H12993

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12993

LOCALITY

State(s):	Washington
General Locality:	Northwest Washington
Sub-locality:	Holmes Harbor to Elger Bay

2018

CHIEF OF PARTY
CDR Marc Moser, NOAA

LIBRARY & ARCHIVES

Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H12993**

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:	**Holmes Harbor to Elger Bay**
Scale:	**40000**
Dates of Survey:	**09/27/2018 to 10/05/2018**
Instructions Dated:	**09/06/2018**
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:

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 H12993

Project: OPR-N305-FA-18

Locality: Northwest Washington

Sublocality: Holmes Harbor to Elger Bay

Scale: 1:40000

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 Holmes Harbor to Elger Bay.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
48° 7' 52.26" N 122° 34' 15.98" W	48° 1' 0.16" N 122° 27' 2.84" W

Table 1: Survey Limits

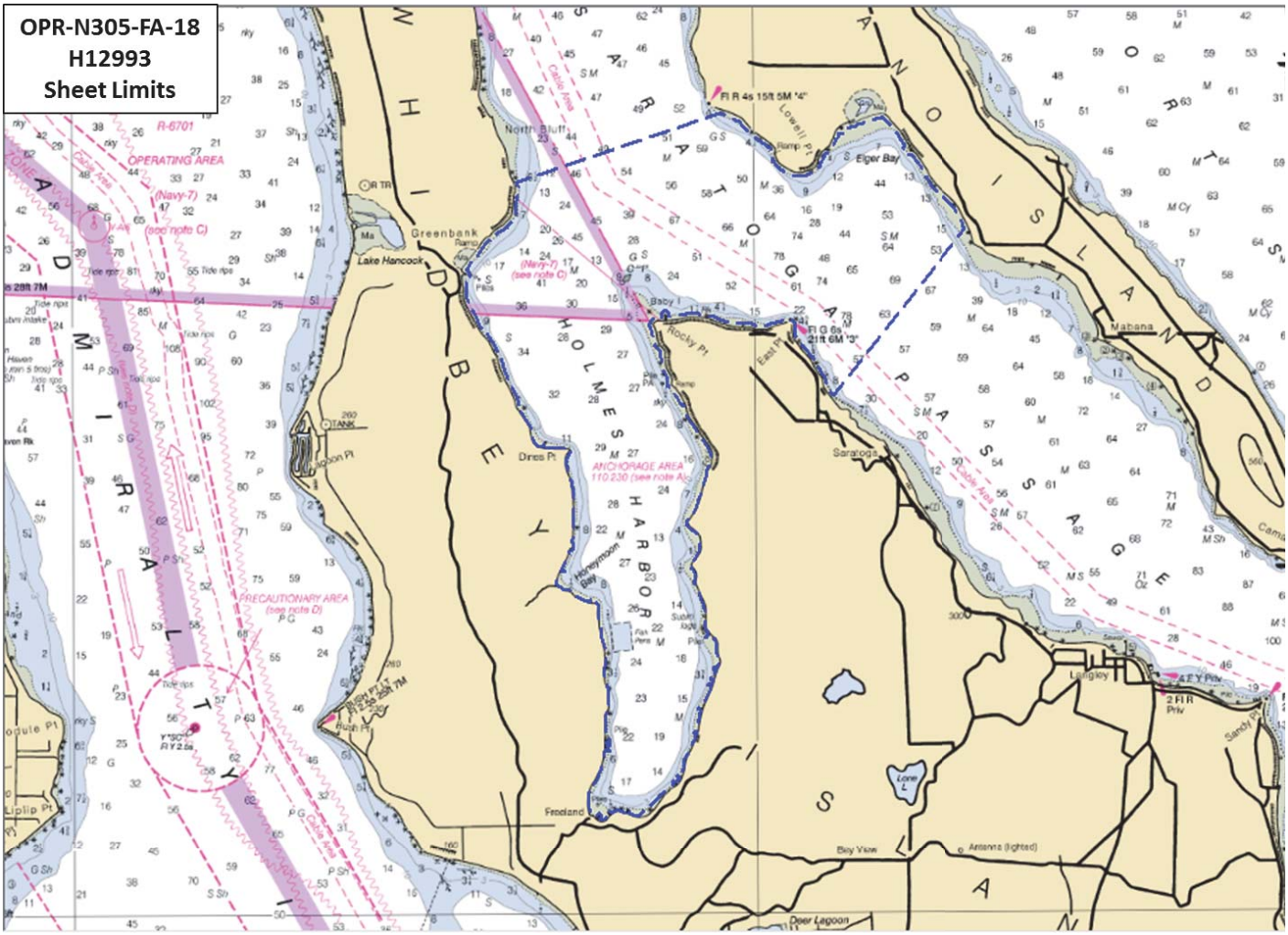


Figure 1: H12993 sheet limits (in blue) overlaid onto Chart 18441

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 2. 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 kelp, the shoreline, or due to time constraints in the project area. An example of such an area is shown in Figure 2.

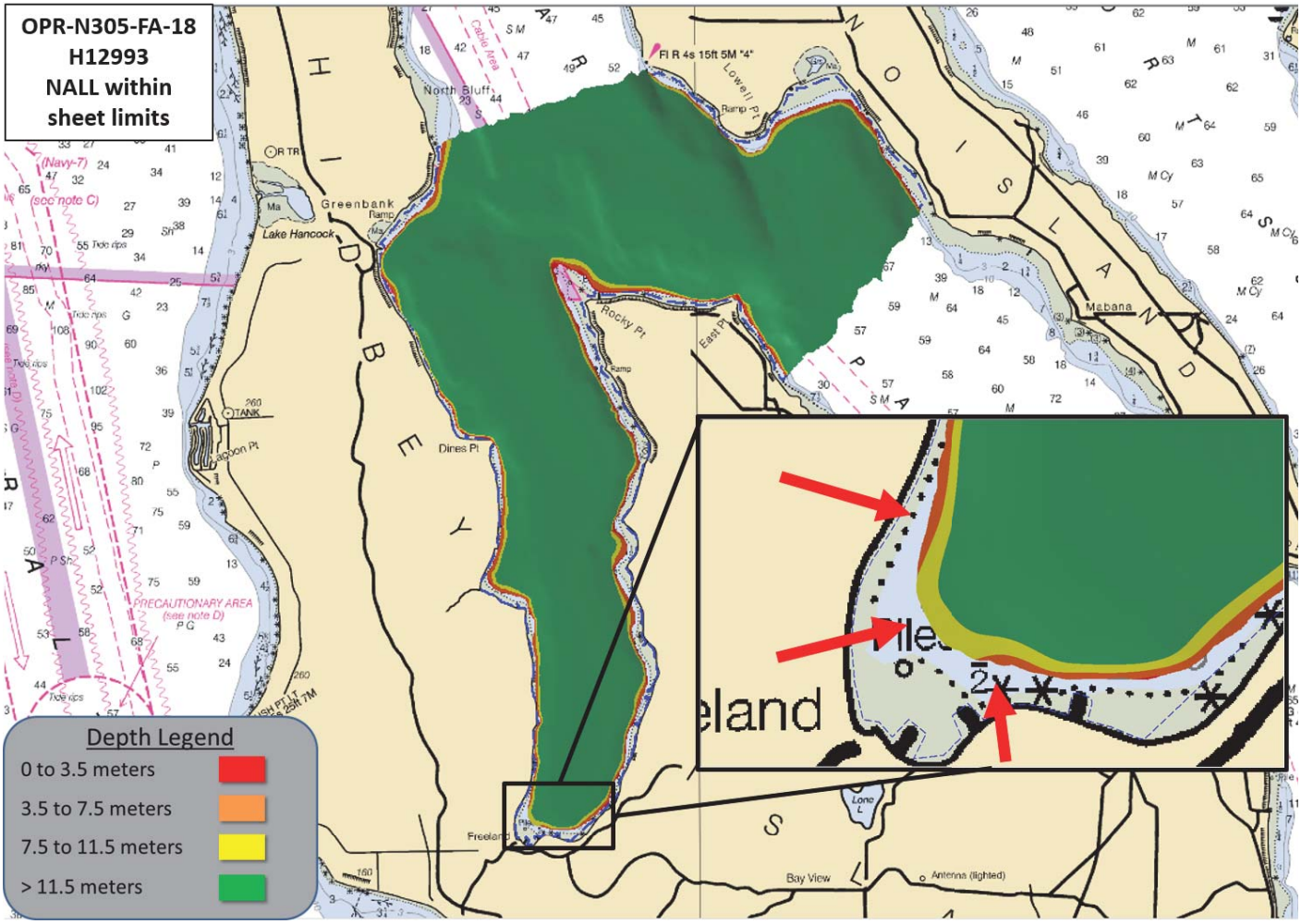


Figure 2: H12993 Example of where the NALL was not reached due to time constraints

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 military traffic transiting to and from Bangor Naval Submarine Base, 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 H12993 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 with complete MBES backscatter

Table 2: Survey Coverage

The entirety of H12993 was acquired with complete coverage MBES, meeting the requirements listed above and in the HSSD. See Figure 3 for an overview of coverage.

