H12798

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12798

LOCALITY

State(s):	Alaska
General Locality:	Bering Strait and Vicinity
Sub-locality:	Northeastern Vicinity of Port Clarence

2017

CHIEF OF PARTY
CDR Mark Van Waes, NOAA

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Date:

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

REGISTRY NUMBER:

HYDROGRAPHIC TITLE SHEET

H12798

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):	**Alaska**
General Locality:	**Bering Strait and Vicinity**
Sub-Locality:	**Northeastern Vicinity of Port Clarence**
Scale:	**40000**
Dates of Survey:	**07/12/2017 to 08/31/2017**
Instructions Dated:	**06/08/2017**
Project Number:	**OPR-R365-FA-17**
Field Unit:	**NOAA Ship *Fairweather***
Chief of Party:	**CDR Mark Van Waes, NOAA**
Soundings by:	**Multibeam Echo Sounder, Single Beam Echo Sounder**
Imagery by:	**Side Scan Sonar, 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 H12798

Project: OPR-R365-FA-17

Locality: Bering Strait and Vicinity

Sublocality: Northeastern Vicinity of Port Clarence

Scale: 1:40000

July 2017 - August 2017

NOAA Ship *Fairweather*

Chief of Party: CDR Mark Van Waes, NOAA

A. Area Surveyed

The survey area is located in Western Alaska within the sub-locality of the northeastern vicinity of Port Clarence.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
65° 18' 46.26" N 166° 40' 11.64" W	65° 13' 46.26" N 166° 20' 19.75" W

