H13202

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13202

LOCALITY

State(s):	Washington
General Locality:	Northwest Washington
Sub-locality:	Skagit and Similk Bays

2018

CHIEF OF PARTY
CDR Marc S. Moser, NOAA

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13202**

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:	**Skagit and Similk Bays**
Scale:	**10000**
Dates of Survey:	**09/22/2018 to 10/04/2018**
Instructions Dated:	**09/06/2018**
Project Number:	**OPR-N305-FA-18**
Field Unit:	**NOAA Fairweather**
Chief of Party:	**CDR Marc S. 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:

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

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Descriptive Report to Accompany Survey H13202

Project: OPR-N305-FA-18

Locality: Northwest Washington

Sublocality: Skagit and Similk Bays

Scale: 1:10000

September 2018 - October 2018

NOAA Fairweather

Chief of Party: CDR Marc S. Moser, NOAA

A. Area Surveyed

The survey area is located in Northwest Washington within the sub locality of Skagit and Similk Bays.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
48° 26' 19.03" N 122° 40' 53.26" W	48° 15' 7.56" N 122° 28' 58.05" W

Table 1: Survey Limits

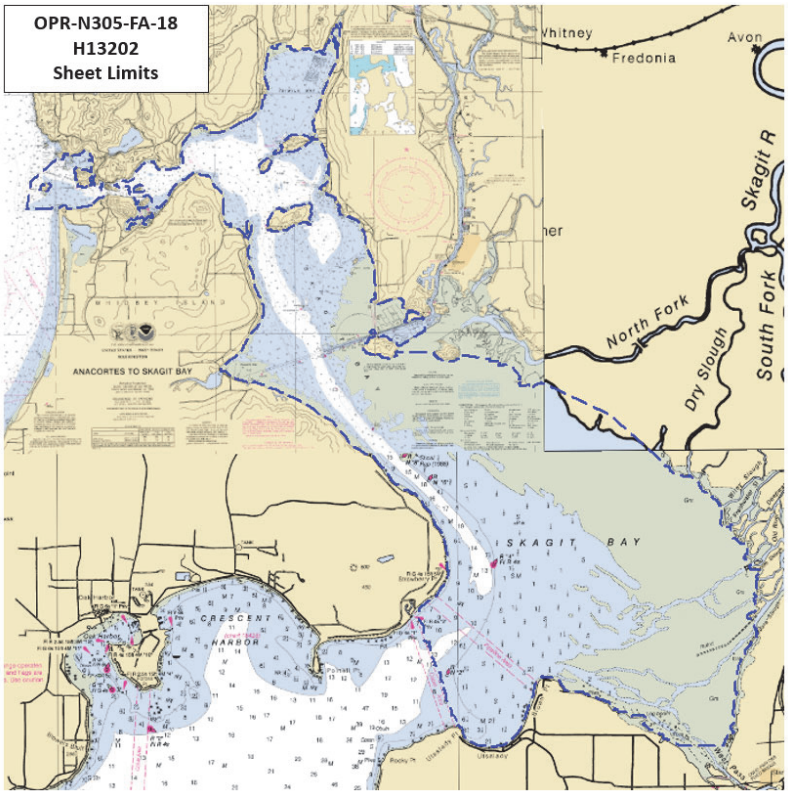


Figure 1: H13202 sheet limits (in blue) overlaid onto Chart 18427, Chart 18441, and Chart 18400

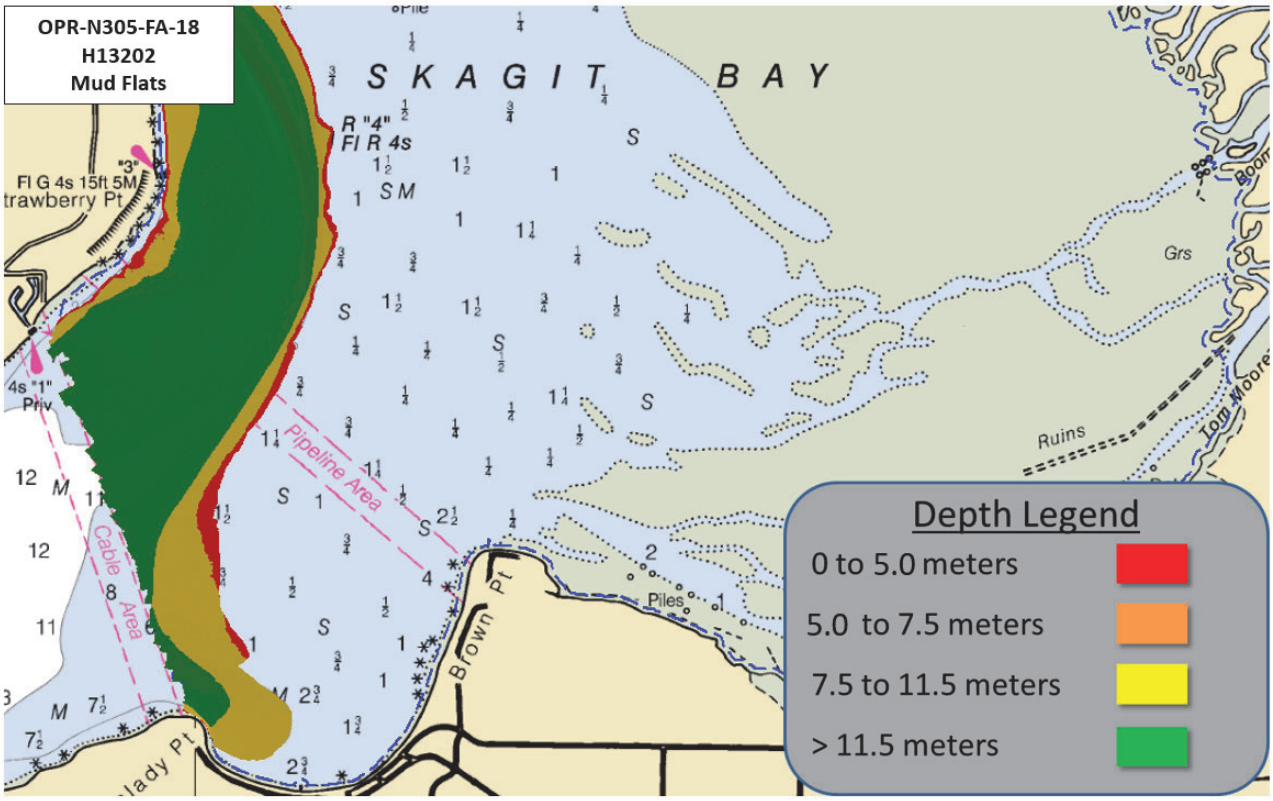


Figure 2: Mud flats that necessitated a 5 meter NALL

Data were acquired to the survey limits in accordance with the requirements in the Project Instructions and the April 2018 NOS Hydrographic Surveys Specifications and Deliverables (HSSD) as shown in Figure 1. Due to the presence of expansive shallow mudflats throughout the survey area, a waiver was requested of and granted by HSD to adjust the NALL definition from 3.5 meters to 5 meters. This allowed for the prioritization of data acquisition in the most navigationally significant areas, eliminating the necessity for days of acquisition within these shallow, relatively homogeneous areas (Figure 2). See Appendix II for a record of this correspondence.

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; it will also support commercial/tribal fishing and recreational boating. 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 H13202 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 (refer to HSSD Sections 5.2.2.3) with complete MBES backscatter

Table 2: Survey Coverage

The entirety of H13202 was acquired with complete coverage multibeam, meeting the requirements listed above and in the HSSD. See Figure 3 for an overview of coverage.

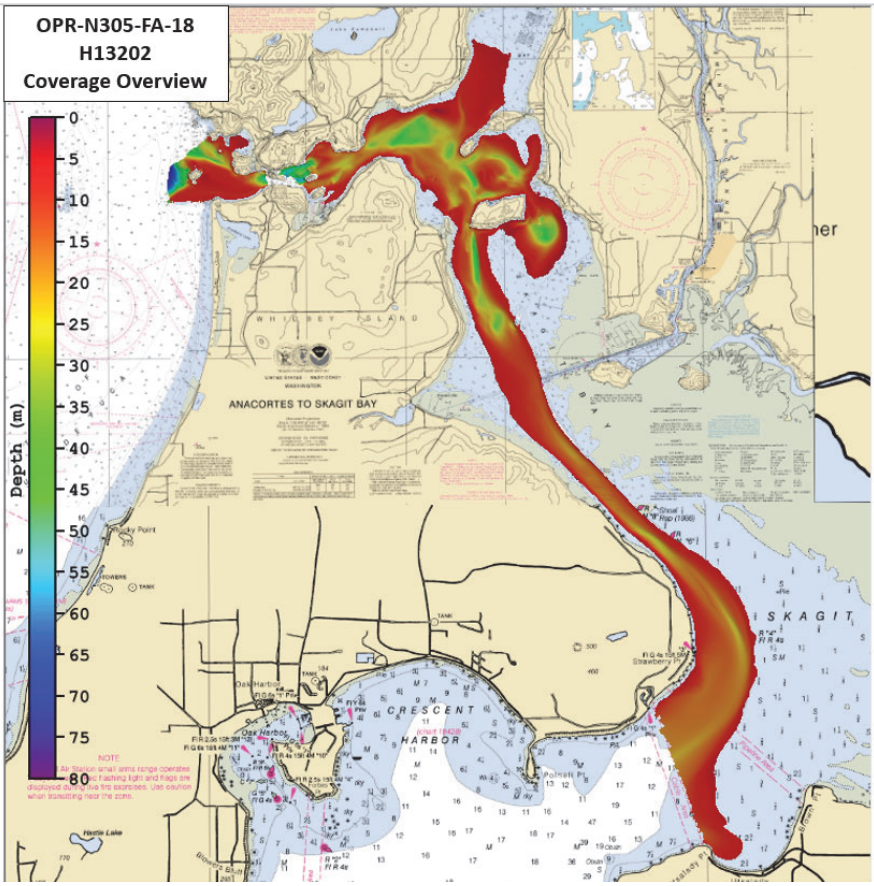


Figure 3: H13202 survey coverage overlaid onto Chart 18427 and Chart 18441

A.5 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	38.30	162.02	174.24	121.26	495.82
	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	13.28	0	0	0	13.28
	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						10.04

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
09/22/2018	265
09/24/2018	267
09/26/2018	269
10/03/2018	276
10/04/2018	277

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the OPR-N305-FA-18 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 V2	Conductivity, Temperature, and Depth Sensor
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 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 2.61% of mainscheme acquisition.

Due to time constraints, crossline acquisition on H13202 fell short of the required 4% of mainscheme acquisition. Crosslines were selected to ensure an adequate spatial distribution throughout the survey area, determining that no significant biases exist in the data acquired. Additionally, visual inspections of overlapping data collected by each vessel/day yielded no evidence of any systemic biases.

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 4), 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 0.09 meters (Figure 5). For the respective depths, the difference surface was compared to the allowable NOAA uncertainty standards. In total, 99.69% of the depth differences between H13202 mainscheme and crossline data were within allowable NOAA uncertainties.

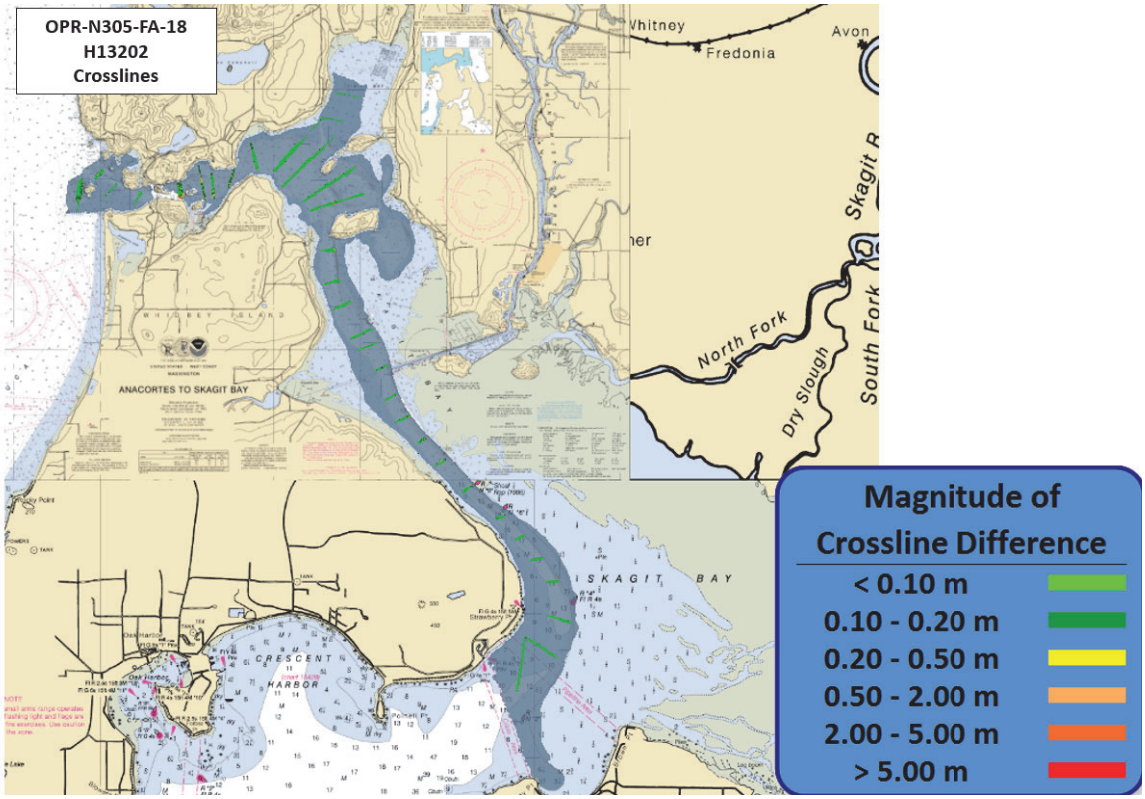


Figure 4: Overview of H13202 crosslines

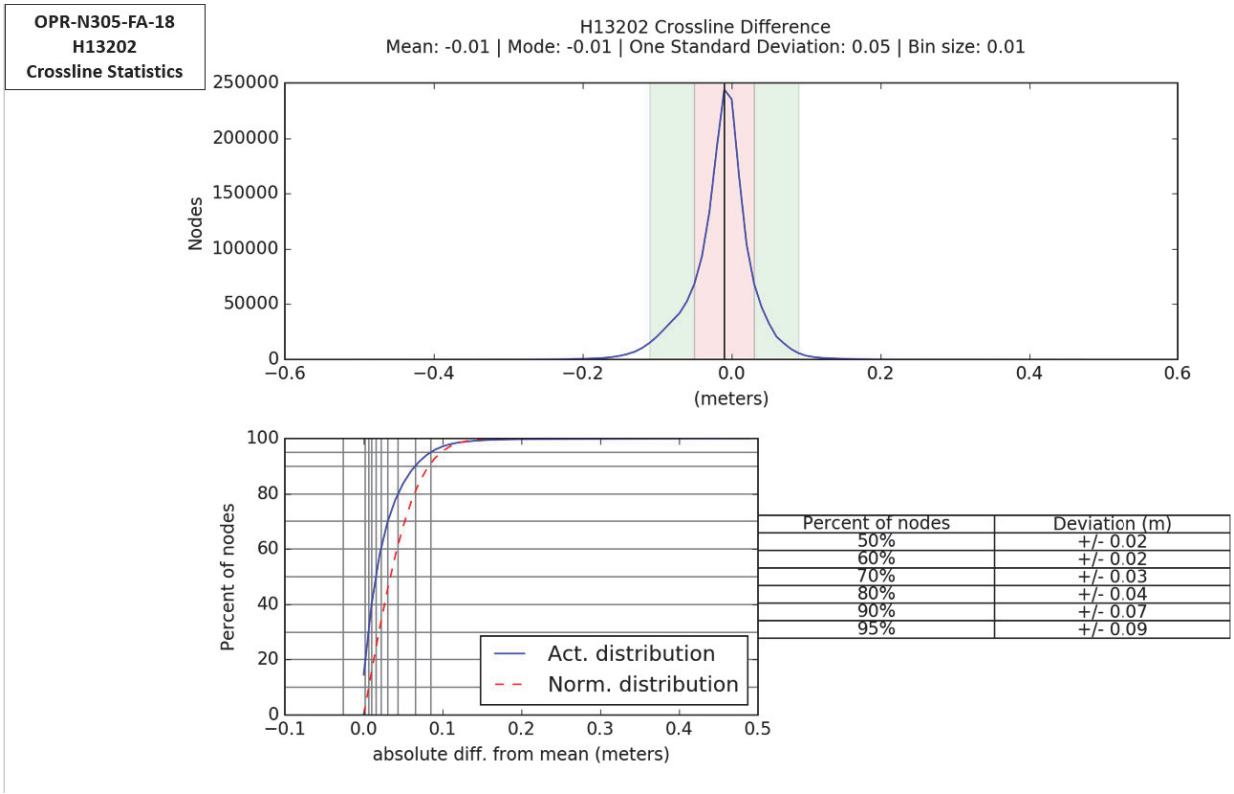


Figure 5: H13202 crossline and mainscheme difference statistics

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 (All Launches)	2 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 H13202. Real-time uncertainties were provided via 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

H13202 junctions with two surveys from prior projects, H11801 and F00682, as shown in Figure 6. Data overlap between H13202 and each adjacent survey was achieved. These areas of overlap between surveys were reviewed with 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 junctions with H13202 are generally within the NOAA allowable uncertainty in their areas of overlap. For all junctions with H13202, a negative difference indicates H13202 was shoaler, and a positive difference indicates H13202 was deeper.