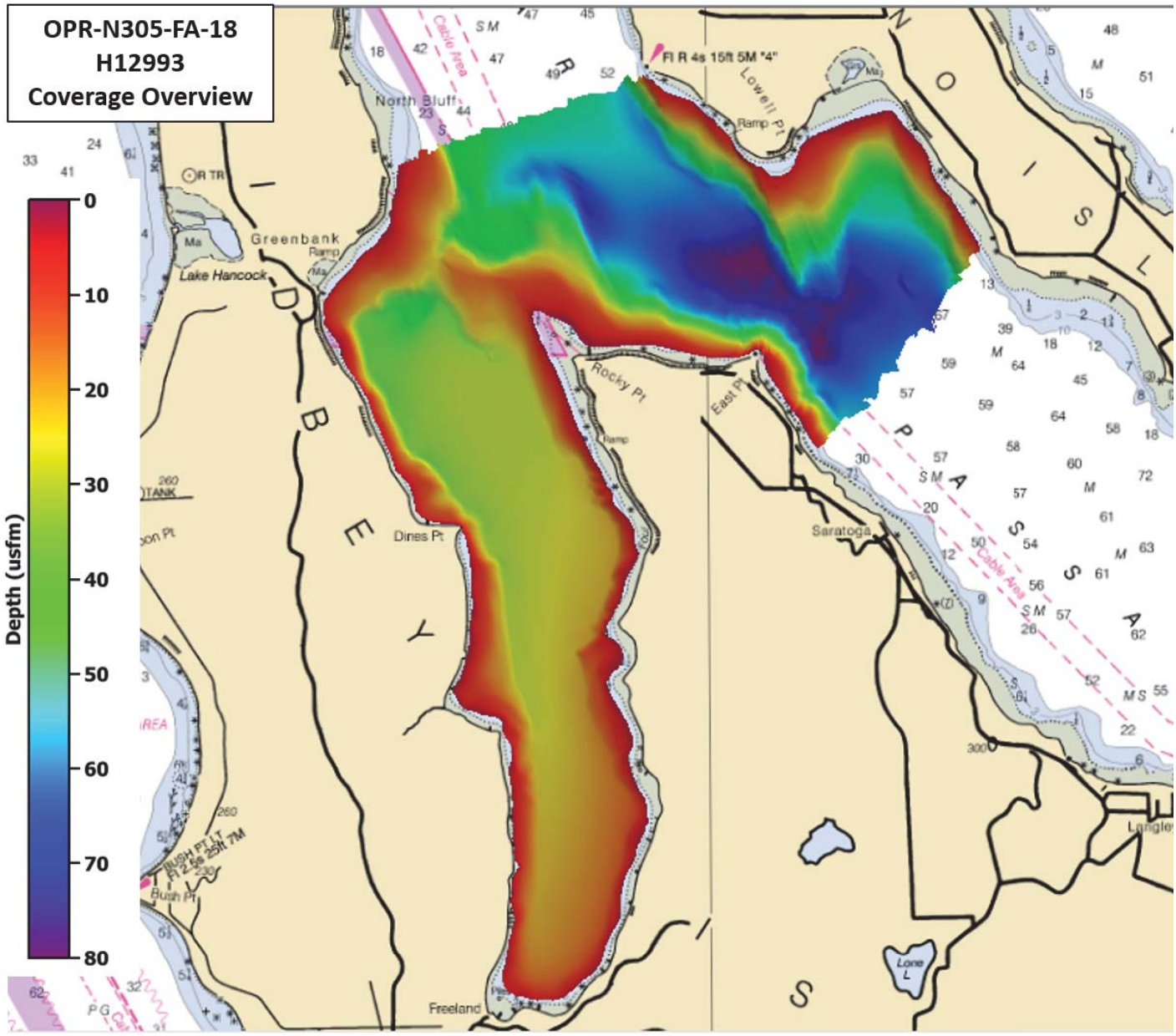


Figure 3: H12993 survey coverage overlaid onto Chart 18441

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	20.70	60.14	71.43	73.91	226.18
	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	9.23	0	0	9.23
	Lidar Crosslines	0	0	0	0	0
Number of Bottom Samples						6
Number Maritime Boundary Points Investigated						0
Number of DPs						0
Number of Items Investigated by Dive Ops						0
Total SNM						12.89

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
09/27/2018	270
10/04/2018	277

Survey Dates	Day of the Year
10/05/2018	278

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 4.08% of mainscheme acquisition.

Crosslines were collected, processed and compared in accordance with Section 5.2.4 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 shoaler) and 95% of nodes falling within +/- 0.27 meters (Figure 5). For the respective depths, the difference surface was compared to the allowable NOAA uncertainty standards. In total, 99.98% of the depth differences between H12993 mainscheme and crossline data were within allowable NOAA uncertainties.

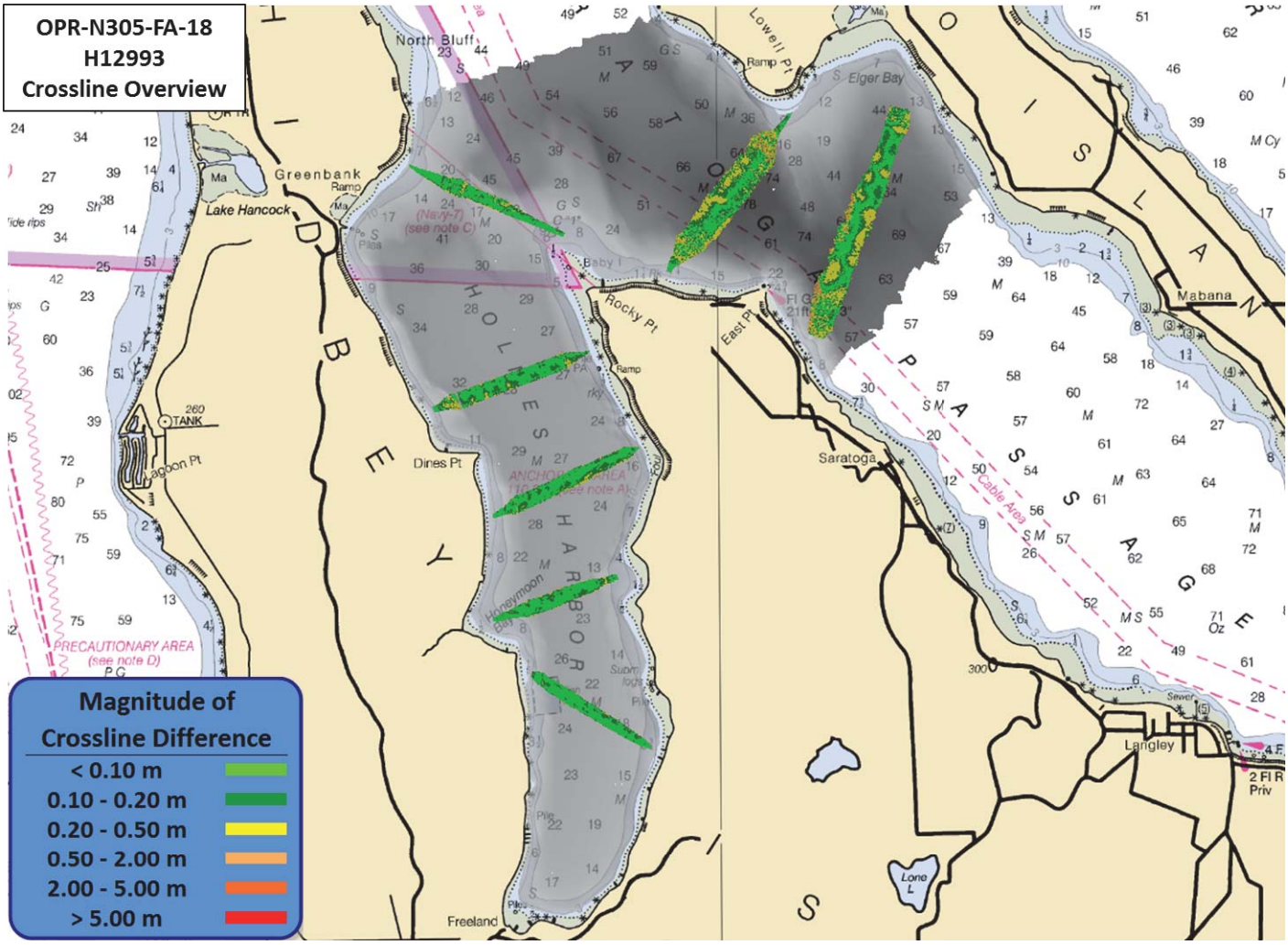
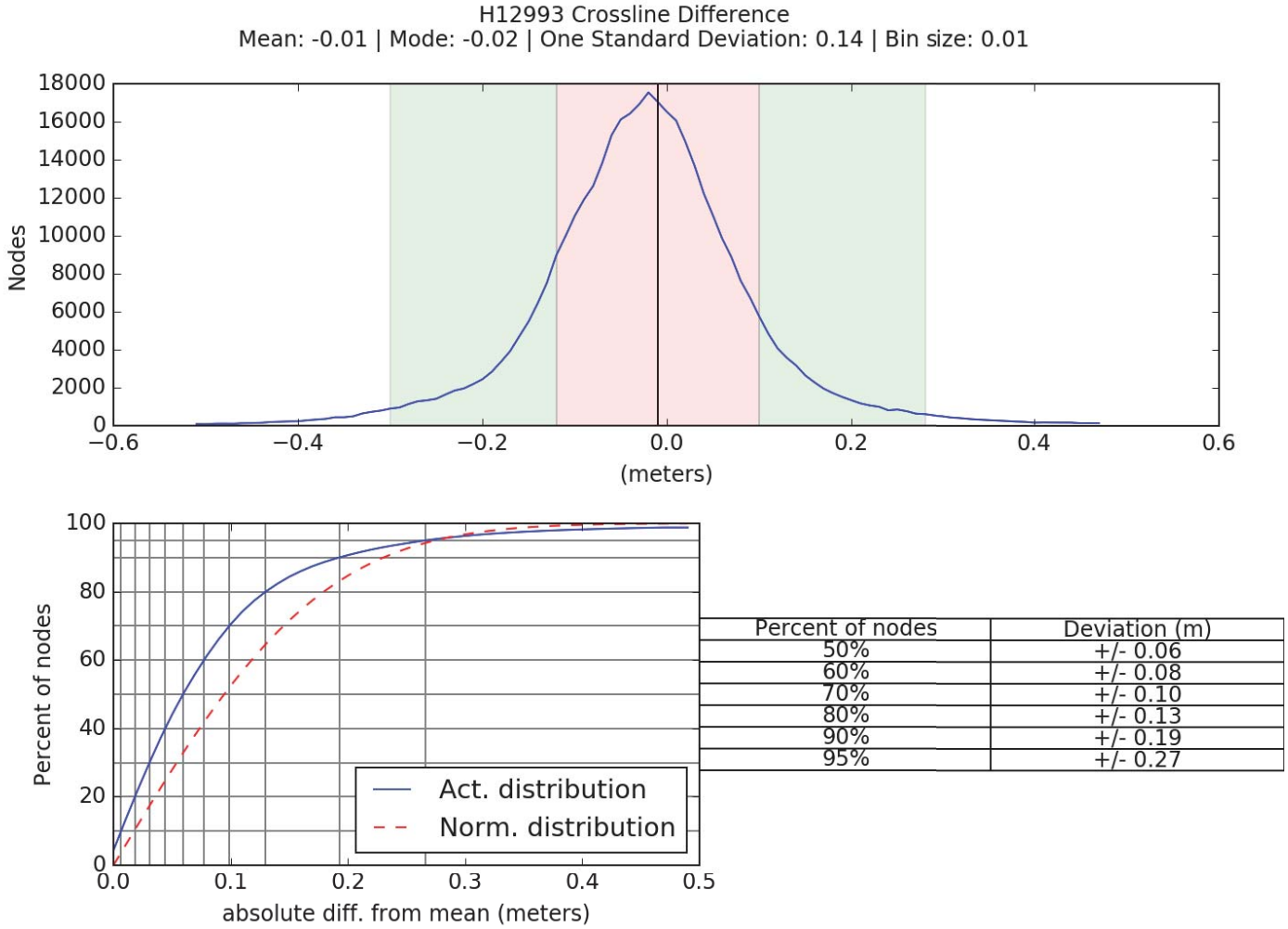


