually due to rapid drops in the seafloor in conjunction with poor geometry from the sonar head. All areas with acoustic shadows were investigated in CARIS subset editor to verify that least depths were found.

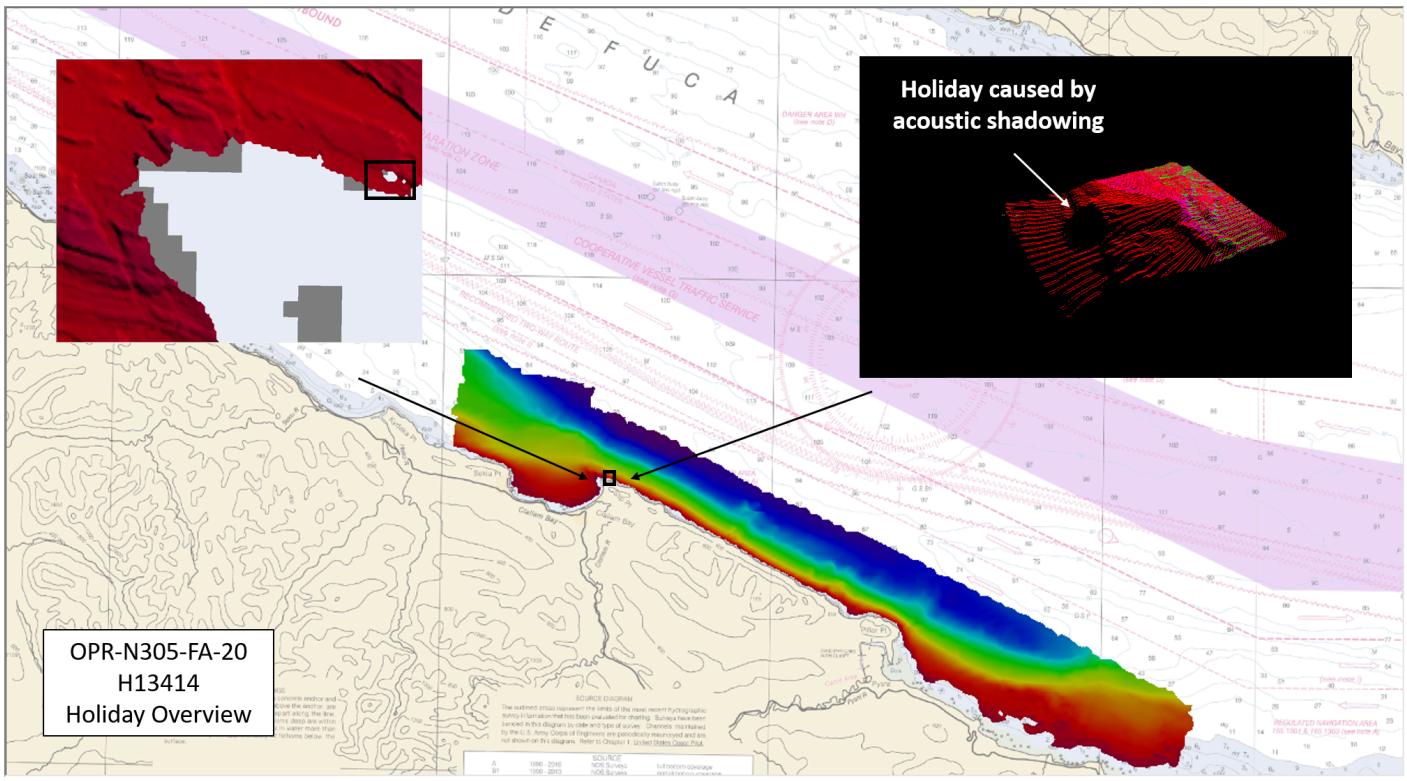


Figure 11: H13414 holiday due to acoustic shadowing

B.2.10 NOAA Allowable Uncertainty

The surface was analyzed using the HydrOffice QC Tools Grid QA feature to determine compliance with specifications. Overall, 99.5+% of nodes within the surface meet NOAA Allowable Uncertainty specifications for H13414 (Figure 12).