Table 1: Survey Limits

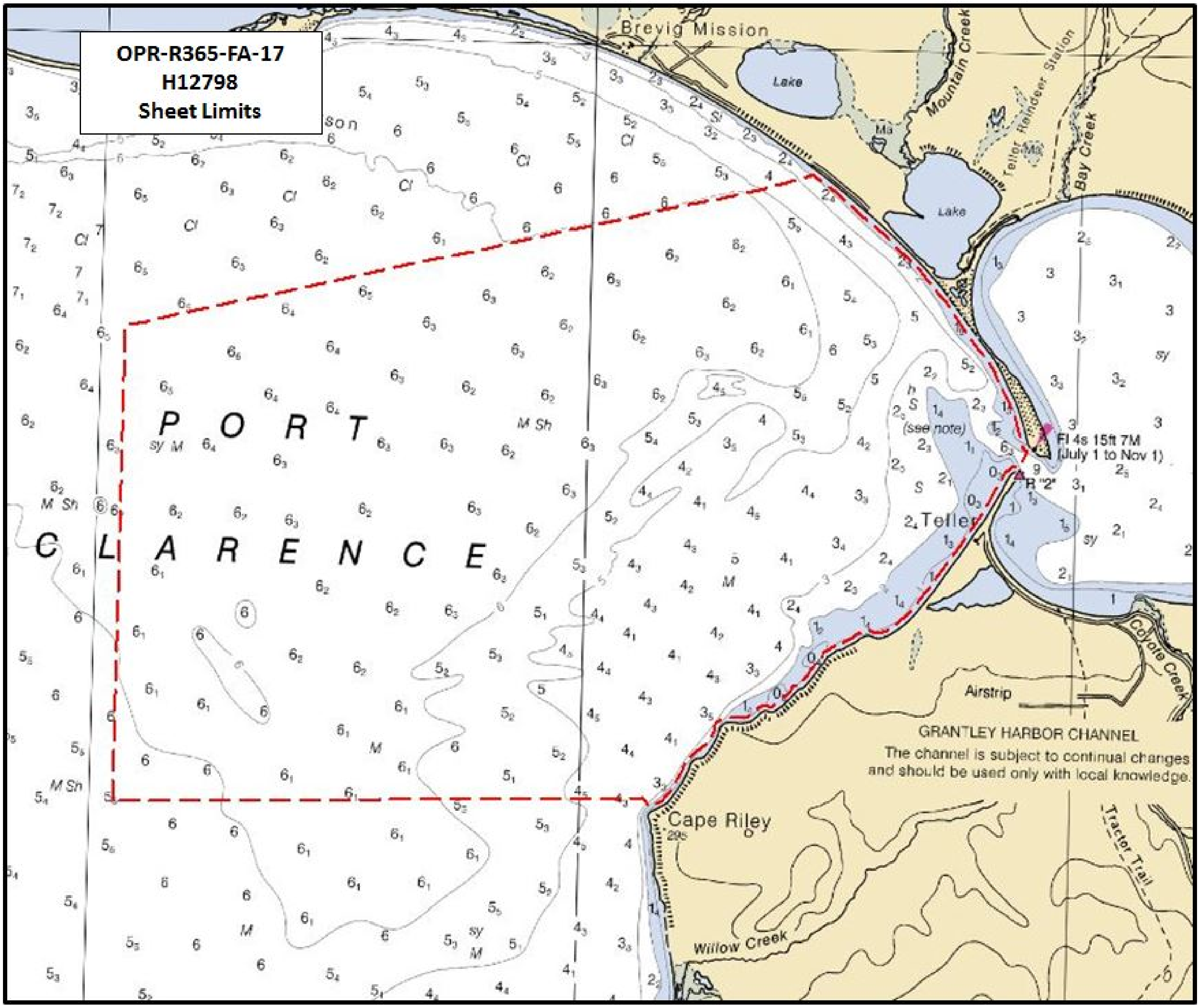


Figure 1: H12798 sheet limits (in red) overlaid onto Chart 16204.

Data were acquired to the survey limits in accordance with the requirements in the Project Instructions and the April 2017 NOS Hydrographic Surveys Specifications and Deliverables (HSSD) as shown in Figure 1.

Additionally, an area from the entrance of Grantley Harbor to Coyote Creek was acquired at the request of the Project Manager (see Figure 2). See Appendix II for a record of this correspondence.

In one area neither the the 4 meter depth contour nor the sheet limits could be reached due to the risks of maneuvering the survey vessel in close proximity to the shoreline. Here the Navigable Area Limit Line (NALL) is defined by the inshore limit of safe navigation (Figure 3).