Figure 4: Overview of H12993 Crosslines



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.08
70%	+/- 0.10
80%	+/- 0.13
90%	+/- 0.19
95%	+/- 0.27

Figure 5: H12993 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 centimeters	13.6 centimeters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Surface
280x (All Launches)	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 H12993. 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

No junctions exist for this survey.

There are no contemporary surveys that junction with this survey.

B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the quality control section of the DAPR.

B.2.5 Equipment Effectiveness

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

B.2.6 Factors Affecting Soundings

Sea Grass and Kelp

Sea grass and kelp were present throughout the nearshore survey area and at times, indistinguishable from the seafloor (Figure 6). 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 7). Documentation can be found in the vessel boat sheets, which are located in the Detached Positions folder.

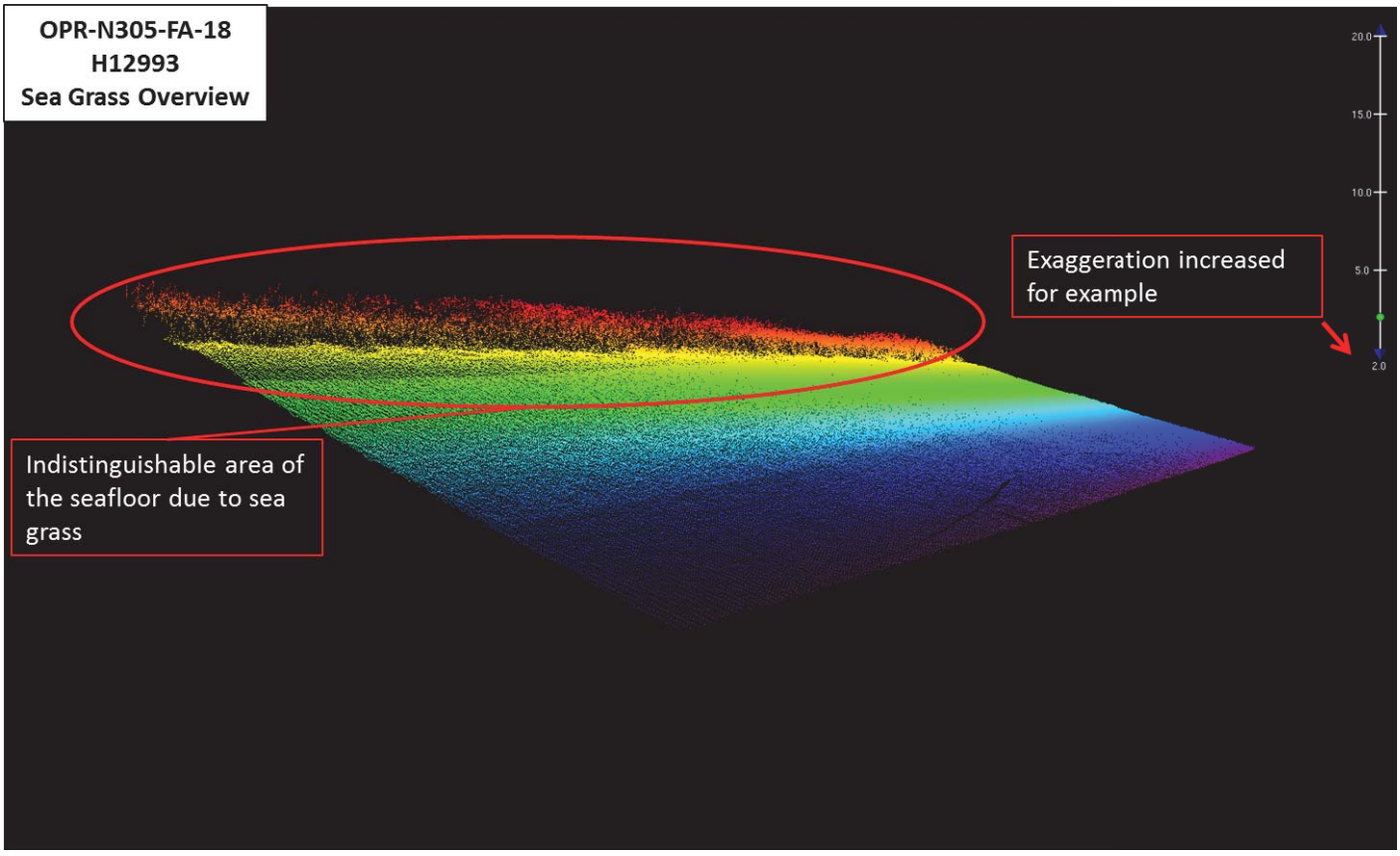


Figure 6: Example of sea grass presence

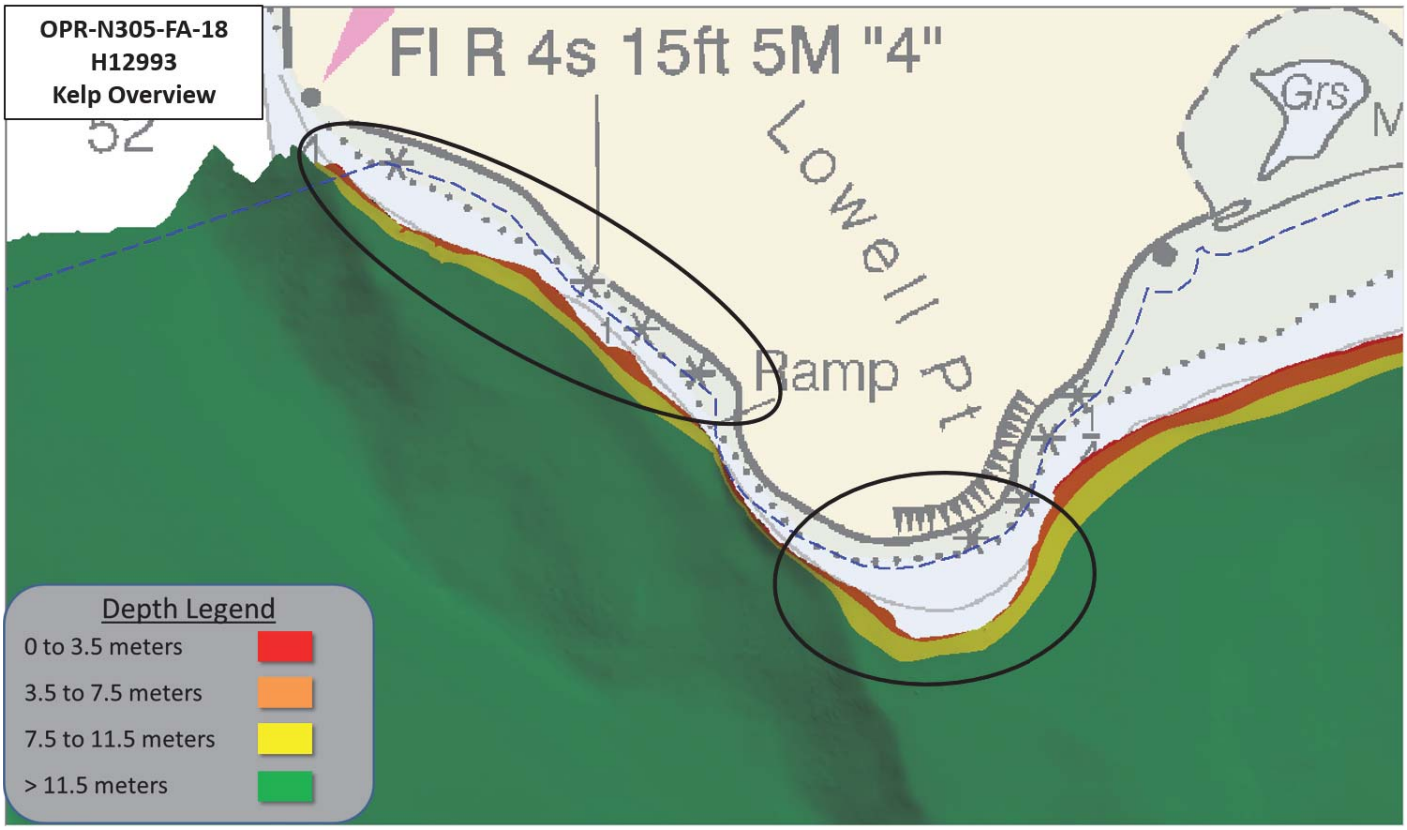


Figure 7: Areas where NALL is defined by kelp limits

Sound Speed Issues

In certain areas, particularly around and throughout the approach to Holmes Harbor, small sound speed issues were apparent, visible primarily as "smiles" (see Figure 8). Surfaces were not significantly impacted, and the data meet NOAA allowable uncertainty parameters. As such, the data remain sufficient to supersede previous data.