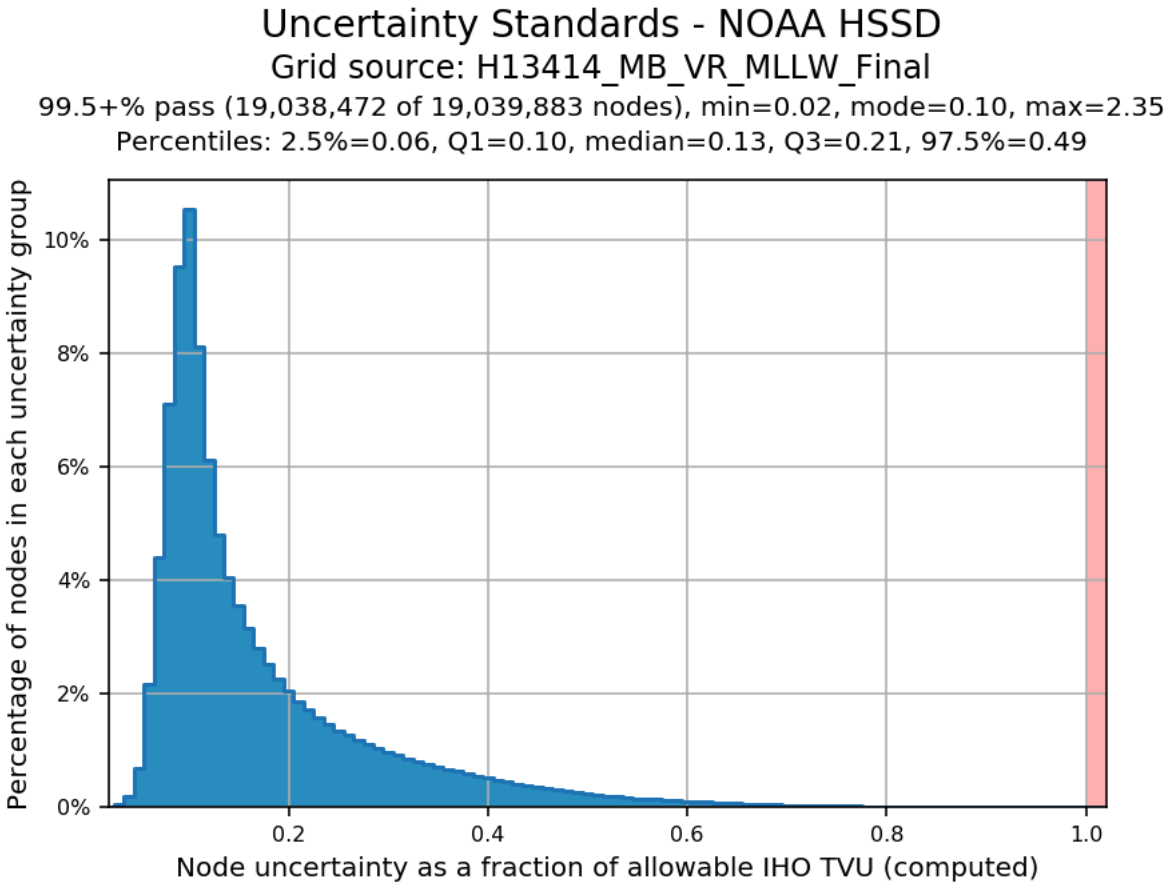


Figure 12: H13414 allowable uncertainty statistics

B.2.11 Density

The surface was analyzed using the HydrOffice QC Tools Grid QA feature to determine compliance with specifications. Density requirements for H13414 were achieved with at least 99.5+% of surface nodes containing five or more soundings as required by HSSD Section 5.2.2.3 (Figure 13).

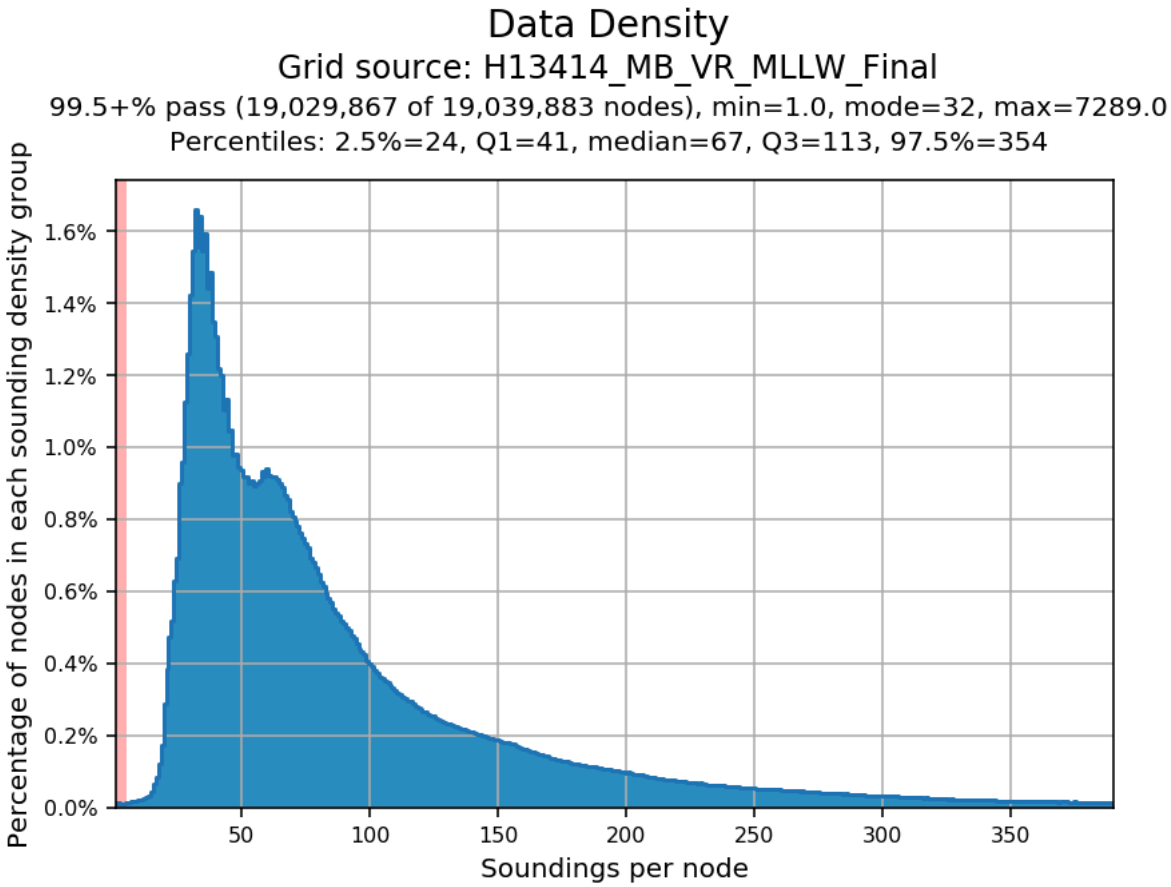


Figure 13: H13414 data density statistics

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

All equipment and survey methods were used as detailed in the DAPR. Raw backscatter data were stored in the .all file for Kongsberg systems. All backscatter were processed to GSF files and a floating point mosaic was created by the field unit via Fledermaus FMGT 7.9.0 . See Figure 14 for a greyscale representation of the complete mosaic. A relative backscatter calibration was performed by HSTB via a patch test in order to bring the survey systems on each of the launches into alignment. See Figure 15 for a table of the calibration values entered into the Processing Settings within FMGT. Approximate inter-calibration corrections for offsets between sonar systems were applied to the mosaic.