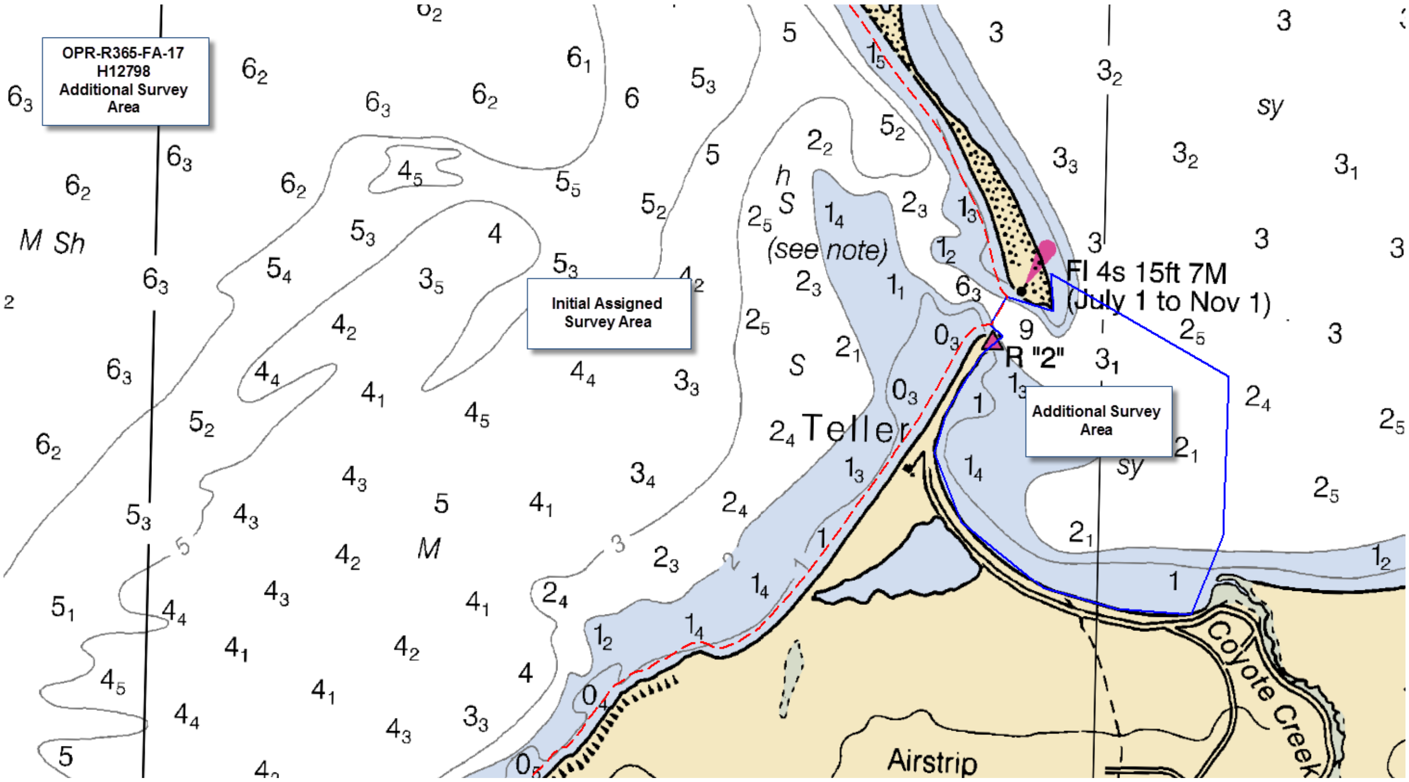


Figure 2: H12798 Sheet limits (in red) with additional coverage area (in blue).

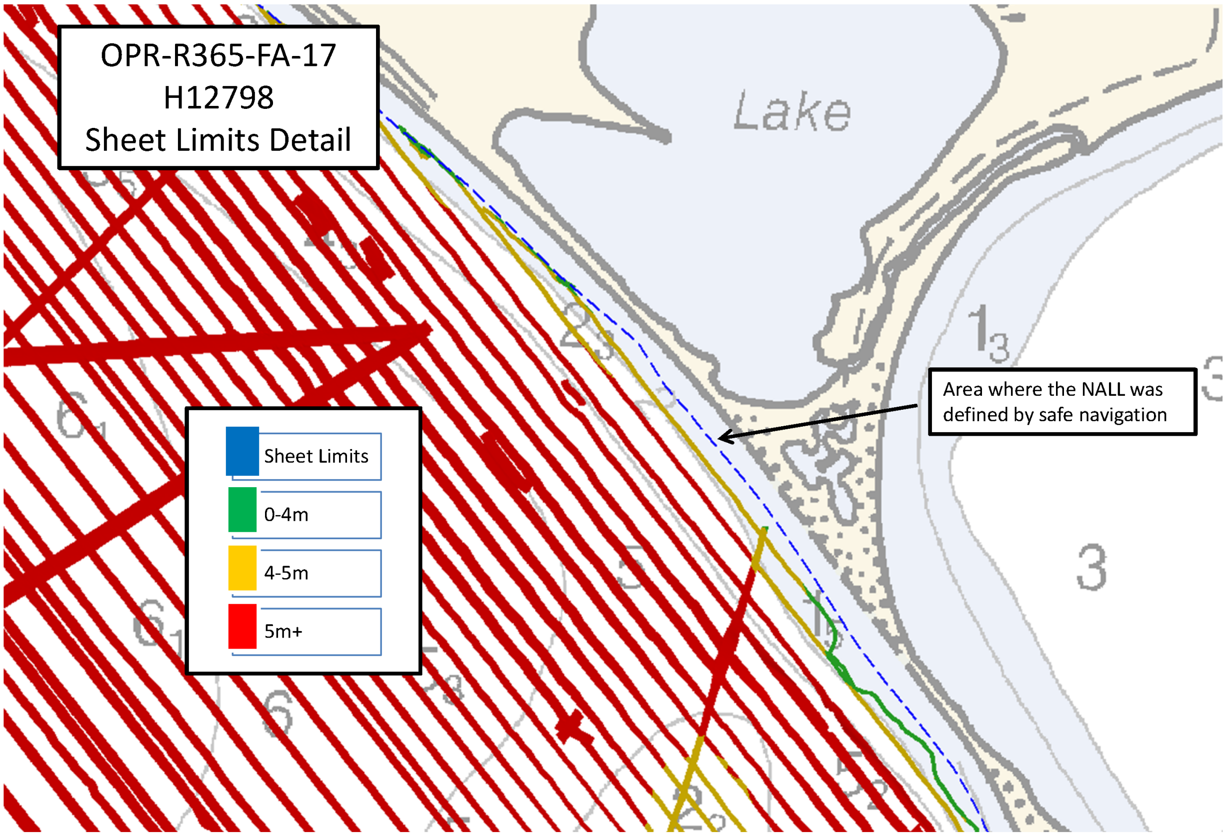


Figure 3: H12798 example of location where the NALL was defined by safe navigation.

