H13204

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13204

LOCALITY

State(s):	Washington
General Locality:	Northwest Washington
Sub-locality:	South of Sucia Island

2018

CHIEF OF PARTY
CDR Marc Moser, NOAA

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Date:

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

REGISTRY NUMBER:

HYDROGRAPHIC TITLE SHEET

H13204

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:	**Northwest Washington**
Sub-Locality:	**South of Sucia Island**
Scale:	**10000**
Dates of Survey:	**09/23/2018 to 10/02/2018**
Instructions Dated:	**09/14/2018**
Project Number:	**OPR-N305-FA-18**
Field Unit:	**NOAA Ship *Fairweather***
Chief of Party:	**CDR Marc Moser, NOAA**
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 H13204

Project: OPR-N305-FA-18

Locality: Northwest Washington

Sublocality: South of Sucia Island

Scale: 1:10000

September 2018 - October 2018

NOAA Ship *Fairweather*

Chief of Party: CDR Marc Moser, NOAA

A. Area Surveyed

The survey area is located in Northwest Washington within the sub locality of South of Sucia Island.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
48° 46' 0.71" N 122° 57' 47.46" W	48° 41' 19.16" N 122° 48' 33.23" W

Table 1: Survey Limits

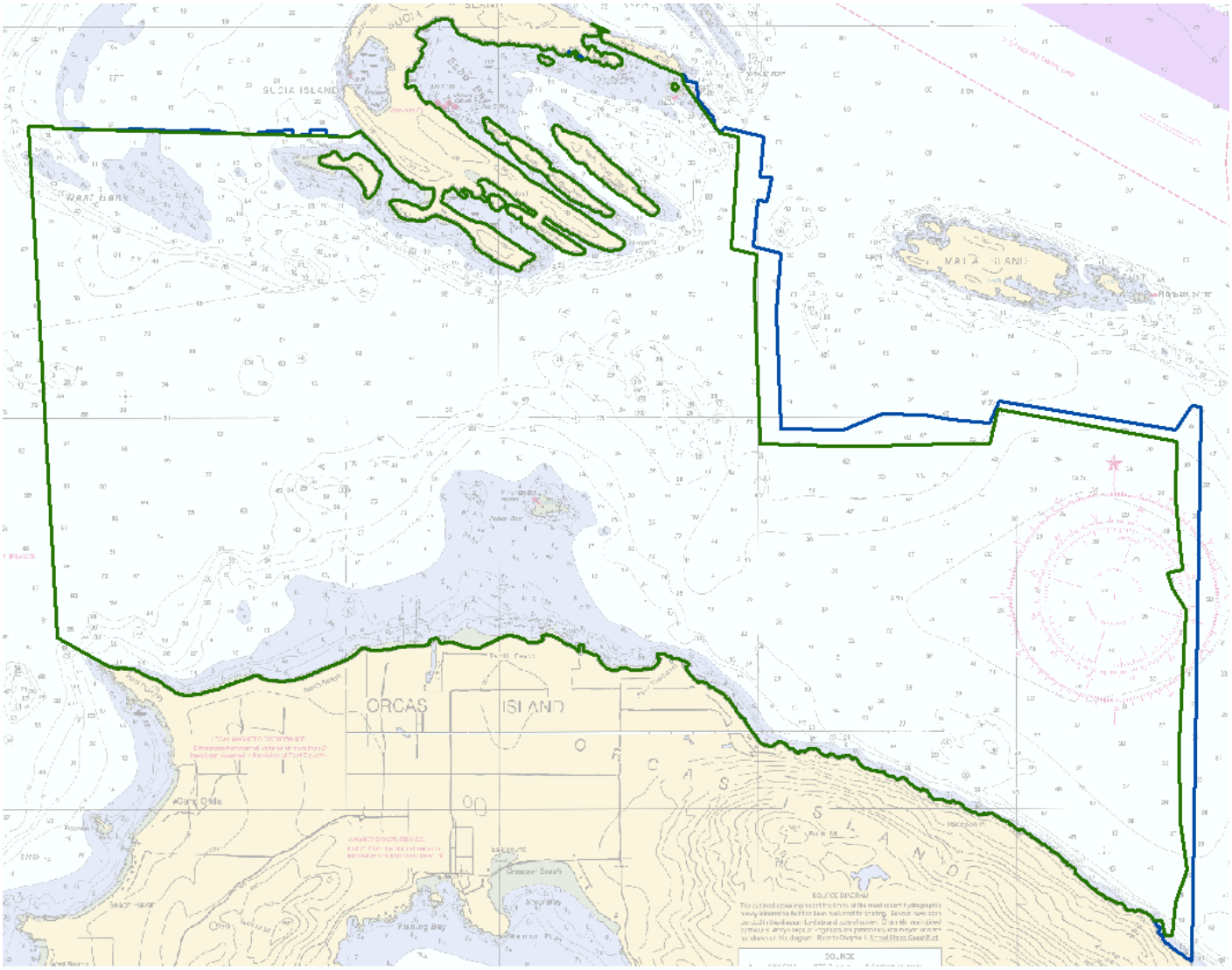


Figure 1: H13204 draft sheet limits (in green) and correct sheet limits (in blue) overlaid onto Chart 18431 and 18430

Due to an error in planning, draft sheet limits provided prior to the receipt of the final Project Reference File (PRF) were used throughout project planning and acquisition (Figure 1). The updated PRF extended the western portion of the sheet limits for H13204 slightly to the north and west, leading to gaps between the acquired coverage and the assigned coverage limits. This led to limited overlap between H13204 and the junctioning surveys (see Section B.2.3).

In all other 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 the kelp and rocky shoreline. An example of such an area is shown in Figure 2.

Additionally, due to time constraints while on project the areas around Little Sucia Island and Fox Cove were not addressed (Figure 3).

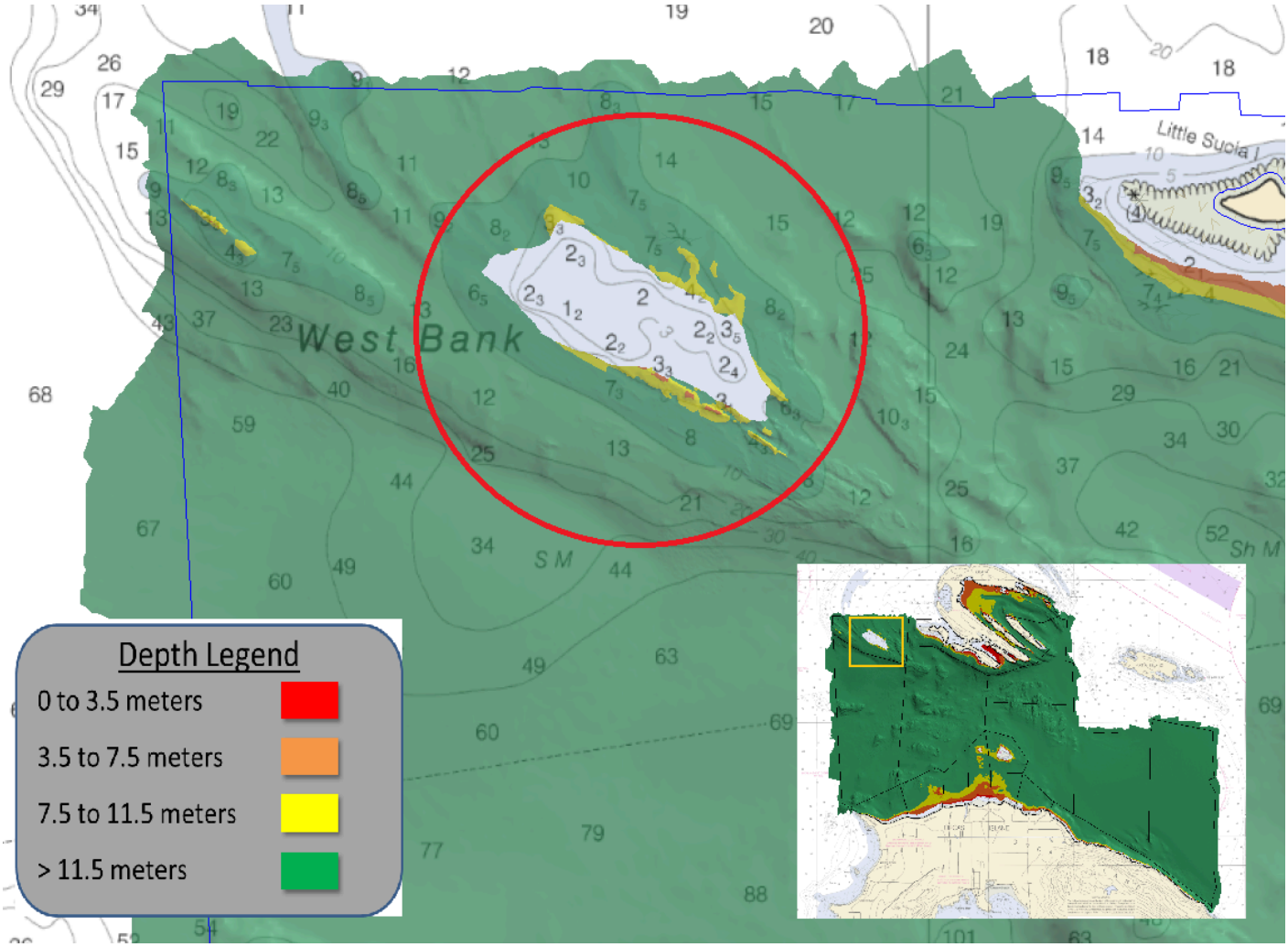


Figure 2: Area where the NALL was defined by the presence of kelp

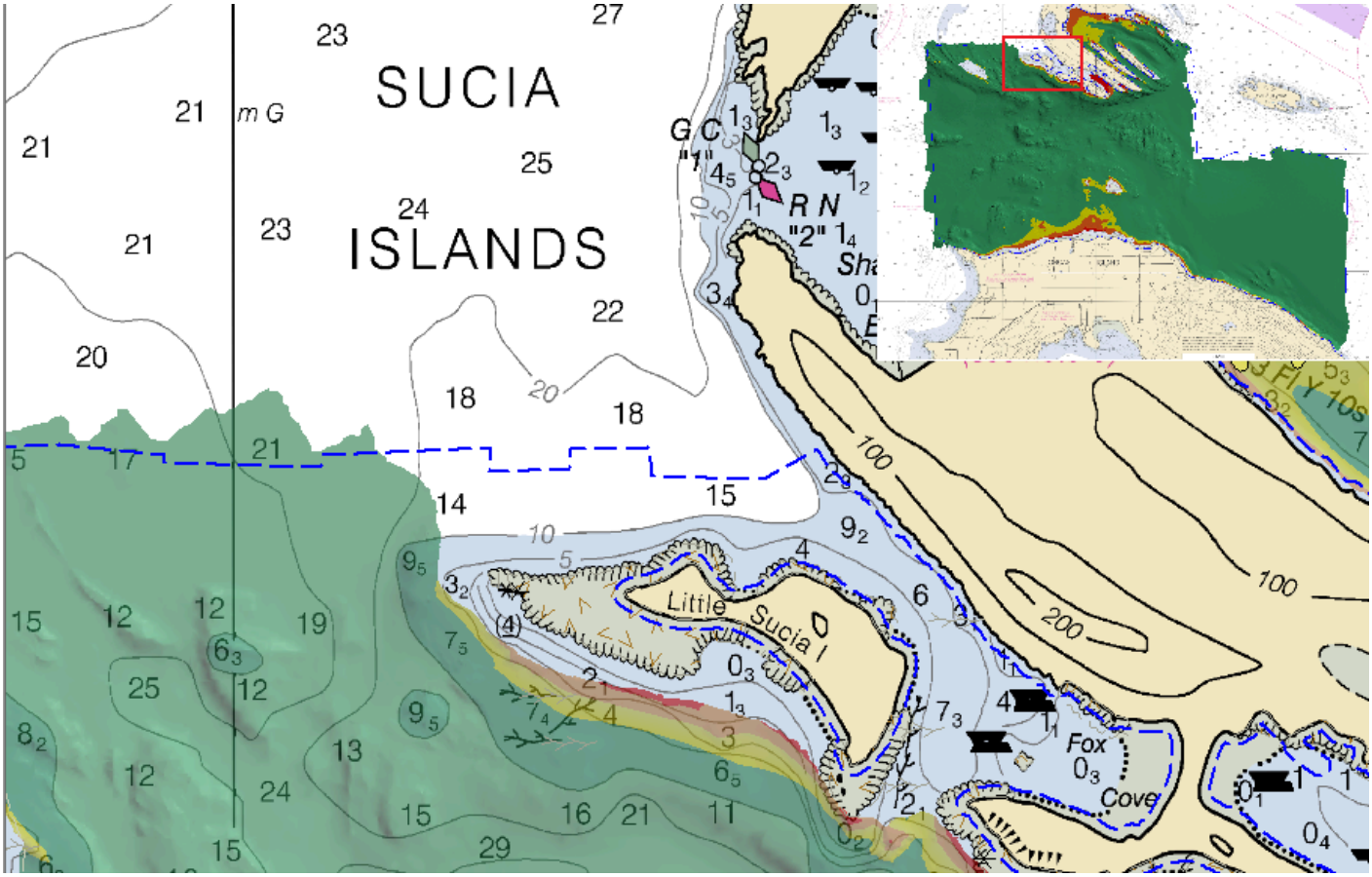


Figure 3: Areas around Little Sucia Island and Fox Cove which are not addressed

A.2 Survey Purpose

The primary purpose of this project is to provide contemporary surveys for updating National Ocean Service nautical charts and products in an area which is critical to the nation's economy. The new bathymetric data will enhance the safety of cargo and tanker traffic transiting to and from the ports of Seattle and Tacoma. H13204 addresses 14.47 square nautical miles of navigationally significant water. 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 H13204 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 H13204 was acquired with complete coverage MBES, meeting the requirements listed above and in the HSSD. See Figure 4 for an overview of coverage.

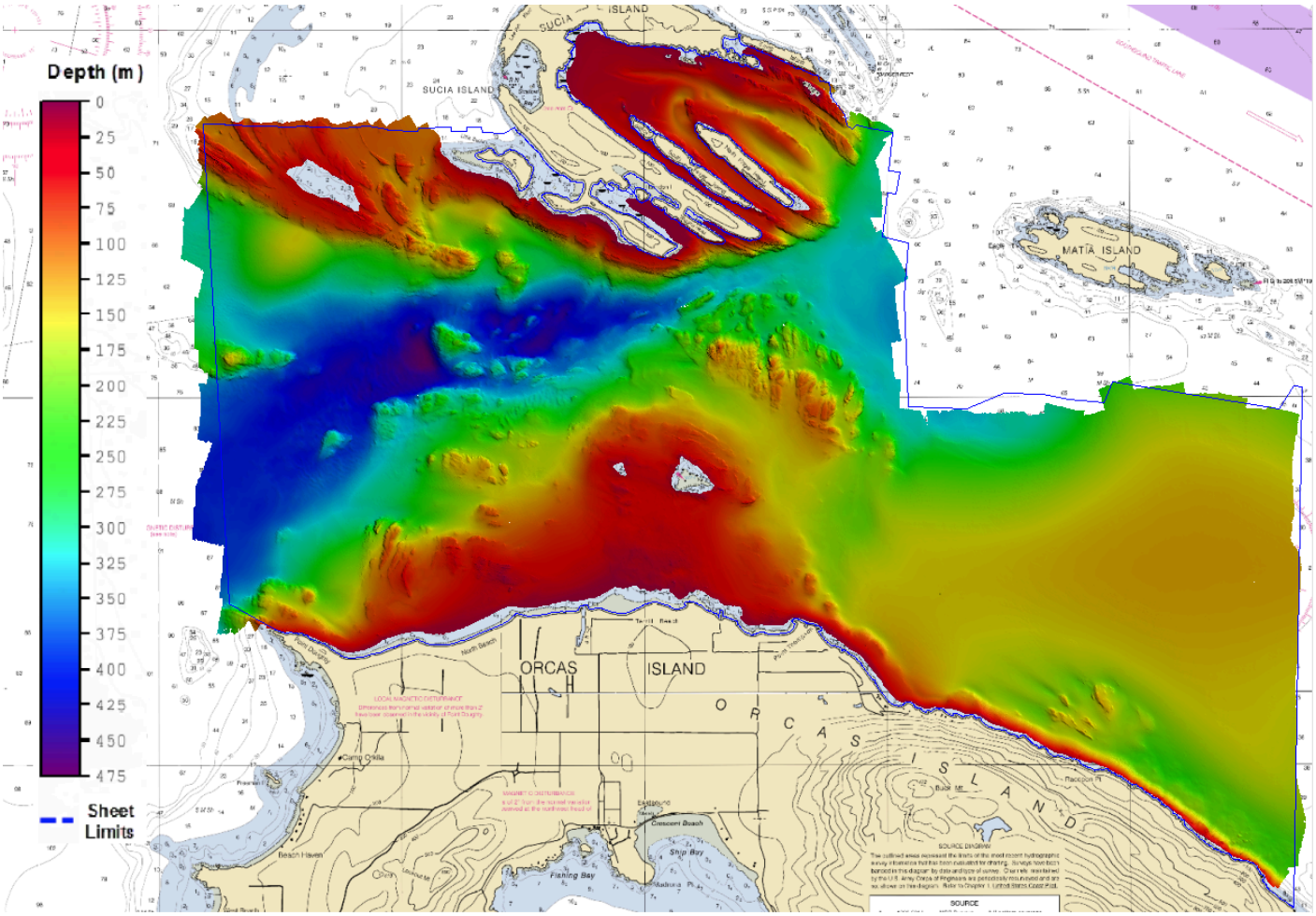


Figure 4: H13204 survey coverage overlaid onto Chart 18431 and 18430

A.6 Survey Statistics

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

	HULL ID	*FA 2805*	*FA 2806*	*FA 2807*	*FA 2808*	*Total*
LNM	**SBES Mainscheme**	0	0	0	0	0
	MBES Mainscheme	0.13	93.74	99.67	83.74	277.27
	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	6.97	0	0	3.60	10.57
	Lidar Crosslines	0	0	0	0	0
Number of Bottom Samples						4
Number Maritime Boundary Points Investigated						0
Number of DPs						0
Number of Items Investigated by Dive Ops						0
Total SNM						14.47

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
09/23/2018	266
09/25/2018	268
10/02/2018	275

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

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

B.1.1 Vessels

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

Hull ID	***2805***	***2806***	***2807***	***2808***
LOA	8.6 meters	8.6 meters	8.6 meters	8.6 meters
Draft	1.1 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
Sea-Bird Scientific	SBE 19plus	Conductivity, Temperature, and Depth Sensor
Applanix	POS MV 320 v5	Positioning and Attitude System
Teledyne RESON	SVP 71	Sound Speed System

Table 6: Major Systems Used

The equipment was installed on the survey platforms as follows: All MBES survey vessels are equipped with POS MV v5 systems for positioning and attitude. All launches utilize Kongsberg EM 2040 MBES, Teledyne RESON SVP 71 surface sound speed sensors, and Sea-Bird Scientific 19plus CTD casts.