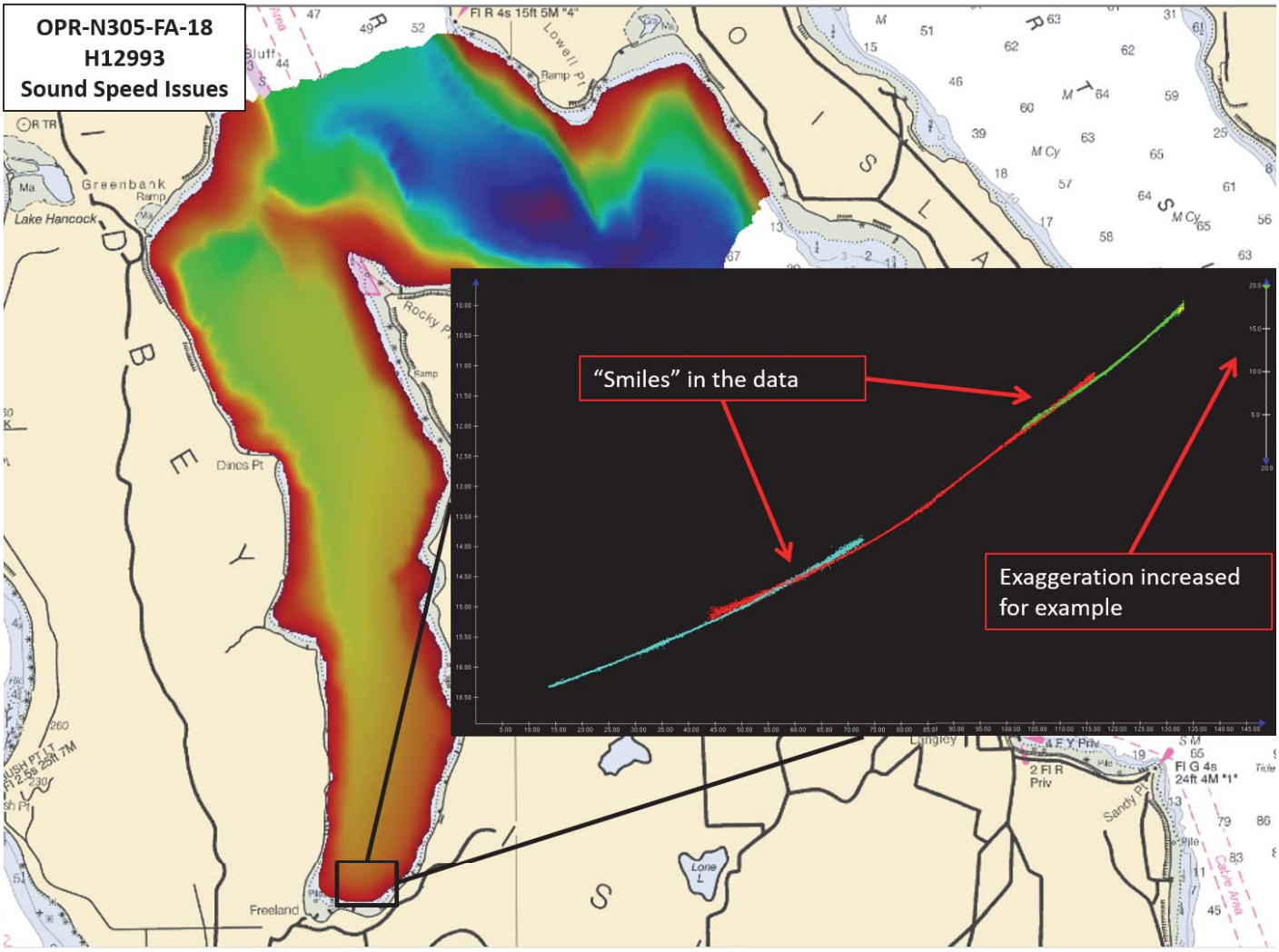


Figure 8: Example of area with sound speed artifacts

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

H12993 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 was 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 a result of acoustic shadowing due to lack of coverage on the inshore side of the object, arising from a rapid change in seafloor height (Figure 9). The hydrographer is confident that the least depth of the object was captured.

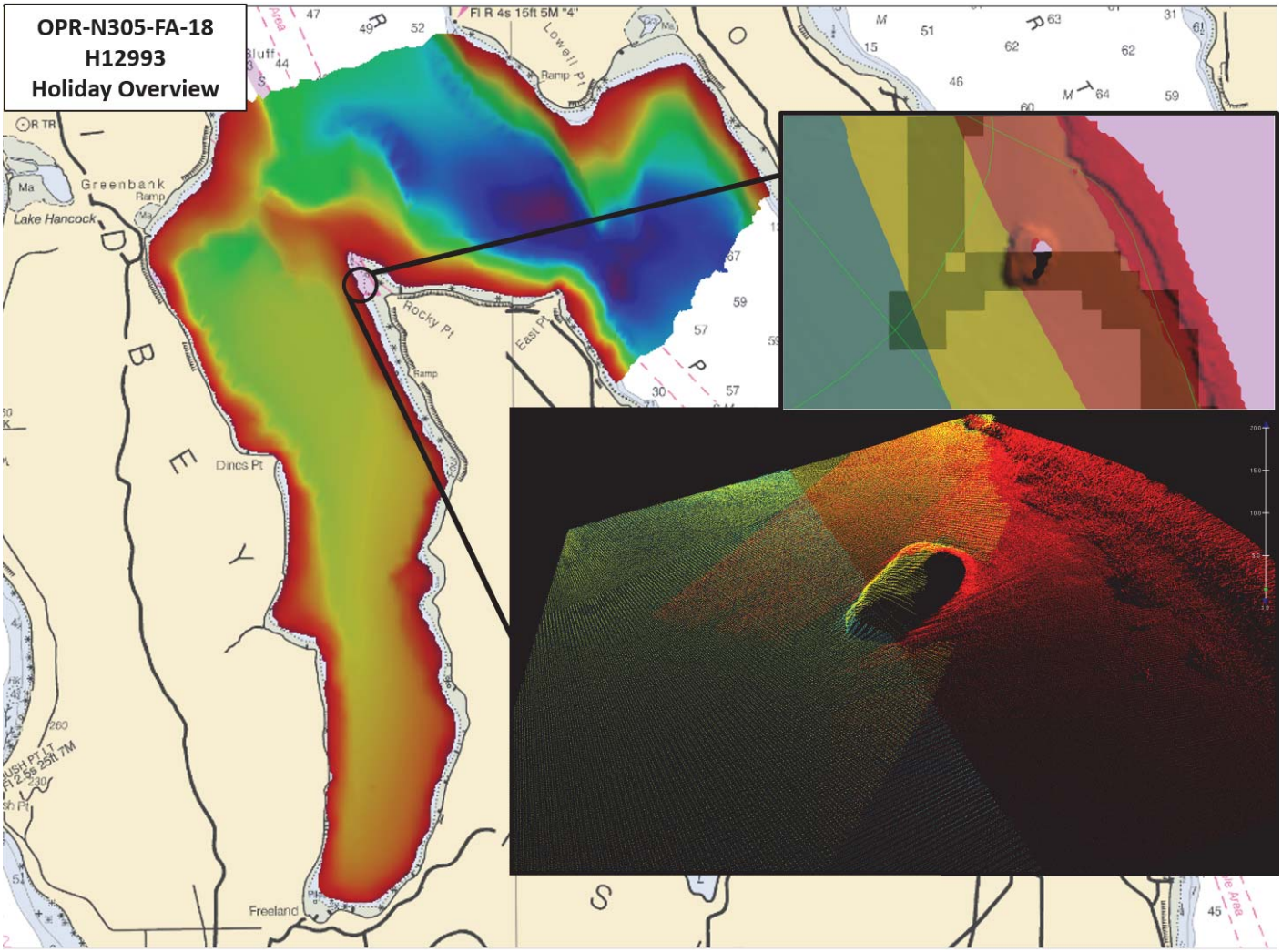


Figure 9: Holiday due to acoustic shadowing

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 standards for H12993. For a graphical representation of compliance with uncertainty standards, see Figure 10 below.