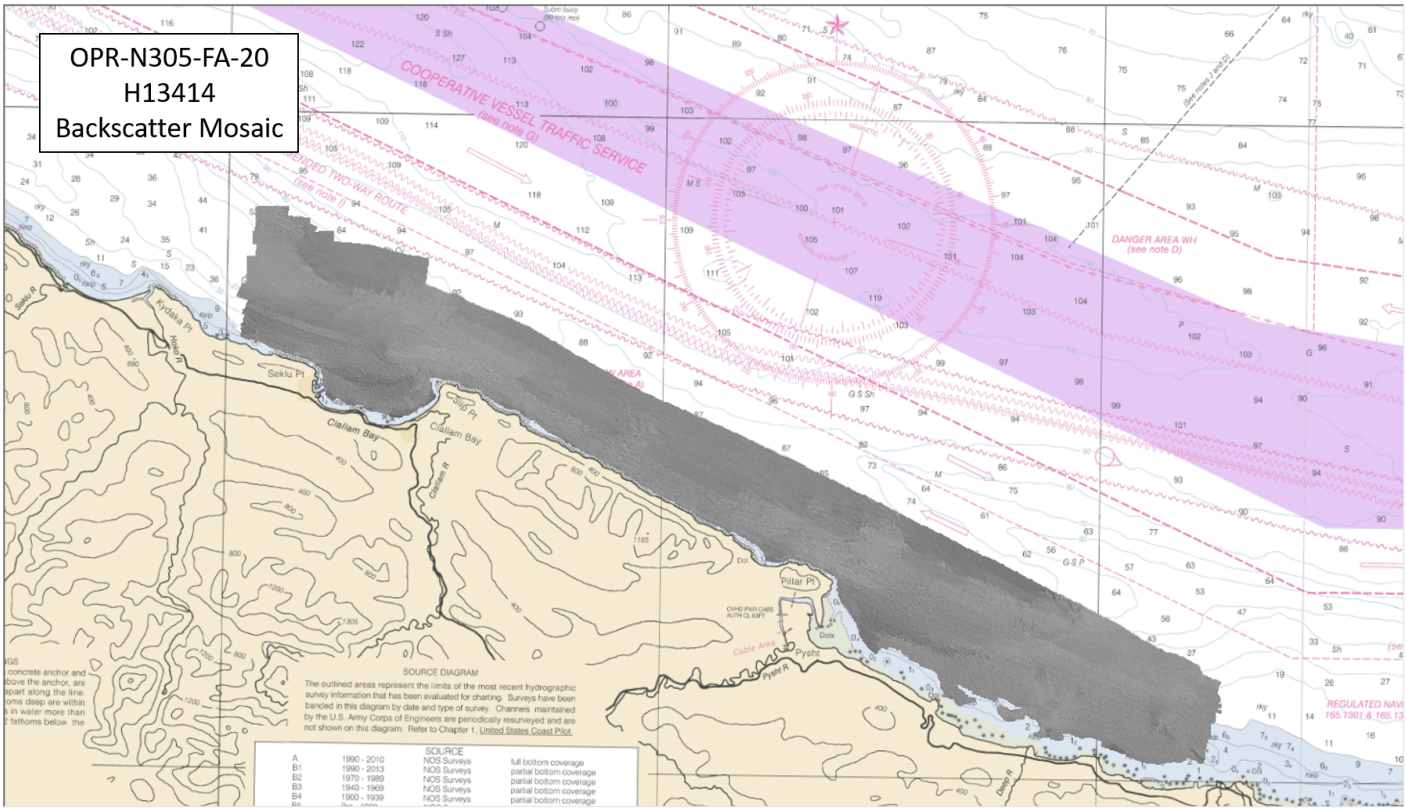


Figure 14: Backscatter mosaic for H13414

	200				300				400		
	Short CW	Med CW	Long CW	FM (Both)	Short CW	Med CW	Long CW	FM (Both)	Short CW	Med CW	Long CW
2805	-1.1	-1.4	-1.8	2.7	-0.7	-0.9	-1.0	-1.4	3	3.9	4.8
2807	-0.3	-0.15	0	0	0	-0.2	-0.3	-0.7	3.3	4.2	5.1
2808	0	0.6	1.2	1.6	-0.3	-0.5	-0.6	-1.0	1.8	2.7	3.6

Figure 15: Backscatter calibration values

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	11.3.8

Table 10: Primary bathymetric data processing software

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

Manufacturer	Name	Version
QPS	Fledermaus	7.9.0

Table 11: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Profile Version 2020.

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
H13414_MB_VR_MLLW_Final.csar	CARIS VR Surface (CUBE)	Variable Resolution	0.8 meters - 171.6 meters	NOAA_VR	Complete MBES
H13414_MB_VR_MLLW.csar	CARIS VR Surface (CUBE)	Variable Resolution	0.8 meters - 171.6 meters	NOAA_VR	Complete MBES

Table 12: Submitted Surfaces

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surfaces for H13414. 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 vary from 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.