B.2 Quality Control

B.2.1 Crosslines

Multibeam/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 3.81% of mainscheme acquisition.

Crosslines were collected, processed and compared in accordance with Section 5.2.4.2 of the HSSD. 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 -0.03 meters (with mainscheme being shoaler) and 95% of nodes falling within +/- 0.36 meters (Figure 6). For the respective depths, the difference surface was compared to the allowable NOAA uncertainty standards. In total, 99.5+% of the depth differences between H13204 mainscheme and crossline data were within allowable NOAA uncertainties.

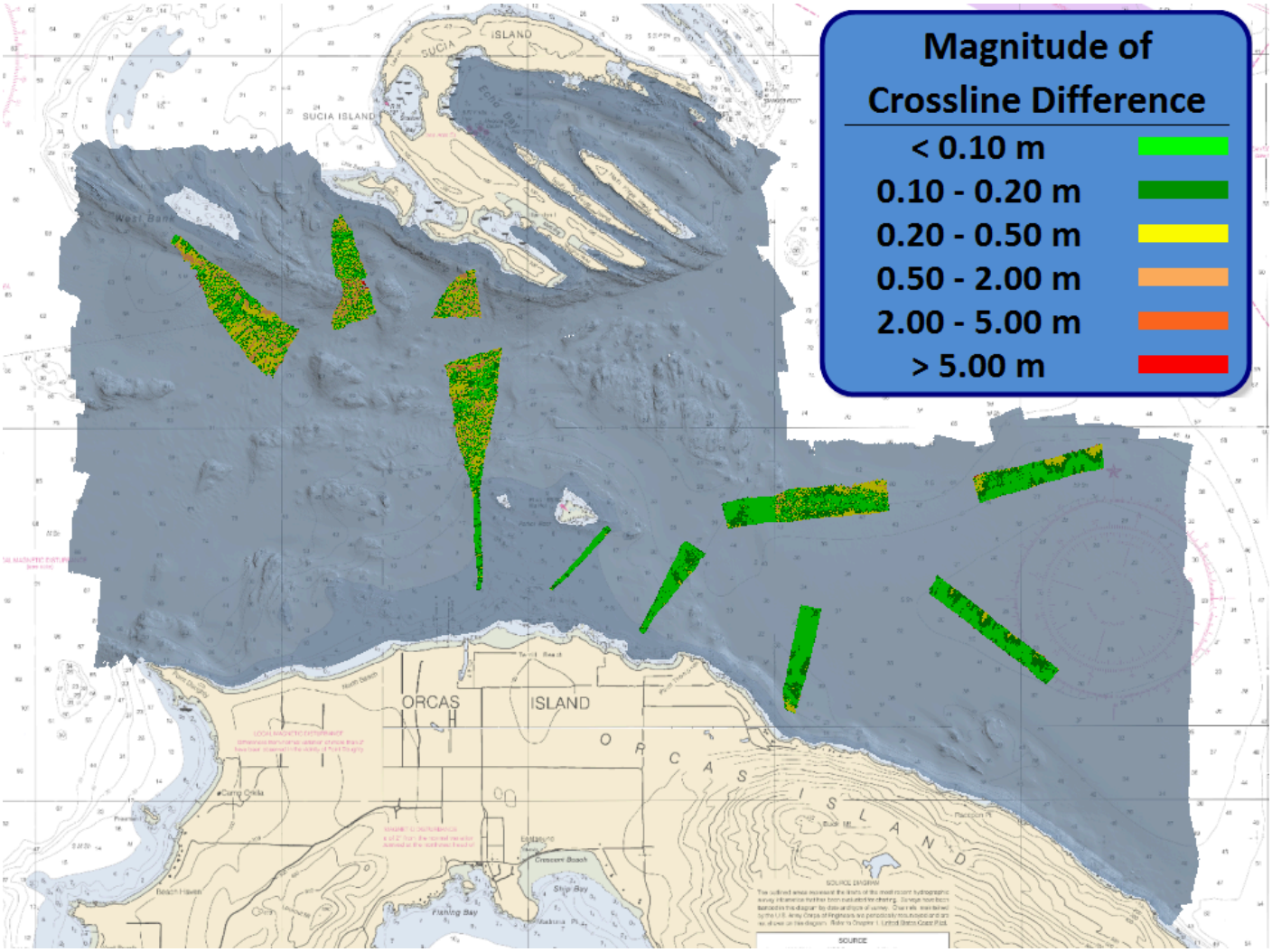
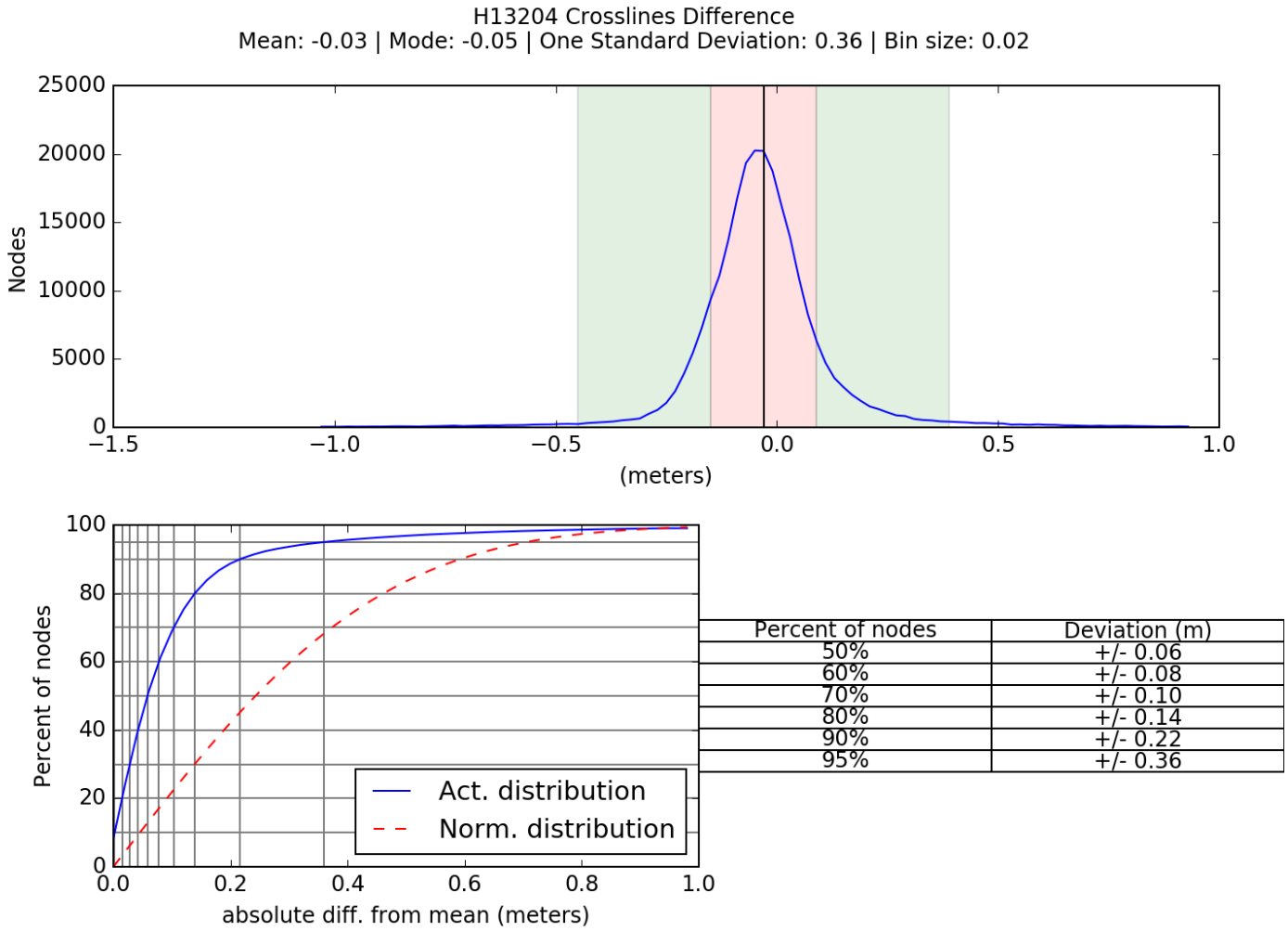


Figure 5: Overview of H13204 crosslines



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.08
70%	+/- 0.10
80%	+/- 0.14
90%	+/- 0.22
95%	+/- 0.36

Figure 6: H13204 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	0.136 meters	0 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Surface
280X	2 meters/second	N/A meters/second	0.5 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 H13204. Real-time uncertainties were provided via EM 2040 MBES data, 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

H13204 junctions with two adjacent surveys from prior projects, H11631 and H11632. See Figure 7 for an overview of H13204 junctions.

Due to the use of draft sheet limits as mentioned above in Section A.1, limited overlap between H13204 and each adjacent survey was achieved. The resultant areas of overlap between surveys were reviewed with CARIS HIPS and SIPS by surface differencing (at equal resolutions) to assess surface agreement, and the hydrographer is confident that the data overlap is sufficient to ensure that no major biases exist in the data as the junctions with H13204 are generally well within the NOAA allowable uncertainty in their areas of overlap. For all junctions with H13204, a negative difference indicates H13204 was shoaler, and a positive difference indicates H13204 was deeper.

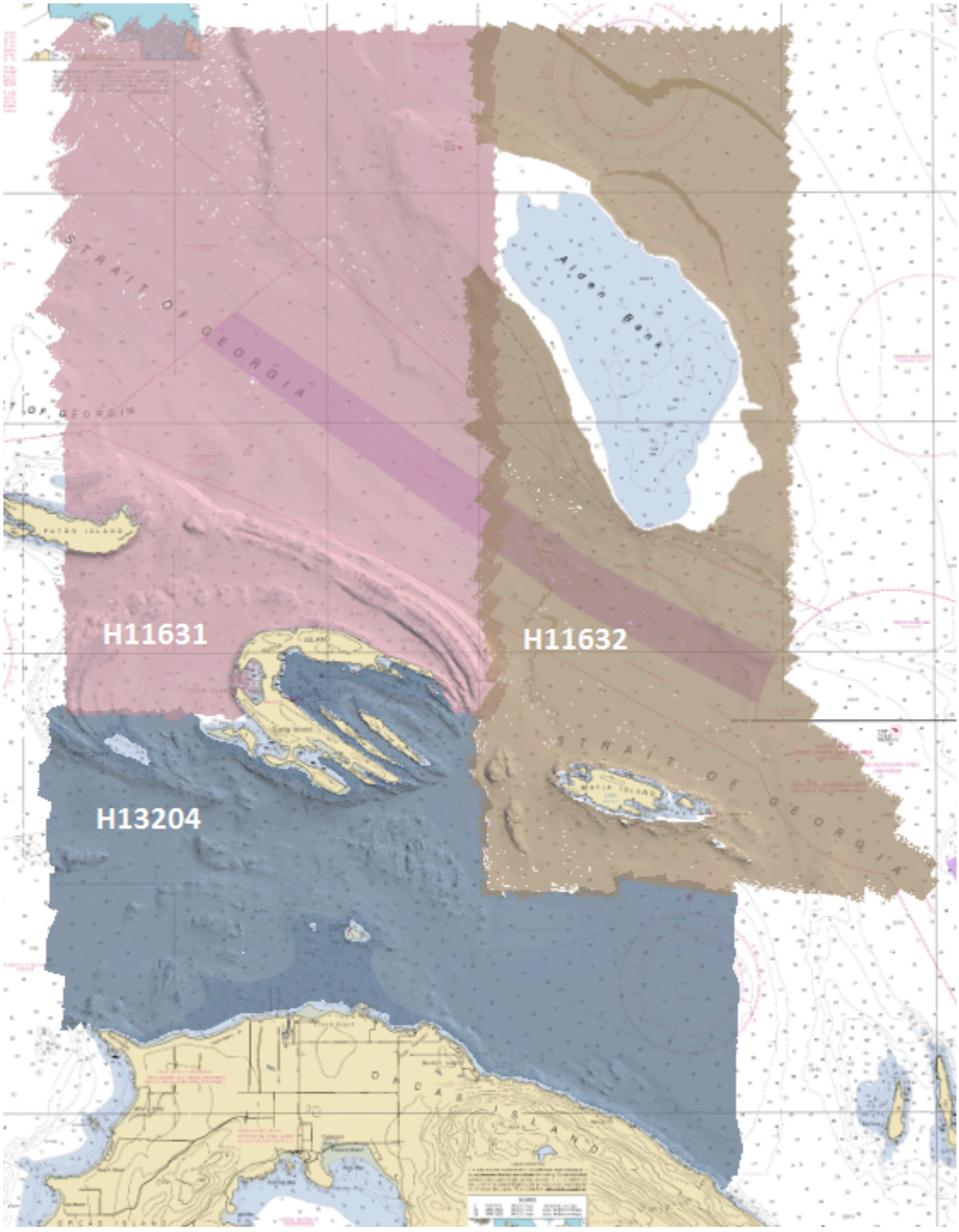


Figure 7: Overview of H13204 junction surveys

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H11631	1:10000	2006	NOAA Ship RAINIER	N
H11632	1:10000	2006	NOAA Ship RAINIER	N

Table 9: Junctioning Surveys

H11631

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface generated from H13204 data and the surface generated from H11631 data (Figure 8 and Figure 9).

The statistical analysis of the difference surface shows a mean of -0.45 meters with 95% of all nodes having a maximum deviation of +/- 2.66 meters, as seen in Figure 10. It was found that grater than 99% of nodes are within the NOAA allowable uncertainty.

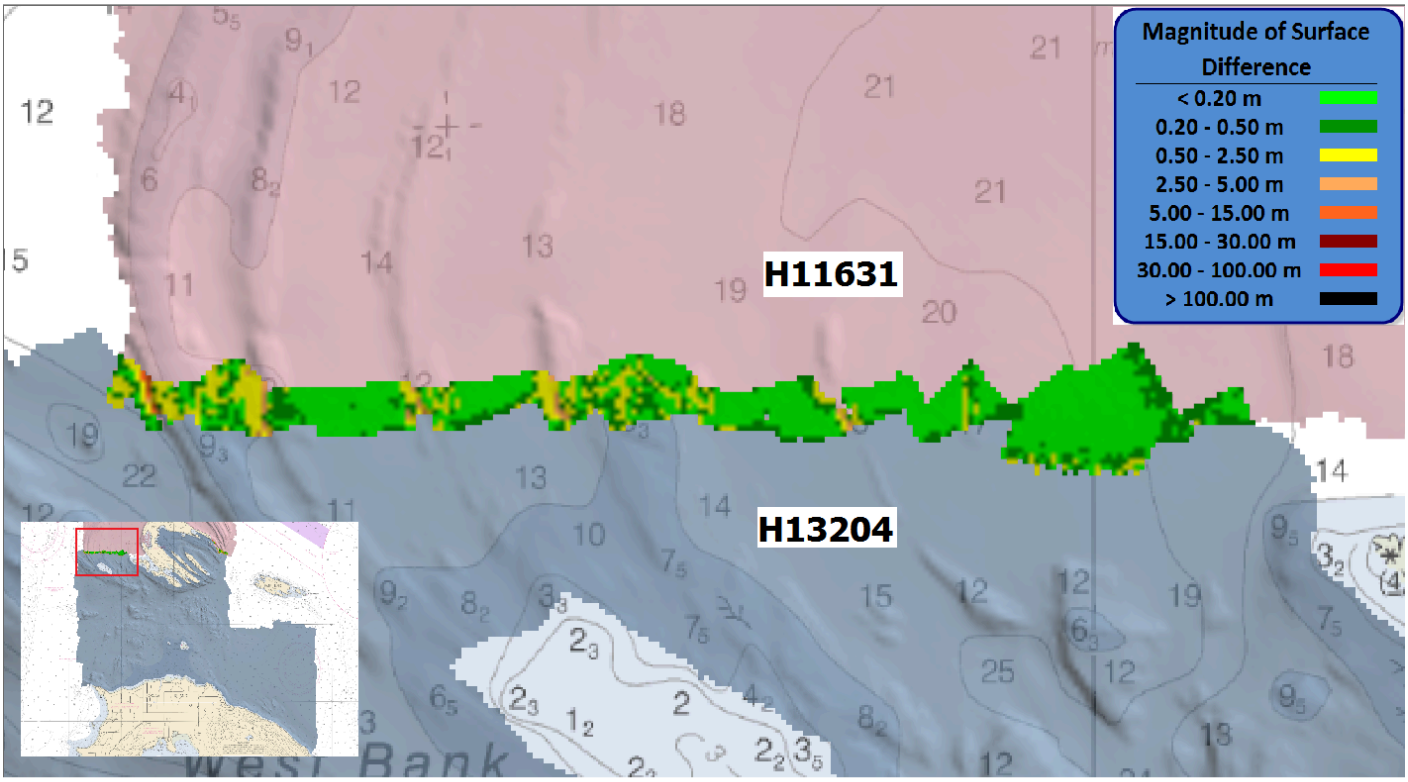


Figure 8: Difference surface between H13204 (in grey) and junctioning survey H11631 (in pink)