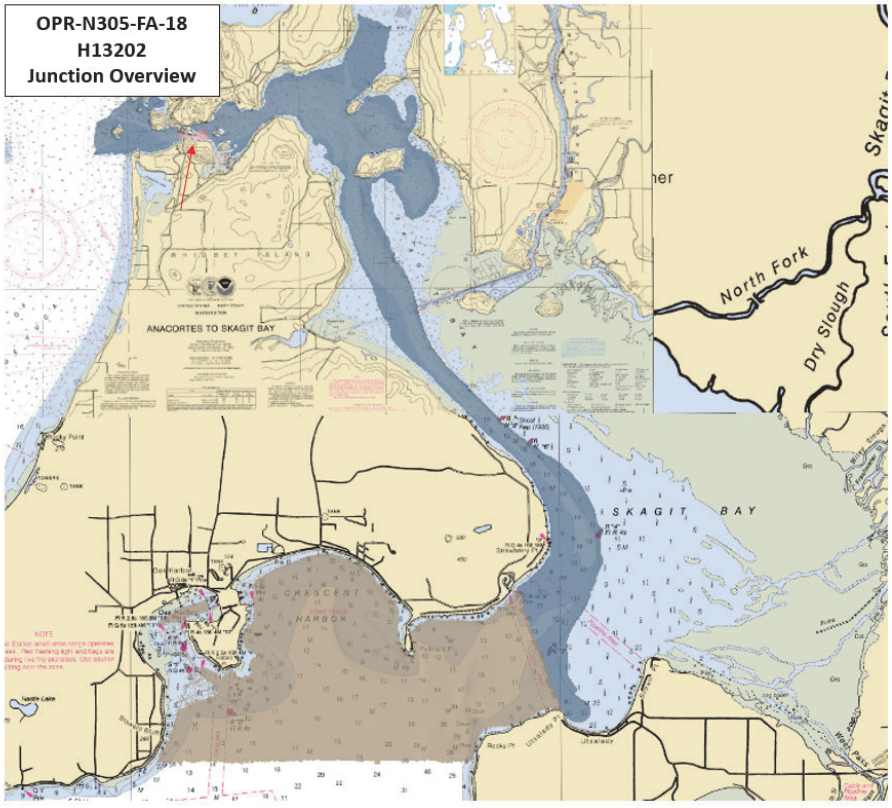


Figure 6: Overview of H13202 junction surveys

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
F00682	1:10000	2016	NOAA Ship FAIRWEATHER	NW
H11801	1:5000	2014	Williamson & Associates, Inc.	SW

Table 9: Junctioning Surveys

F00682

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface from H13202 and the surface from F00682 (Figure 7). The statistical analysis of the difference surface shows a mean of 1.1 meters with 95% of all nodes having a maximum deviation of +/-0.78 meters, as seen in Figure 8. It was found that 97.03% of nodes are within the NOAA allowable uncertainty.

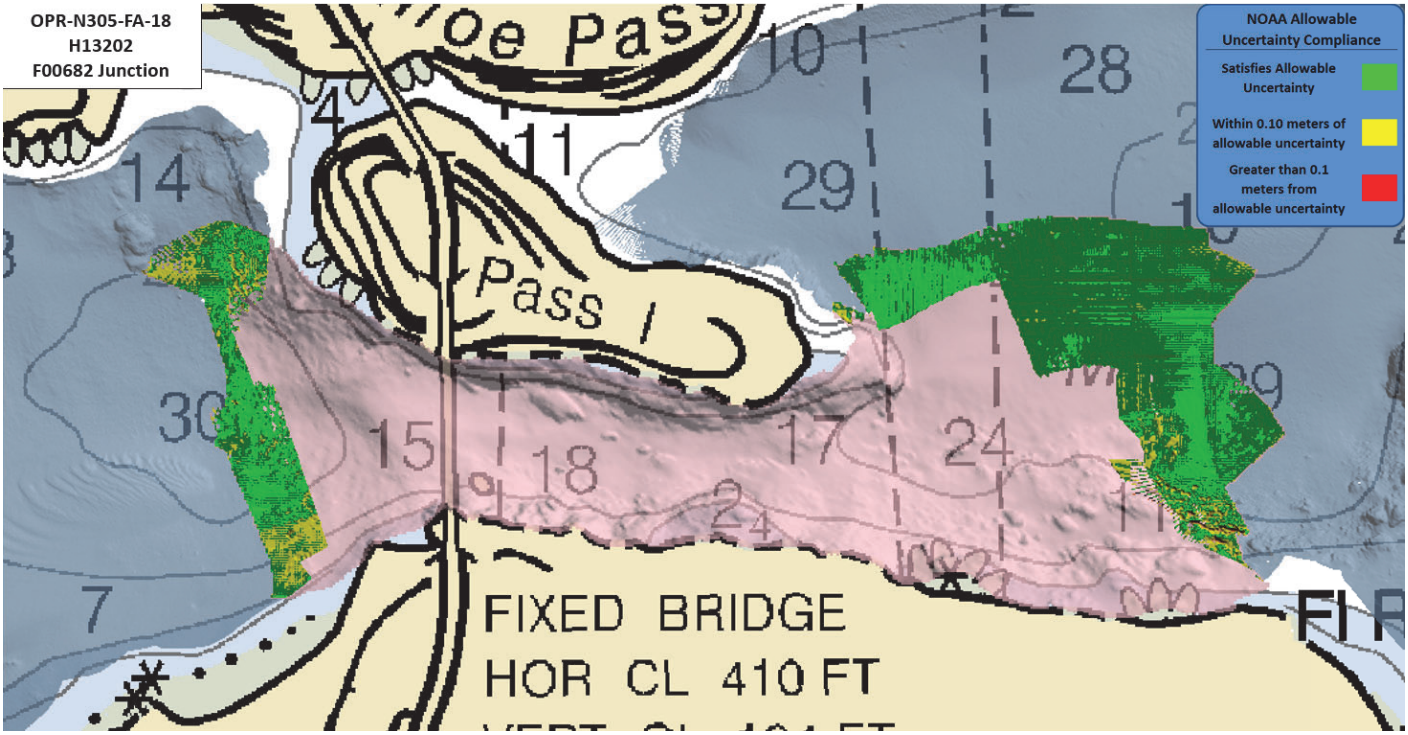


Figure 7: Difference surface between H13202 (gray) and junctioning survey F00682 (pink)

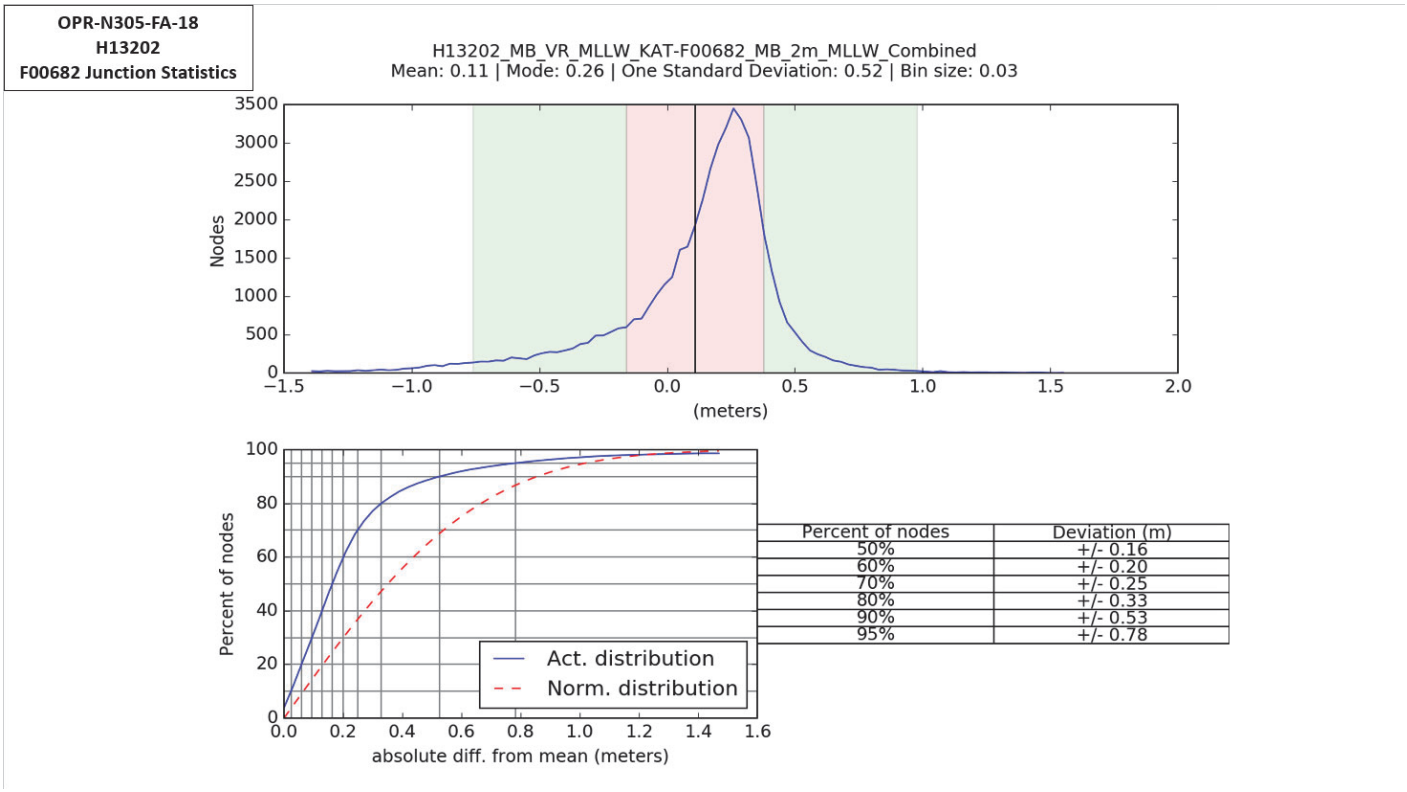


Figure 8: Difference surface statistics between H13202 and F00682

H11801

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface from H13202 and the surface from H11801 (Figure 9). The statistical analysis of the difference surface shows a mean of -0.11 meters with 95% of all nodes having a maximum deviation of +/-0.26 meters, as seen in Figure 10. It was found that 99.69% of nodes are within the NOAA allowable uncertainty.

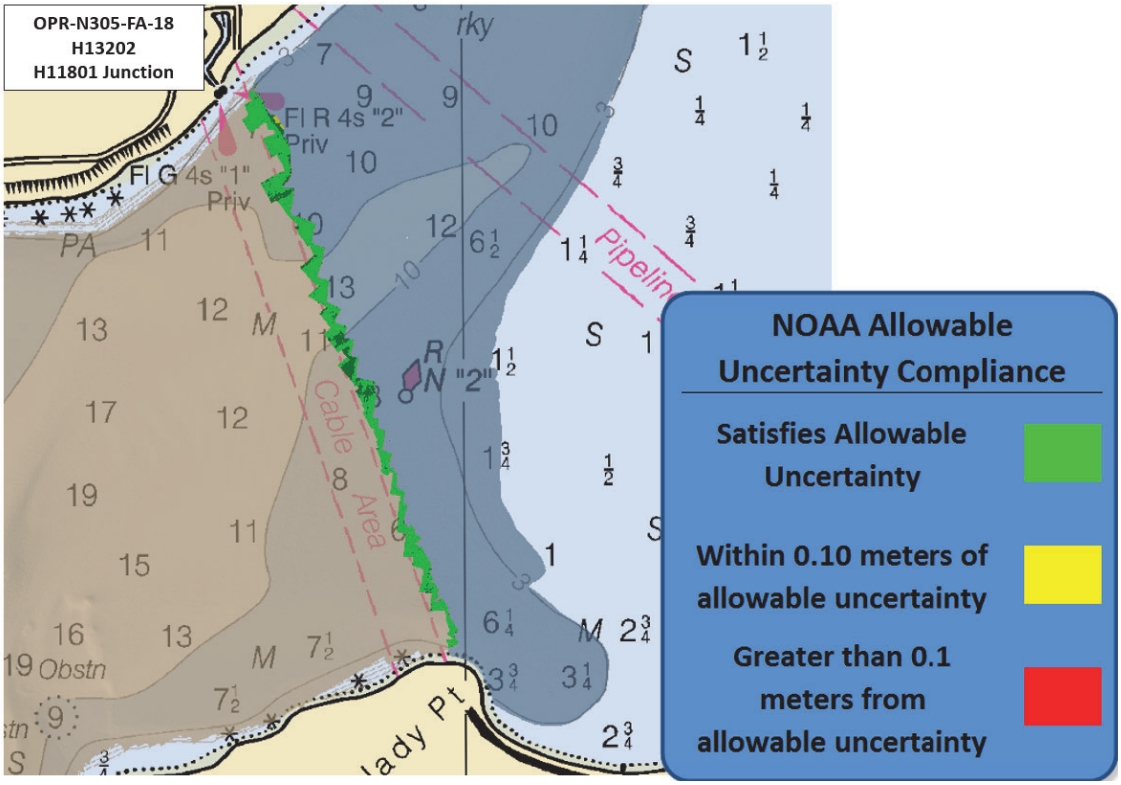


Figure 9: Difference surface between H13202 (blue) and junctioning survey H11801 (brown)

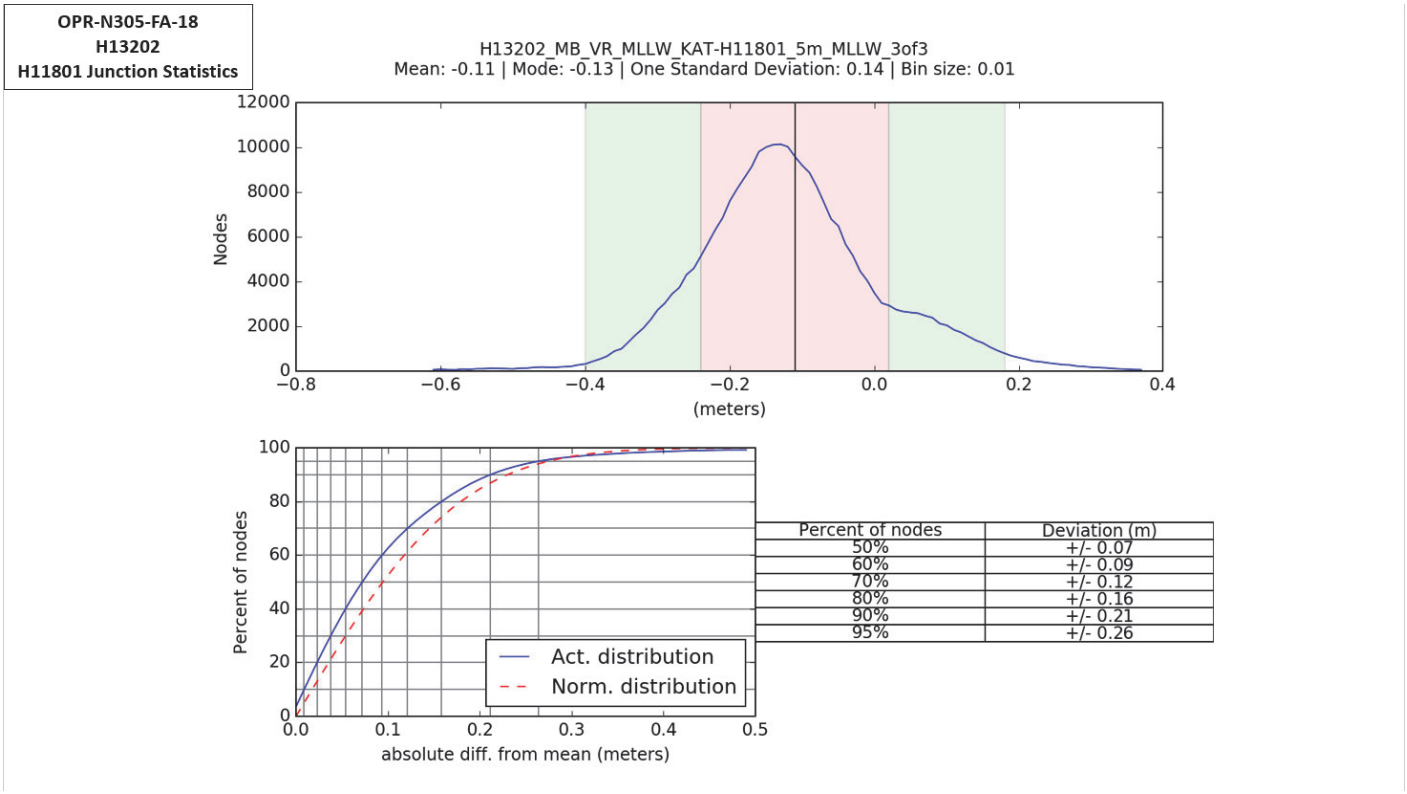


Figure 10: Difference surface statistics between H13202 and H11801

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

Sound Speed Issues

Evidence of minor sound speed issues arose in the southern portion of H13202. These manifested in the form of slight "smiles" within the sonar sounding dataset, however the magnitude of the error was determined to be well within the allowable TVU (Figure 11).