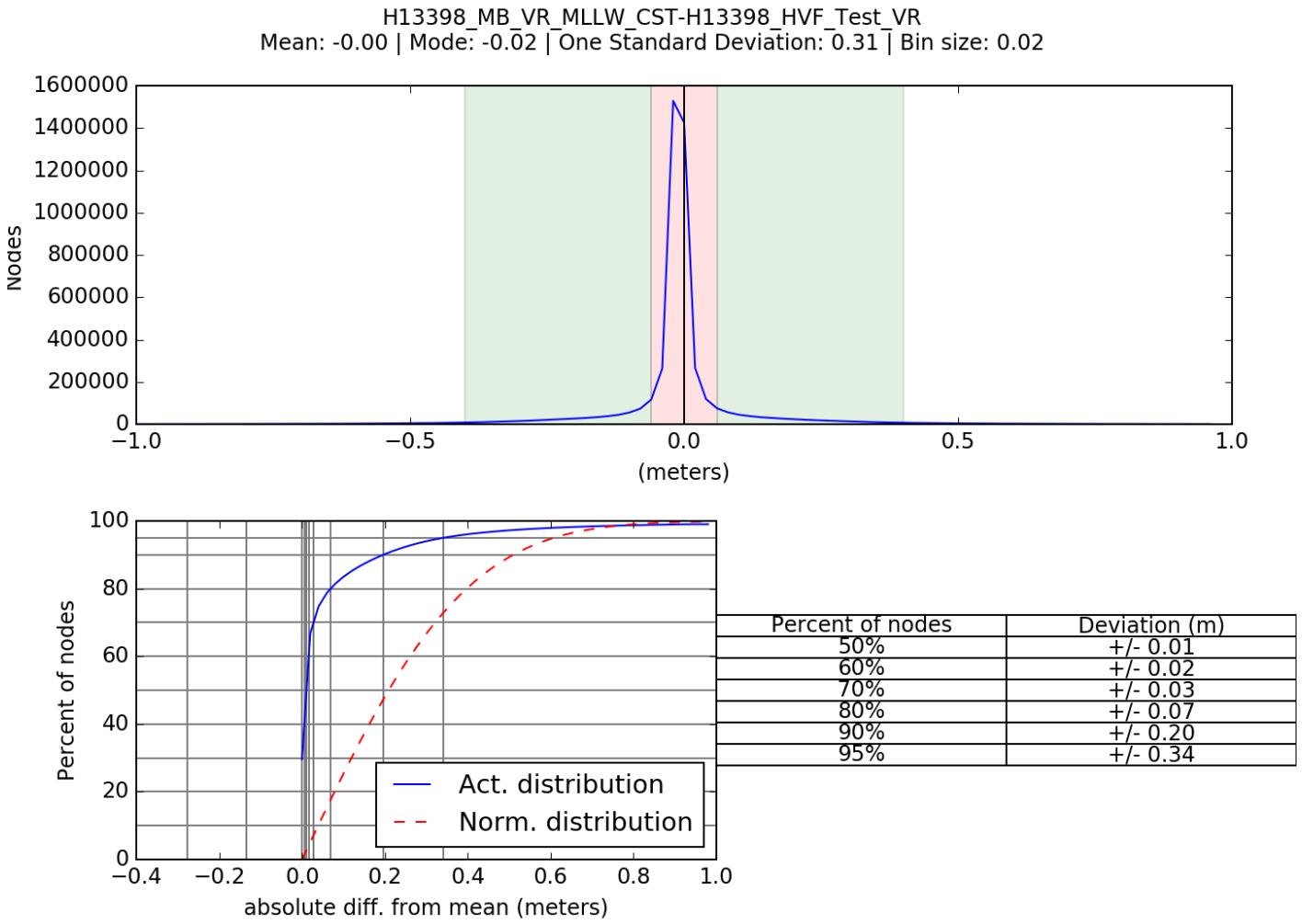
Flier Finder, part of the QC Tools package within HydrOffice, was used to assist the search for spurious soundings following gross cleaning. Flier Finder was run iteratively until all remaining flagged fliers were deemed to be valid aspects of the surface.

B.5.3 Data Logs

Data acquisition and processing notes are included in the acquisition and processing logs, and additional processing such as final separation model reduction and sound speed application are noted in the H13414 Data Log spreadsheet. All data logs are submitted digitally in the Separates I folder.

B.5.4 HVF Error

The DAPR includes the correct offsets in terms of what information is input into our systems. This information, unfortunately, did not make its way into the HVF. The offset inputs in the HVF are not applied directly to the data and are only used to determine uncertainty. These small differences do not seem to impact the uncertainty values. To assess this we created a test project and processed a small section of the data with the updated HVF and created a surface. We then compared the resulting uncertainty with the old HVF and new HVF which mirrors the DAPR and the POS offsets. We then utilized compare grids to assess the differences between "Correct HVF Surface" and the "Incorrect HVF Surface". The mean difference was 0.0m. Output graphs are attached.



Percent of nodes	Deviation (m)
50%	+/- 0.01
60%	+/- 0.02
70%	+/- 0.03
80%	+/- 0.07
90%	+/- 0.20
95%	+/- 0.34

Figure 16: Surface Comparison between Incorrect HVF and Correct HVF data

C. Vertical and Horizontal Control

Per Section 5.2.2.1.3 of the 2020 Field Procedures Manual no Horizontal and Vertical Control Report has been generated for H13414.

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-N305-RA-20_sheetsuffforVdat__100m_NAD83-MLLW_geoid12b.csar

Table 13: ERS method and SEP file

ERS methods were used as the final means of reducing H13414 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 10.

The following PPK methods were used for horizontal control:

- RTX

Vessel kinematic data were post-processed using Applanix POSPac processing software and RTX positioning methods 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.

WAAS

During real-time acquisition, all platforms 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 H13414, as no DGPS stations were available for real-time horizontal control.

D. Results and Recommendations

D.1 Chart Comparison

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
US4WA36M	1:100000	30	07/09/2020	07/09/2020

Table 14: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.3 Charted Features

Survey H13414 has one PA wreck feature disproved by full coverage MBES and backscatter. However, there was insufficient MBES to disprove the unobserved charted rock (Feature ID US 0000000068 00001) 0.18 NM southwest of Slip Point. While MBES over the rock was acquired, the entire disproval radius of 150 m was not ensonified in accordance with Section 7.3.4.2 of the HSSD. The H13414 Final Feature File addresses these features.