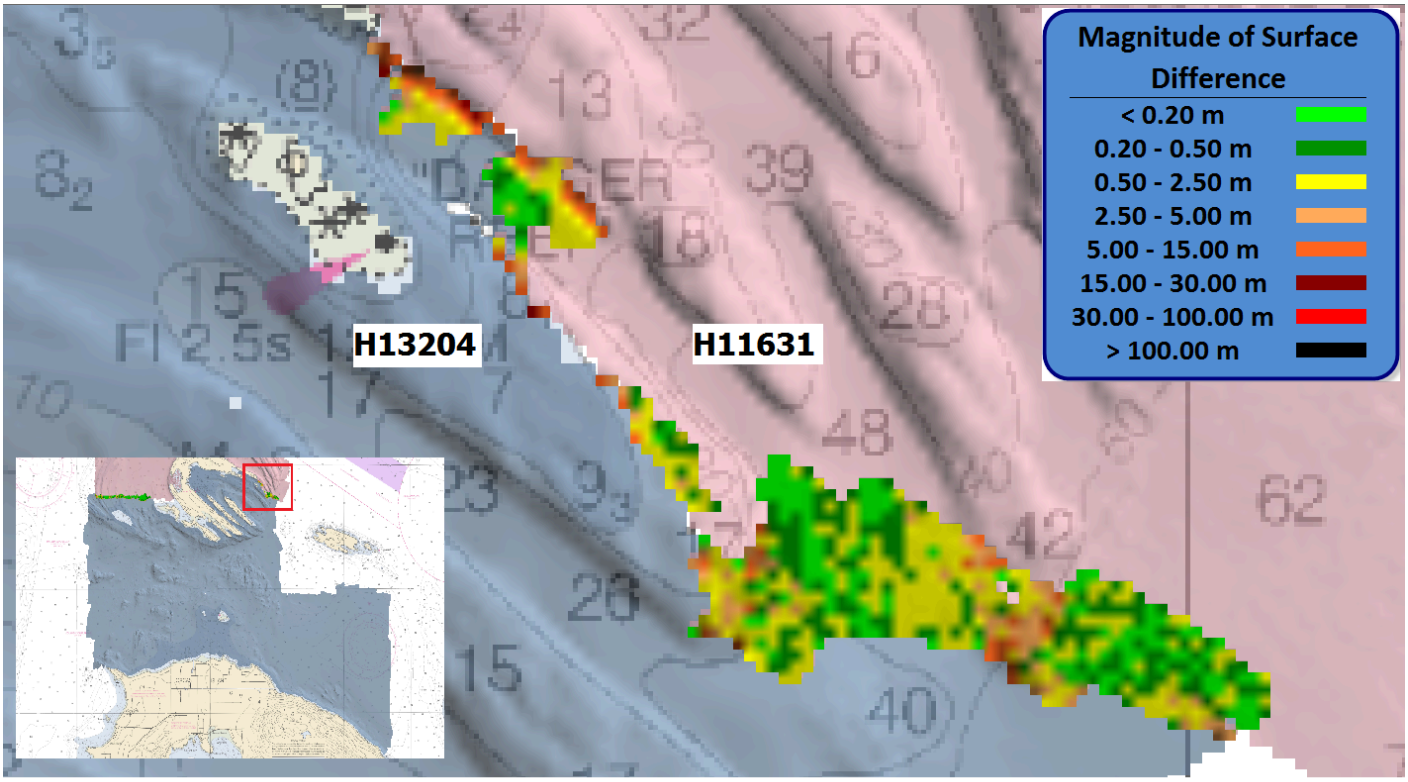
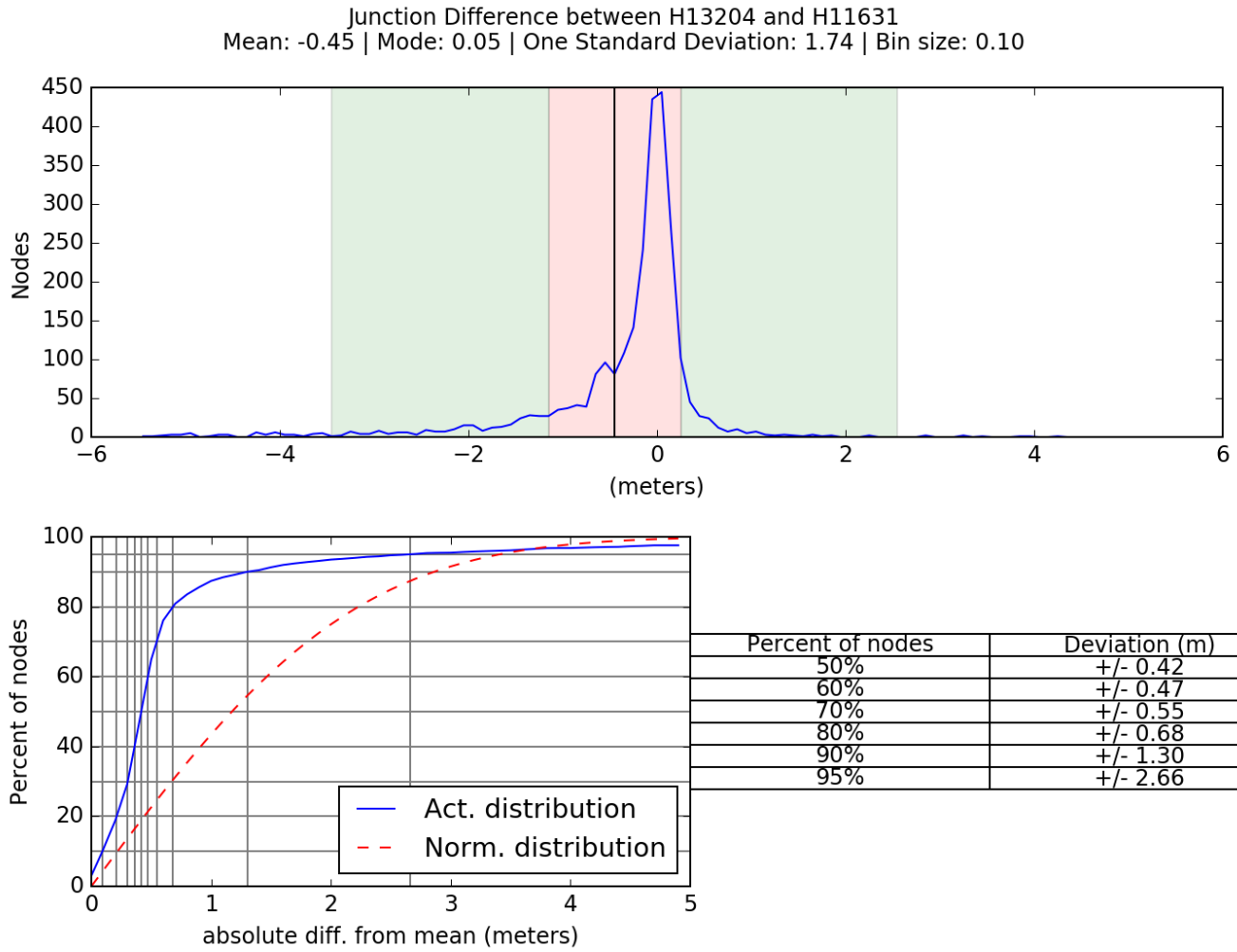


Figure 9: Difference surface between H13204 (in grey) and junctioning survey H11631 (in pink)



Percent of nodes	Deviation (m)
50%	+/- 0.42
60%	+/- 0.47
70%	+/- 0.55
80%	+/- 0.68
90%	+/- 1.30
95%	+/- 2.66

Figure 10: Difference surface statistics between H13204 and H11631

H11632

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface generated from H13204 data and the surface generated from H11632 data (See Figure 11).

The statistical analysis of the difference surface shows a mean of 0.9 meters with 95% of all nodes having a maximum deviation of +/- 2.18 meters, as seen in Figure 12. It was found that 98% of nodes are within the NOAA allowable uncertainty.

Although the areas of overlap are generally sparse between these two surveys, the aforementioned statistics provide confidence that no major systematic biases exist within the data.

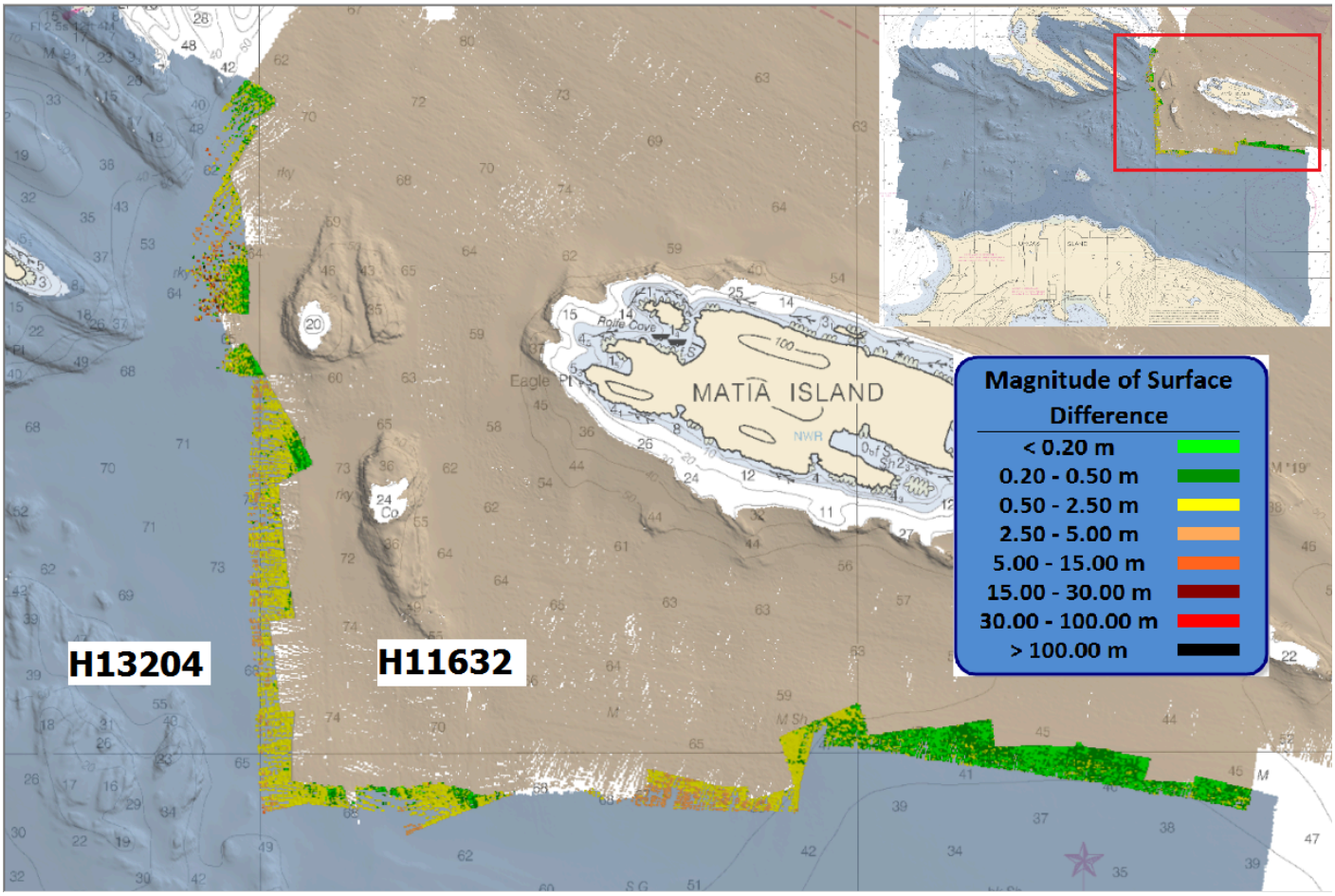
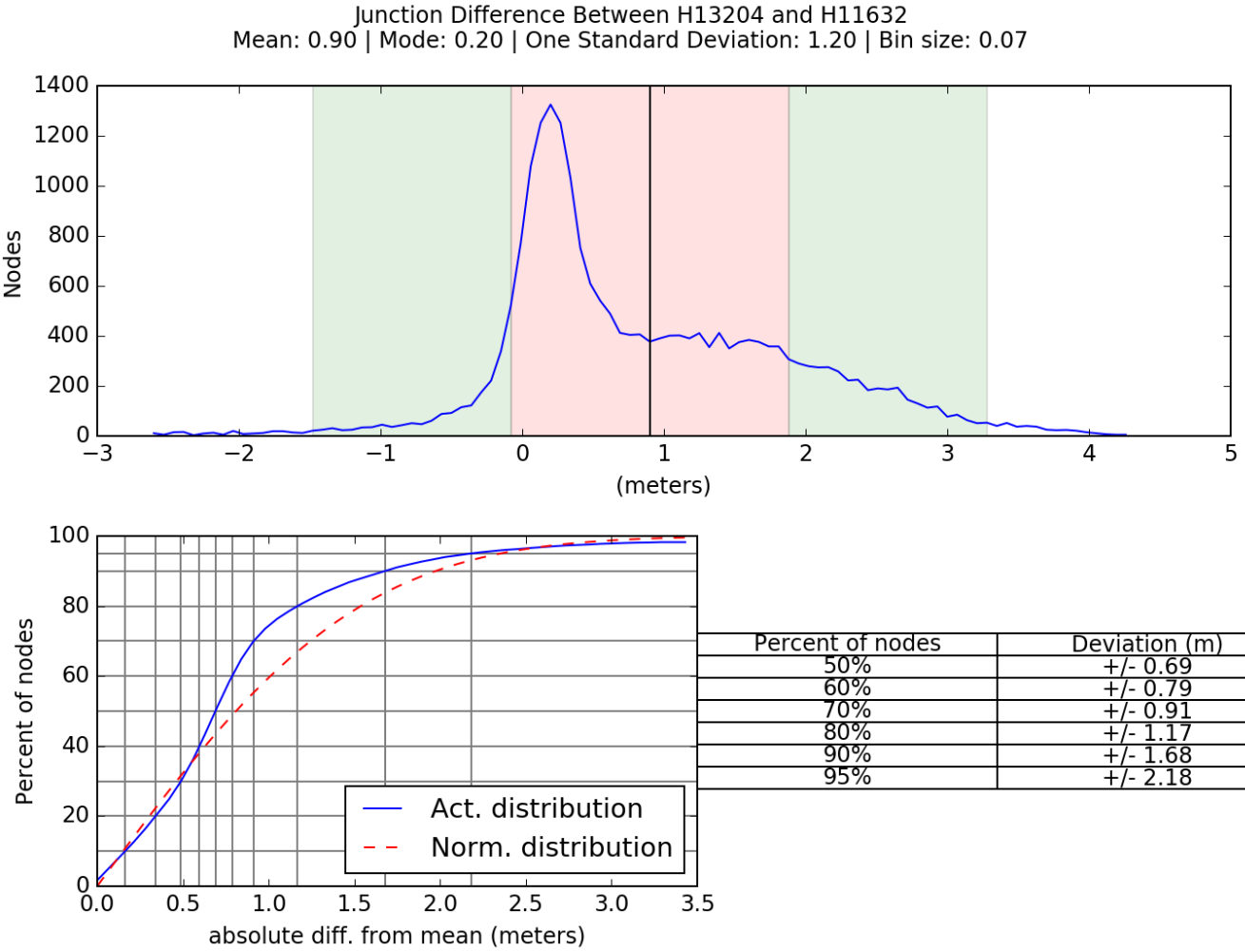


Figure 11: Difference surface between H13204 (grey) and junctioning survey H11632 (brown)



Percent of nodes	Deviation (m)
50%	+/- 0.69
60%	+/- 0.79
70%	+/- 0.91
80%	+/- 1.17
90%	+/- 1.68
95%	+/- 2.18

Figure 12: Difference surface statistics between H13204 and H11632

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

Sea Grass and Kelp

Sea grass and kelp were present throughout the nearshore survey area and at times, indistinguishable from the seafloor (Figure 13). In areas where they were distinguishable, the soundings on the vegetation were rejected to enable more accurate representation of the true seafloor. Where vegetation was indistinguishable, all soundings were retained. Furthermore, 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 14). Documentation can be found in the vessel boat sheets, which are located in the Detached Positions folder.