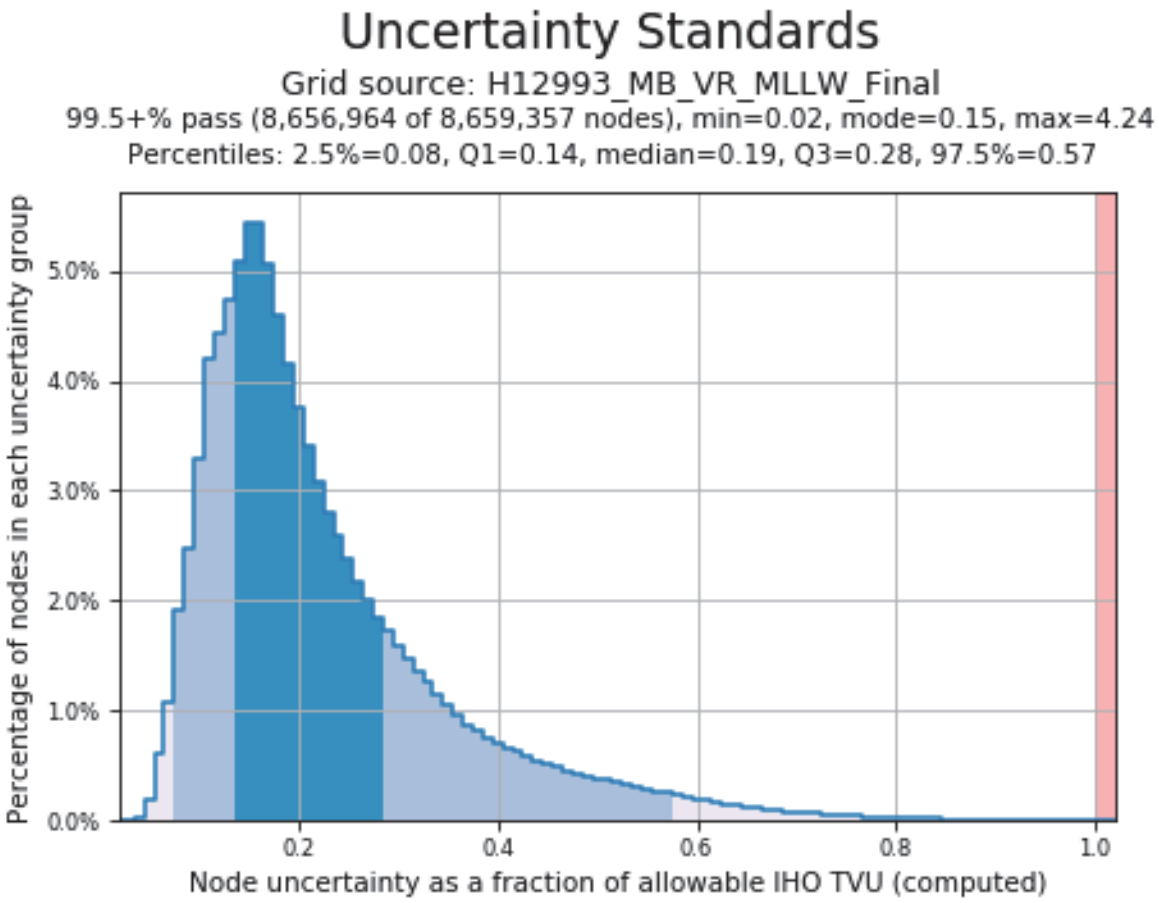


Figure 10: H12993 Allowable Uncertainty statistics

B.2.11 Density

The surface was analyzed using the HydrOffice QC Tools Grid QA feature and the results are shown in Figure 11 below. Density requirements for H12993 were achieved with at least 99.5+% of the surface nodes containing five or more soundings as required by HSSD Section 5.2.2.3.

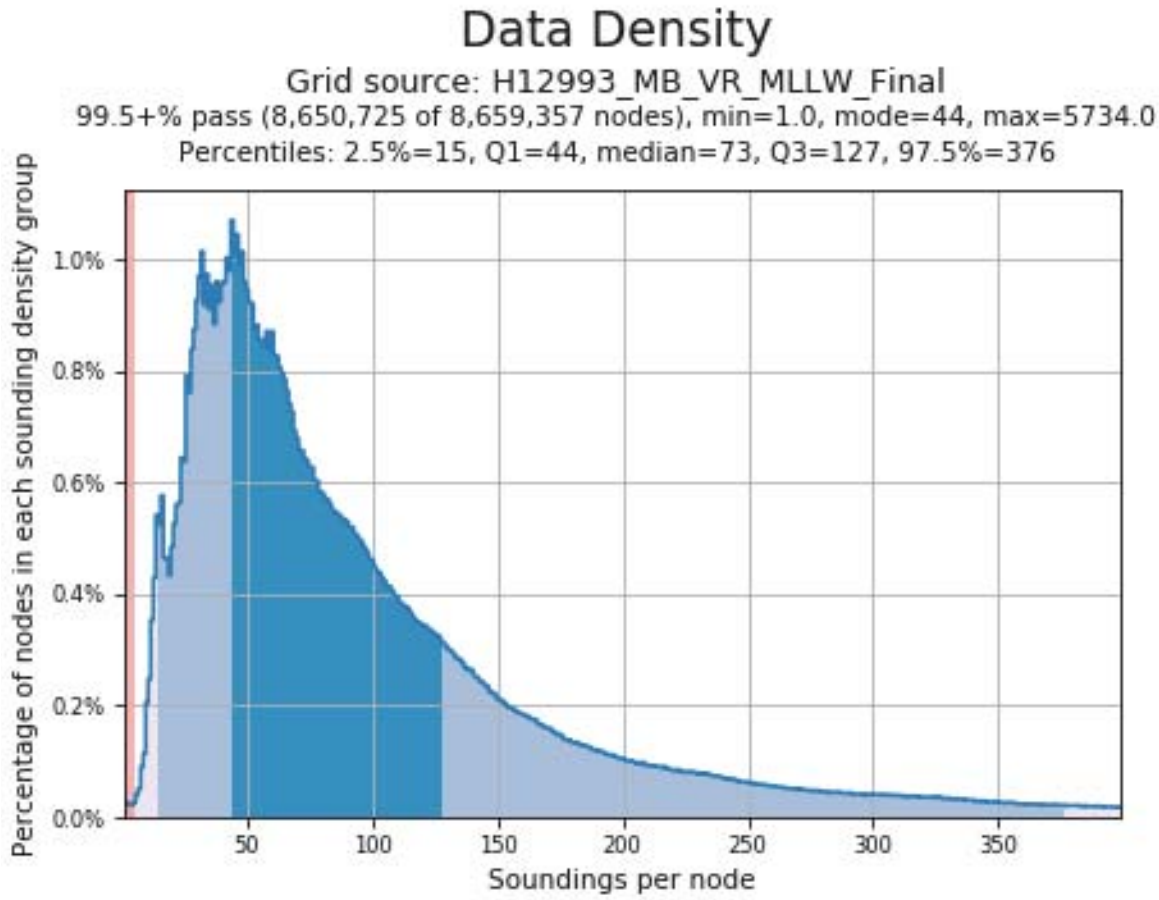


Figure 11: H12993 Data Density statistics

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 Kongsberg systems. All backscatter were processed to GSF files, and a floating point mosaic per sonar frequency 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 data of the same frequency to be mosaicked together across the different platforms. See Figure 12 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. See Figure 13 for a greyscale representation of the complete 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 12: Backscatter Calibration Values

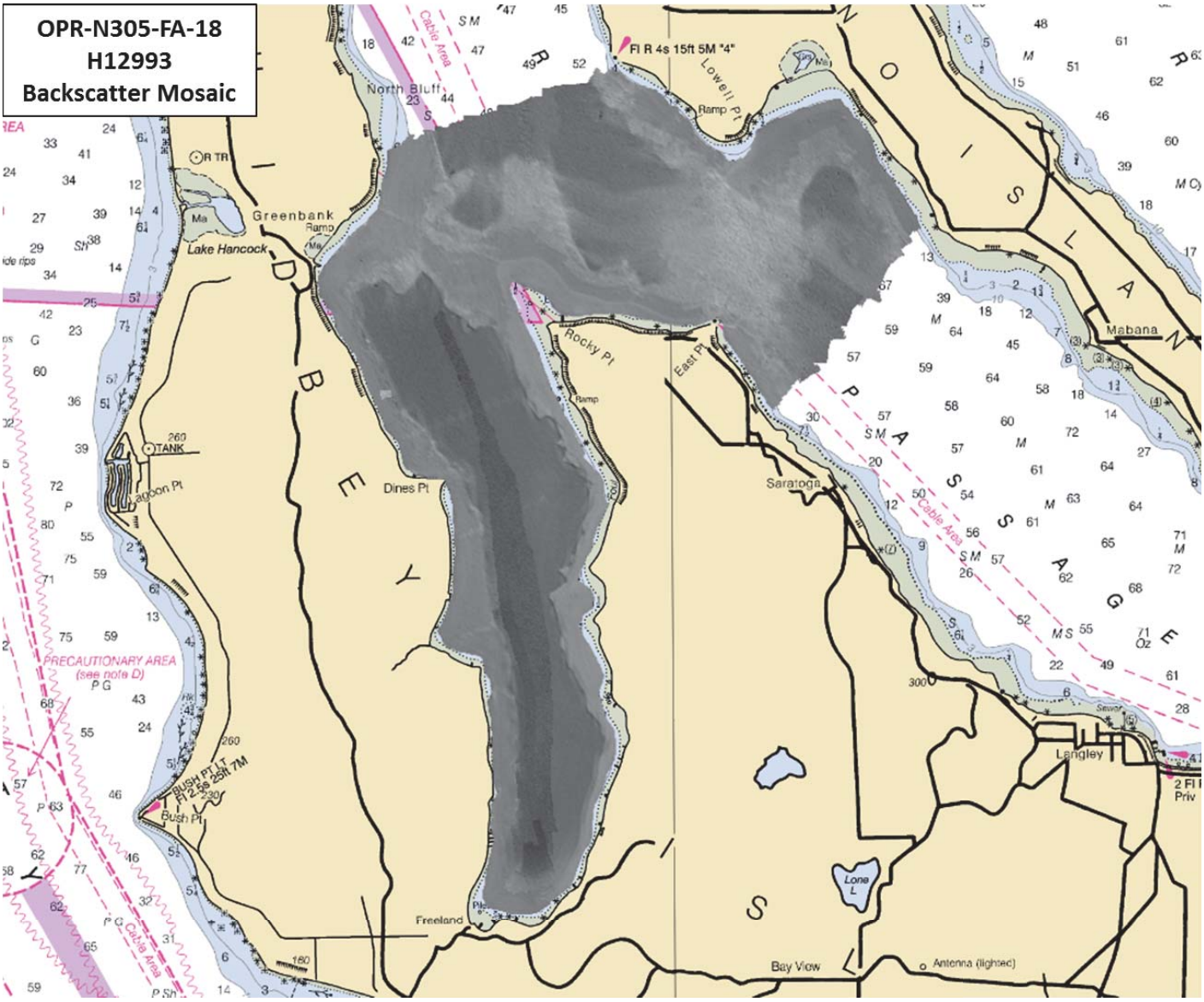


Figure 13: Backscatter Mosaic

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
Caris	HIPS/SIPS	10.4.5

Table 9: 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 10: 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
H12993_MB_VR_MLLW_Final.csar	CARIS VR Surface (CUBE)	1-8 meters	0.24 meters - 147.77 meters	NOAA_VR	Complete MBES
H12993_MB_VR_MLLW.csar	CARIS VR Surface (CUBE)	1-8 meters	0.24 meters - 147.77 meters	NOAA_VR	Complete MBES

Table 11: Submitted Surfaces

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surfaces for H12993. 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.