D.1.4 Uncharted Features

Survey H13414 has nine new ledge features that are addressed in the H13414 Final Feature File.

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

One aid to navigation (ATON) exists for this survey. The lighted buoy was on station and serving as intended. Refer to the H13414 Final Feature File.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

Seven bottom samples were acquired in accordance with the Project Instructions for survey H13414. All bottom samples were entered in the H13414 Final Feature File. See Figure 16 for a graphical overview of sample locations.

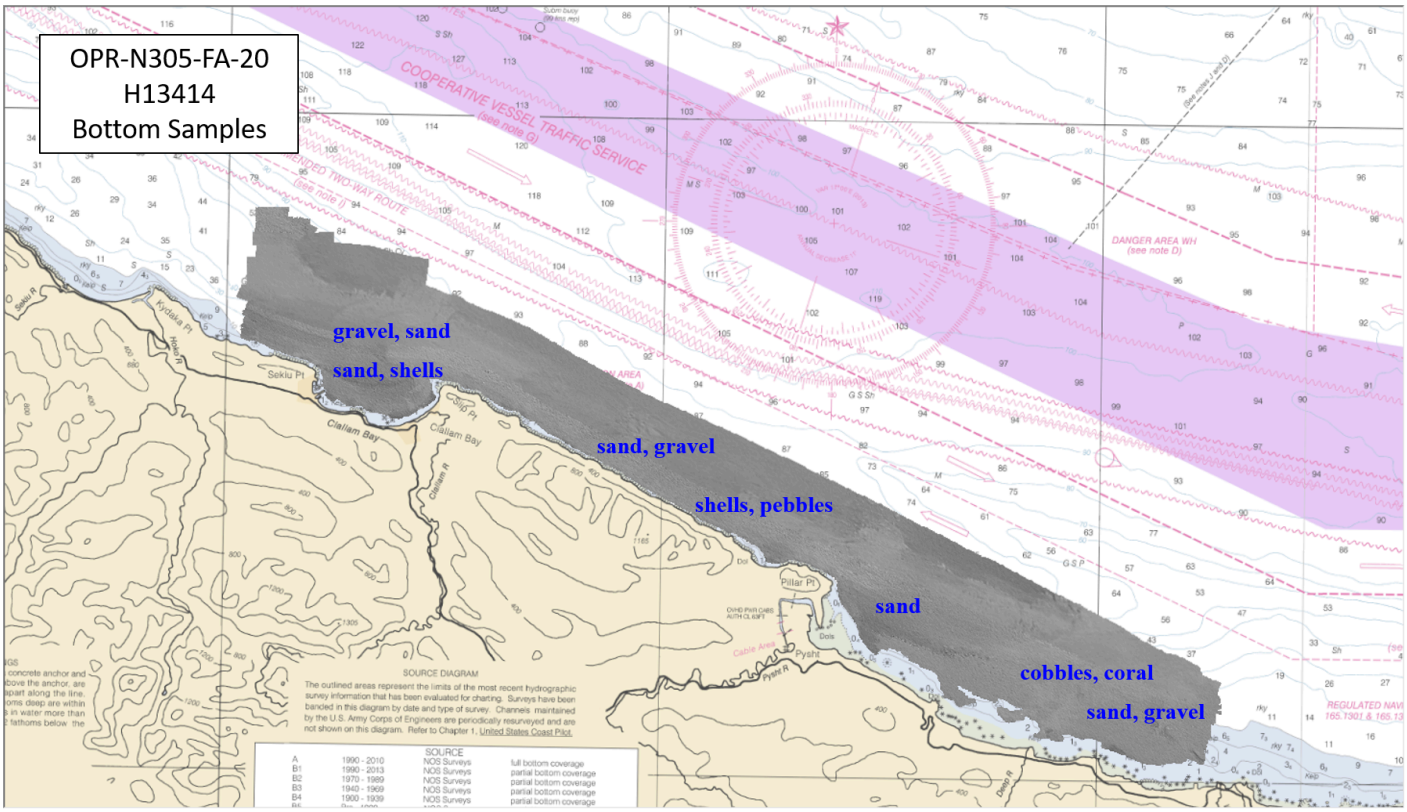


Figure 17: H13414 bottom sample locations

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

Unknown seafloor features in the southeastern region of H13414 were investigated in CARIS Subset Editor with 5x exaggeration. See Figure 17 for on overview of the feature locations. Depth across the area with these features ranged from 7 to 32 m (Figure 18 and 19). Features were up to 0.68 m in height and 15.37 m in width (Figures 20-22). One potential explanation for these features are methane features.