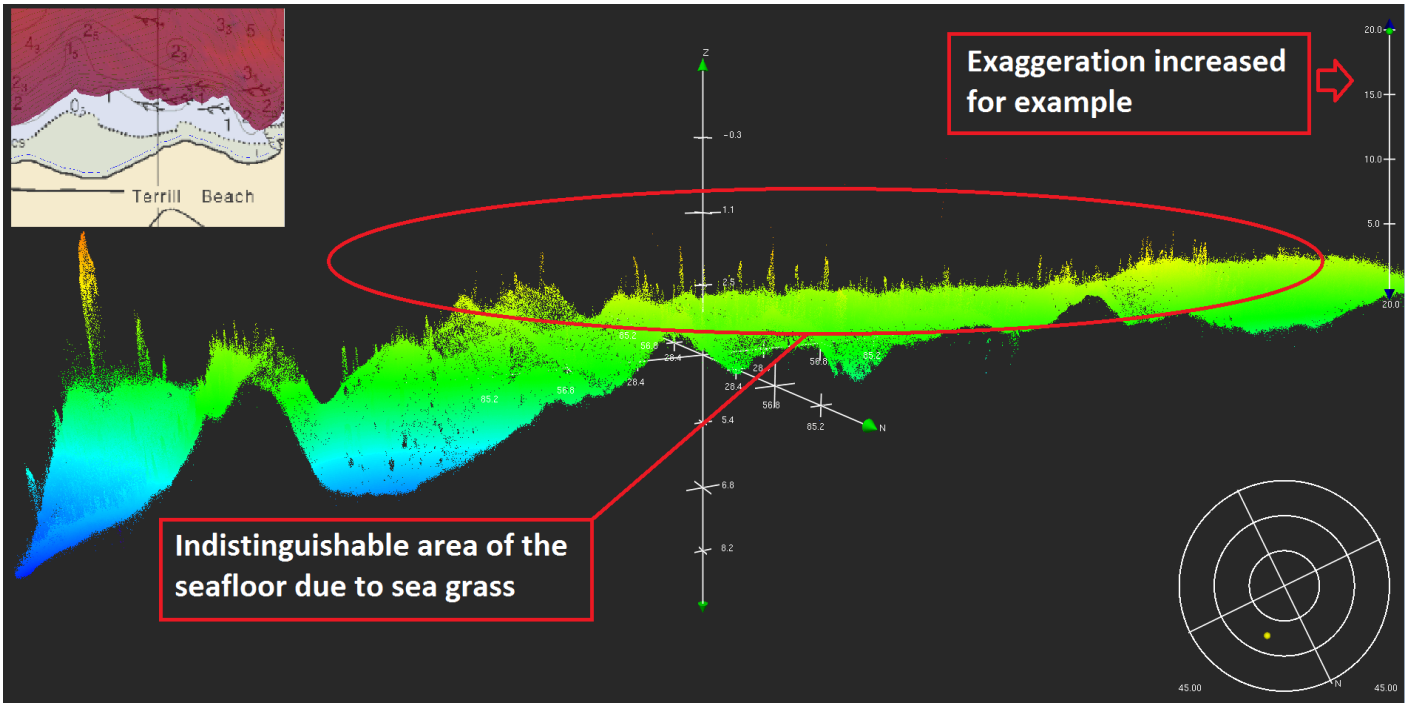


Figure 13: Example of sea grass presence

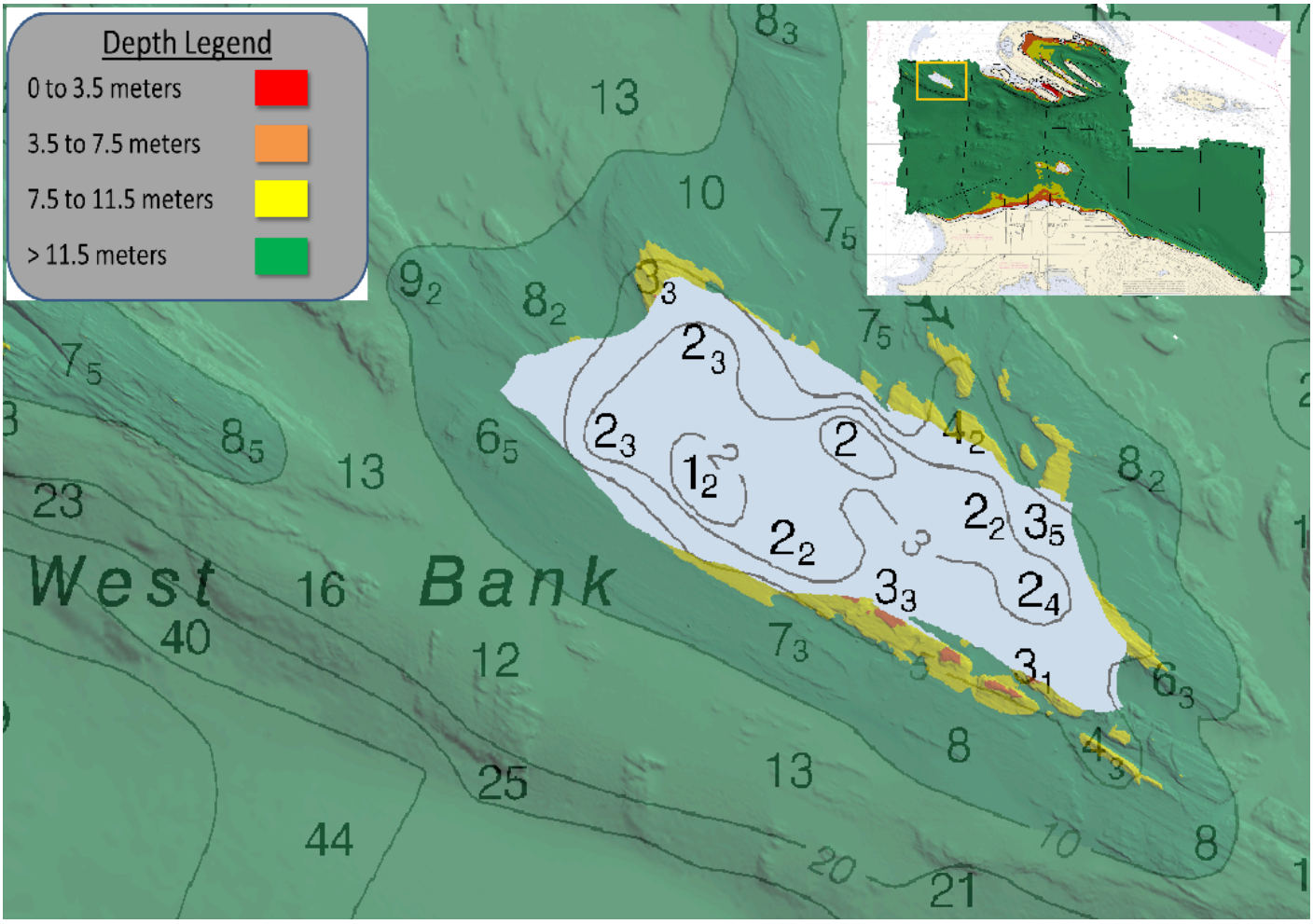


Figure 14: Areas where NALL is defined by kelp limits

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 there was a change in surface sound speed greater than two meters per second. 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

H13204 data were reviewed in CARIS HIPS and SIPS for holidays in accordance with Section 5.2.2.3 of the HSSD. Eleven apparent holidays were identified via the 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 numbering of all flagged holidays below are in reference to Figure 15.

Of the eleven flagged holidays, two were a result of gaps in coverage around North Finger Island and South Finger Island; the holidays marked 2 and 4 were due to gaps in coverage around areas delineated as containing dense kelp which precluded launch acquisition and have been designated as kelp areas in the Final Feature File (FFF); those marked 6 and 9 were flagged atop features included in the FFF where the least depth was determined during shoreline investigation; and flagged holiday 3 was due to a gap in coverage around the National Wildlife Refuge on Parker Reef, which is marked by an ATON included in the FFF.

Holiday 1 is due to inadequate line spacing in a steep rocky area, where rapid shoaling caused rapidly decreasing swath widths. This area was investigated in CARIS Subset Editor, and the hydrographer is confident that no hazards to navigation are likely to exist within the data gap (Figure 16). Due to time constraints while on project, additional data were not able to be collected over the aforementioned gap.

Three holidays (5, 7, and 8) are atop underwater rocks on which the least depth was not determined. Holiday 5 is surrounding a reported underwater rock (Rep 2009) that is specifically described in section D.1.3 (Figure 17). Holiday 7 is surrounding a 1 foot charted sounding over which it was deemed by the field party as unsafe to acquire additional data (Figure 18). Holiday 8 is surrounding a charted submerged rock south of Ewing Island over which it was considered unsafe to acquire additional data (Figure 19). Reasonable attempts were made to acquire data over these submerged hazards, and increased caution is advised to mariners transiting through these areas.

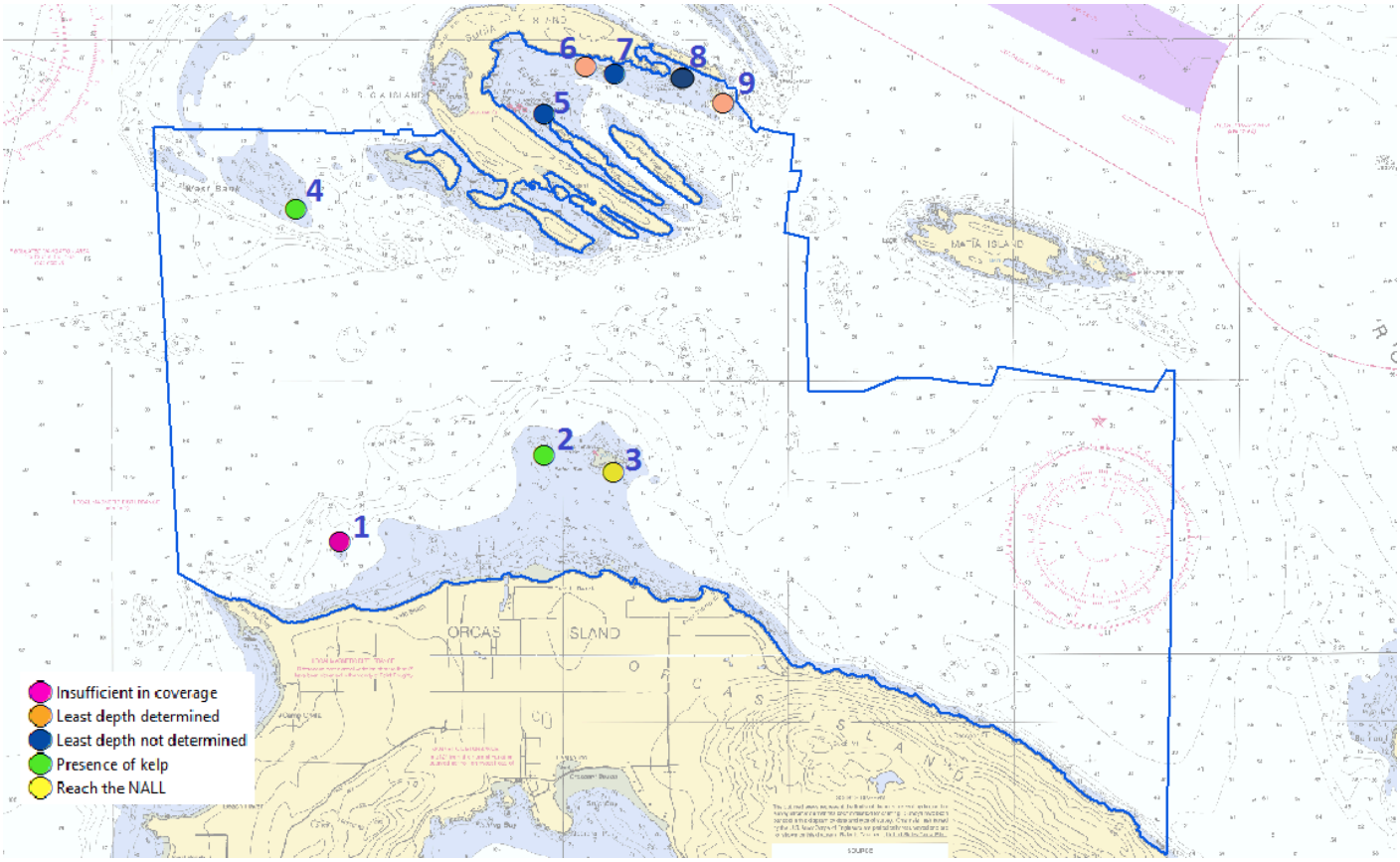


Figure 15: Overview of areas flagged by QC Tools Holiday Finder

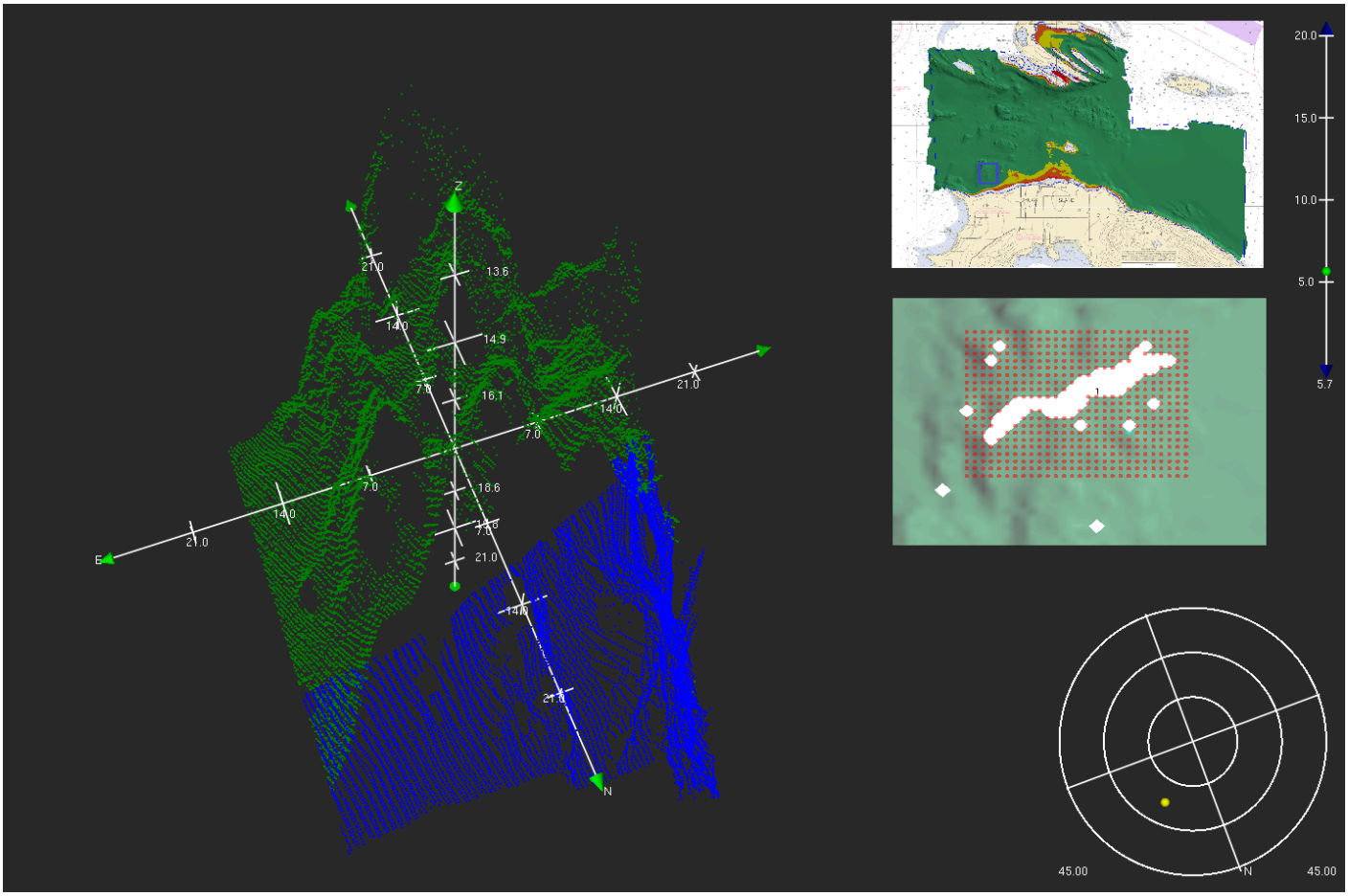


Figure 16: Holiday 1: Gap in coverage due to inadequate line spacing

Figure 17: Holiday 6: Reported submerged rock over which a least depth could not be determined

Figure 18: Holiday 7: Charted shoal in Echo Bay that could not be safely developed

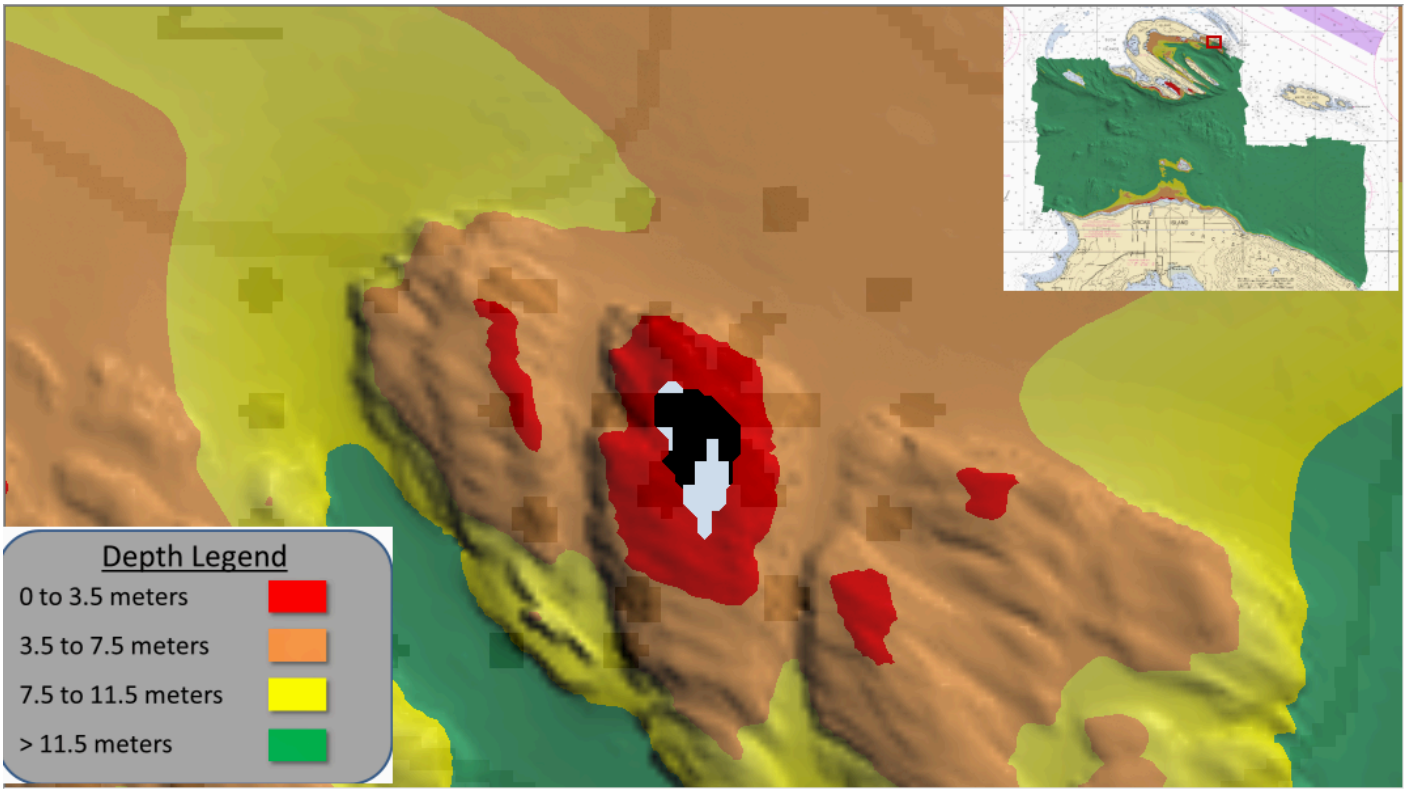


Figure 19: Holiday 8: Charted submerged rock south of Ewing Island

B.2.10 NOAA Allowable Uncertainty

The surface was analyzed using the Pydro QC Tools Grid QA feature to determine compliance with specifications. Overall, greater than 99% of nodes meet NOAA allowable uncertainty specifications for H13204. For a graphical representation of compliance with uncertainty standards, see Figure 20 below.