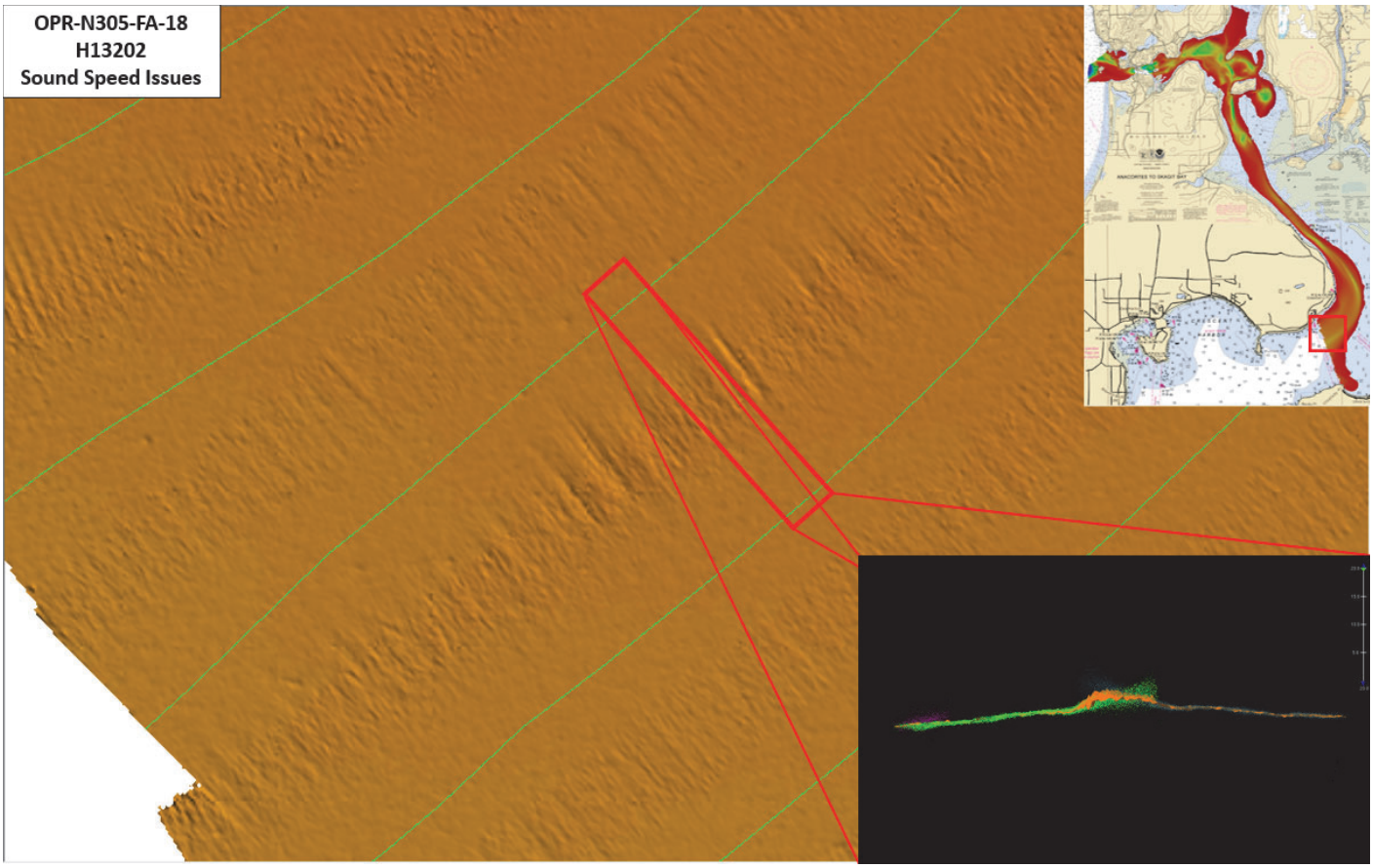


Figure 11: Slight sound speed artifacts. The surface is vertically exaggerated 5 times and the subset has been exaggerated 20 times.

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. 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

H13202 data were reviewed in CARIS HIPS and SIPS for holidays in accordance with Section 5.2.2.3 of the HSSD. Nine apparent holidays which meet 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. Four of the flagged holidays are due to bathymetry surrounding land areas. An explanation of the remaining five gaps in coverage are discussed below.

One holiday in the vicinity of Lone Tree Point was due to the presence of a charted fish pen impeding data acquisition and leading to excessive noise in the area (Figure 12). The fish pen has been attributed and included in the Final Feature File for this project. One holiday in Similk Bay is due to improper line spacing while developing the NALL prior to the receipt of the waiver to change the NALL definition from 3.5 meters to 5 meters within the mudflats (Figure 13). Since this holiday was located well beyond the established 5 meter contour in a relatively homogeneous area, it was decided not to acquire data over the gap. The remaining three holidays are due to improper line spacing, and are located in the main channel in the southern and central portions of H13202, shown in Figure 14. Each holiday was investigated by the hydrographer, and it was determined that the presence of any hazards within the data gaps is highly unlikely. Due to time constraints while on project, additional data were not able to be collected over the aforementioned gaps.

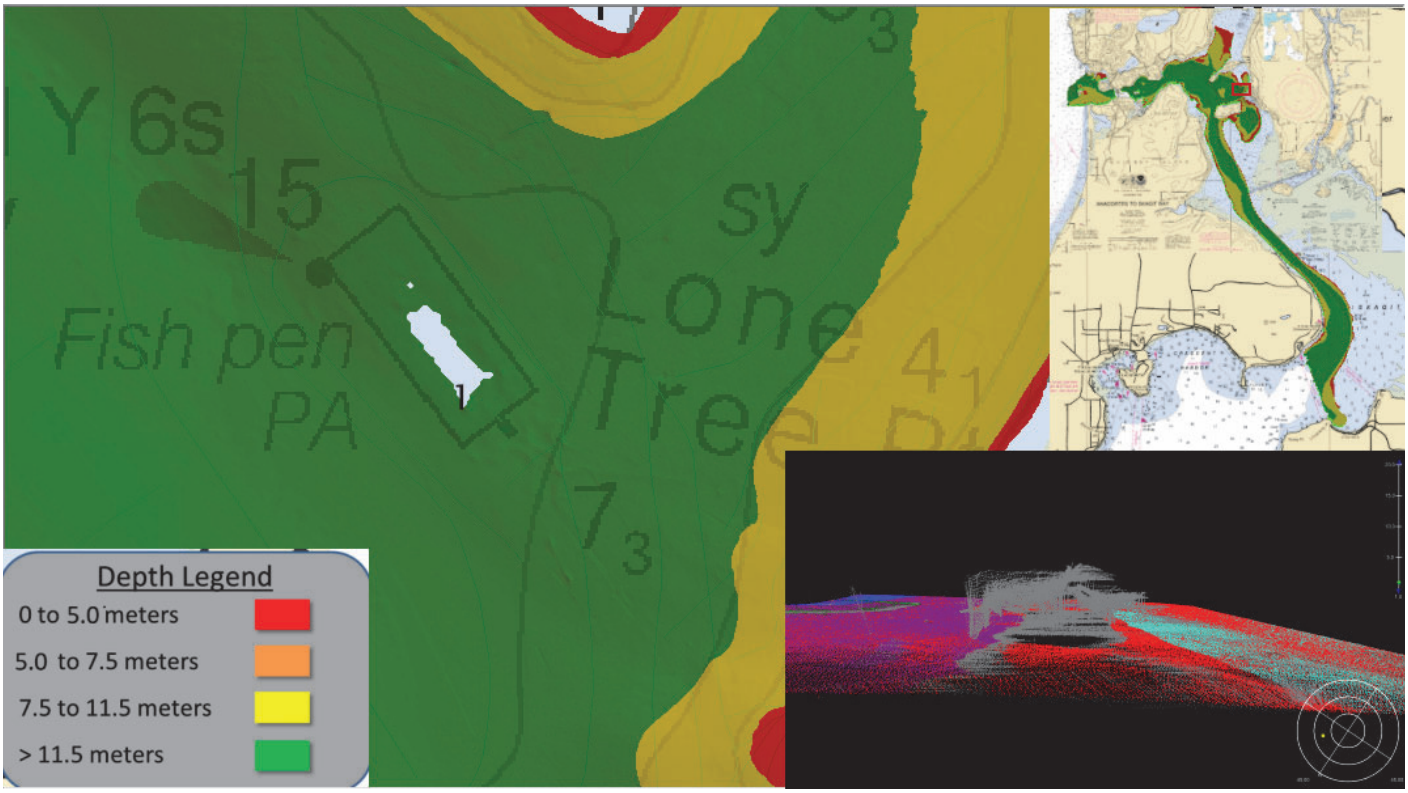


Figure 12: Holiday due to presence of a charted fish pen

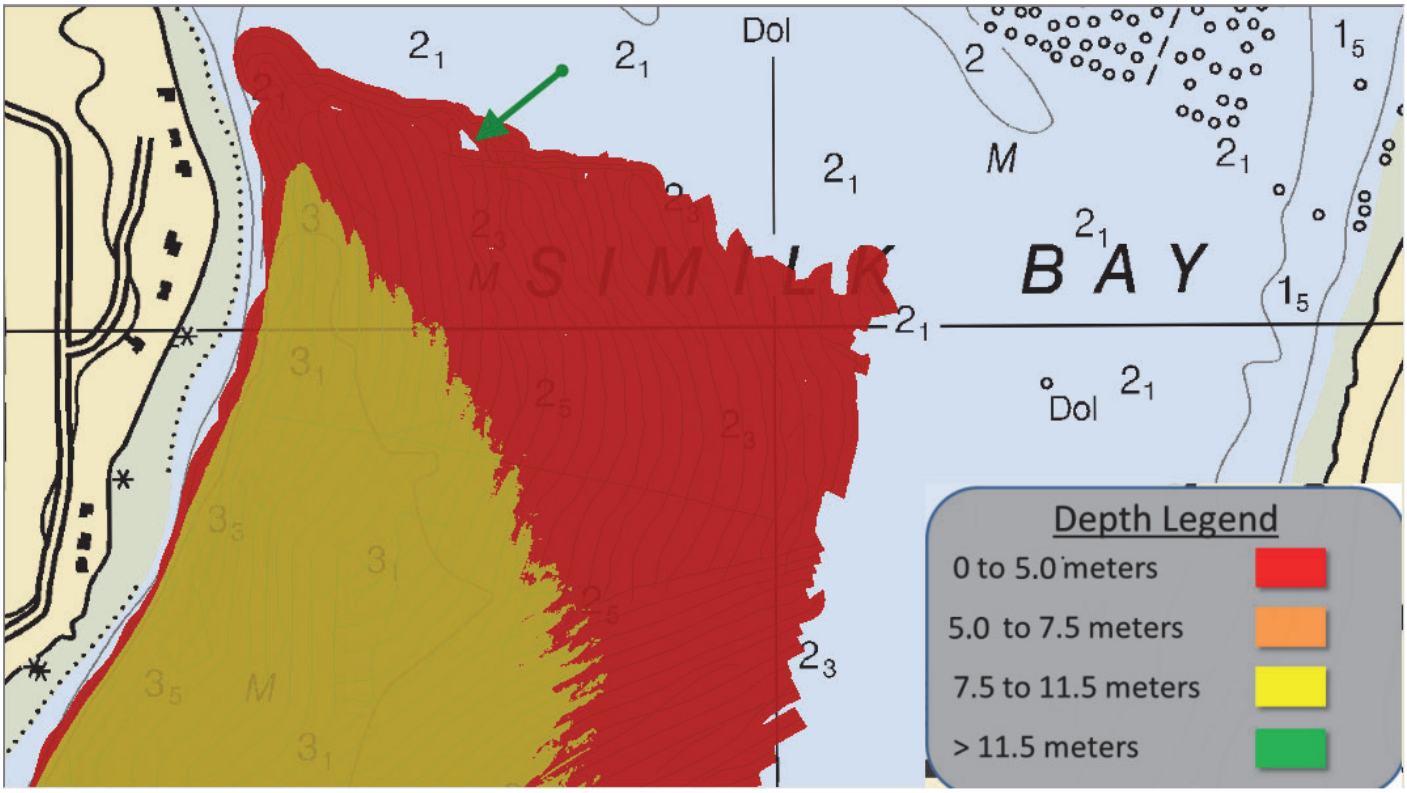


Figure 13: Holiday inside the 5m NALL in Similk Bay

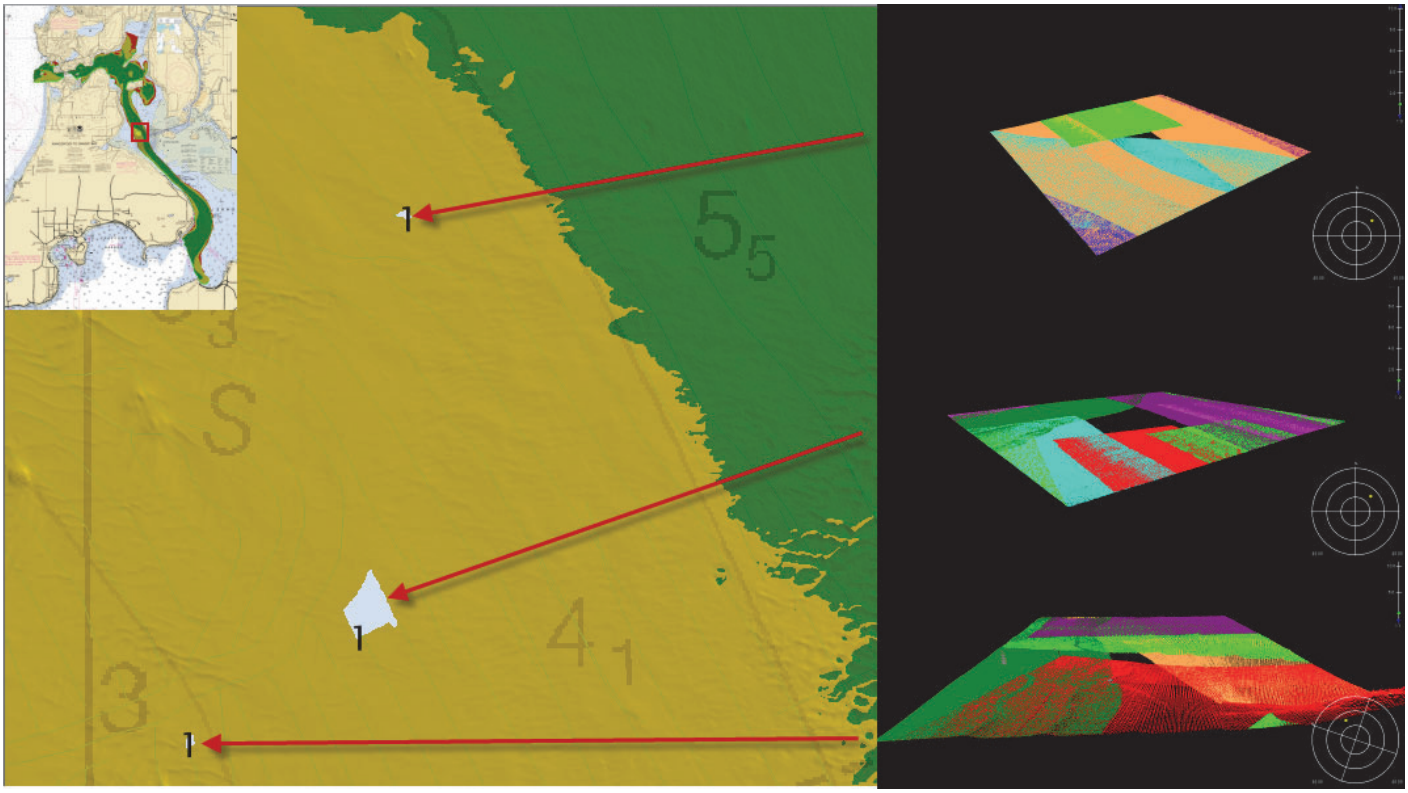


Figure 14: Holidays (denoted by red arrows) inside the main channel

B.2.10 NOAA Allowable Uncertainty

The surface was analyzed using the HydrOffice QC Tools Grid QA feature to determine compliance with specifications. Overall, 99.99% of nodes within the surface meet NOAA Allowable Uncertainty specifications for H13202. For a graphical representation of compliance with uncertainty standards, see Figure 15 below.