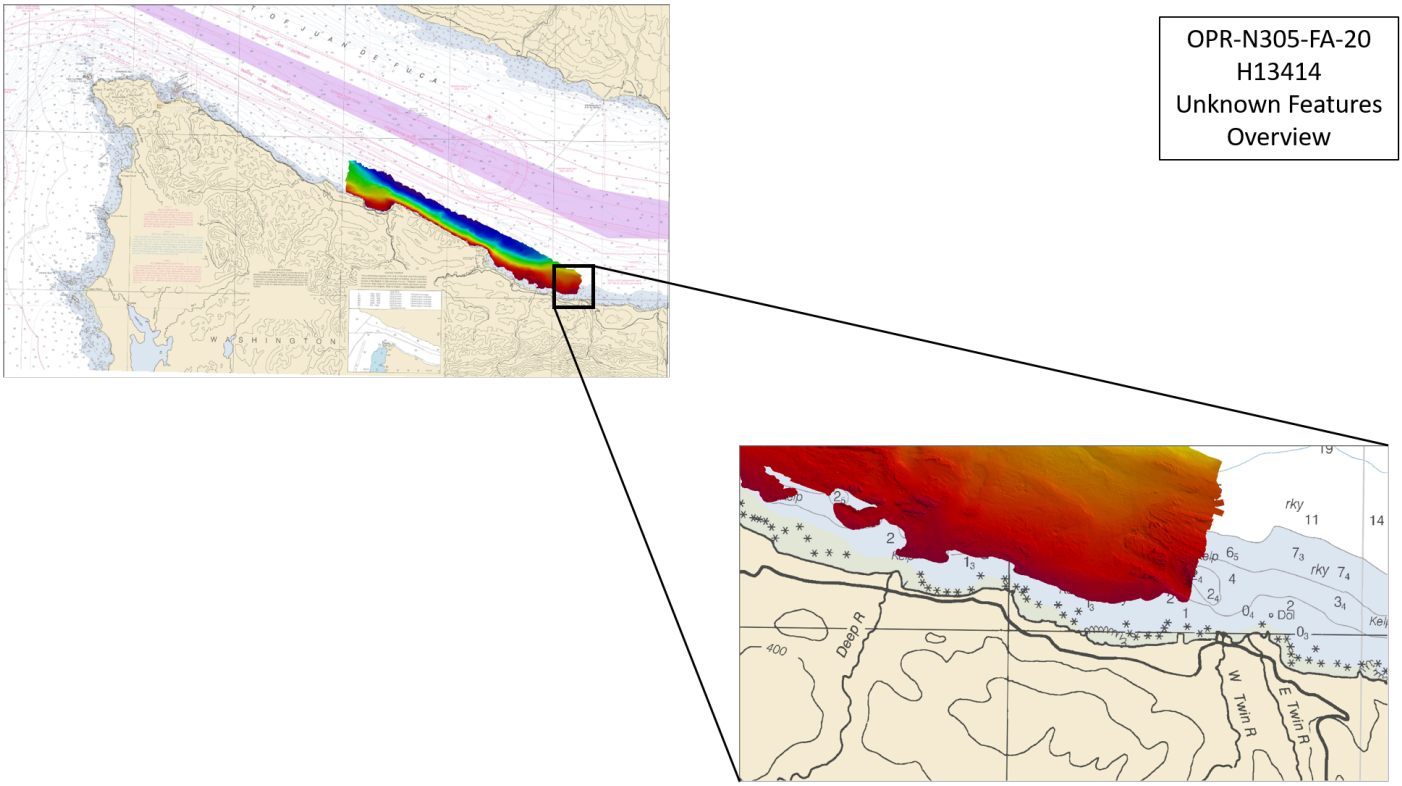


Figure 18: Overview of unknown seafloor features

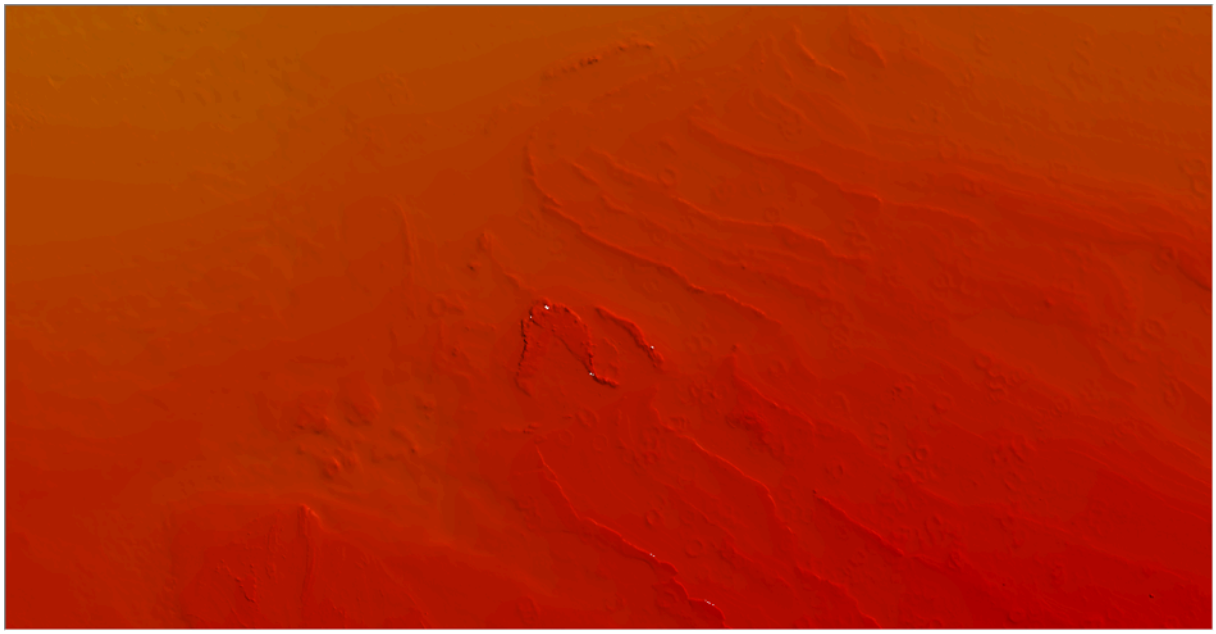


Figure 19: No vertical exaggeration in CARIS Subset Editor

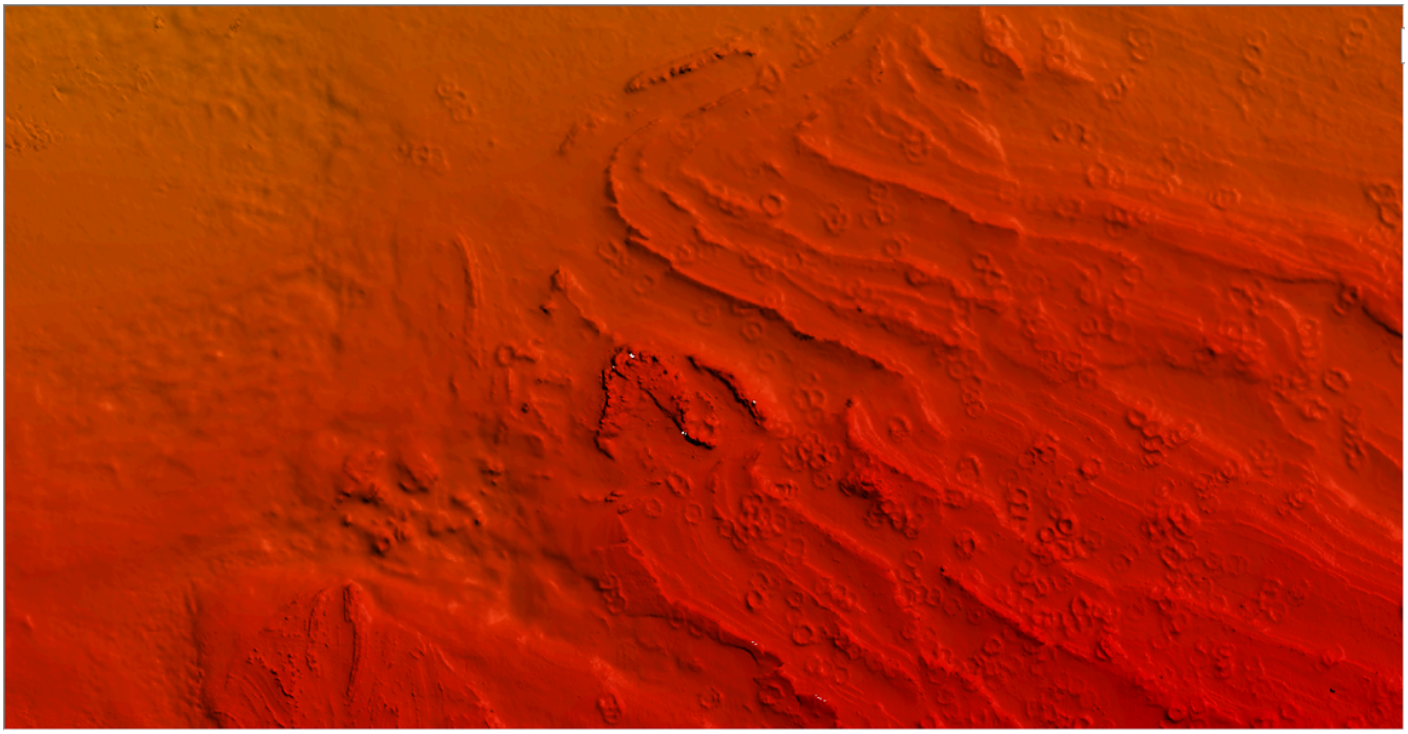