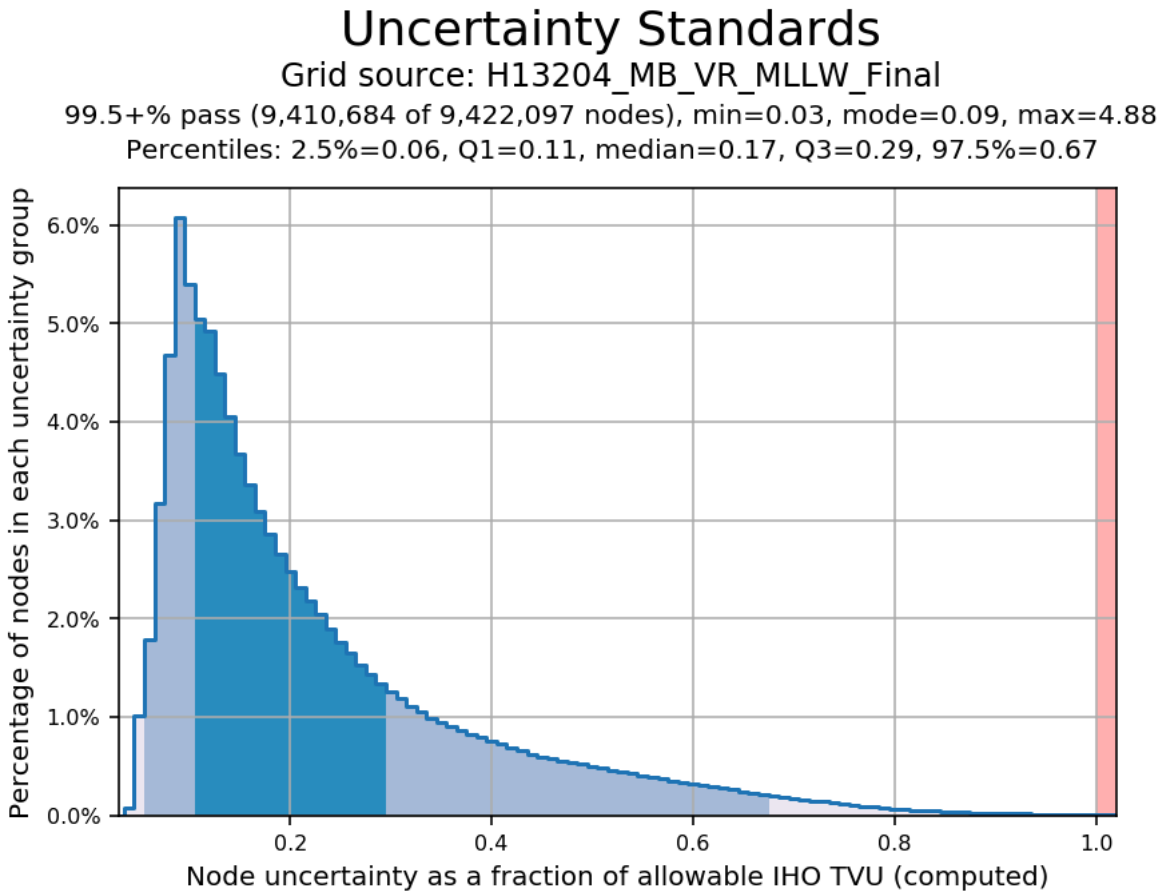


Figure 20: H13204 Allowable Uncertainty statistics

B.2.11 Density

The surface was analyzed using the Pydro QC Tools Grid QA feature to determine compliance with specifications. Overall, 99.98% of nodes meet density specifications for H13204. For a graphical representation of compliance with density standards, see Figure 21 below.

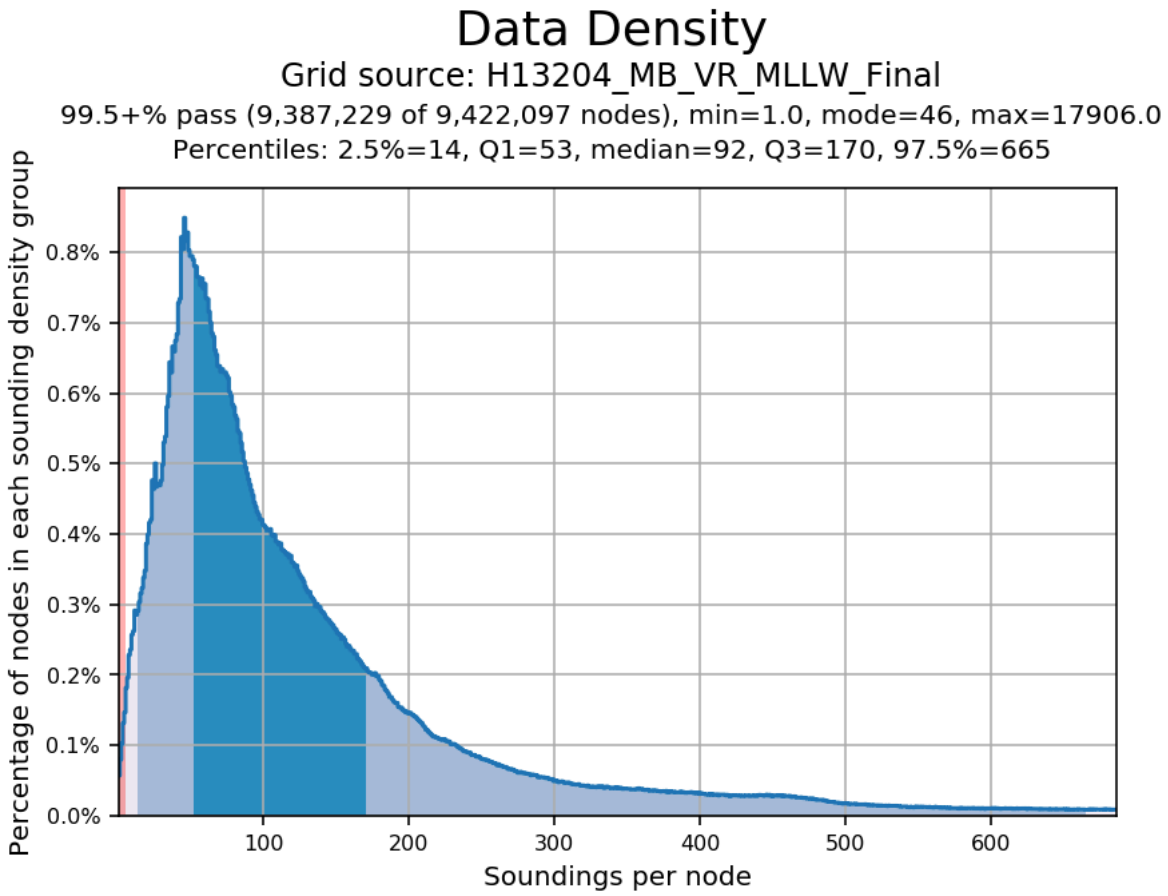


Figure 21: H13204 Data Density statistics

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

Raw Backscatter data were stored in the .all file for the Kongsberg systems. All backscatter have been processed by the field unit via Fledermaus FMGT 7.8.5. 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, allowing for better consistency between the mosaics generated for each platform. See Figure 22 for a greyscale representation of the complete mosaic. See Figure 23 for a table of the calibration values entered into the Processing Settings within FMGT.

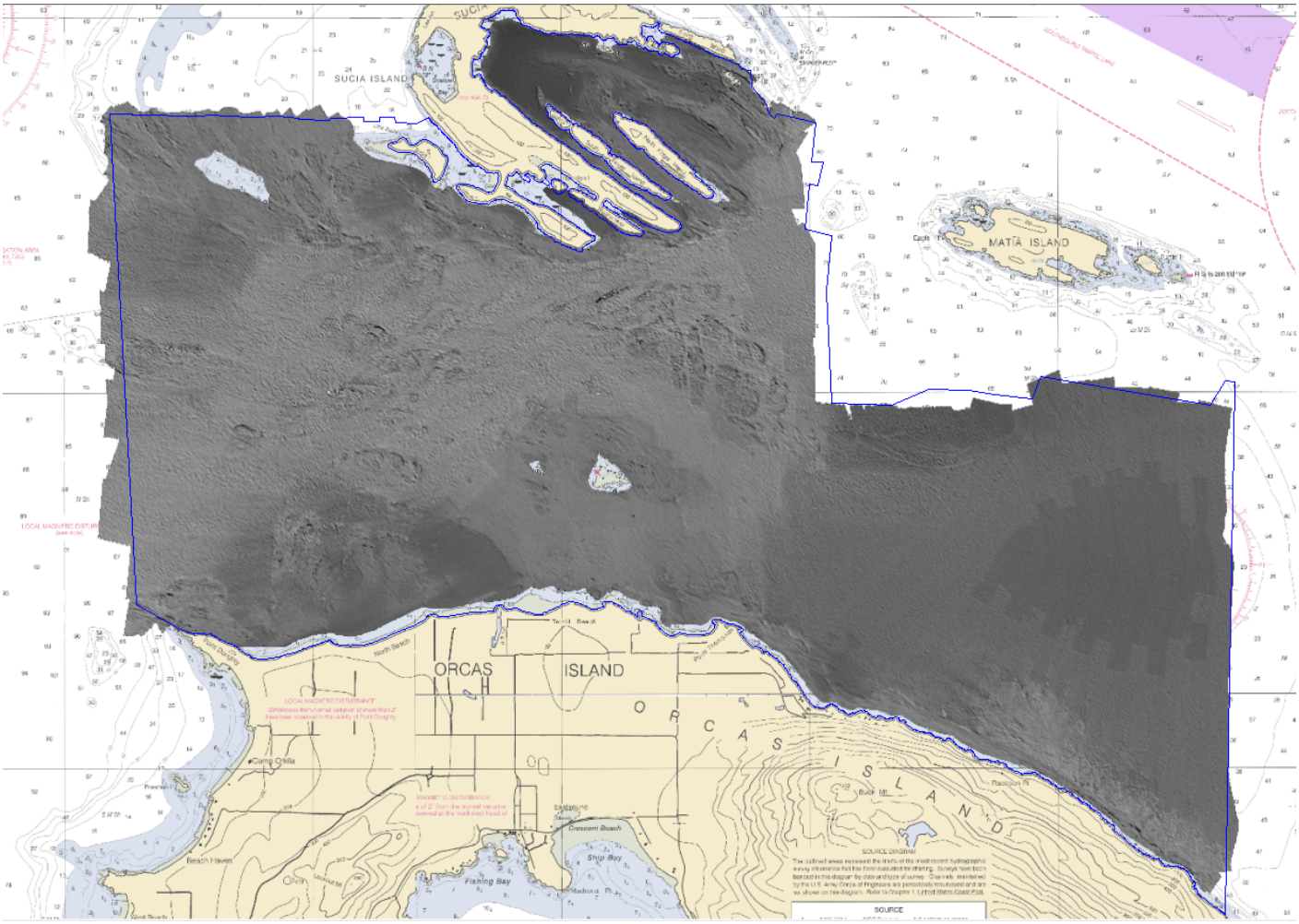


Figure 22: H13204 Backscatter Mosaic

	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	2.1	2.25	2.4	2.7	2.1	2.7	3.3	3	3	3.9	4.8
2806	1.8	1.8	1.8	2.4	0.9	1.35	1.8	1.8	3.6	4.65	5.7
2807	-0.3	-0.15	0	0	-1.8	-0.9	0	0.6	3.3	4.2	5.1
2808	0	0.6	1.2	1.6	-2.7	-1.95	-1.2	-2.1	1.8	2.7	3.6

Figure 23: 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
Teledyne CARIS	HIPS/SIPS	10.4.5

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 FMGT	7.8.5

Table 11: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Extended Attribute Files version 5.7.

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
H13204_MB_VR_MLLW	CARIS VR Surface (CUBE)	1-16 meters	-0.7 meters - 193.2 meters	NOAA_VR	Complete MBES
H13204_MB_VR_MLLW_Final	CARIS VR Surface (CUBE)	1-16 meters	-0.7 meters - 193.2 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 in Survey H13204. The surfaces have been reviewed where noisy data, or "fliers," were 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 v5, part of the QC Tools package within Pydro, 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 steep slopes and dynamic nature of the seafloor.

B.5.3 Data Logs

Data acquisition and processing notes are included in the acquisition and processing logs, and additional processing such as final tide and sound speed application are noted in the H13204 Data Log spreadsheet. All data logs are submitted digitally in the Separates I folder.

C. Vertical and Horizontal Control

Per Section 5.1.2.3 of the 2014 Field Procedures Manual, no Horizontal and Vertical Control Report has been generated for H13204.

C.1 Vertical Control

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

Traditional Methods Used:

- TCARI

File Name	Status
9444900.tid	Final Approved
9449424.tid	Final Approved
9449880.tid	Final Approved

Table 13: Water Level Files (.tid)

File Name	Status
H13202_H13204.tc	Final

Table 14: Tide Correctors (.zdf or .tc)

A request for final approved tides was sent to N/OPS1 on 10/24/2018. The final tide note was received on 11/02/2018.

The TCARI grid was utilized for the reduction of all features to MLLW.

ERS Datum Transformation

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

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	VDatumShape_xyNAD83-MLLW_geoid12b.csar

Table 15: ERS method and SEP file

ERS methods via a VDATUM separation model were used as the final means of reducing H13204 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.

DGPS

The following DGPS Stations were used for horizontal control:

DGPS Stations
Whidbey Island, WA - 302 kHZ

Table 16: USCG DGPS Stations

Differential correctors from the US Coast Guard beacon at Whidbey Island, WA - 302 kHz (100 BPS) were used in real-time for acquisition when not otherwise noted in the acquisition logs.

D. Results and Recommendations

D.1 Chart Comparison

A comparison was performed between survey H13204 and ENCs US5WA40M and US5WA41M using CARIS HIPS and SIPS sounding and contour layers derived from the surface generated from H13204 data. The contours and soundings were overlaid on the chart to assess differences between the surveyed soundings and charted depths. An eight meter grid was generated from the ENC by extracting all soundings from the chart and creating an interpolated TIN surface which could be differenced with the surface generated from H13204 data. All data from H13204 should supersede charted data. In general, surveyed soundings agree with the majority of charted depths. A full discussion of the comparisons follows below.

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?
US5WA40M	1:25000	16	06/04/2018	06/04/2018	NO
US5WA41M	1:25000	20	12/08/2018	12/08/2018	NO

Table 17: Largest Scale ENCs

US5WA40M

In order to visualize trends in the comparison of H13204 data and ENC US5WA40M, an eight meter TIN surface was generated from the ENC sounding layer. This surface was then differenced with a corresponding surface from H13204 and is visualized in Figure 24. In this difference surface red colors indicate H13204 is shoaler than the ENC US5WA40M, green colors indicate agreement, and blue colors indicate H13204 is deeper than ENC US5WA40M.

Soundings from H13204 are in general agreement with charted depths on ENC US5WA40M, with most depths agreeing to 1-2 fathoms as shown in Figure 26.

Contours from H13204 are in general agreement with charted contours on ENC US5WA40M as shown in Figure 27.

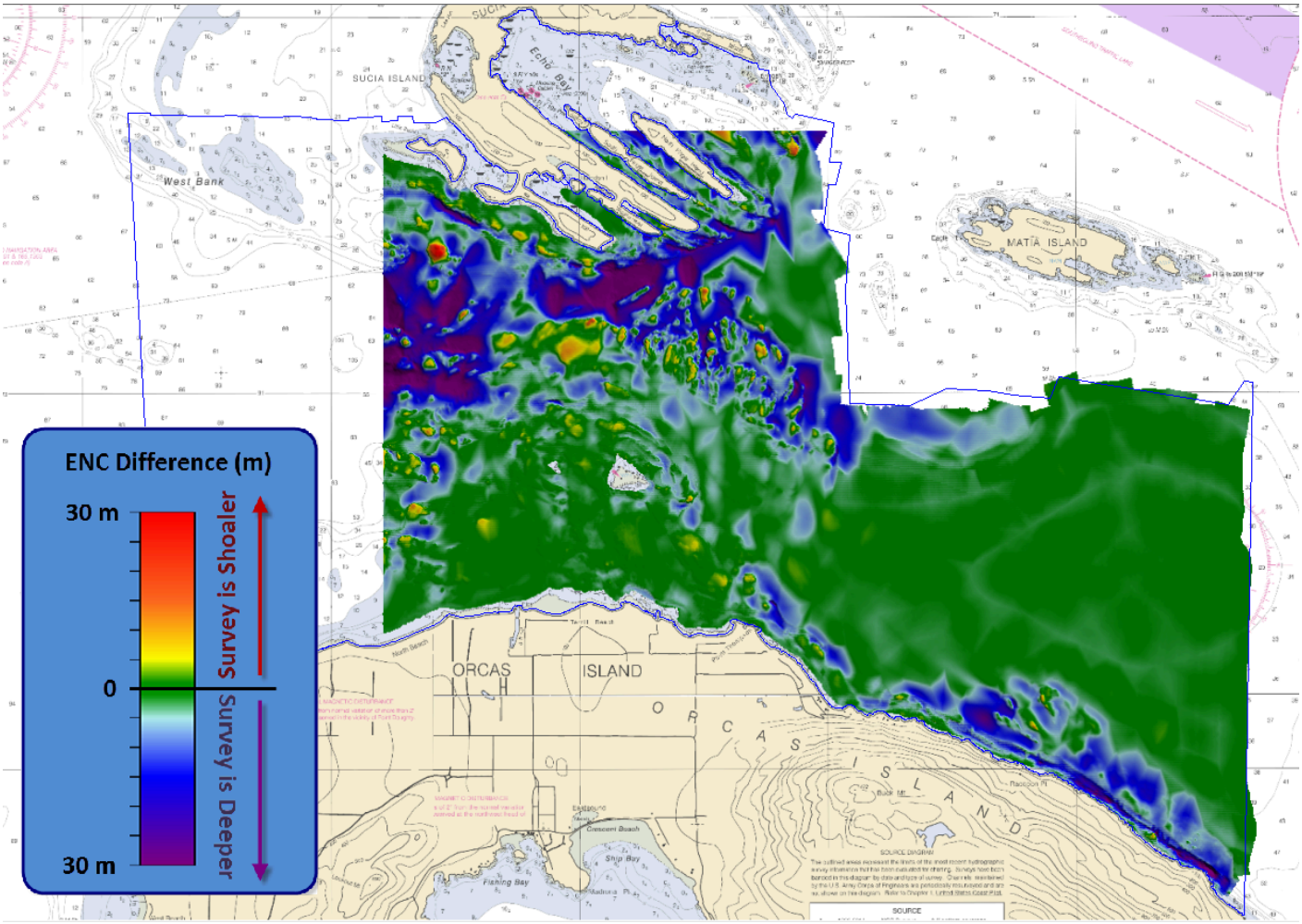
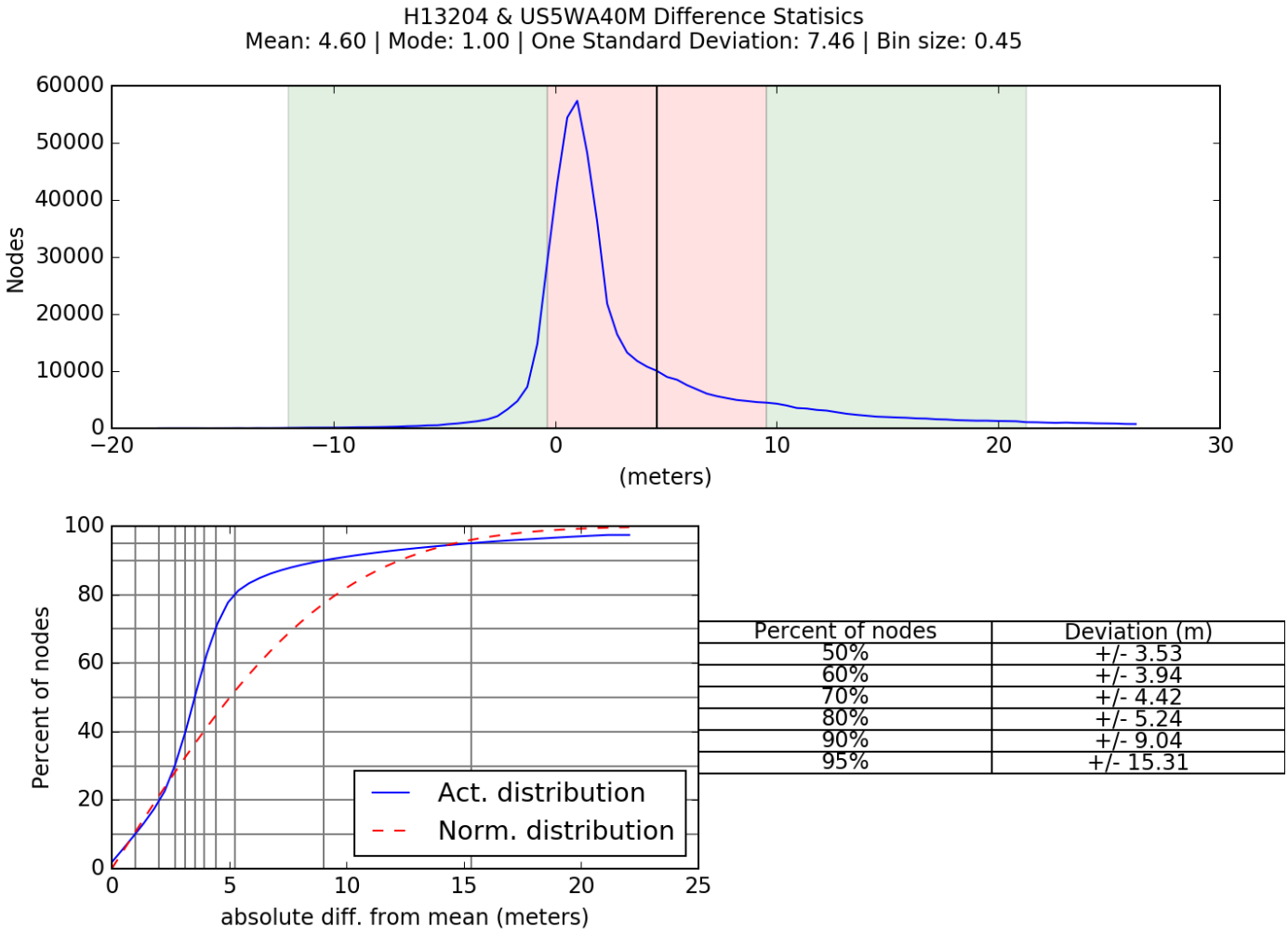