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 H12993 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 H12993.

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
9447130.tid	Final Approved

Table 12: Water Level Files (.tid)

File Name	Status
H12993_H12994.tc	Final

Table 13: Tide Correctors (.zdf or .tc)

A request for final approved tides was sent to N/OPS1 on 10/12/2018. The final tide note was received on 11/01/2018.

ERS Methods Used:

ERS via VDATUM

Ellipsoid to Chart Datum Separation File:

VDatumShape_xyNAD83-MLLW_geoid12b

ERS methods were used as the final means of reducing H12993 to MLLW for submission following the successful application of SBETs. 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 Projected UTM 10.

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

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 of detached positions (DP) and bottom samples.

D. Results and Recommendations

D.1 Chart Comparison

A comparison was performed between survey H12993 and ENC US4WA11M using CARIS HIPS and SIPS sounding and contour layers derived from the VR surface. The contours and soundings were overlaid on the charts to assess differences between the surveyed soundings and charted depths. ENCs were compared to a VR grid by extracting all soundings from the chart and creating an interpolated TIN surface which could be differenced with the surface from H12993.

All data from H12993 should supersede charted data. In general, surveyed soundings agree with the majority of charted depths. A full discussion of the comparison 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?
US4WA11M	1:80000	37	04/27/2018	11/28/2018	NO

Table 14: Largest Scale ENCs

US4WA11M

Soundings from H12993 are in general agreement with charted depths on ENC US4WA11M, with most depths agreeing to 2 fathoms as shown in Figure 14. The largest differences are seen in steeper areas where differences range to 10 fathoms as seen in Figure 16.

To more accurately visualize trends within these differences, an 8 meter TIN surface was interpolated from the ENC sounding layer. This surface was then differenced with a corresponding 8 meter surface from H12993 and visualized in Figure 14. In this difference surface red colors indicate H12993 was shoaler than the ENC US4WA11M, green colors indicate agreement, and blue colors indicate H12993 was deeper than ENC US4WA11M. As expected, the flat plain of Holmes Harbor is in close agreement with ENC US4WA11M while the more dynamic Saratoga Passage and the entrance to Holmes Harbor exhibit areas both shoaler and deeper than those expressed in ENC US4WA11M. As mentioned previously, the areas of most rapid depth change experience the greatest inaccuracies. There does not appear to be a pattern determining why these areas of rapid change are either shoaler or deeper than charted.

Contours from H12993 are in general agreement with charted contours on ENC US4WA11M as shown in Figure 17. The largest differences are seen in Elger Bay, from East Point to Rocky Point, in Honeymoon Bay and in the southeastern area of Holmes Harbor where surveyed contours differ by up to 100 meters. In most cases, the surveyed contours are inshore of the charted contours.

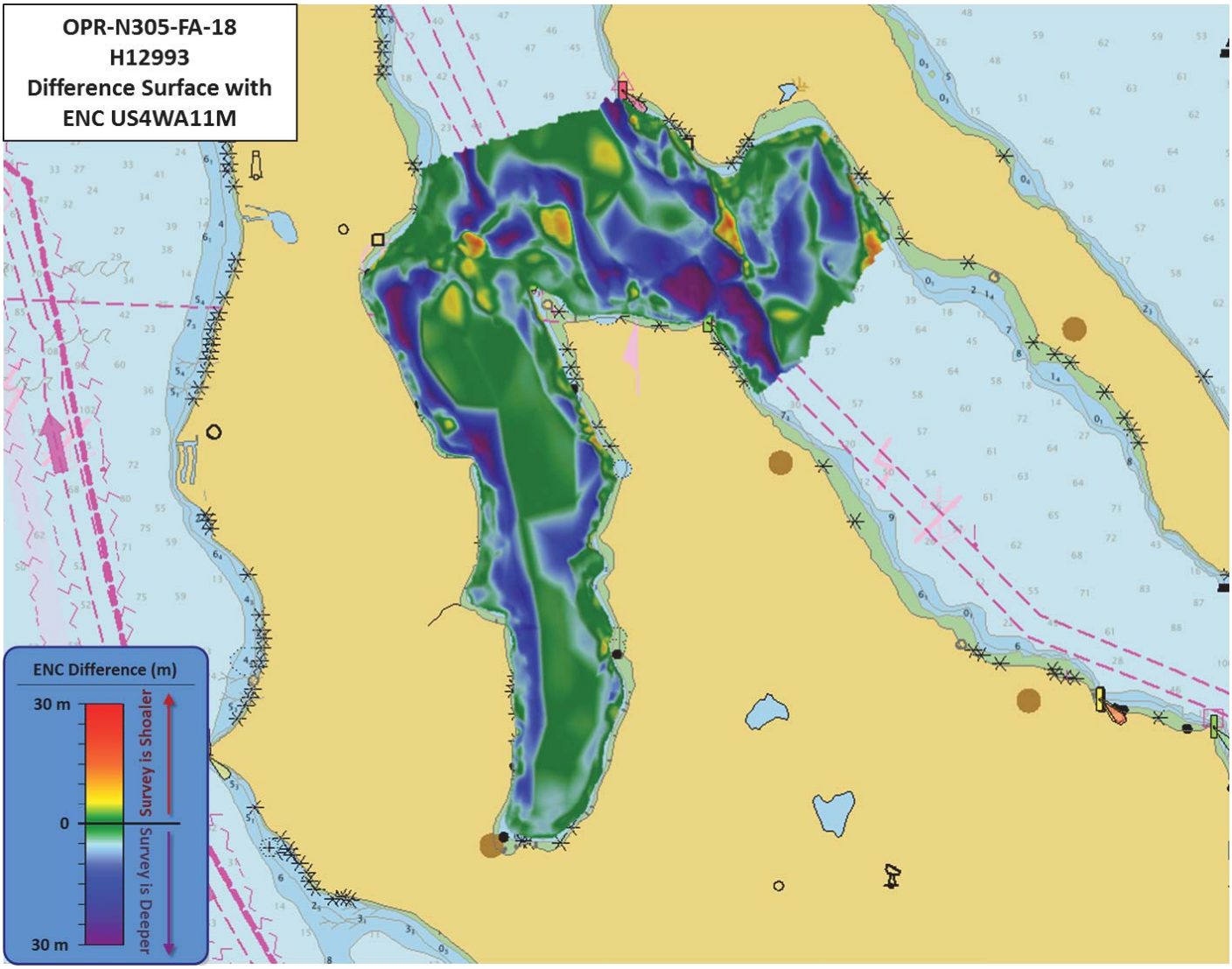
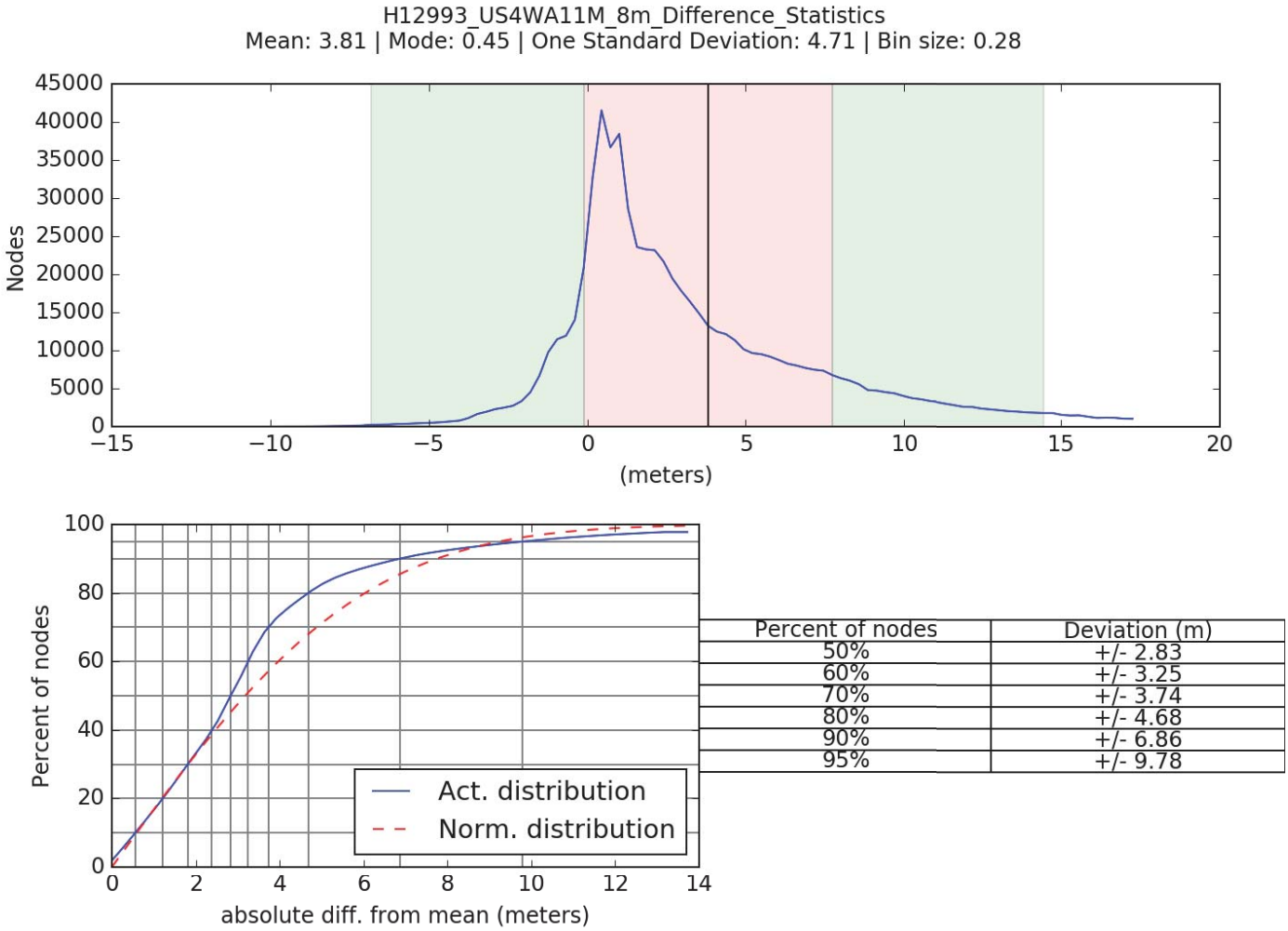