Grantley Harbor Expansion Correspondence is appended at the end of this report.

A.2 Survey Purpose

Alaska has more miles of coastline than any other state in the United States. As maritime shipping activity in the Arctic increases in use and feasibility, as natural resources are discovered, and access through previously ice-bound routes for shipping becomes more prevalent there is a need to determine a safe route for transit. The retreat of seasonal sea ice in the Arctic has facilitated the steady growth of vessel traffic from commercial shipping, cruise liners, research vessels, commercial and recreational fishing, and, in the long term, oil and gas exploration in the Bering Strait. The Bering Strait is a narrow passage that provides the only marine passage between the North Pacific and Arctic oceans. Port Clarence, located just south of the Bering Strait, was last surveyed in 1951. Port Clarence is one of the only areas that offers protection from storms and is often used as a port of refuge by barge vessels hauling fuel and goods. When seeking refuge from storms, the most protected southern portions of Port Clarence are frequently avoided due to the unknown depths. Additionally, a high priority request was made on behalf of United States Coast Guard (USCG), Crowley Marine Corporation, and Alaska Marine Pilots because of grounding risk. This area has also been identified as a major development priority for Alaska and the Arctic region.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired in H12798 meet side scan sonar (SSS) with concurrent multibeam echo sounder (MBES) coverage requirements for complete coverage, as required by Section 5.2.2 of the 2017 HSSD. This includes crosslines (see Section B.2.1), NOAA allowable uncertainty (see Section B.2.11) and density requirements (see Section B.2.12). Additional compliance statistics can be found in the Standards and Compliance Review located in Appendix II of this report.

A.4 Survey Coverage

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

Water Depth	Coverage Required
All waters in survey area	Complete coverage

Table 2: Survey Coverage

The entirety of H12798 was acquired with 100% SSS with concurrent MBES, meeting the requirements listed above and in the HSSD. See Figure 4 for an overview of coverage. All possible contacts found in SSS imagery were identified and developed via MBES as per section 5.2.2 in the HSSD. All investigated contacts are shown in Figure 5. Due to the completion of all assigned work on this project ahead of schedule, additional coverage was acquired outside of the initial extent of the assigned sheet limits of H12798 at the request of the Hydrographic Surveys Division Operations Branch (HSD-OPS). This area is located in the channel between Port Clarence and Grantley Harbor, and within Grantley Harbor in the area northeast of Teller. This area was surveyed with a combination of MBES, SSS and SBES. See Figure 6 for an overview of coverage within Grantley Harbor. The entirety of H12798 was acquired with full bottom coverage, meeting the requirements listed above and in the HSSD.