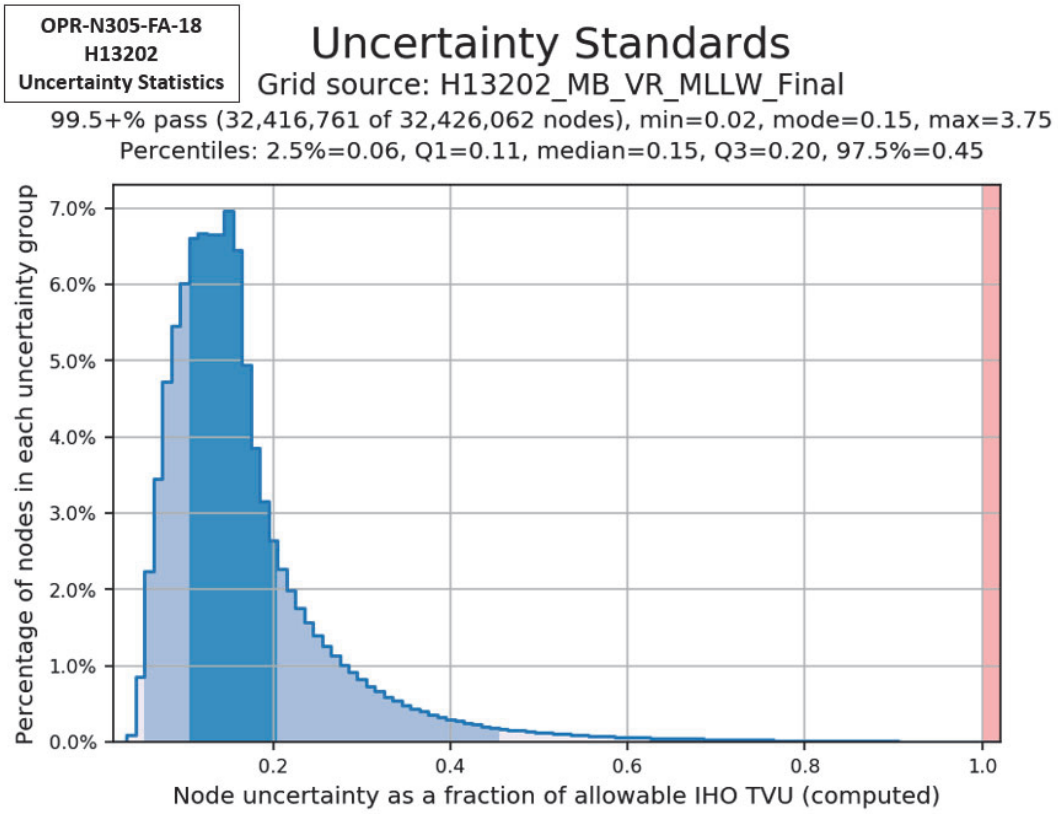


Figure 15: H13202 compliance with uncertainty requirements.

B.2.11 Density

The surface was analyzed using the HydrOffice QC Tools Grid QA feature. Density requirements for H13202 were achieved with at least 99.93% of surface nodes containing five or more soundings as required by HSSD Section 5.2.2.3. For a graphical representation of compliance with density standards, see Figure 16 below.

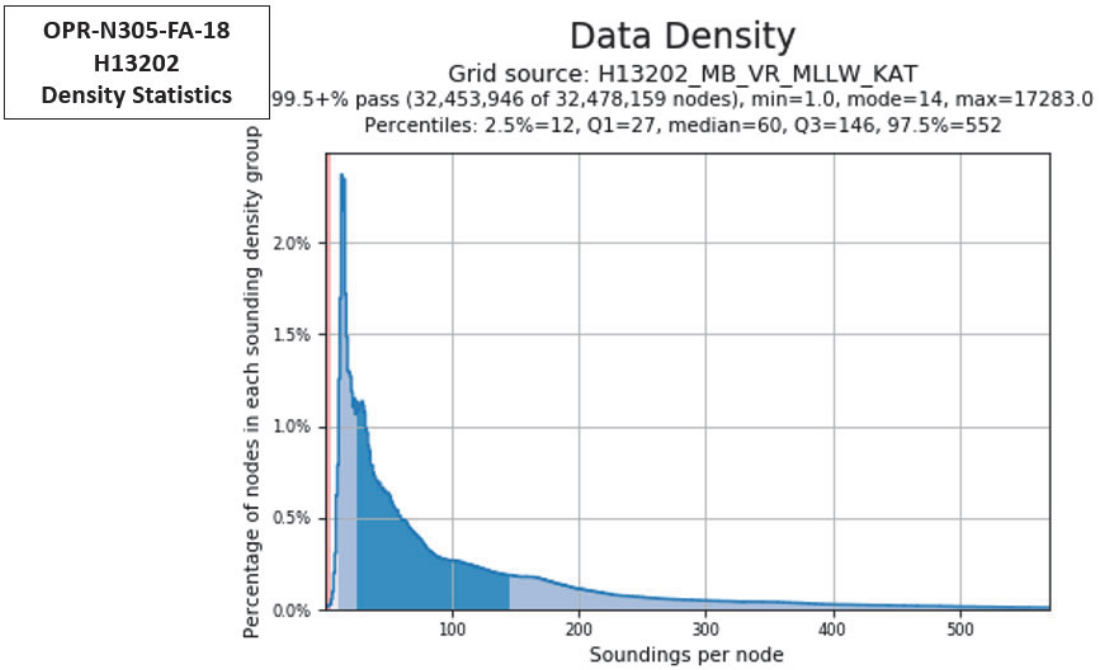


Figure 16: H13202 compliance with density requirements.

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 Kongsberg systems. All backscatter were processed to GSF files and a floating point mosaic was created 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. This allowed for data of the same frequency to be mosaicked together across each platform. See Figure 17 for a table of the calibration values entered into the Processing Settings within FMGT. See Figure 18 for a greyscale representation of the complete mosaic.

OPR-N305-FA-18 H13202 Backscatter Calibration Values	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 17: Calibration values for backscatter calculation.

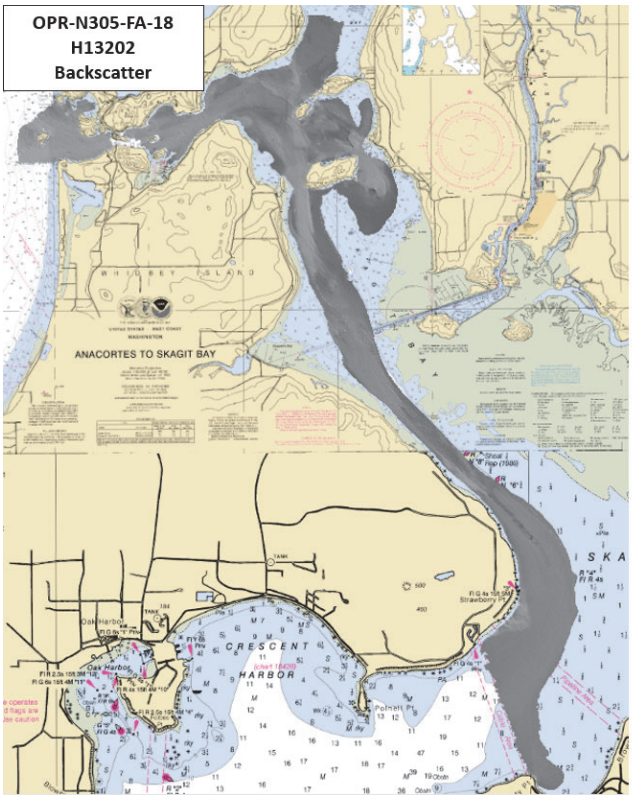


Figure 18: Overview of H13202 backscatter mosaic

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 and 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
H13202_MB_VR_MLLW_Final	CARIS VR Surface (CUBE)	Variable Resolution	0.2 meters - 77.1 meters	NOAA_VR	Complete MBES
H13202_MB_VR_MLLW	CARIS VR Surface (CUBE)	Variable Resolution	0.2 meters - 77.1 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 H13202. 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, 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 steep slopes and dynamic nature of the seafloor.

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 H13202.

C.1 Vertical Control

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

ERS Methods Used:

ERS via VDATUM

Ellipsoid to Chart Datum Separation File:

VDatumShape_xyNAD83-MLLW_geoid12b.csar

ERS methods via a VDATUM separation model were used as the final means of reducing H13202 data to MLLW for submission. The final TCARI grid was used to reduce all features to MLLW.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum 1983.

The projection used for this project is UTM Zone 10 North.

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.

For further details regarding the processing and quality control checks performed, see the H13202 POSPAC Processing Logs spreadsheet located in the Separates folder.

Differential correctors from the US Coast Guard beacon at Whidbey Island (302kHz) were used in real-time for acquisition when not otherwise noted in the acquisition logs, and were the sole method of positioning bottom samples.

The following DGPS Stations were used for horizontal control:

DGPS Stations
Whidbey Island (302kHz)

Table 13: USCG DGPS Stations

D. Results and Recommendations

D.1 Chart Comparison

A comparison was performed between survey H13202 and ENCs US4WA11M and US5WA31M using CARIS HIPS and SIPS sounding and contour layers derived from the 4 meter combined surface. The contours and soundings were overlaid on the charts to assess differences between the surveyed soundings and charted depths. All data from H13202 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?
US5WA31M	1:25000	22	03/28/2018	03/28/2018	NO
US4WA11M	1:80000	37	08/08/2018	08/08/2018	NO

Table 14: Largest Scale ENCs

US5WA31M

Soundings from H13202 are in a general agreement with charted depths on ENC US5WA31M, with most depths agreeing to 1 fathom as shown in Figure 19. The largest differences are seen in the deepest portion of the marked ship channel, where differences range to 7 fathoms as seen in Figure 20.

To more accurately visualize trends within these differences, a 4 meter TIN surface was interpolated from the ENC sounding layer. This surface was then differenced with a corresponding 4 meter surface from H13202 and visualized in Figure 21. In this difference surface red colors indicate H13202 was shoaler than

ENC US5WA31M, green colors indicate agreement, and blue colors indicate H13202 was deeper than ENC US5WA31M. For a statistical analysis of the difference surface, see Figure 22. For the majority of the survey area there is agreement between H13202 and ENC US5WA31M. At the edges of the marked channel there are differences that are to be expected from erosion of the muddy seabed.

Contours from H13202 are in a general agreement with charted contours on ENC US5WA31M as shown in Figure 23. The largest differences are seen in the marked channel, where surveyed and charted contours differ by over 7 fathoms as seen in Figure 24.

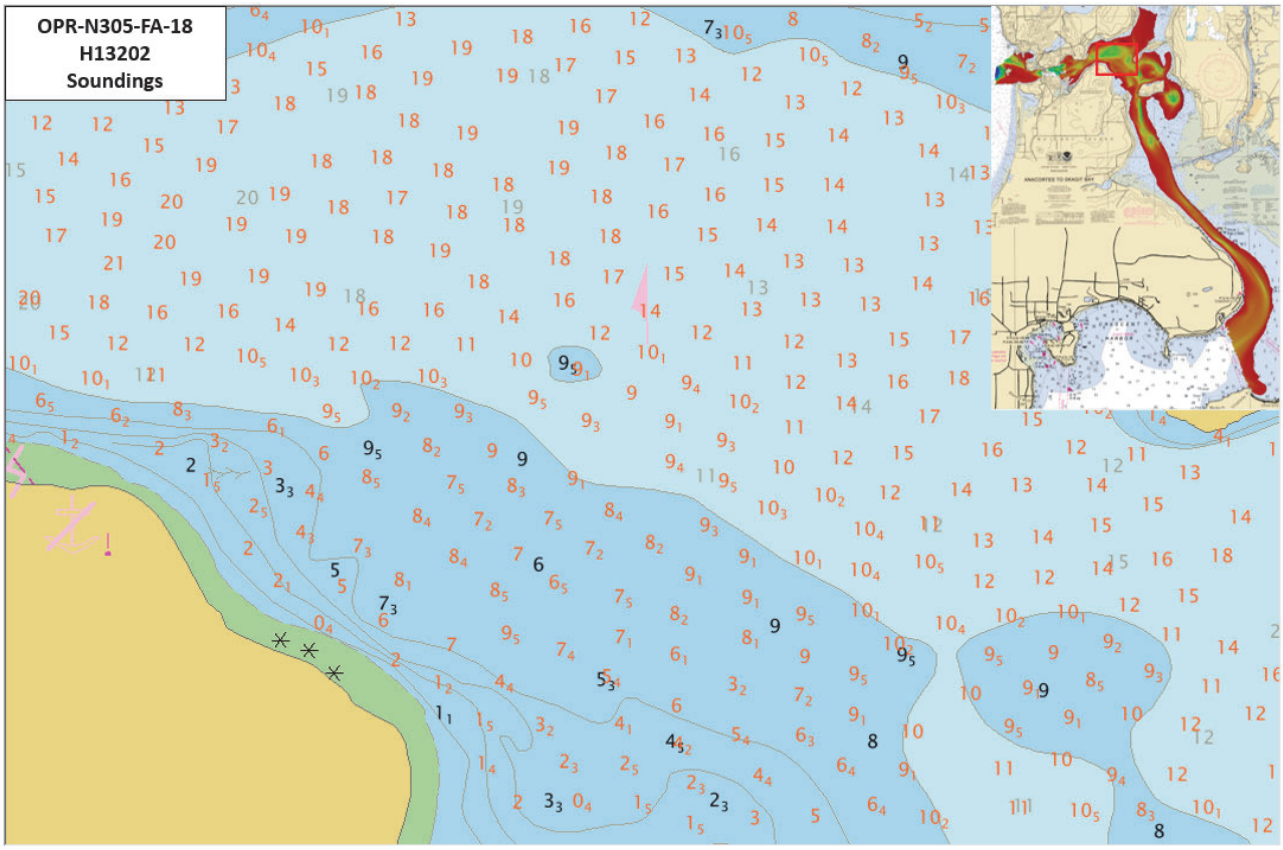


Figure 19: Comparison of charted depths from ENC US5WA31M (in gray) and soundings from H13202 (in orange)