Figure 14: Difference surface between H12993 and interpolated TIN surface from US4WA11M



Percent of nodes	Deviation (m)
50%	+/- 2.83
60%	+/- 3.25
70%	+/- 3.74
80%	+/- 4.68
90%	+/- 6.86
95%	+/- 9.78

Figure 15: Difference surface statistics between H12993 and interpolated TIN surface from US4WA11M

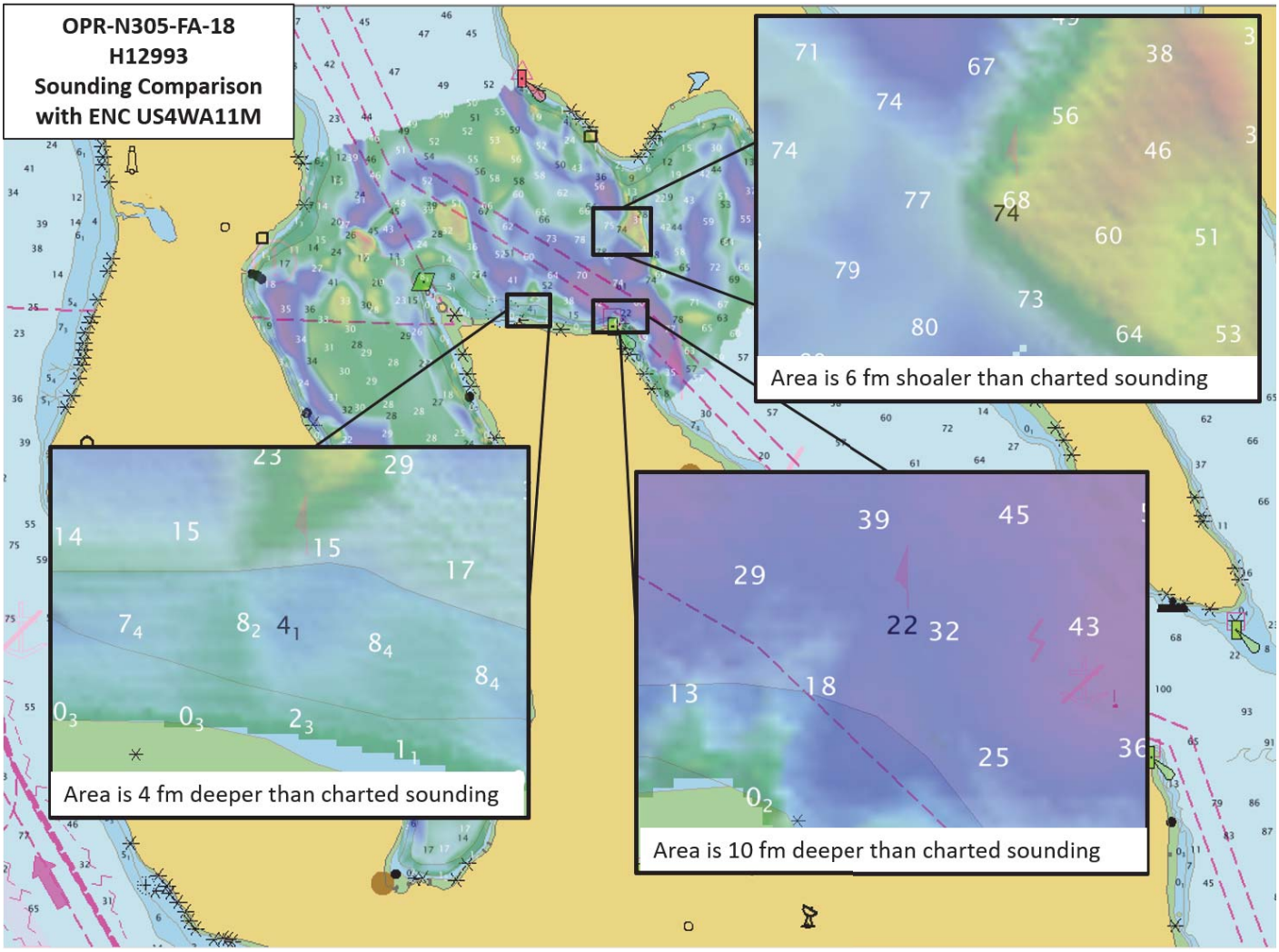


Figure 16: Close up of area where significant differences between H12993 soundings (in white) and ENC US4WA11M depths (in black)

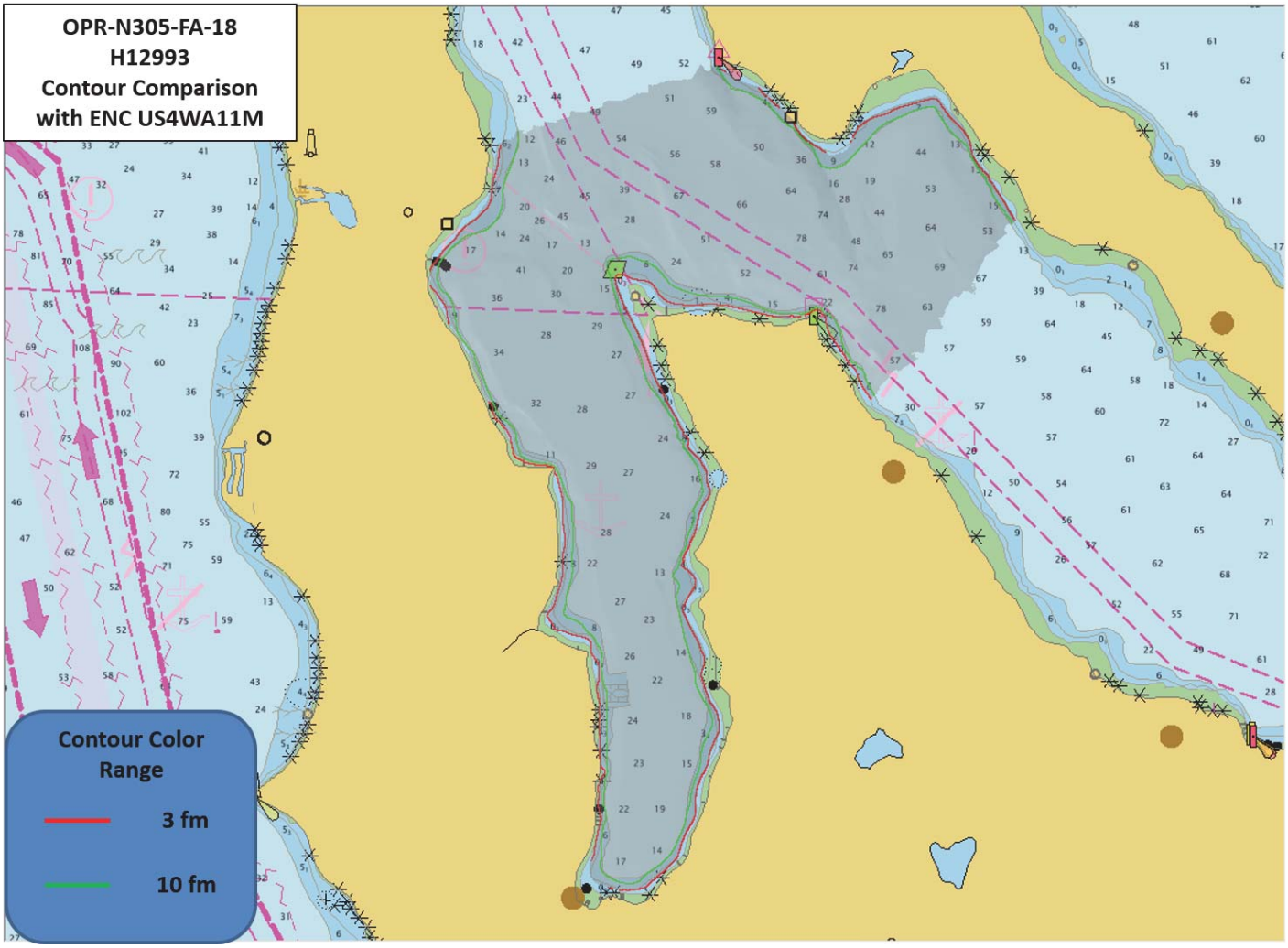


Figure 17: Overview of H12993 contours overlaid onto ENC US4WA11M

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

One feature containing the label PA was assigned for this survey. The feature in question is a pile and is located on the eastern shoreline of Holmes Harbor roughly 1600m south of Baby Island. The feature was charted incorrectly and repositioned roughly 145m to the southeast. There are two piles in the new position, although only one is attributed due to their proximity to each other. The piles are made out of wood and are always visible.

D.1.4 Uncharted Features

Survey H12993 has 15 new features that are addressed in the H12993 Final Feature File. Of these features, there are 2 new Underwater Rocks of which 0 are submitted as DTONs, 3 new kelp features, 1 new pile, 1 new shoreline construction, 6 new seabed areas, and 1 new land area in conjunction with 1 new land elevation feature.

D.1.5 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

D.1.6 Channels

The entirety of Holmes Harbor is an unrestricted general anchorage area. Depths range from 42 fathoms at the head of the harbor all the way to the shoreline. No channels exist for this survey. There are no precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas, or channel and range lines within the survey limits.

D.1.7 Bottom Samples

Six bottom samples were acquired in accordance with the Project Instructions for survey H12993. All bottom samples were entered in the H12993 Final Feature File. See Figure 18 for a graphical overview of sample locations.