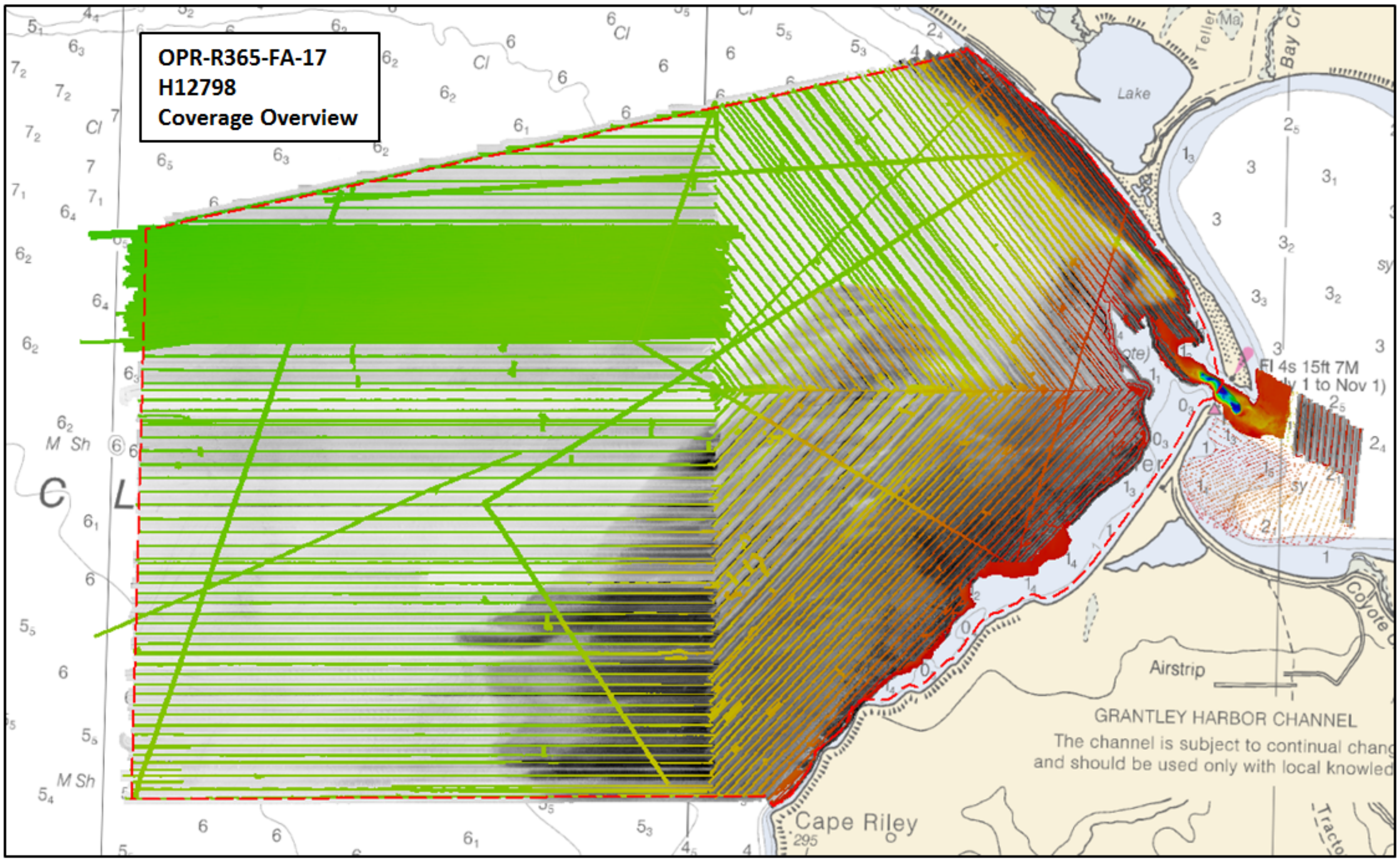


Figure 4: H12798 survey coverage (1 meter surface) overlaid onto Chart 16204.