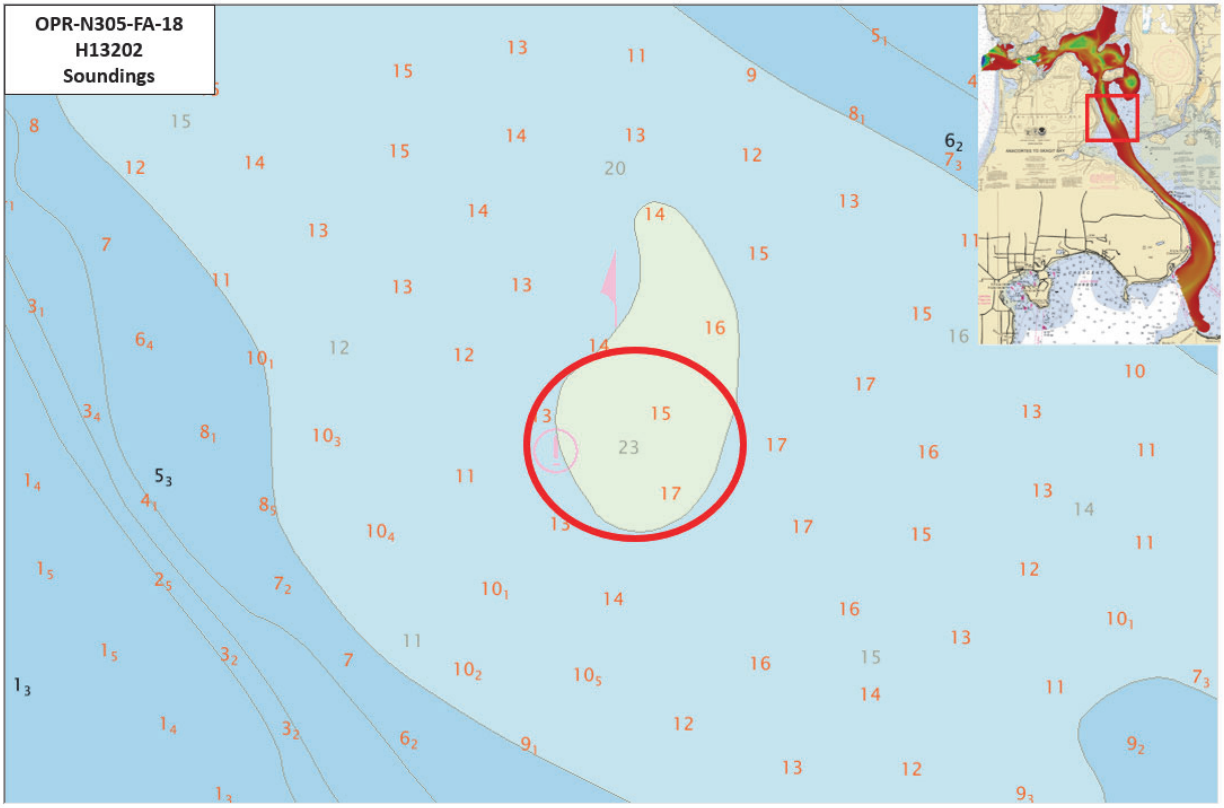


Figure 20: Close up of marked channel where a significant difference exists (circled in red) between the charted depths from ENC US5WA31M (in gray) and soundings from H13202 (in orange)

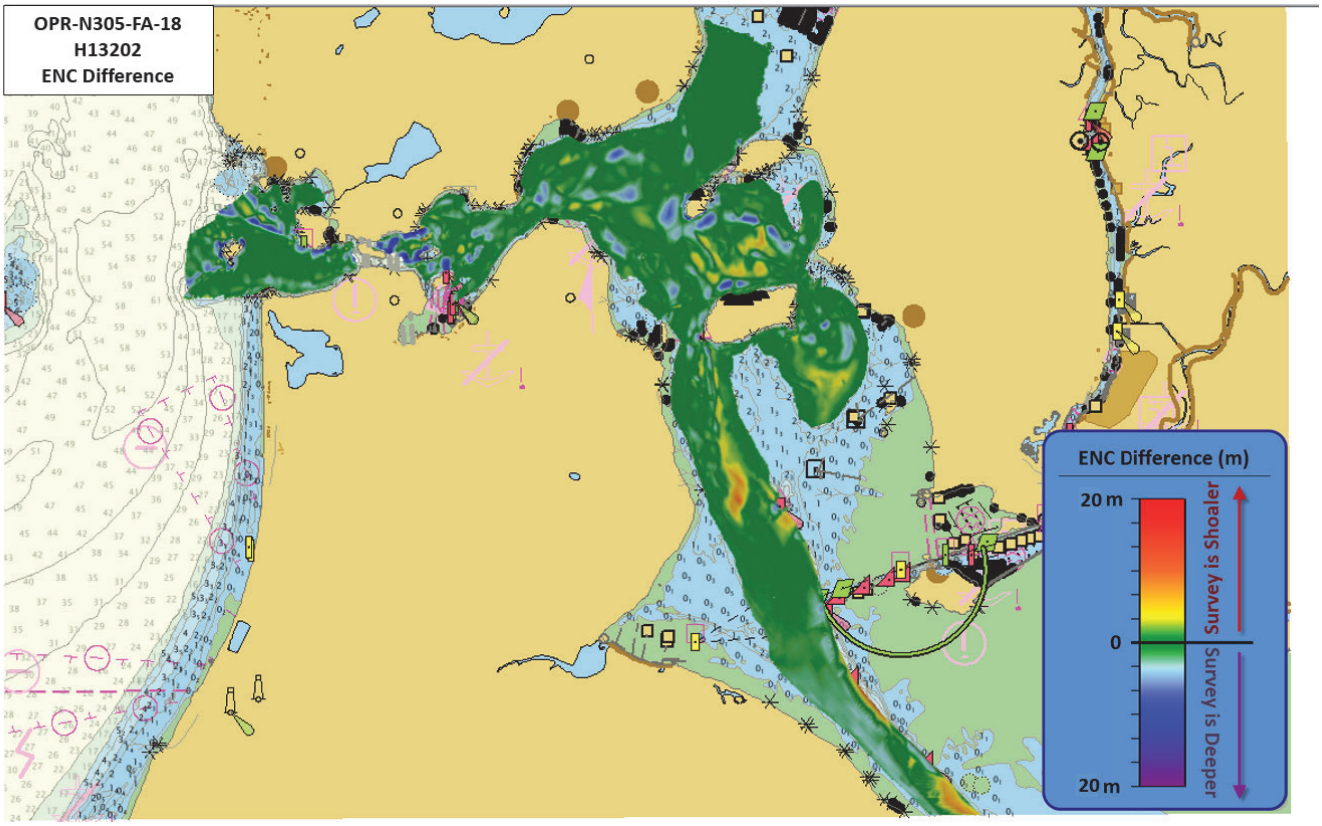
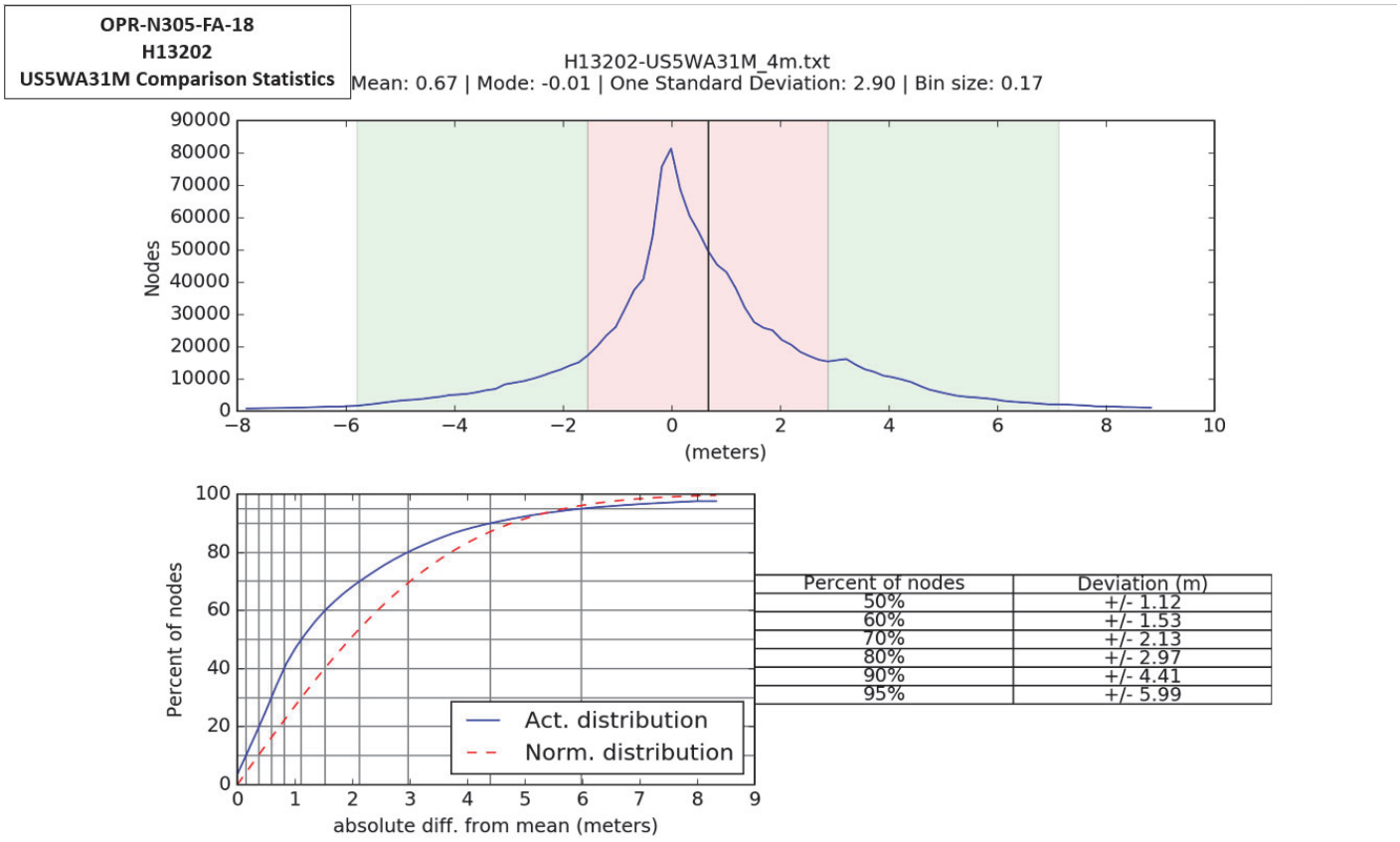


Figure 21: Difference surface between H13202 and interpolated TIN surface from U5WA31M.



Percent of nodes	Deviation (m)
50%	+/- 1.12
60%	+/- 1.53
70%	+/- 2.13
80%	+/- 2.97
90%	+/- 4.41
95%	+/- 5.99

Figure 22: Difference surface statistics between H13202 and interpolated TIN surface from US3WA31M.

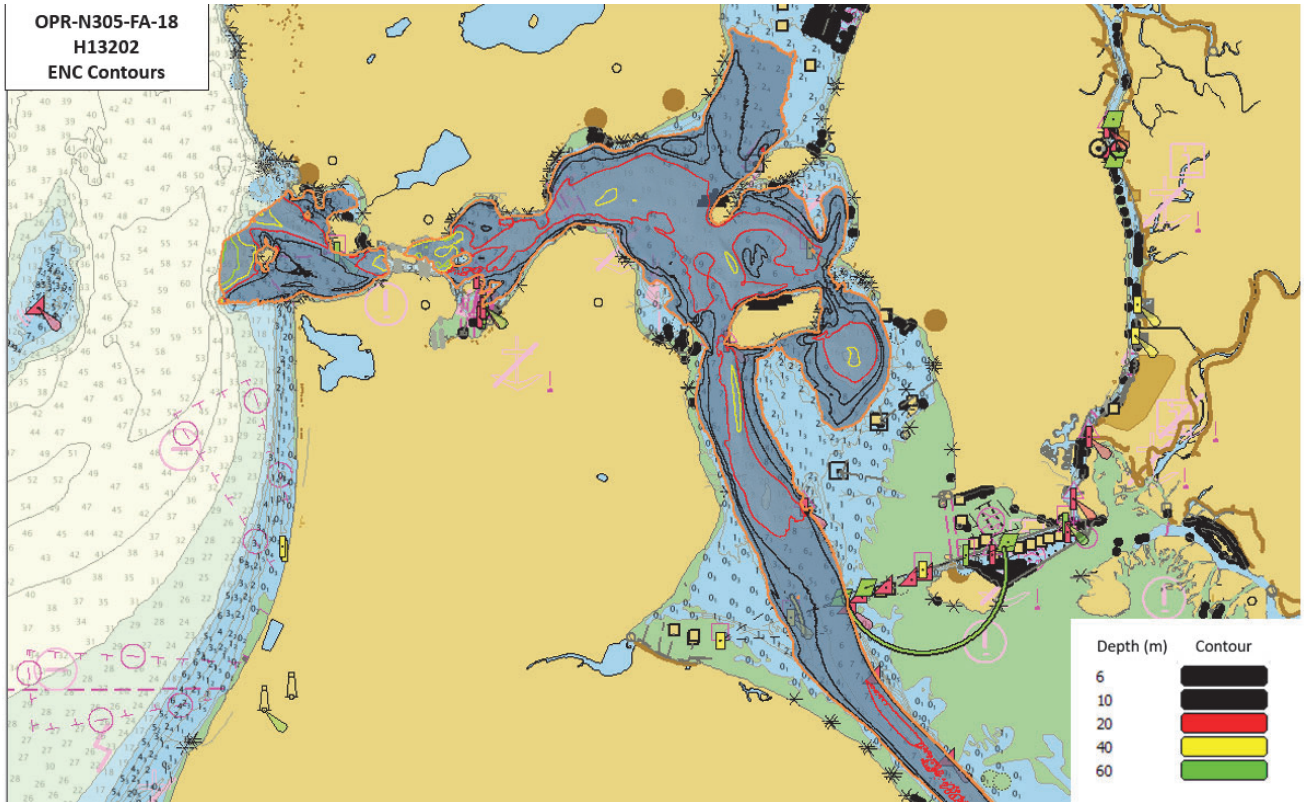


Figure 23: Overview of H13202 contours overlaid onto ENC US5WA31M.

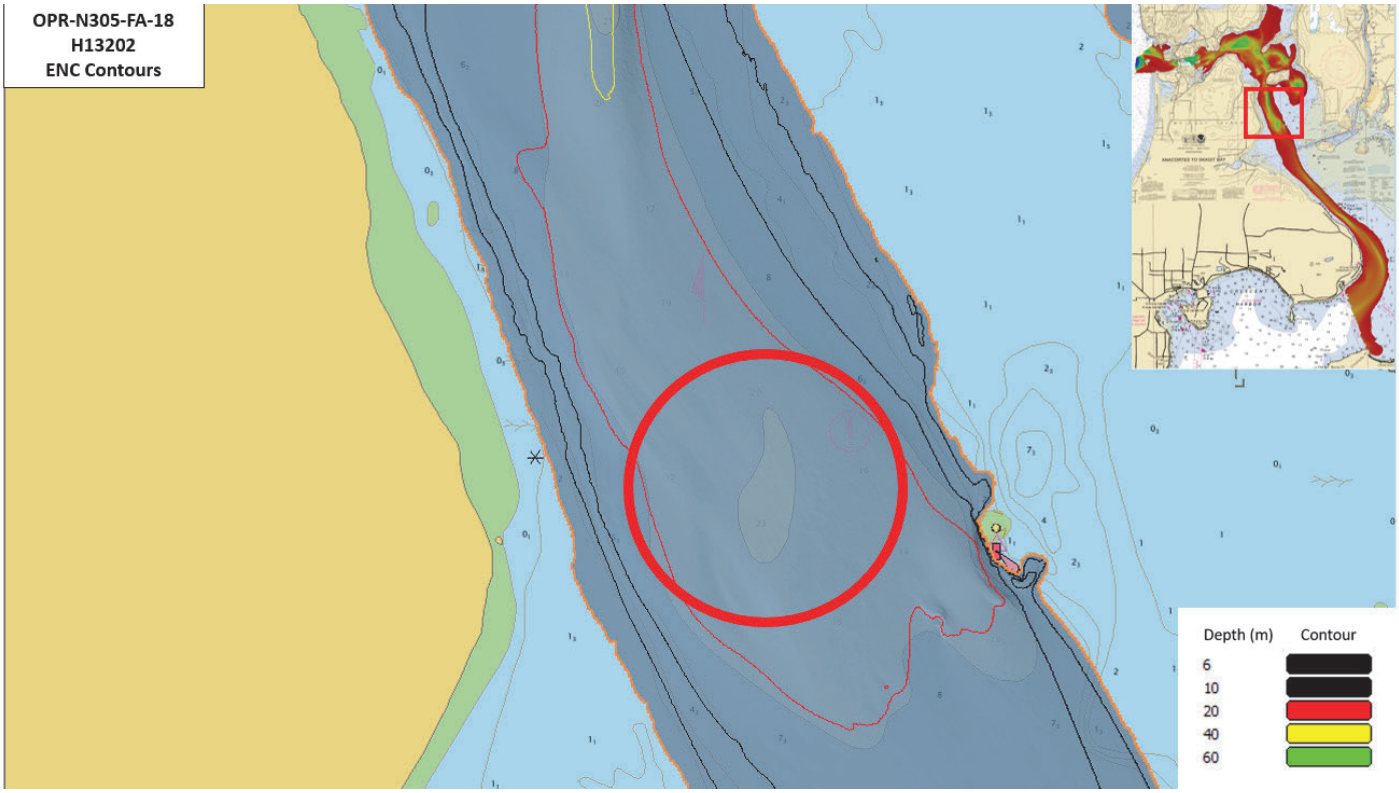


Figure 24: Close up of marked channel where a significant difference exists between H13202 contours and ENC US5WA31M.