Figure 24: Difference surface between H13204 and interpolated TIN surface from US5WA40M



Percent of nodes	Deviation (m)
50%	+/- 3.53
60%	+/- 3.94
70%	+/- 4.42
80%	+/- 5.24
90%	+/- 9.04
95%	+/- 15.31

Figure 25: Difference surface statistics between H13204 and interpolated TIN surface from US5WA40M

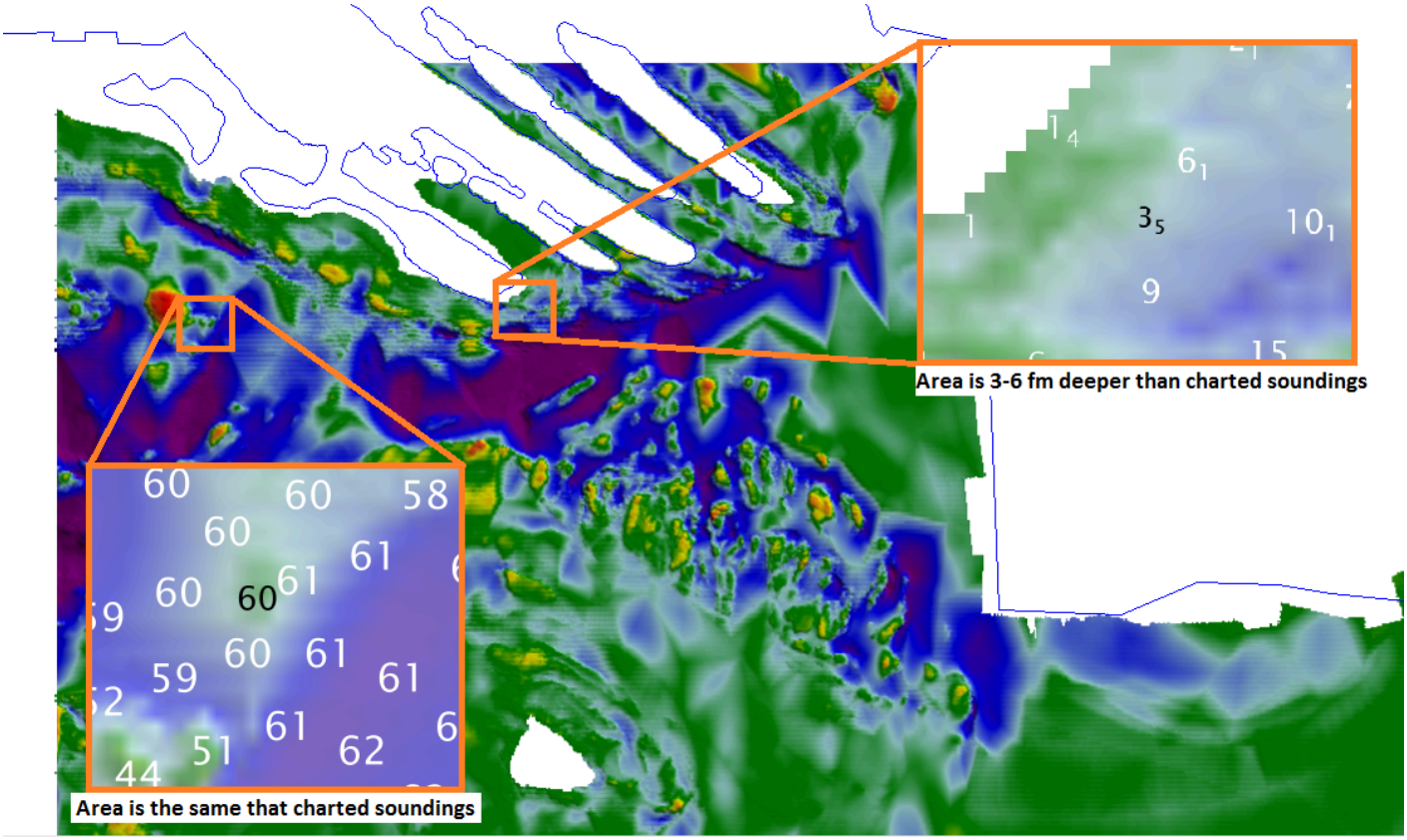


Figure 26: Sounding comparison between H13204 (white) and ENC US5WA40M (black)

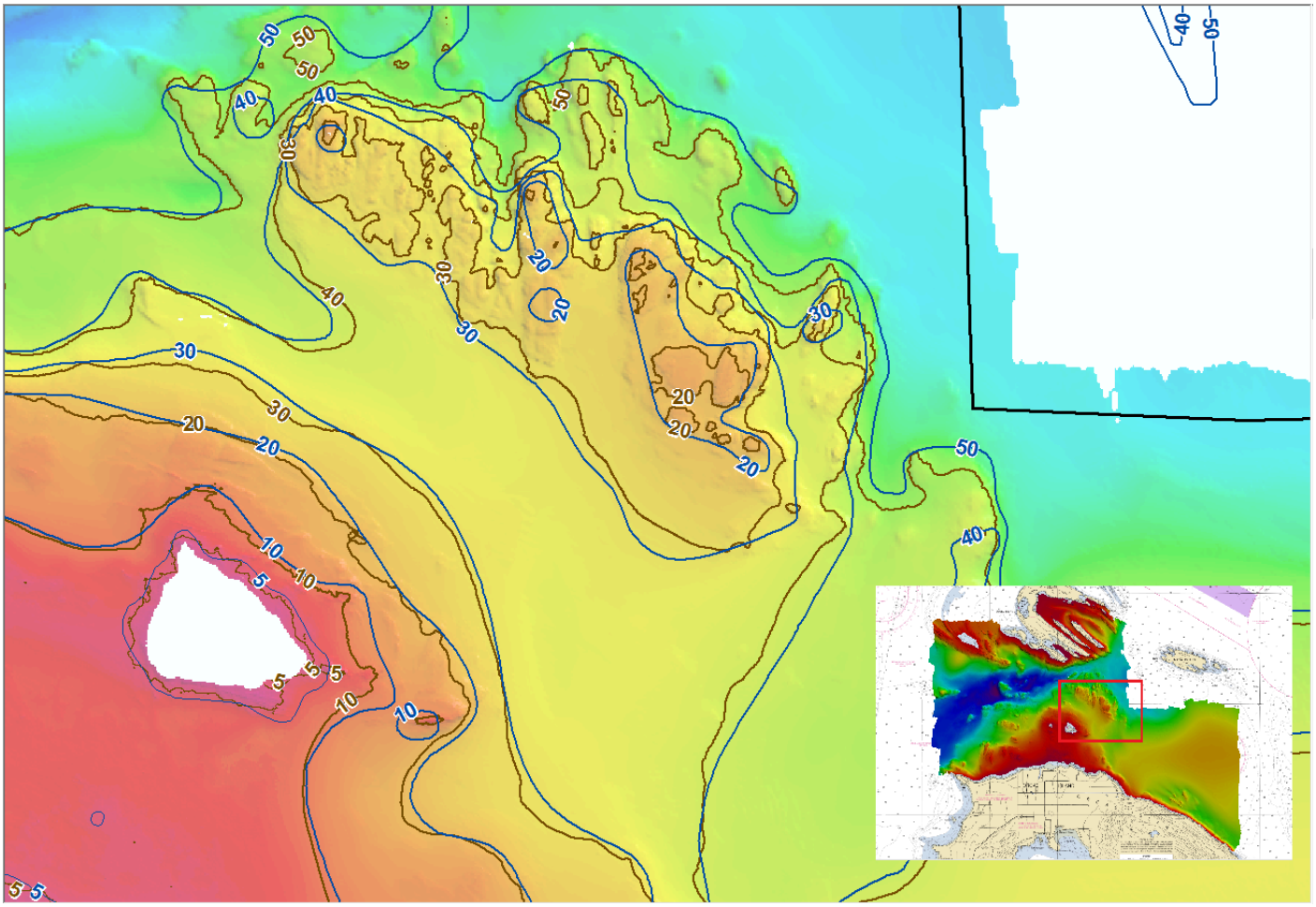


Figure 27: Contour comparison between H13204 (brown) and ENC US5WA40M (blue)

US5WA41M

In order to visualize trends in the comparison of H13204 data and ENC US5WA41M, an eight meter TIN surface was generated from the ENC sounding layer. This surface was then differenced with a corresponding surface from H13204 and is visualized in Figure 28. In this difference surface red colors indicate H13204 is shoaler than the ENC US5WA41M, green colors indicate agreement, and blue colors indicate H13204 is deeper than ENC US5WA41M.

Soundings from H13204 are in general agreement with charted depths on ENC US5WA41M, with most depths agreeing to 1-3 fathoms as shown in Figure 30.

Contours from H13204 are in general agreement with charted contours on ENC US5WA41M as shown in Figure 31.

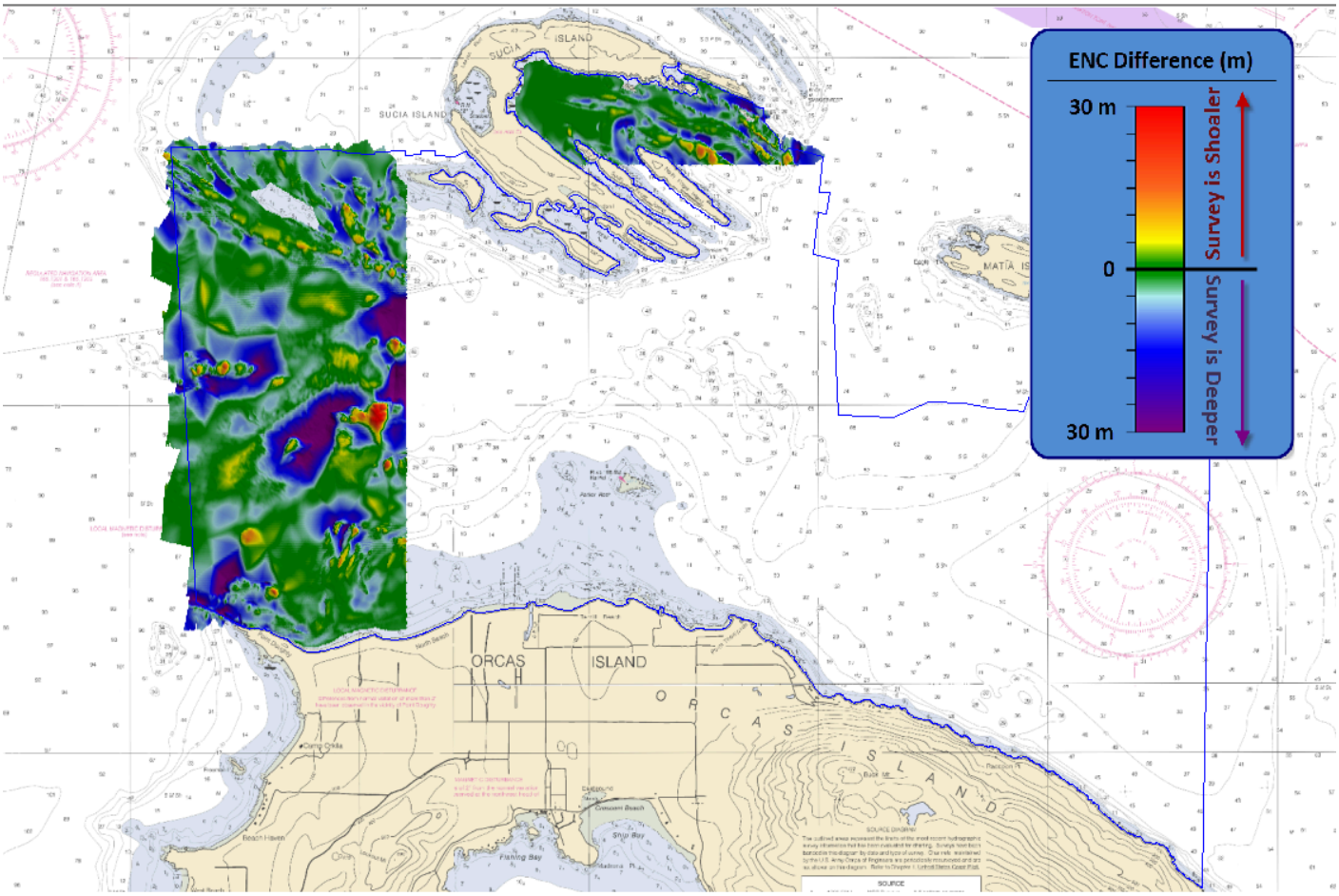
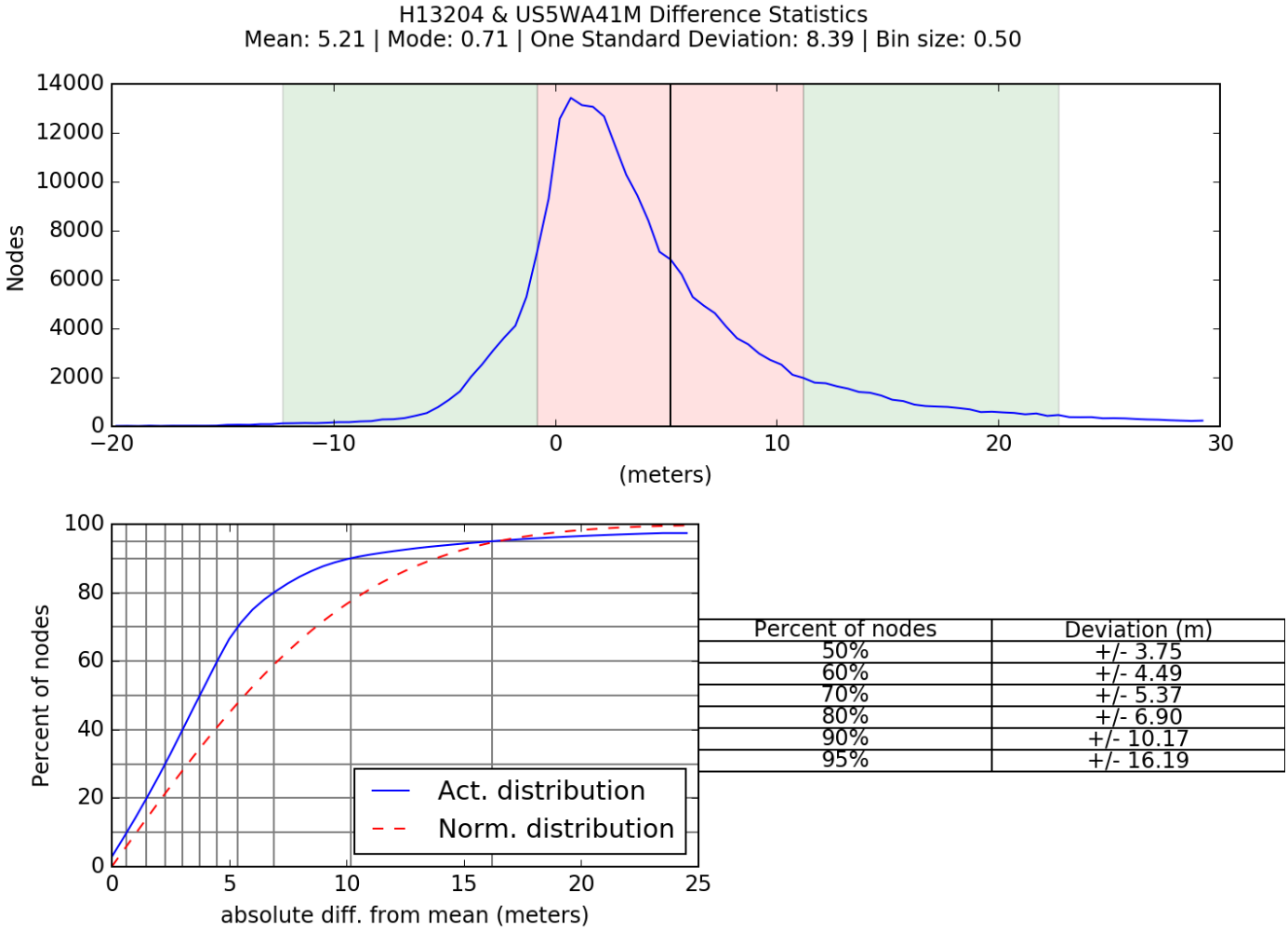