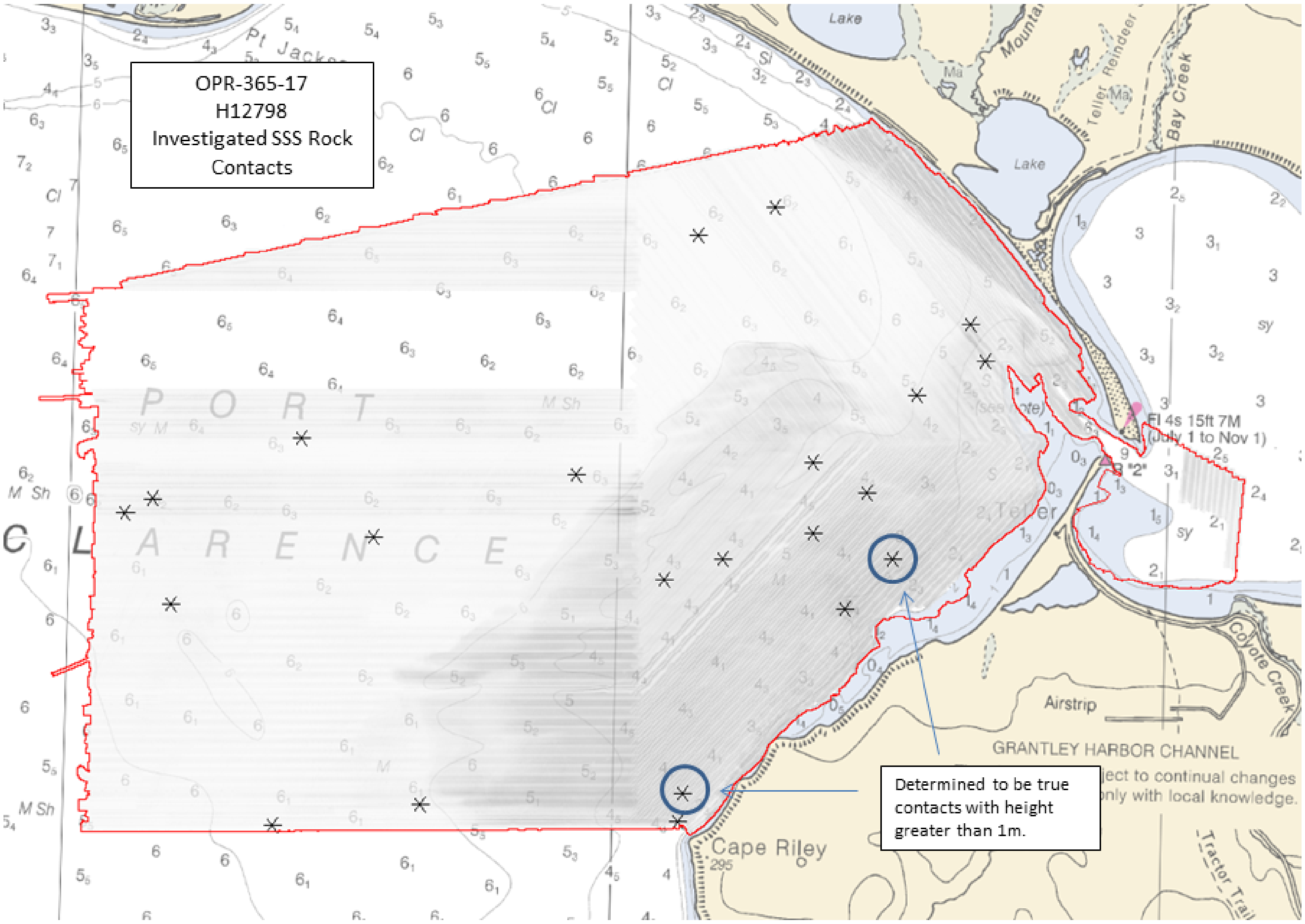


Figure 5: H12798 investigated SSS contacts.