US4WA11M

Soundings from H13202 are in a general agreement with charted depths on ENC US4WA11M, with most depths agreeing to 1 fathom as shown in Figure 25.

To more accurately visualize trends within these differences, a 4 meter TIN surface was interpolated from the ENC sounding layer. This surface was then differenced with a corresponding 4 meter surface from H13202 and visualized in Figure 26. In this difference surface red colors indicate H13202 was shoaler than ENC US4WA11M, green colors indicate agreement, and blue colors indicate H13202 was deeper than ENC US4WA11M. For the majority of the survey area there is agreement between H13202 and ENC US4WA11M (Figure 27). At the edges of the marked channel there are differences that are to be expected from erosion of the muddy seabed.

Contours from H13202 are in a general agreement with charted contours on ENC US4WA11M as shown in Figure 28.

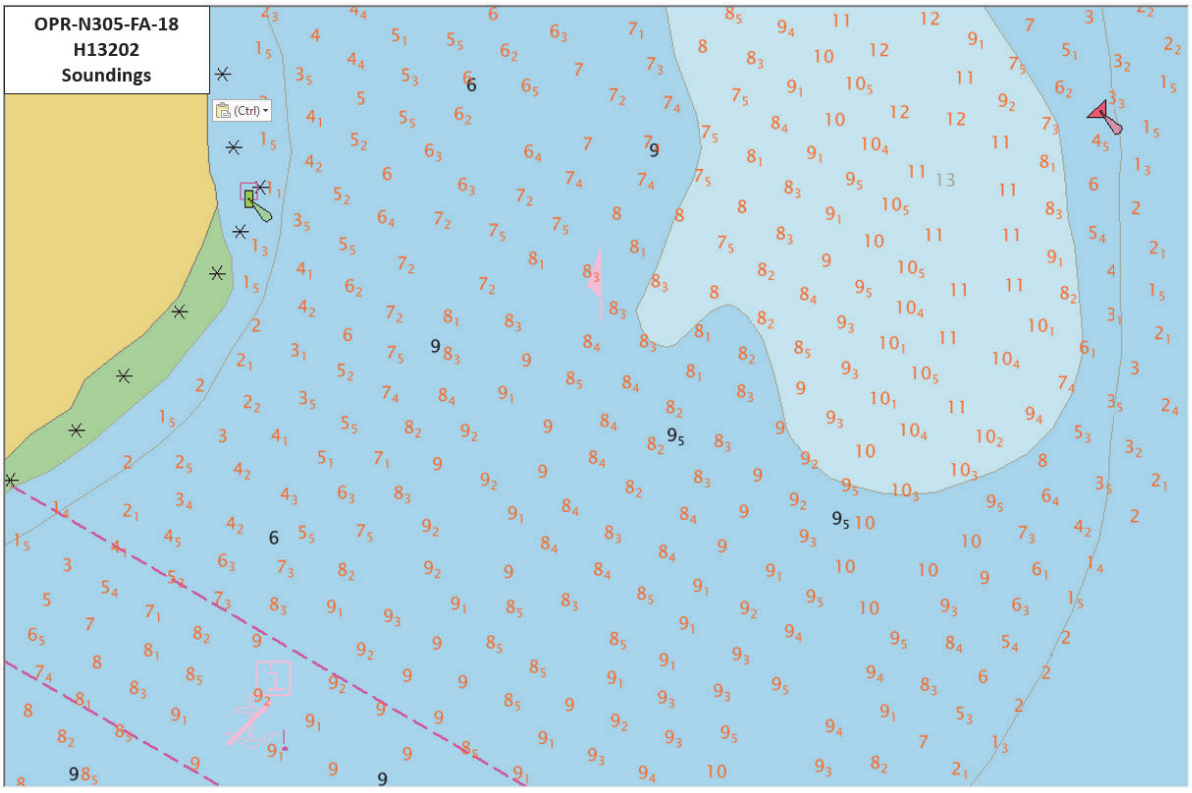


Figure 25: Comparison of charted depths from ENC US4WA11M and soundings from H13202 (in orange)

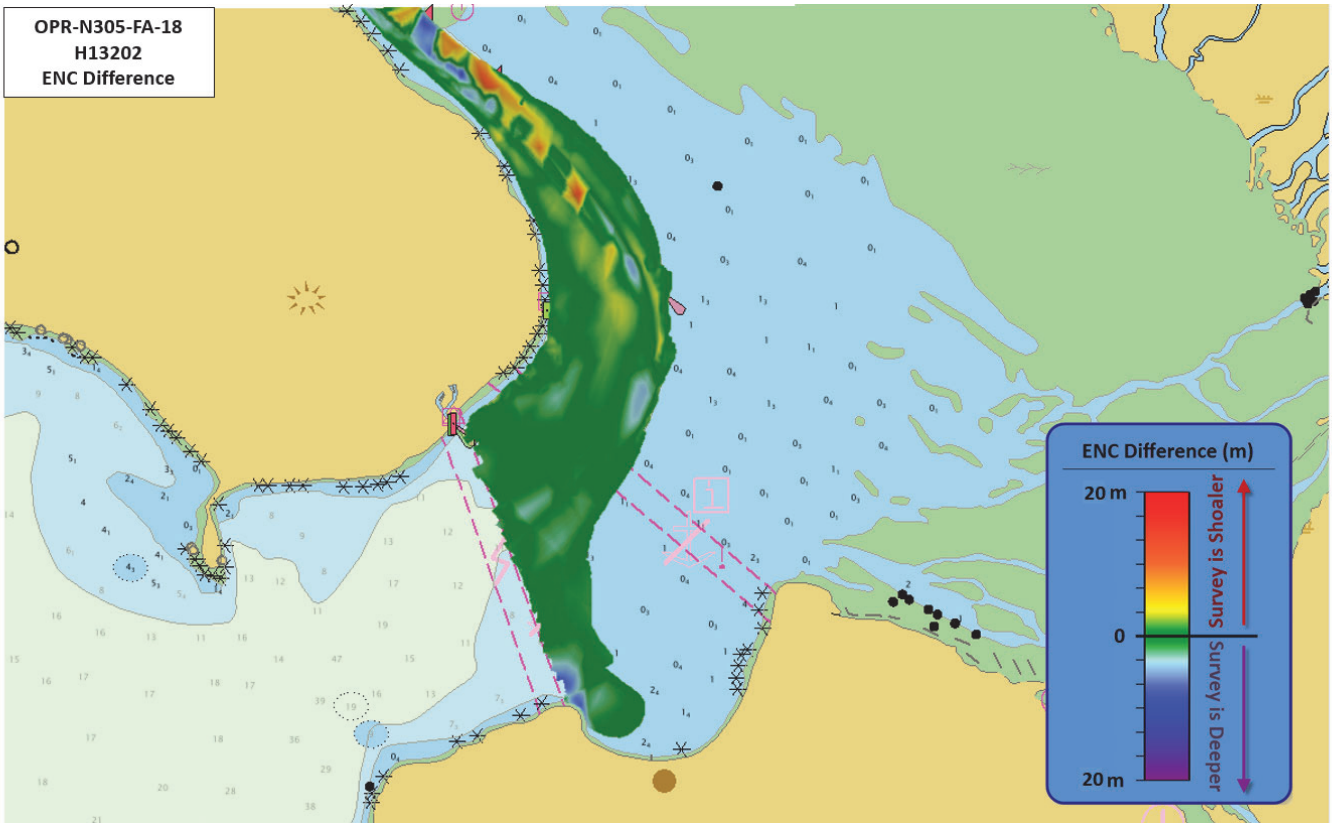
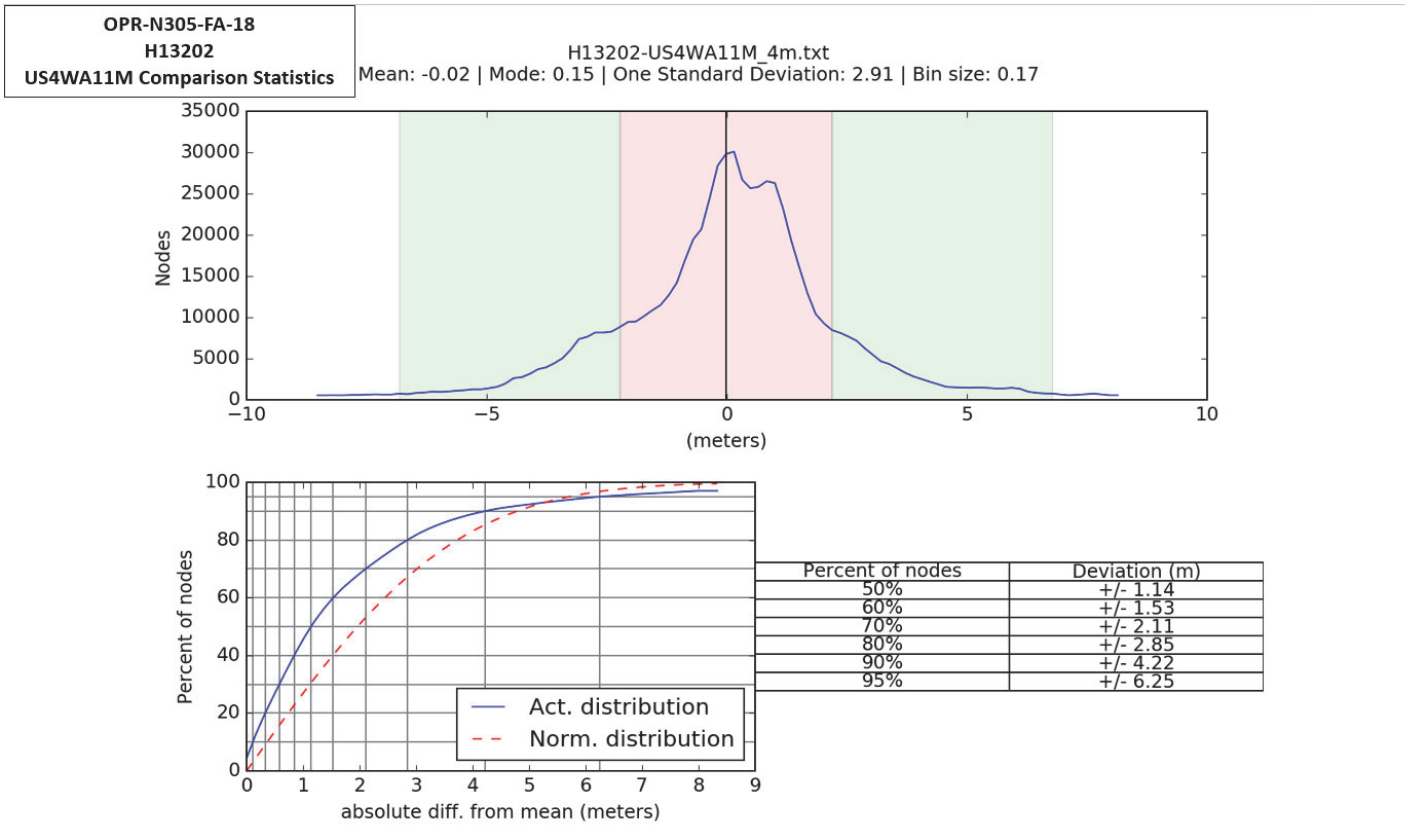


Figure 26: Difference surface between H13202 and interpolated TIN surface from U4WA11M



Percent of nodes	Deviation (m)
50%	+/- 1.14
60%	+/- 1.53
70%	+/- 2.11
80%	+/- 2.85
90%	+/- 4.22
95%	+/- 6.25

Figure 27: Difference surface statistics between H13202 and interpolated TIN surface from US3WA11M

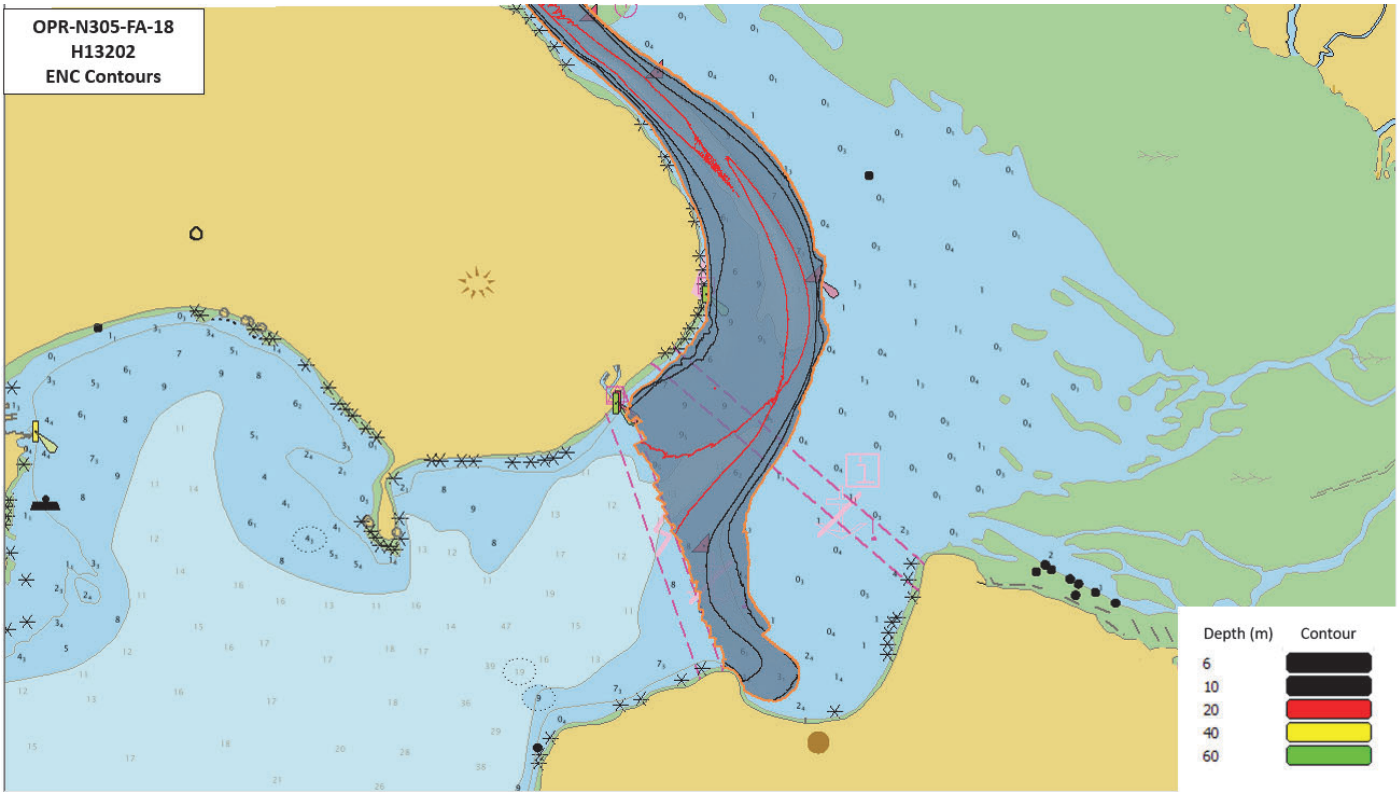


Figure 28: Overview of H13202 contours overlaid onto ENC US4WA11M

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

One Reported Shoal exists within the survey area, but was not investigated due to being inshore of the NALL (Figure 29). One Position Approximate fish pen was observed to be its charted position, as discussed in B.2.9 (Figure 12).