Figure 20: Surface vertically exaggerated 5x in CARIS Subset Editor

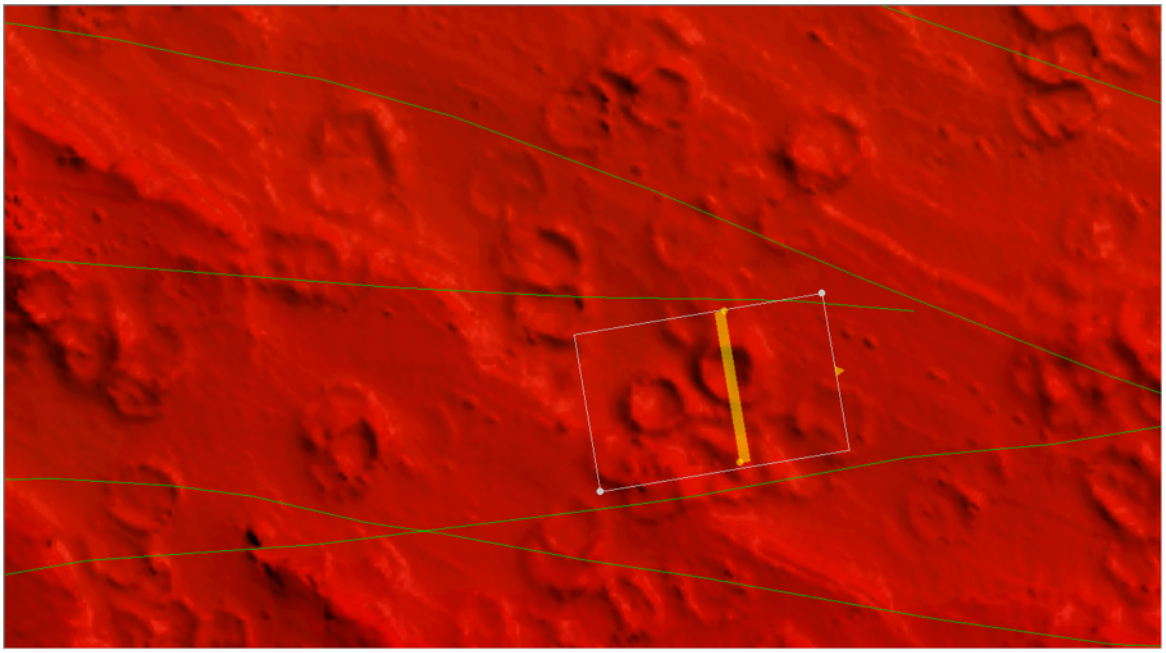


Figure 21: Overview of unknown feature subset vertically exaggerated 5x in in CARIS Subset Editor