Figure 28: Difference surface between H13204 and interpolated TIN surface from US5WA41M



Percent of nodes	Deviation (m)
50%	+/- 3.75
60%	+/- 4.49
70%	+/- 5.37
80%	+/- 6.90
90%	+/- 10.17
95%	+/- 16.19

Figure 29: Difference surface statistics between H13204 and interpolated TIN surface from US5WA41M

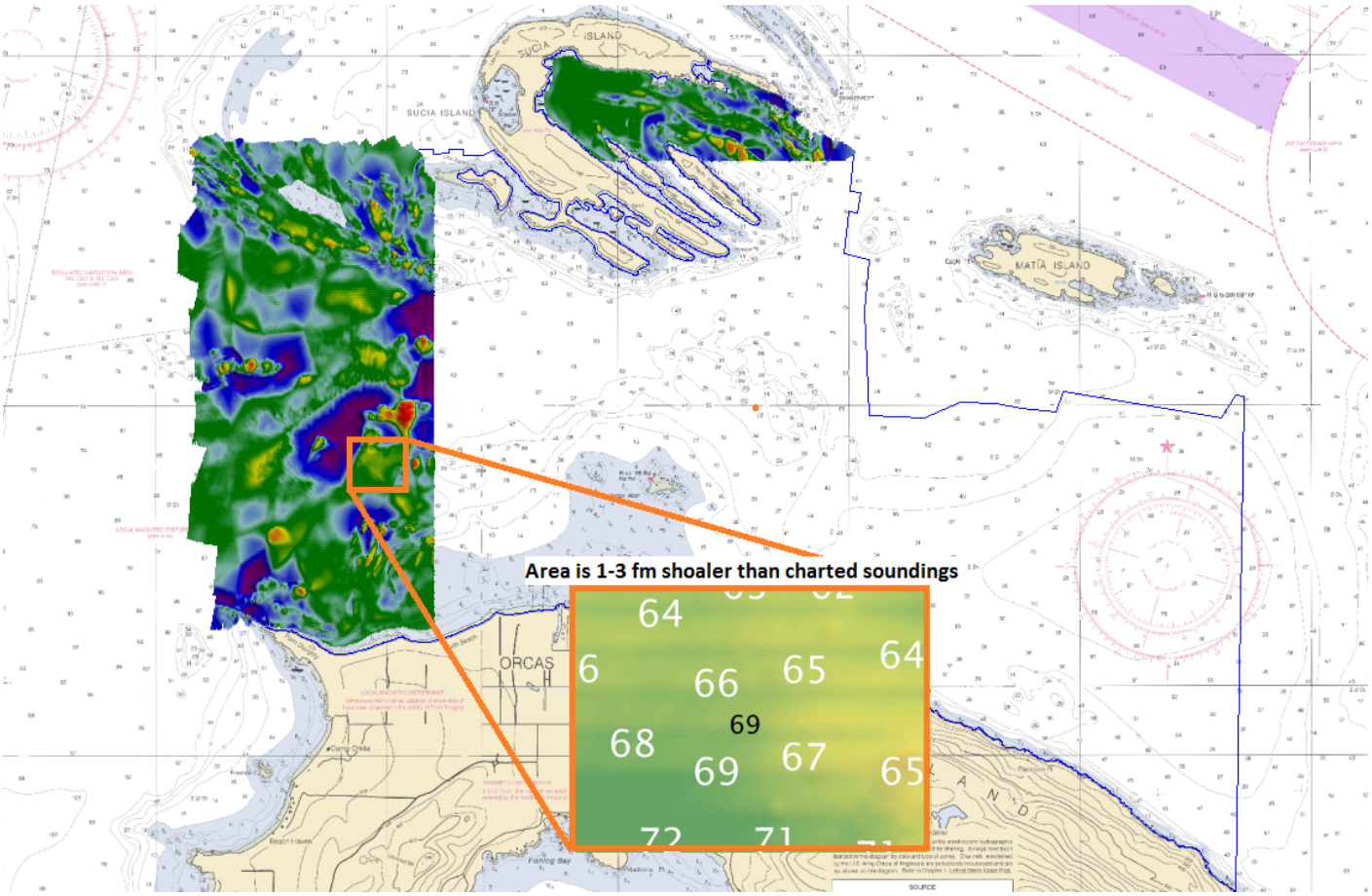


Figure 30: Sounding comparison between H13204 (white) and ENC US5WA41M (black)

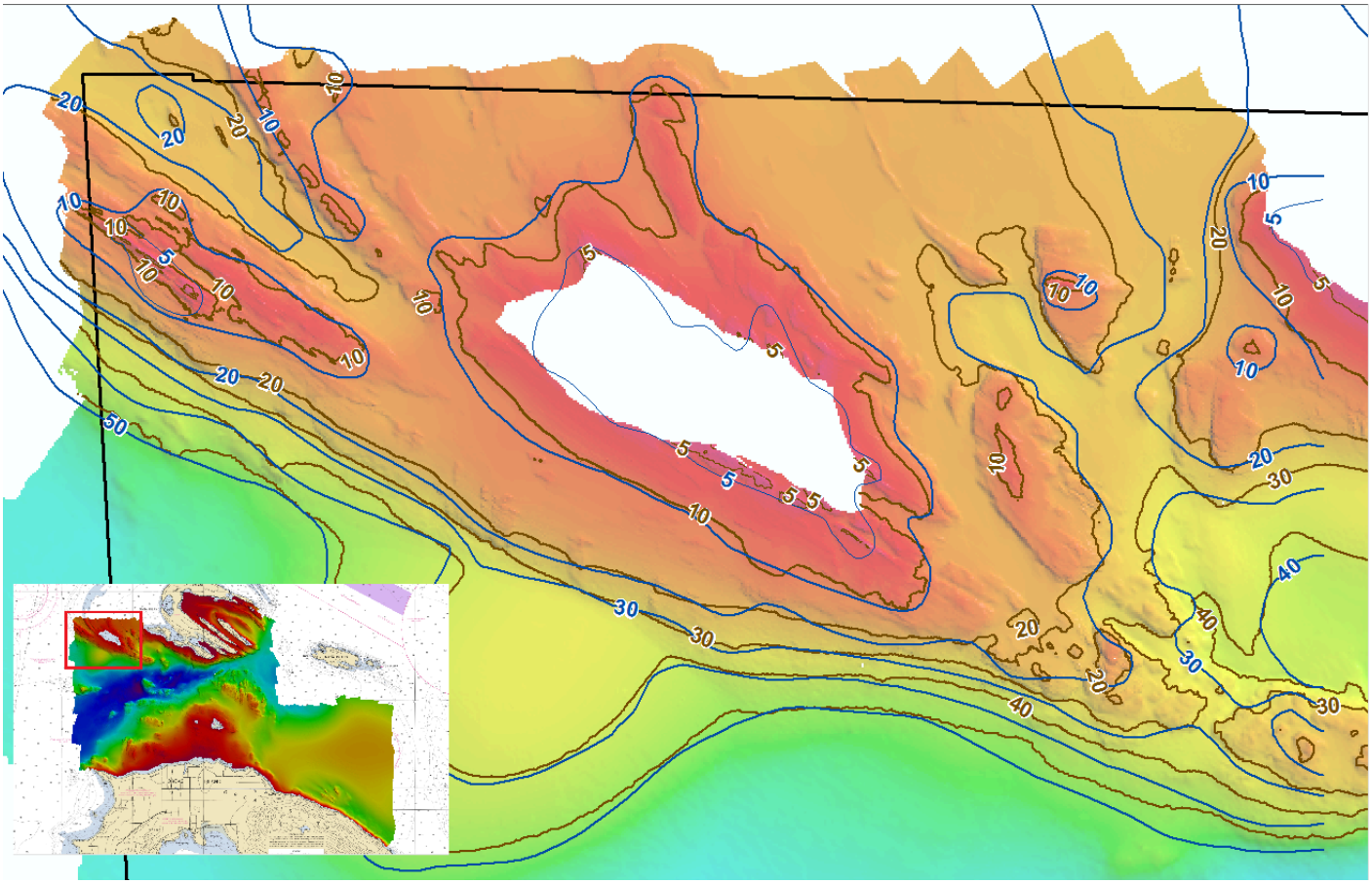


Figure 31: Contour comparison between H13204 (brown) and ENC US5WA41M (blue)

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

A submerged rock reported in 2009 in the western portion of Echo Bay was confirmed to exist in the reported position, however the least depth was not determined due to the limitations of safely maneuvering the launch in the vicinity (Figure 32). Special caution should be taken by those transiting through this area.

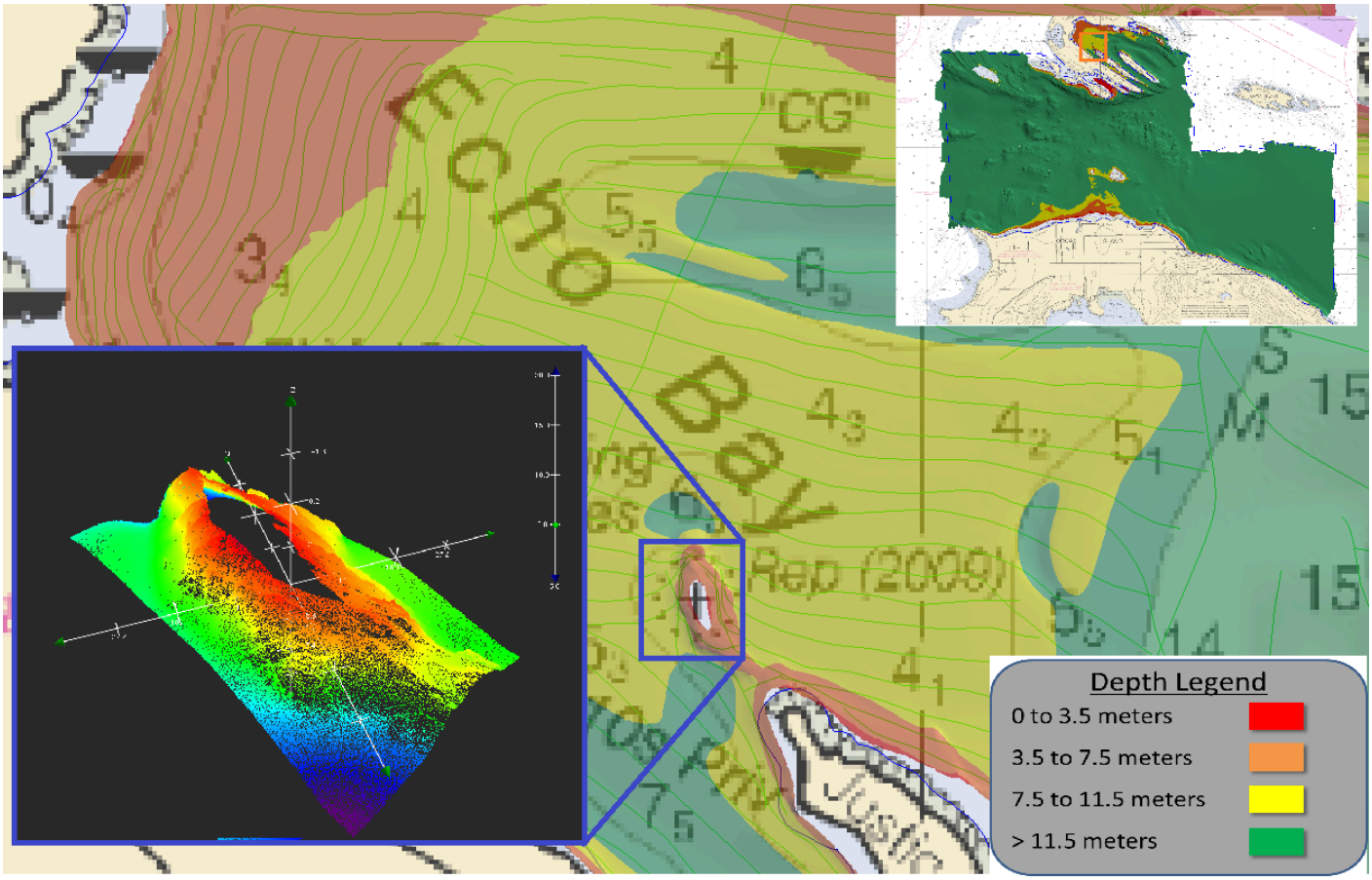


Figure 32: H13204 charted shoal Rep (2009)

D.1.4 Uncharted Features

Survey H13204 has 16 new features that are addressed in the H13204 Final Feature File. Of these features there are 4 new seabed areas from bottom samples, 1 new foul area, 2 new land elevation for a corresponding islet, 5 new underwater rocks, 2 new kelp points, and 2 new kelp areas.

D.1.5 Shoal and Hazardous Features

Two uncharted shoals were discovered south of Parker Reef and north of Terrill Beach, with least depths of 2.7 and 2.2 meters (Figures 33, 34, 35). These shoals were determined to be in an area that did not warrant the submission of a Danger to Navigation Report, as the likelihood of deeper draft vessels transiting through this area is low. Increased attention should be given by mariners transiting in the vicinity.

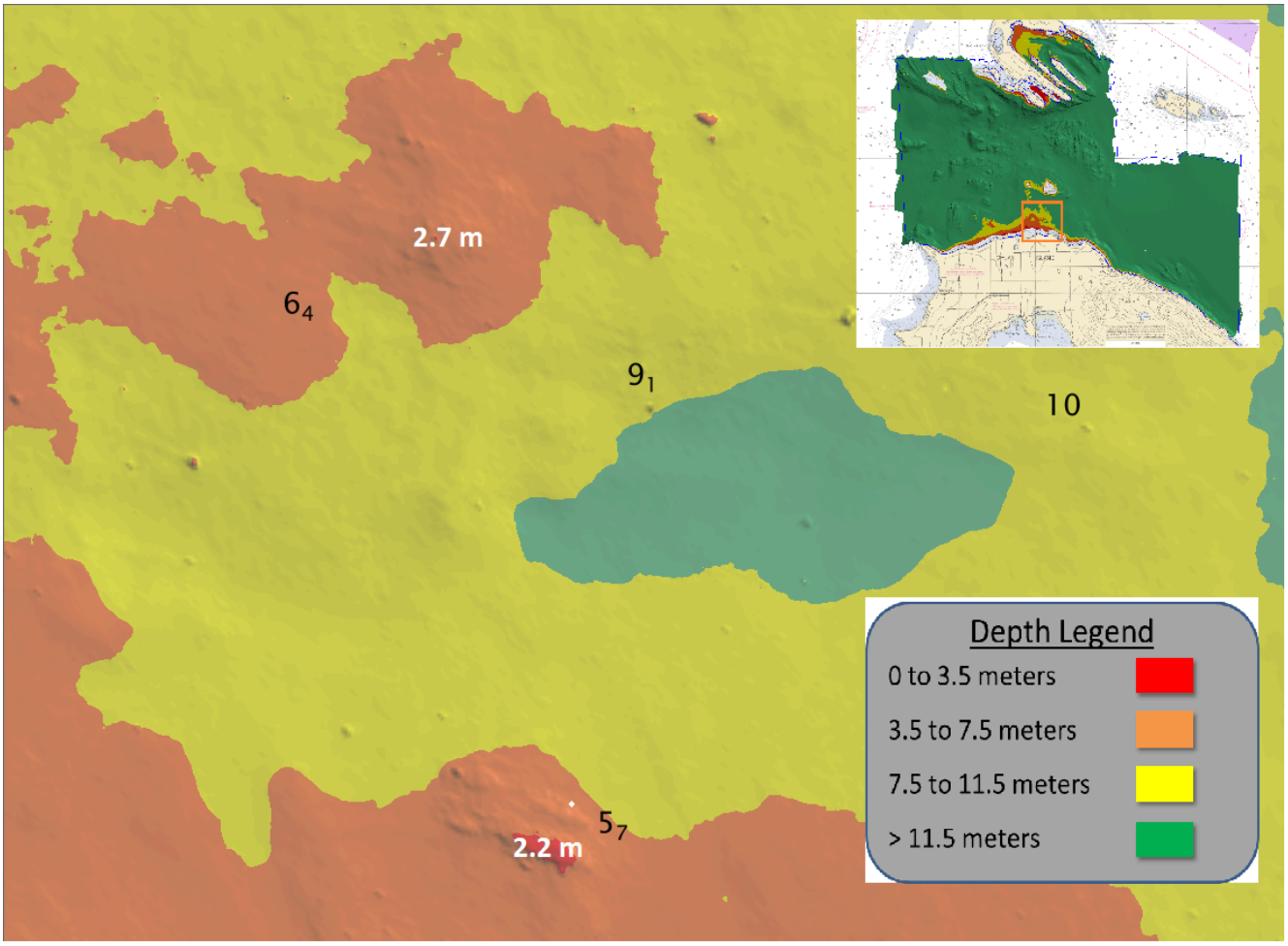


Figure 33: Uncharted shoals in the vicinity of Terril Beach

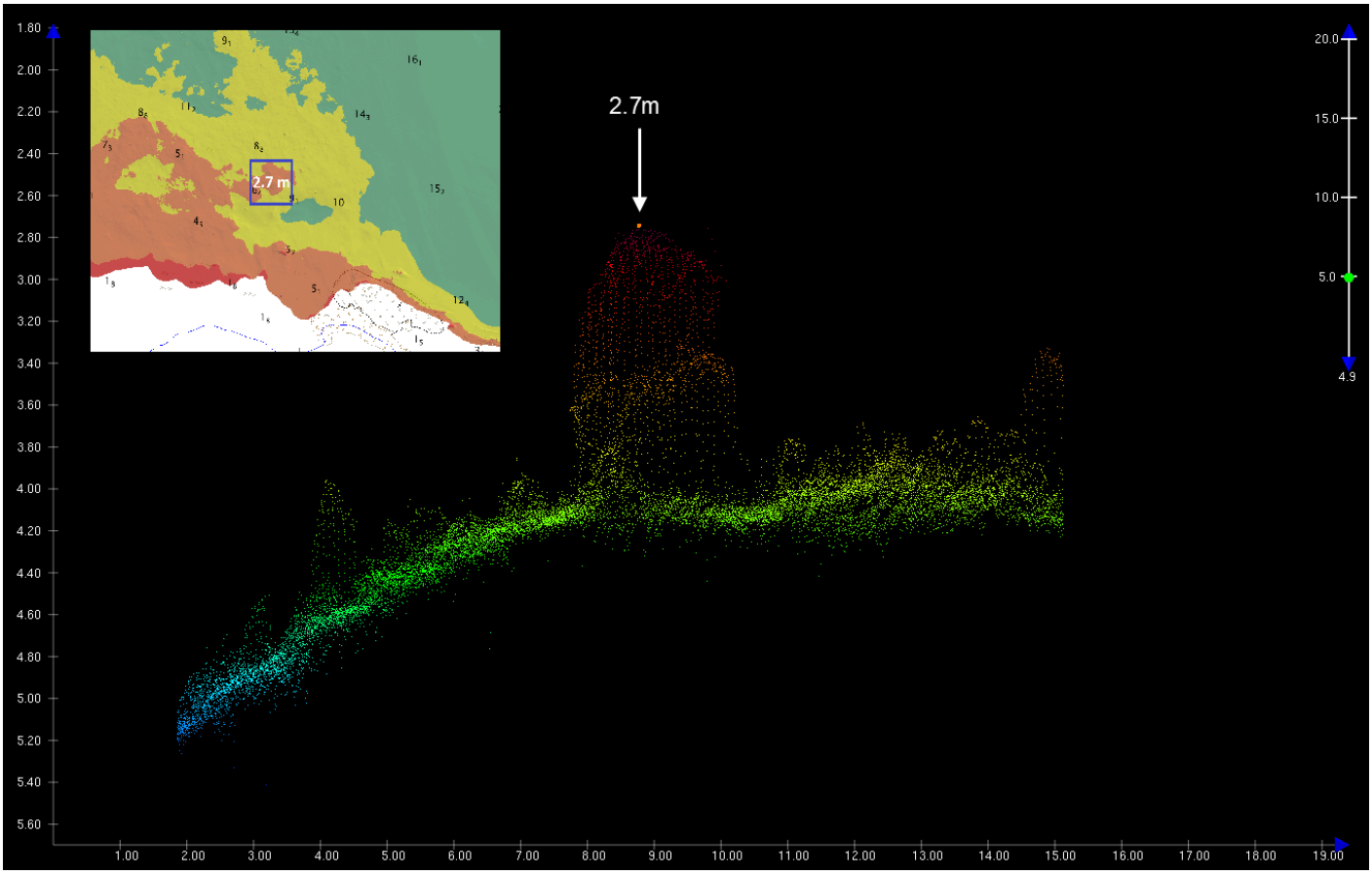


Figure 34: Subset of the northern shoal (2D view)