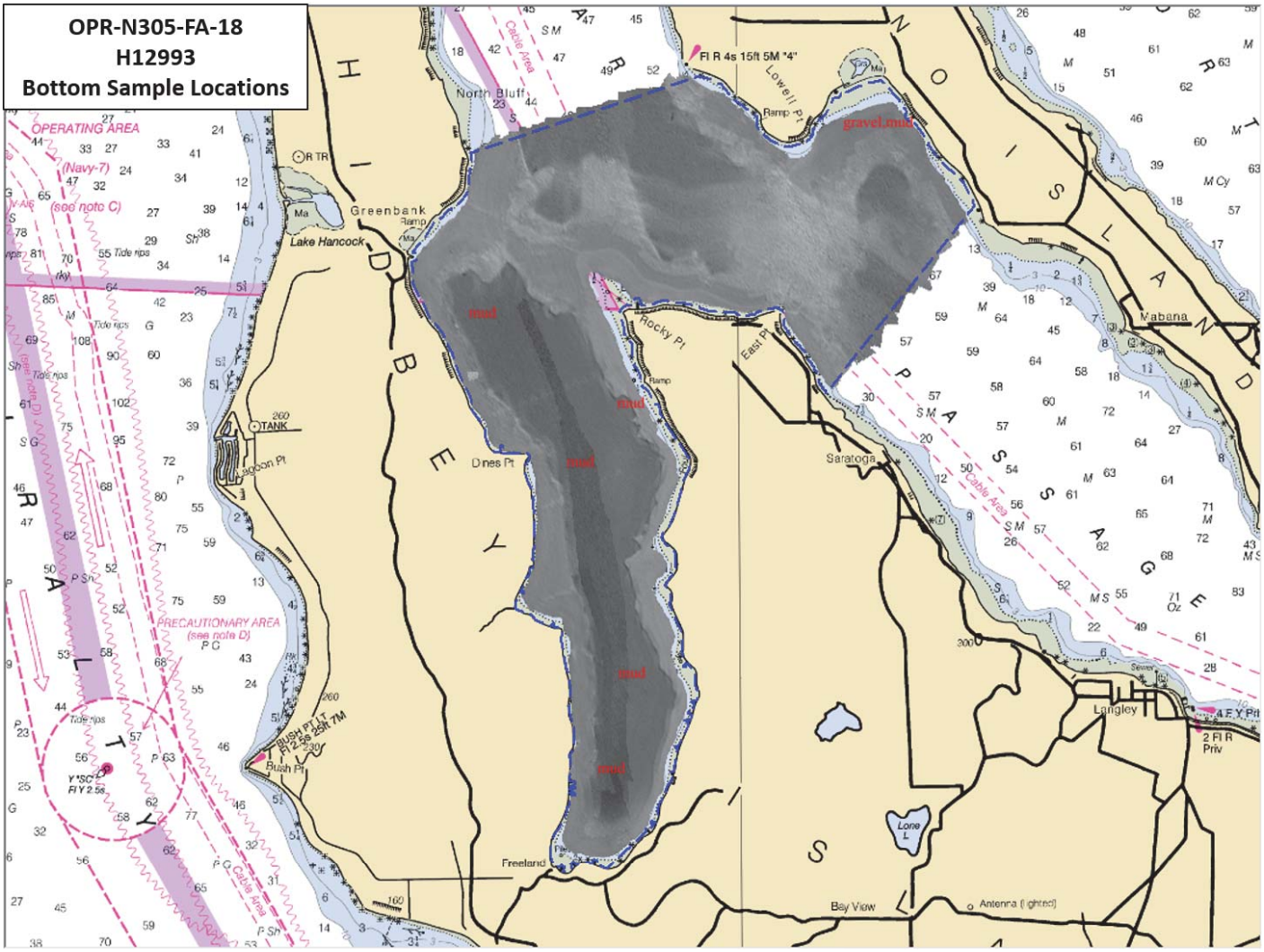


Figure 18: H12993 Bottom Sample Locations

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 in DP forms and boat sheets during field operations were scanned and included in the Separates I Detached Positions folder. Shoreline verification procedures for H12993 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

One ATON was assigned for this survey. The ATON was on-station and serving its intended purpose. The ATON was attributed in the Final Feature Final with the description of "Retain" as per HSSD Section 7.3.5.

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 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 in the Descriptive Report.

Approver Name	Approver Title	Approval Date	Signature
CDR Marc Moser	Chief of Party	02/14/2019	MOSER.MARC.STANTON.1163193902 Digitally signed by MOSER.MARC.STANTON.1163193902 Date: 2019.02.14 15:05:44 -08'00'
CHST Samuel Candio	Chief Survey Technician	02/14/2019	
HST Simon Swart	Sheet Manager	02/14/2019	SWART.SIMON.EDWARD.1543761962 Digitally signed by SWART.SIMON.EDWARD.1543761962 Date: 2019.02.14 14:58:48 -08'00'

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

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : October 17, 2018

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-N305-FA-18
HYDROGRAPHIC SHEET: H12993 and H12994

LOCALITY: Holmes Harbor to Elger Bay; Vicinity of Hansville, WA
TIME PERIOD: September 27 - October 06, 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): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.389 meters

TIDE STATION USED: 9447130 Seattle, WA
Lat. 47° 36.1' N Long. 122° 20.3' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 3.199 meters

REMARKS: RECOMMENDED GRID

Please use the TCARI grid "H12993_H12994.tc" as the final grid for project OPR-N305-FA-18, Registry Nos. H12993 & H12994, during the time period September 27 - October 06, 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: 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.

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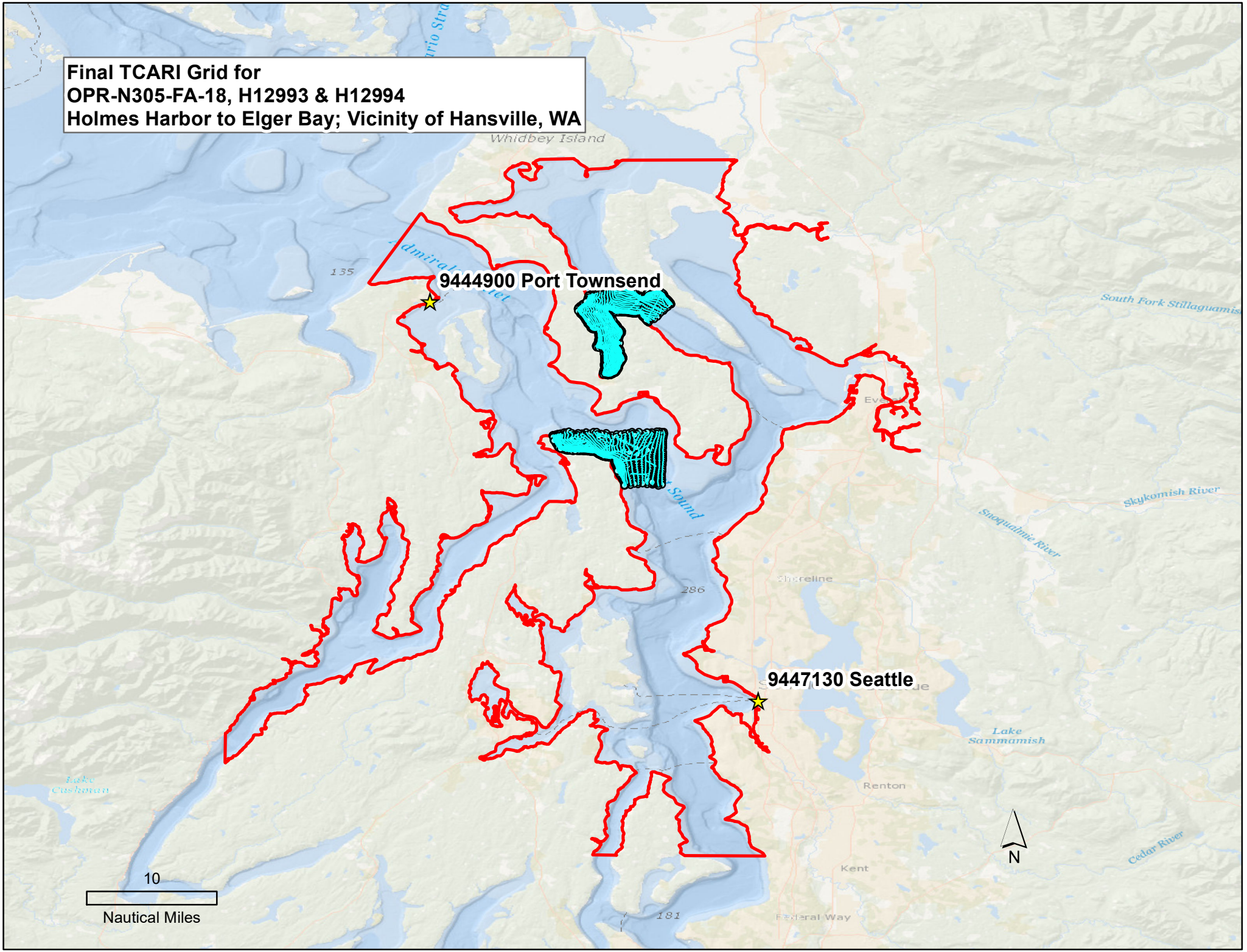
CHIEF, PRODUCTS AND SERVICES BRANCH


Final TCARI Grid for
OPR-N305-FA-18, H12993 & H12994
Holmes Harbor to Elger Bay; Vicinity of Hansville, WA
9444900 Port Townsend
9447130 Seattle
Whidbey Island
Admiralty Inlet
Puget Sound
South Fork Stillaguamish
Skykomish River
Snoqualmie River
Lake Sammamish
Lake Cushman
Renton
Kent
Federal Way
Cedar River
135
286
181
10
Nautical Miles
N

APPROVAL PAGE

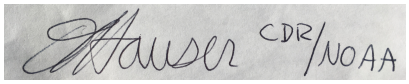
H12993

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