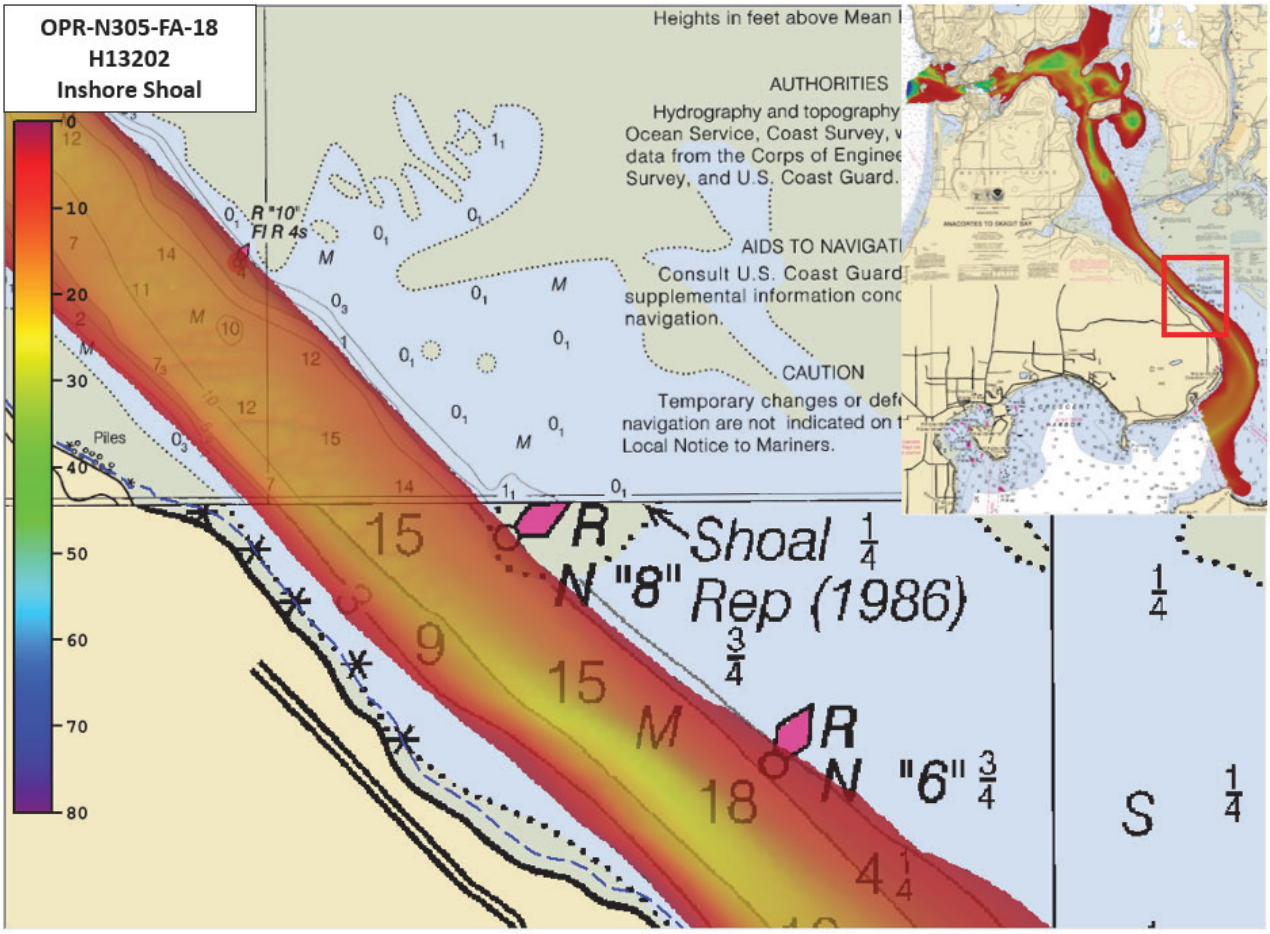


Figure 29: Charted shoal inshore of NALL

D.1.4 Uncharted Features

Survey H13202 has 15 new features that are addressed in the H13202 Final Feature File. Of these features, there are 7 new Seabed Areas (from bottom samples), 1 new wreck, 4 new kelp features, 1 new islet with a corresponding LNDELV, and 1 new LNDELV for a previously charted islet.

D.1.5 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.6 Channels

A charted and maintained channel exists within the survey limits, but was not investigated due to being inshore of the NALL (Figure 30).

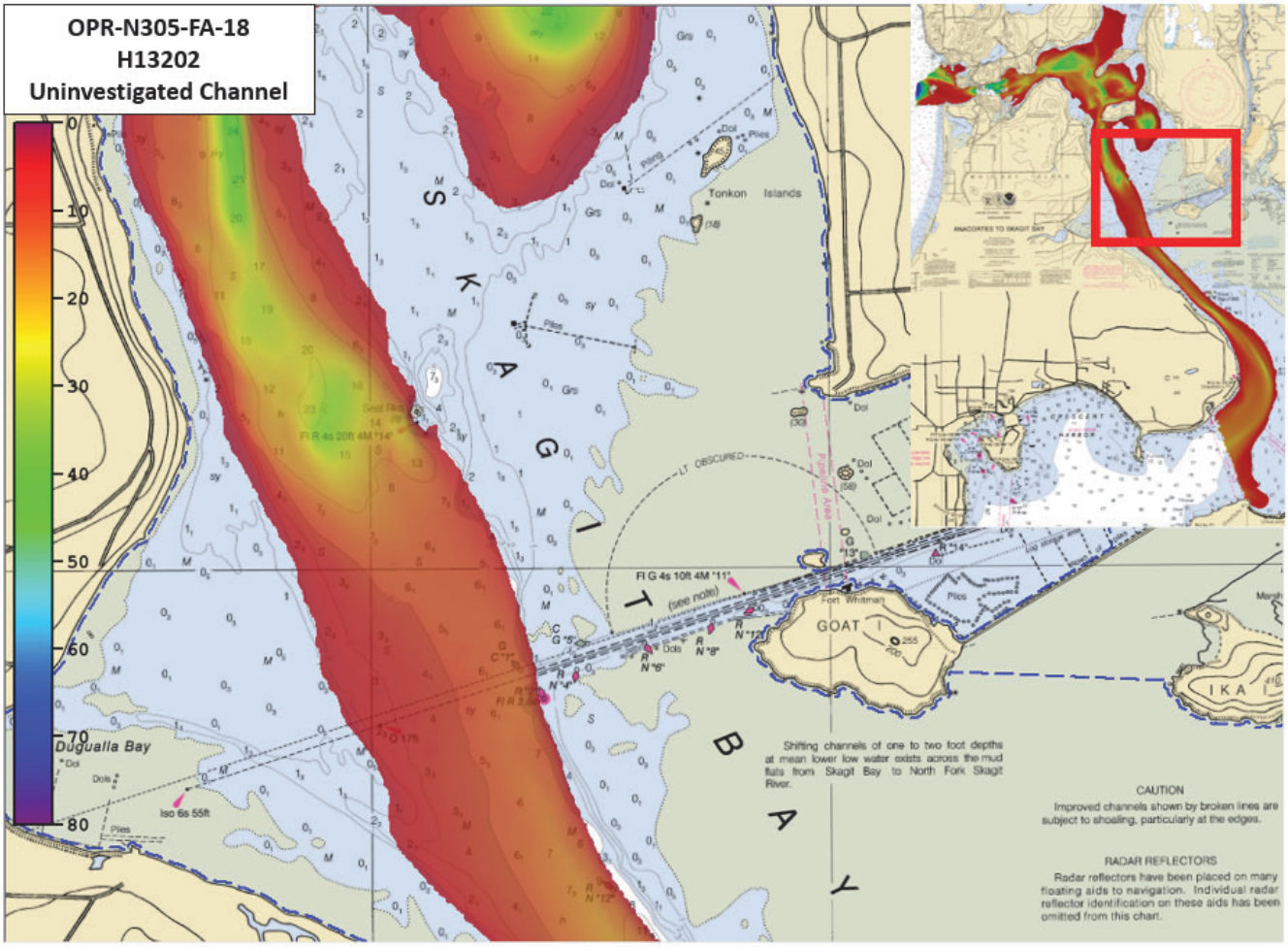


Figure 30: Channel inside the survey limits of H13202, inshore of NALL

D.1.7 Bottom Samples

7 bottom samples were acquired in accordance with the Project Instructions for survey H13202. All bottom samples were entered in the H13202 Final Feature File. See Figure 31 for a graphical overview of sample locations.

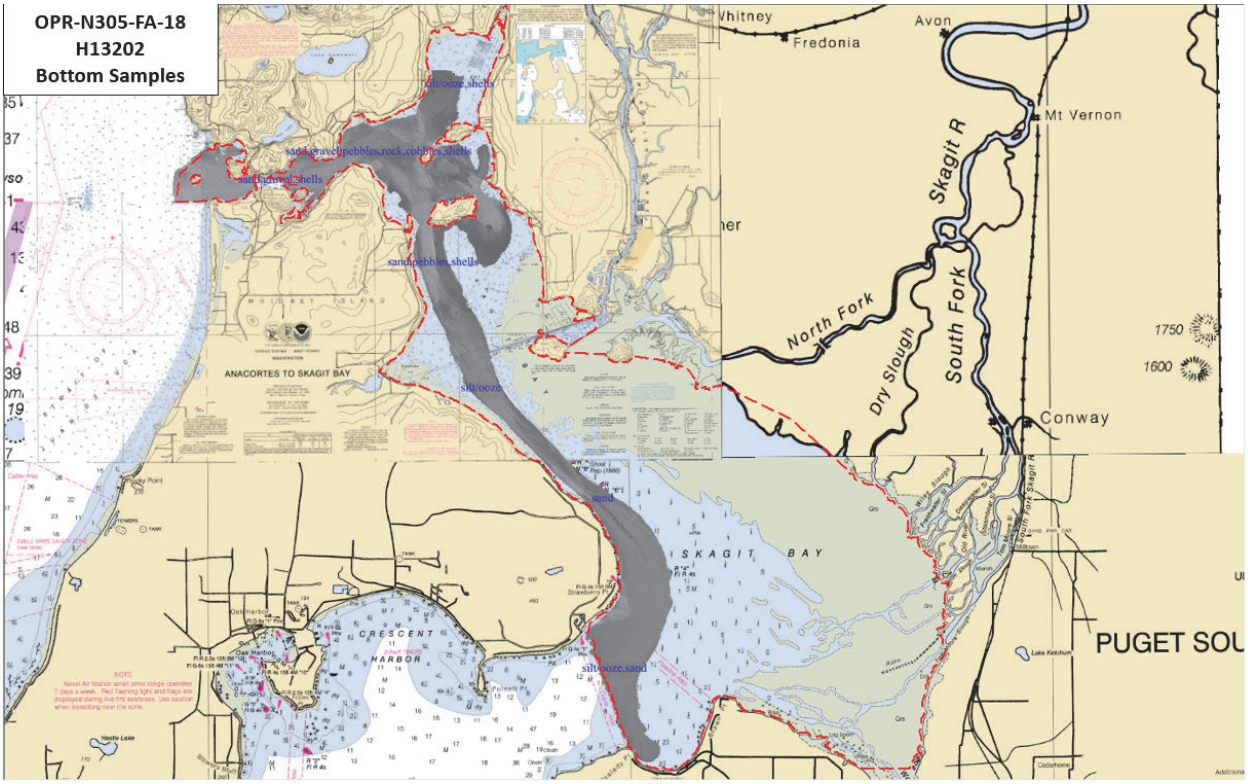


Figure 31: H13202 overview of bottom sample locations

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 on boat sheets during field operations were scanned and included in the Separates I Detached Positions folder. Shoreline verification procedures for H13202 conform to those detailed in the DAPR.

D.2.2 Prior Surveys

No prior survey comparisons exist for this survey.

D.2.3 Aids to Navigation

All aids to navigation in the survey area were confirmed to be on station and serving their intended purpose.

D.2.4 Overhead Features

Overhead power cables exist within the survey limits, but were not assigned for investigation (Figure 32).

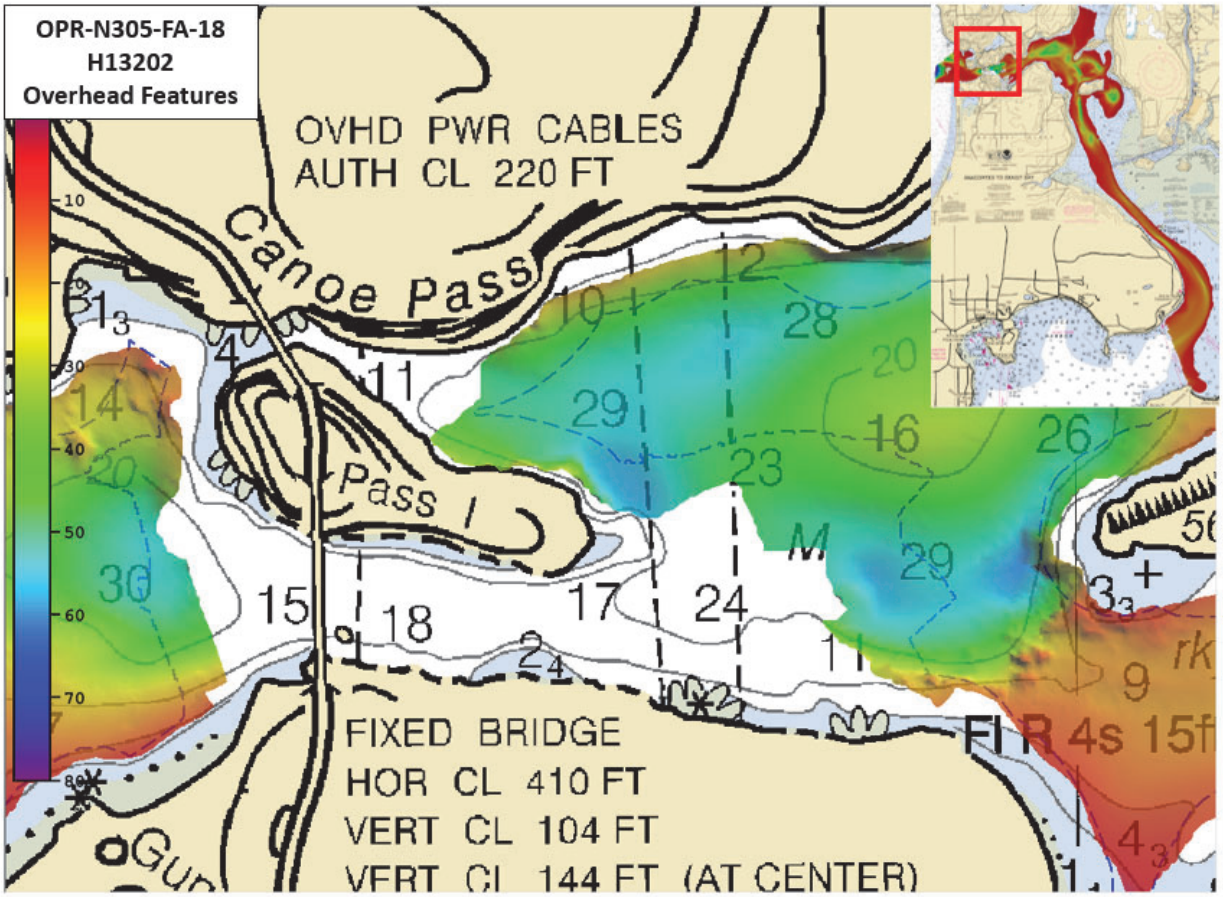


Figure 32: Uninvestigated overhead power cables within H13202 survey limits

D.2.5 Submarine Features

Submarine pipelines exist the survey limits, but were not assigned for investigation (Figure 33).