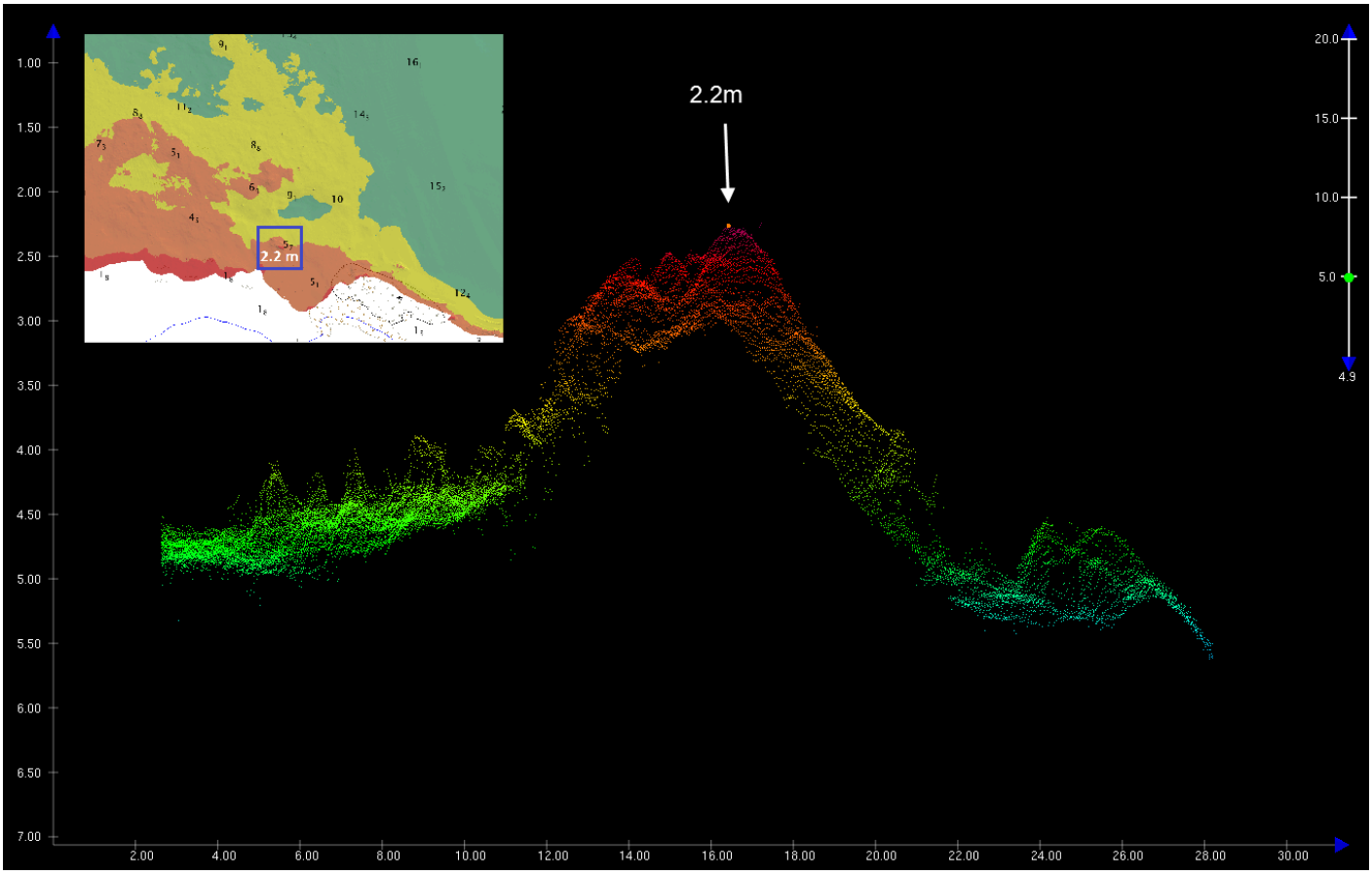


Figure 35: Subset of the southern shoal (2D view)

D.1.6 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.1.7 Bottom Samples

Four bottom samples were acquired in accordance with the Project Instructions for survey H13204. Two additional bottom samples were attempted, but were unsuccessful due to swells and strong currents creating environmental conditions that were too dangerous to safely conduct a bottom sample.

All successful bottom samples were entered in the H13204 Final Feature File. See Figure 36 for a graphical overview of sample locations.

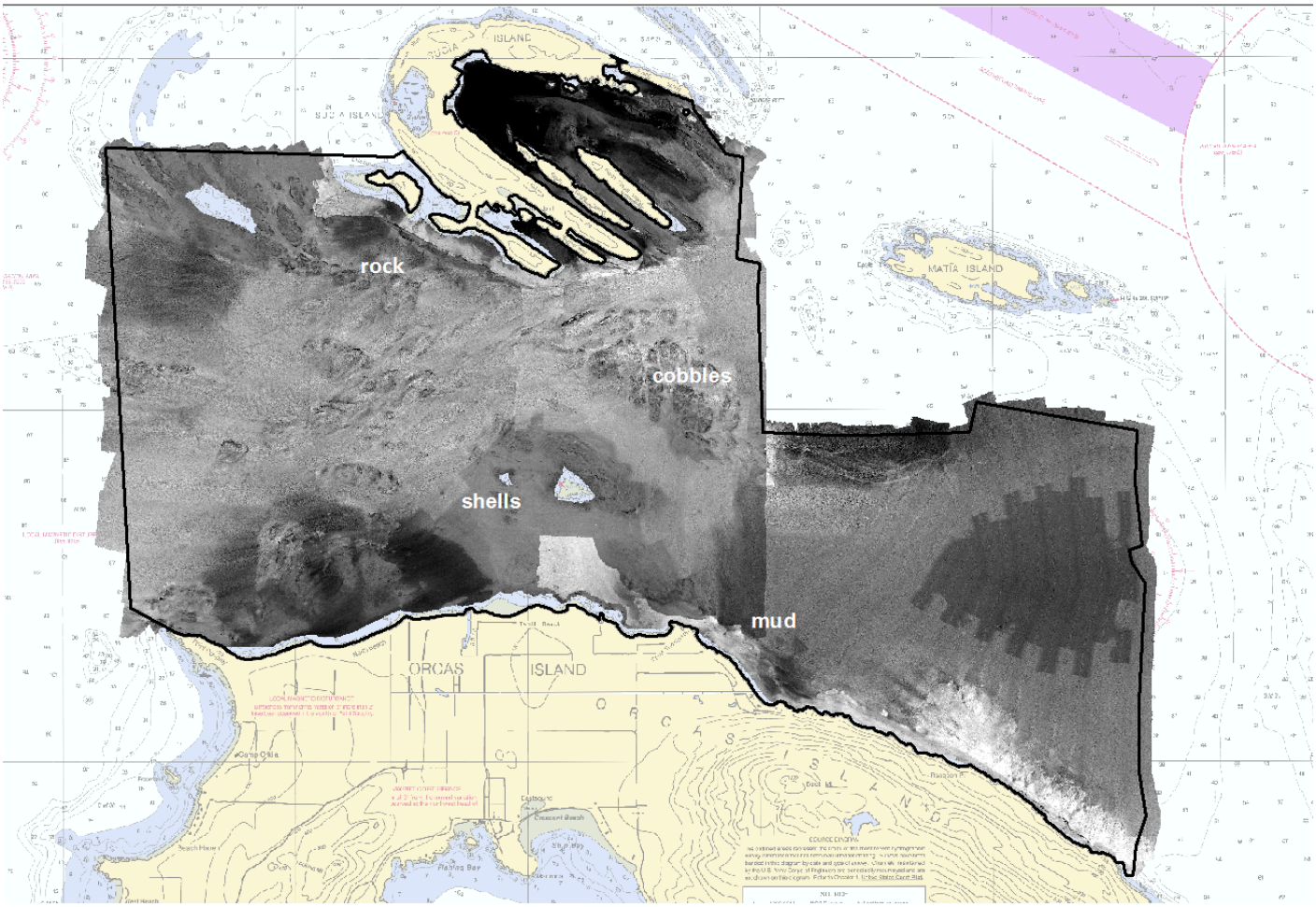


Figure 36: H13204 bottom sample locations

D.2 Additional Results

D.2.1 Shoreline

Fairweather personnel conducted limited shoreline verification and reconnaissance, utilizing traditional shoreline methods, at times near predicted negative or low tides within the survey limits. Inaccessible features inshore of the NALL were attributed in the Final Feature File with the description of “Not Addressed” and remarks of “Retain as charted, not investigated due to being inshore of NALL” as per HSSD Section 7.3.1. Annotations, information, and diagrams collected boat sheets during field operations were scanned and included in the Separates I Detached Positions folder. Shoreline verification procedures for H13204 conform to those detailed in the DAPR.

D.2.2 Aids to Navigation

Thirteen ATONs were assigned for this survey: eight lights, two daymarks and two beacons.

All ATONs were on-station and serving their intended purpose. The ATONs were attributed in the Final Feature File with the description of "Retain" as per HSSD Section 7.3.5.

D.2.3 Overhead Features

No overhead features exist for this survey.

D.2.4 Submarine Features

No submarine features exist for this survey.

D.2.5 Platforms

No platforms exist for this survey.

D.2.6 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.7 Abnormal Seafloor and/or Environmental Conditions

No abnormal seafloor and/or environmental conditions exist for this survey.

D.2.8 Construction and Dredging

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

D.2.9 New Survey Recommendation

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

D.2.10 Inset Recommendation

No new insets are recommended for this area.

E. Approval Sheet

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

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

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys 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 herein.

Approver Name	Approver Title	Approval Date	Signature
CDR Marc S. Moser, NOAA	Commanding Officer	03/22/2019	MOSER.MARC.STANTON.1163193902 Digitally signed by MOSER.MARC.STANTON.1163193902 Date: 2019.03.25 12:54:43 -07'00'
HCST Sam Candio	Chief Survey Technician	03/22/2019	
HST Dmitry Malinkin	Sheet Manager	03/22/2019	

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

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

PROVISIONAL TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : October 24, 2018

HYDROGRAPHIC BRANCH: Pacific

HYDROGRAPHIC PROJECT: OPR-N305-FA-18

HYDROGRAPHIC SHEET: H13202; H13204

LOCALITY: Skaget and Simik Bays; South of Sucia Island, WA

TIME PERIOD: September 22 - October 04, 2018

TIDE STATION USED: 9444900 Port Townsend, WA
Lat. 48° 6.8′ N Long. 122° 45.6' W

PLANE OF REFERENCE (MEAN LOWER LOW WATER): 2.389 meters

HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 0.000 meters

TIDE STATION USED: 9449424 Cherry Point, WA
Lat. 48° 51.8′ N Long. 122° 45.5' W

PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters

HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.535 meters

TIDE STATION USED: 9449880 Friday Harbor, WA
Lat. 48° 32.7' N Long. 123° 0.8' W

PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters

HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.167 meters

REMARKS: RECOMMENDED GRID

Please use the TCARI grid "H13202_13204.tc" as the final grid for project OPR-N305-FA-18, Registry Nos. H13202 & H13204, during the time period between September 22 and October 04, 2018.

Refer to attachments for grid information.

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

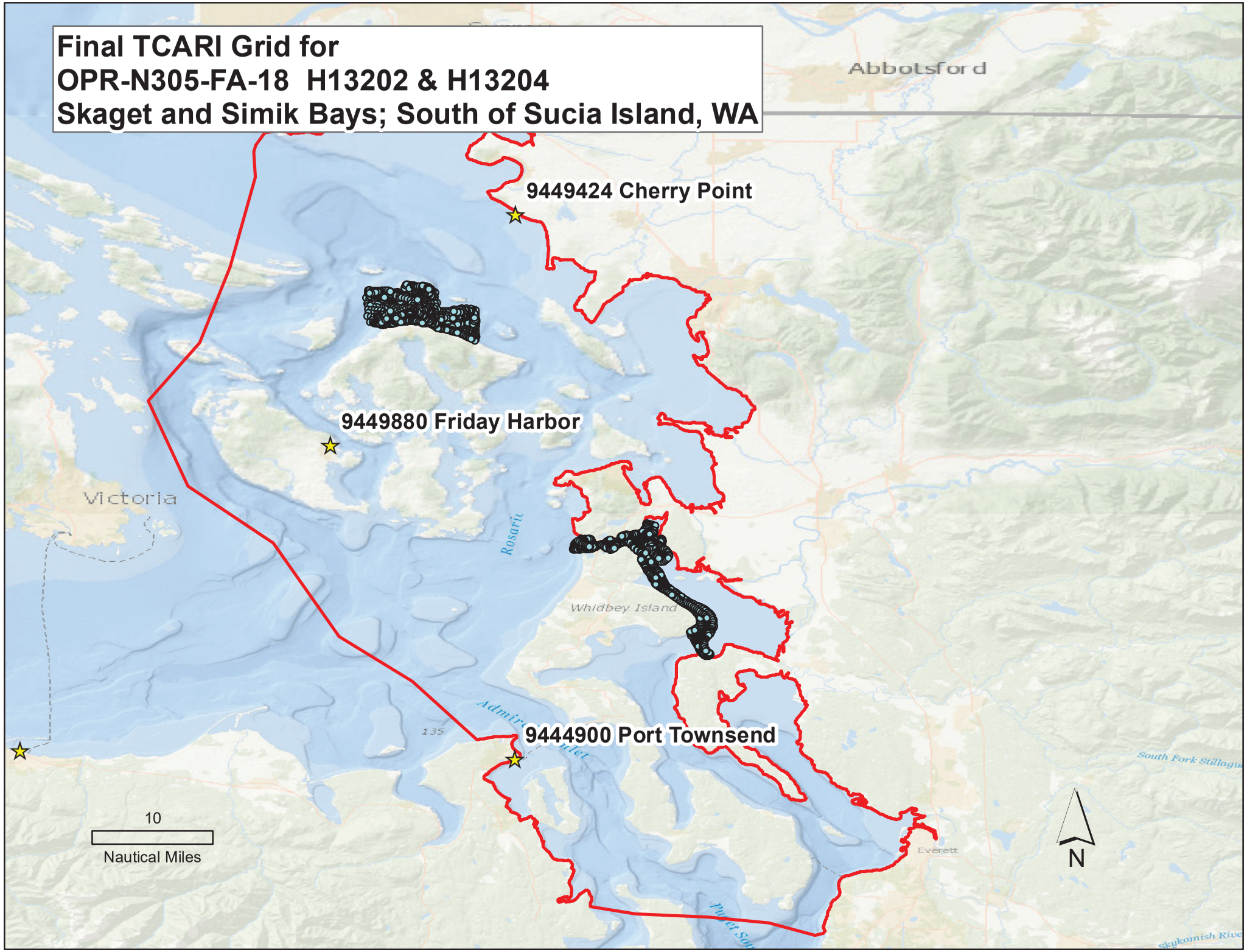
Note 2: Annual leveling for 9449424 Cherry Point, WA was not completed in the past year. A review of the verified leveling records from August 2007 to August 2017 shows the tide station benchmark network to be stable within an allowable 0.009 m tolerance. This Tide Note may be used as final stability verification for survey OPR-N305-FA-18, H13202 & H13204. CO-OPS will immediately provide a revised Tide Note should subsequent leveling records indicate any benchmark network stability movement beyond the allowable 0.009 m tolerance.

Note 3: Due to an inaccurate shoreline, survey track lines fall outside of the TCARI grid boundaries in some areas. TCARI will extrapolate the tide corrector to cover these soundings.

FANELLI.COLLEEN.MEGHAN.1369720100

Digitally signed by FANELLI.COLLEEN.MEGHAN.1369720100
Date: 2018.11.02 10:41:29 -04'00'

ACTING BRANCH CHIEF, PRODUCTS AND SERVICES BRANCH


Final TCARI Grid for
OPR-N305-FA-18 H13202 & H13204
Skaget and Simik Bays; South of Sucia Island, WA
9449424 Cherry Point
9449880 Friday Harbor
9444900 Port Townsend
Abbotsford
Victoria
Whidbey Island
Everett
10
Nautical Miles
N

APPROVAL PAGE

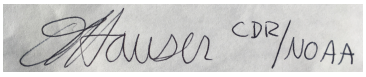
H13024

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

The following products will be sent to NCEI for archive

- Descriptive Report
- Collection of Bathymetric Attributed Grids (BAGs)
- Collection of backscatter mosaics
- Processed survey data and records
- Bottom Samples
- GeoPDF of survey product

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

Approved:  HAUSER.OLIVIA.A.1275636009 2020.03.20 09:17:50 -07'00'

Commander Olivia Hauser, NOAA
Chief, Pacific Hydrographic Branch