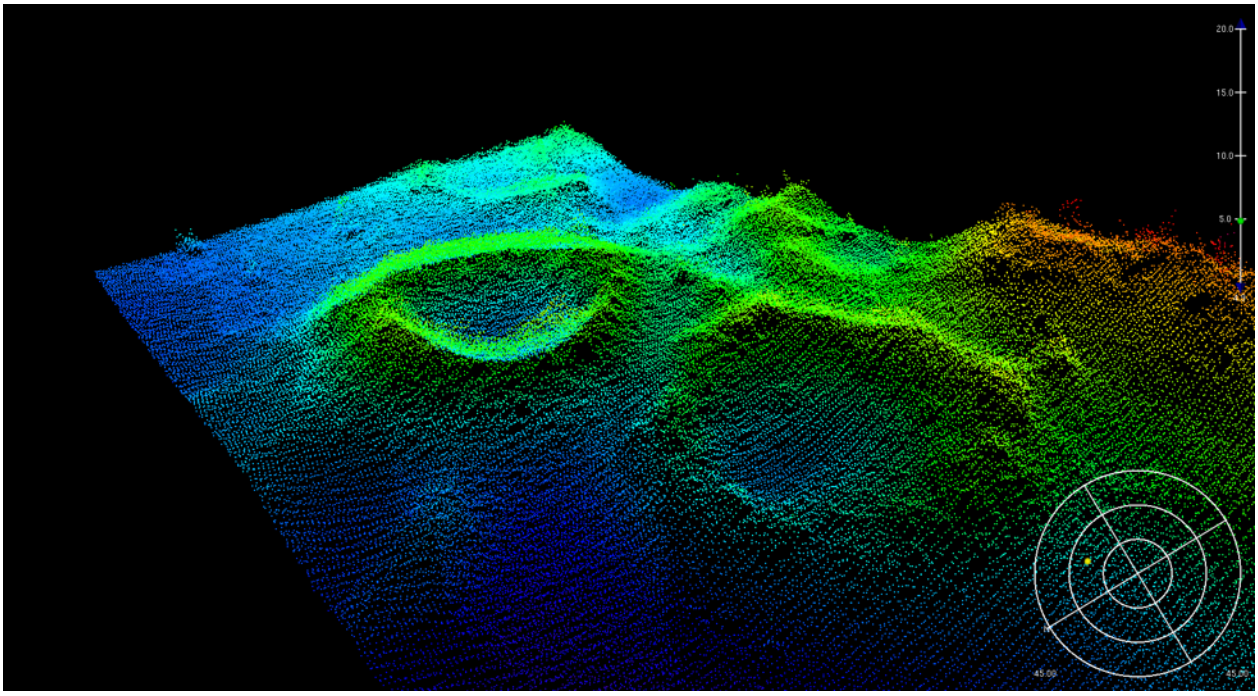


Figure 22: 3D view of unknown feature subset vertically exaggerated 5x in in CARIS Subset Editor

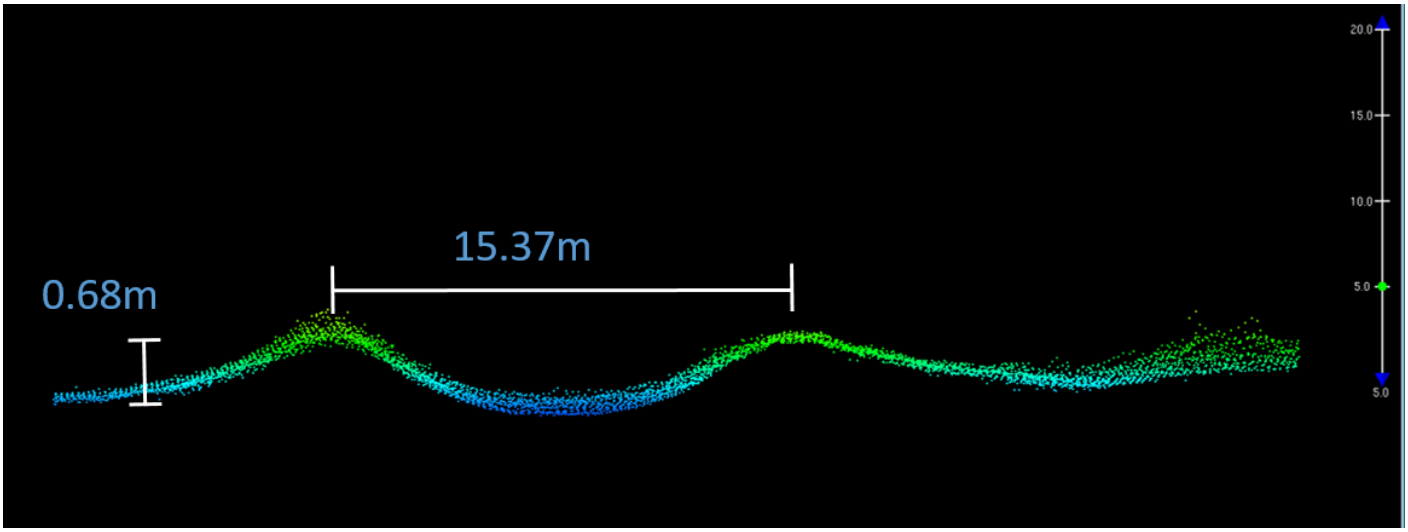


Figure 23: 2D view of unknown feature subset vertically exaggerated 5x in in CARIS Subset Editor

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, 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.

Report Name	Report Date Sent
Data Acquisition and Processing Report	2020-01-08

Approver Name	Approver Title	Approval Date	Signature
John Kidd, LT /NOAA	Chief of Party	12/30/2019	
Collin Walker, LTJG/NOAA	Sheet Manager	12/30/2019	

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