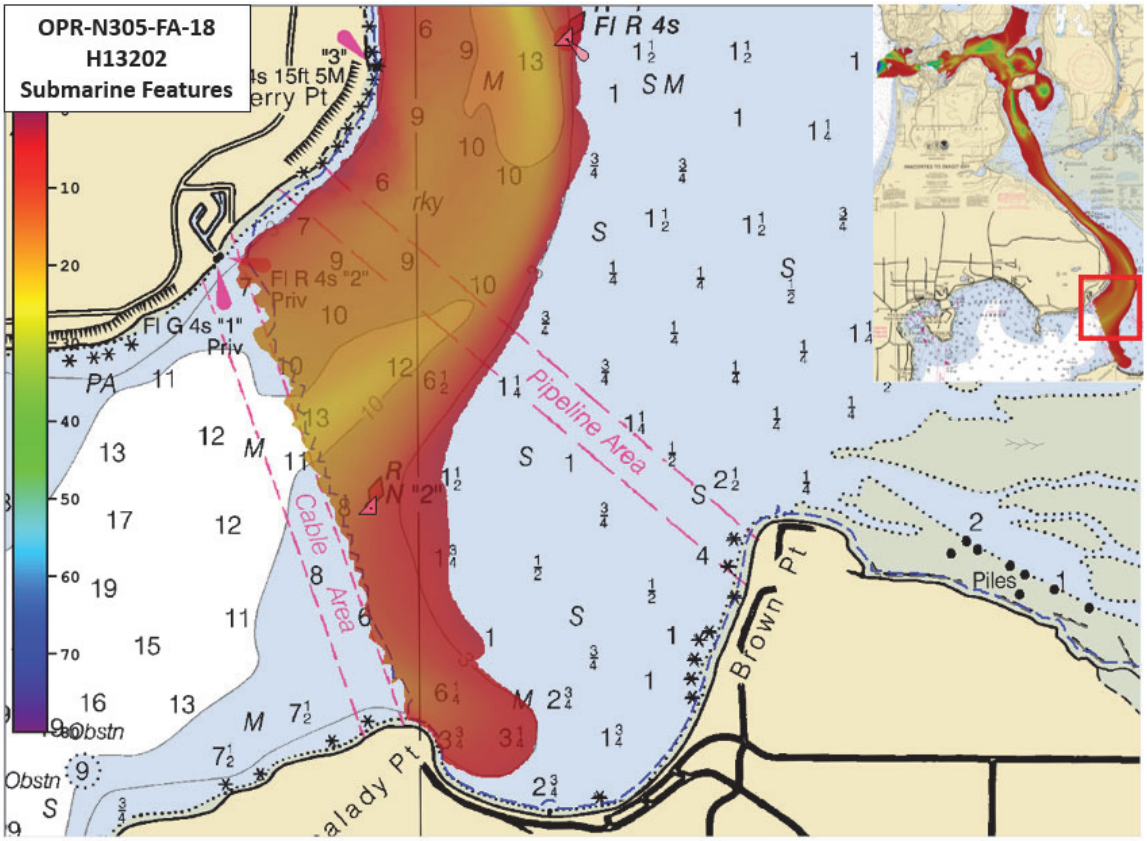


Figure 33: Uninvestigated submarine pipeline within H13202 survey limits

D.2.6 Platforms

Three offshore platforms were assigned for investigation, two fell inside the NALL and were not investigated (Figure 34). The remaining offshore platform was disproved using 100% multibeam sonar coverage (Figure 35).

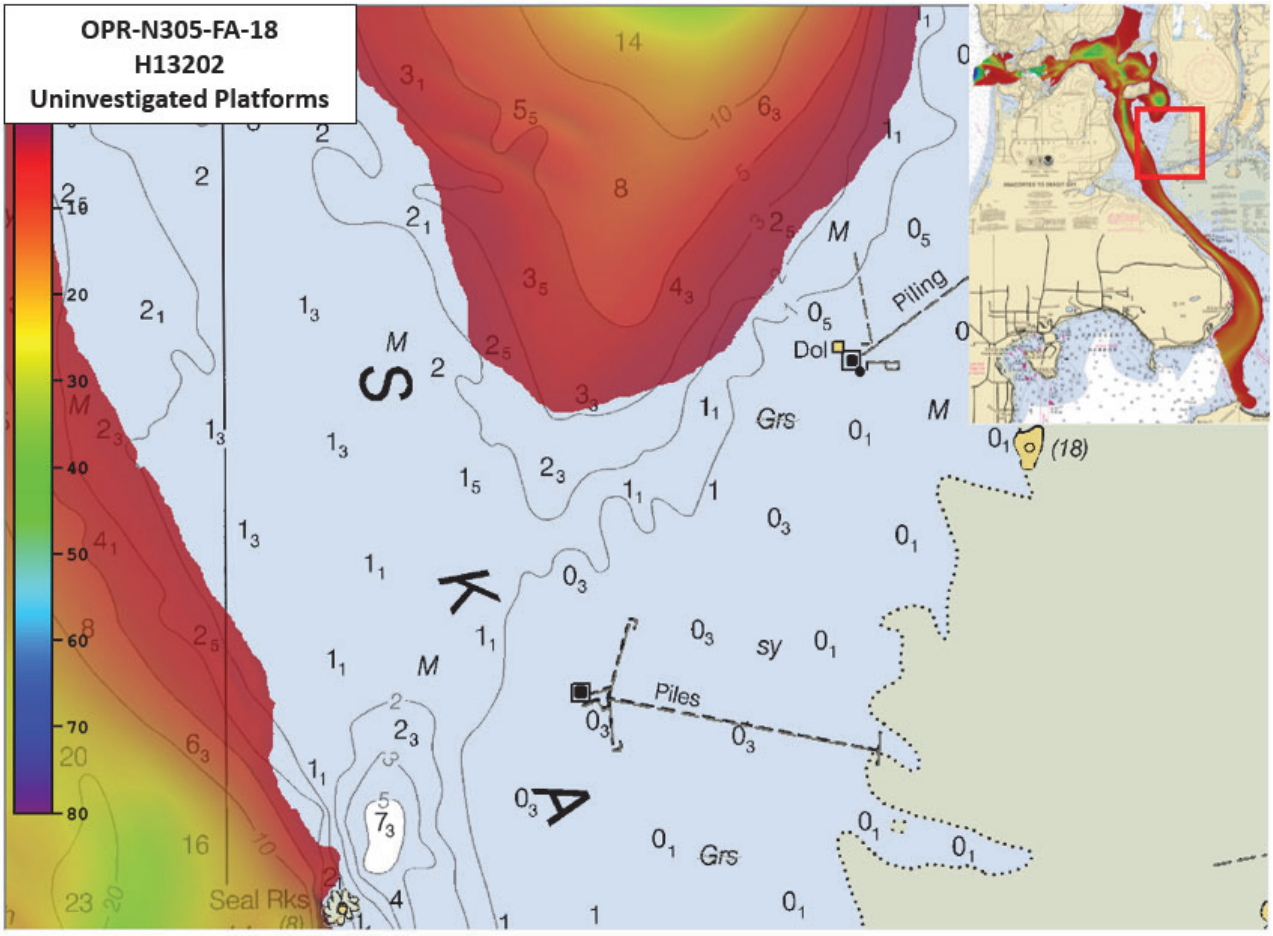


Figure 34: Charted platforms inside the NALL

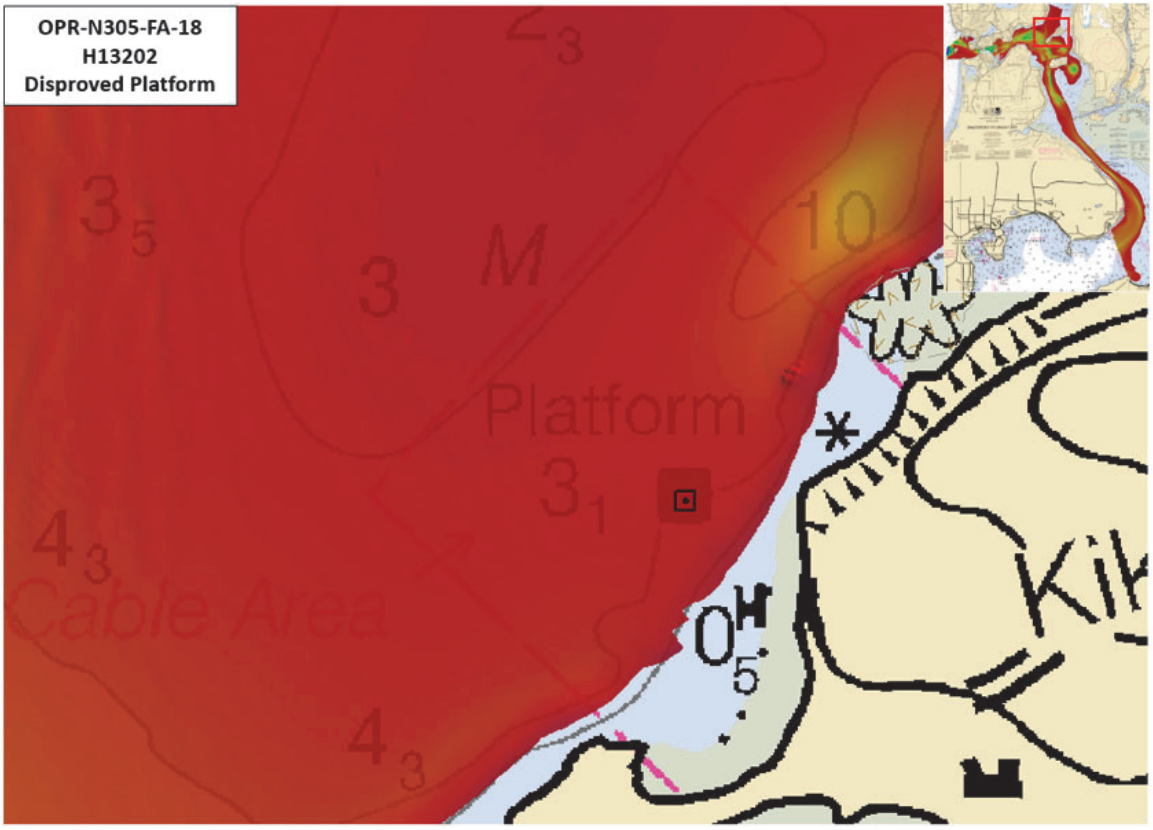


Figure 35: Charted platform covered by 100% MBES coverage

D.2.7 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.8 Abnormal Seafloor and/or Environmental Conditions

No abnormal seafloor and/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 Recommendation

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

D.2.11 Inset Recommendation

No new insets are recommended for this area.

E. Approval Sheet

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

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

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys 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	04/02/2019	MOSER.MARC.STANTON.1163193902 Digitally signed by MOSER.MARC.STANTON.1163193902 Date: 2019.04.02 08:16:39 -07'00'
CHST Sam Candio	Chief Survey Technician	04/02/2019	
ENS Kevin A. Tennyson, NOAA	Sheet Manager	04/02/2019	TENNYSON.KEVIN.ALEXANDER.1539170682 Digitally signed by TENNYSON.KEVIN.ALEXANDER.1539170682 Date: 2019.04.02 07:48:02 -07'00'

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	Continually Operating Reference Staiton
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
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
HSSD	Hydrographic Survey Specifications and Deliverables

Acronym	Definition
HSTP	Hydrographic Systems Technology Programs
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
NAIP	National Agriculture and Imagery Program
NALL	Navigable Area Limit Line
NM	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
PST	Physical Science Technician
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
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
TPE	Total Propagated Error
TPU	Topside Processing Unit
USACE	United States Army Corps of Engineers
USCG	United Stated Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDA	Global Positiong System timing message
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).

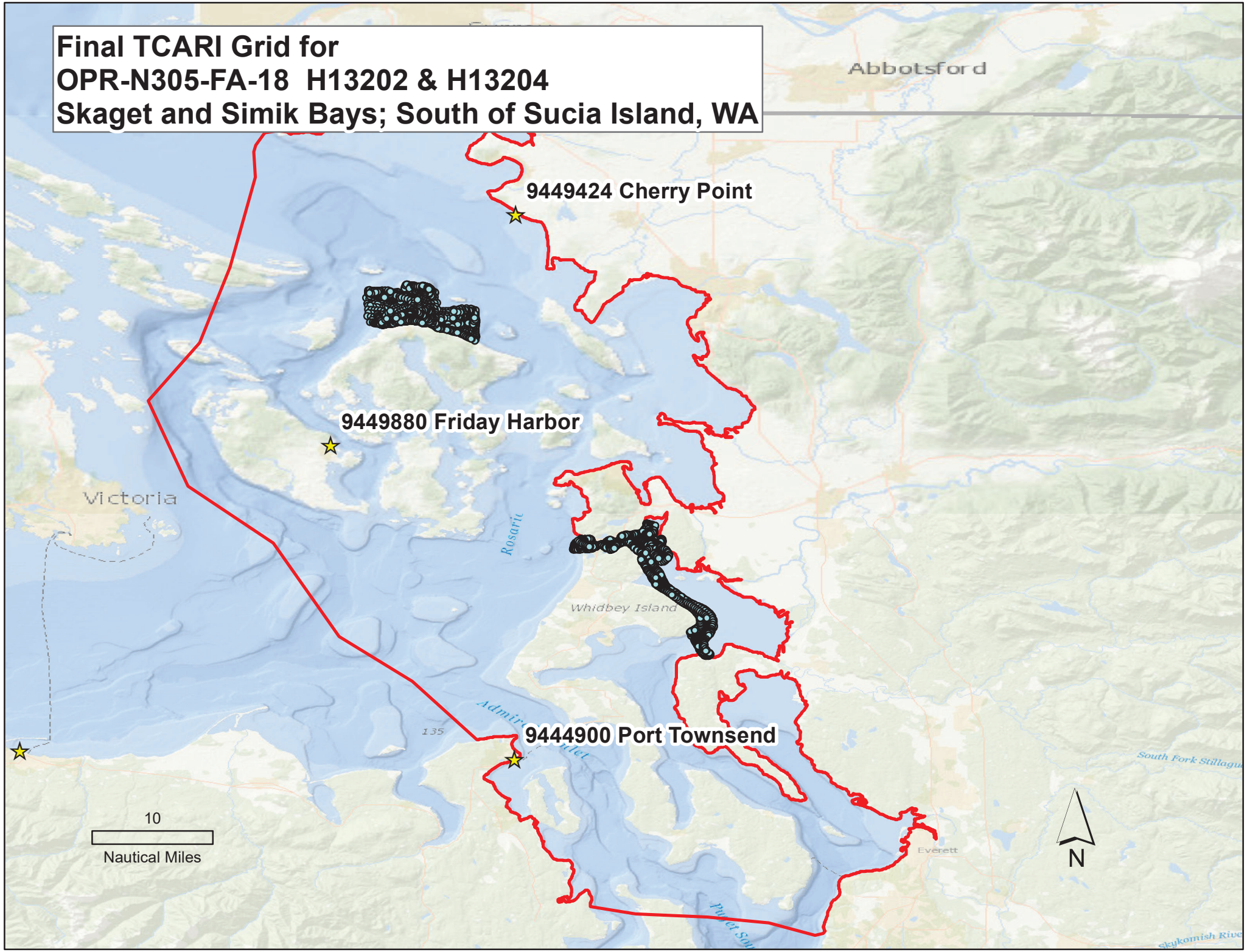
Note 2: Annual leveling for 9449424 Cherry Point, WA was not completed in the past year. A review of the verified leveling records from August 2007 to August 2017 shows the tide station benchmark network to be stable within an allowable 0.009 m tolerance. This Tide Note may be used as final stability 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
Abbotsford
9449424 Cherry Point
9449880 Friday Harbor
Victoria
Rosario
Whidbey Island
9444900 Port Townsend
135
Everett
South Fork Stillagu
10
Nautical Miles
N

APPROVAL PAGE

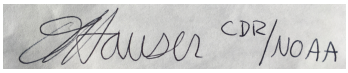
H13202

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 products

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.



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Approved:_____

Commander Olivia Hauser, NOAA
Chief, Pacific Hydrographic Branch