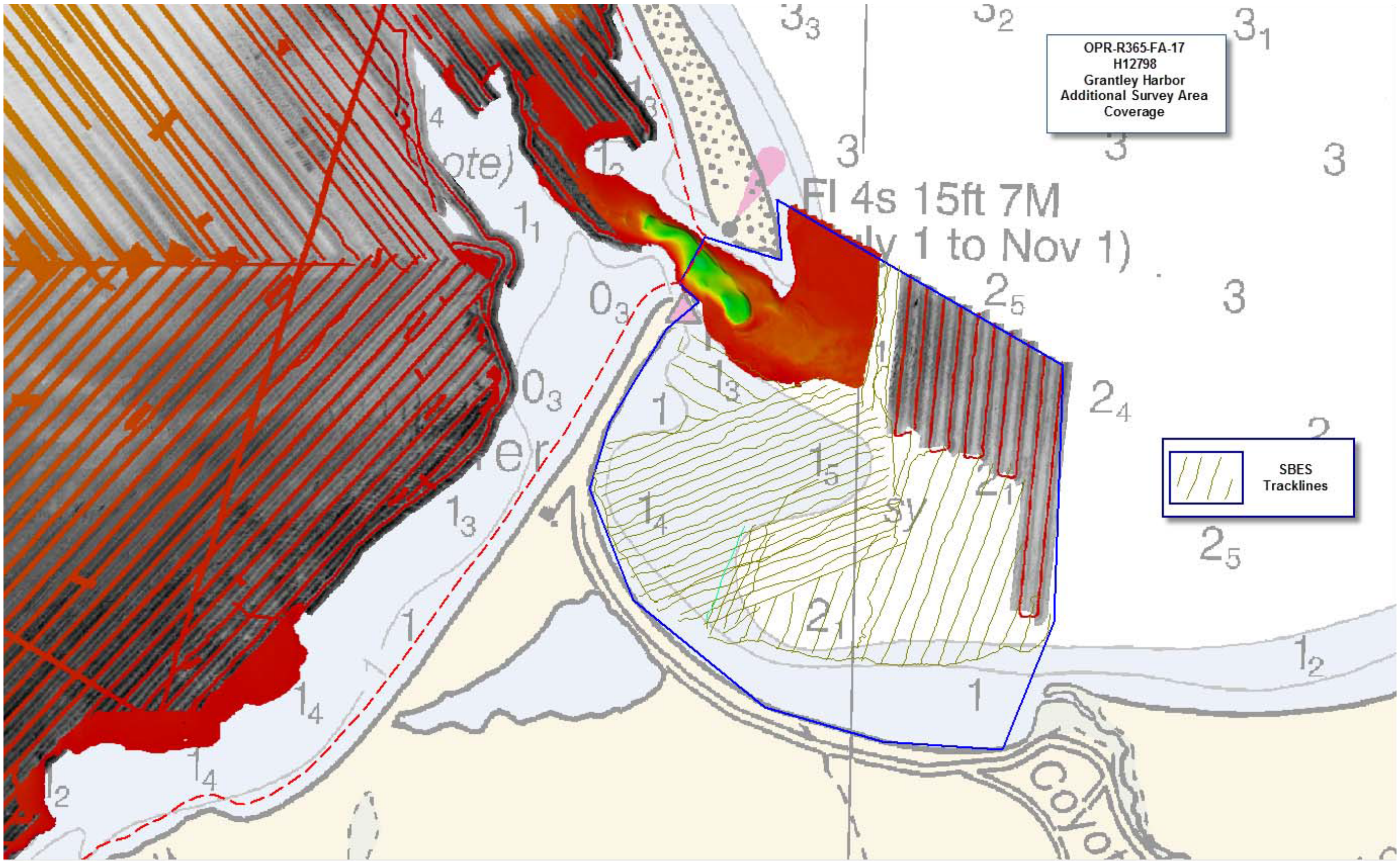


Figure 6: H12798 overview of Grantley Harbor area coverage overlaid onto Chart 16204.

A.6 Survey Statistics

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

	HULL ID	*FA 2302*	*S-220*	*FA 2808*	*FA 2807*	*FA 2806*	*Total*
LNM	SBES Mainscheme	28.41	0	0	0	0	28.41
	MBES Mainscheme	0	172.55	0	12.70	28.64	213.89
	Lidar Mainscheme	0	0	0	0	0	0
	SSS Mainscheme	0	0	0	0	0	0
	SBES/SSS Mainscheme	0	0	0	0	0	0
	MBES/SSS Mainscheme	0	0	222.26	251.01	0	473.27
	SBES/MBES Crosslines	0	3.34	0	0	39.56	42.9
	Lidar Crosslines	0	0	0	0	0	0
Number of Bottom Samples							5
Number Maritime Boundary Points Investigated							0
Number of DPs							0
Number of Items Investigated by Dive Ops							0
Total SNM							33.0

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
07/21/2017	202
07/22/2017	203

Survey Dates	Day of the Year
07/24/2017	205
07/25/2017	206
07/26/2017	207
07/30/2017	211
07/31/2017	212
08/01/2017	213
08/02/2017	214
08/03/2017	215
08/04/2017	216
08/08/2017	220
08/09/2017	221
08/10/2017	222
08/11/2017	223
08/14/2017	226
08/15/2017	227
08/21/2017	233
08/22/2017	234
08/23/2017	235
08/29/2017	241
08/31/2017	243

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	***S220***	***2806***	***2807***	***2808***	***2302***
LOA	70.4 meters	8.64 meters	8.64 meters	8.64 meters	7.0 meters
Draft	4.8 meters	1.12 meters	1.12 meters	1.12 meters	0.6 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
Kongsberg Maritime	EM 710	MBES
CEE HydroSystems	CEEPULSE	SBES
Sea-Bird Scientific	19plus V2	Conductivity, Temperature, and Depth Sensor
Teledyne RESON	SVP 70	Sound Speed System
Teledyne RESON	SVP 71	Sound Speed System
Applanix	POS MV 320 v5	Positioning and Attitude System
Klein Marine Systems	System 5000	SSS
Garmin	GLO	Positioning System

Table 6: Major Systems Used

The equipment was installed on the survey platforms as follows: S220 utilizes the Kongsberg EM 710 MBES, SVP 70 surface sound speed sensors, and Sea-Bird Scientific 19plus for conductivity, temperature, and depth (CTD) casts. Launches 2806, 2807 and 2808 utilize Kongsberg EM 2040 MBES, Teledyne RESON SVP71 surface sound speed sensors, and Sea-Bird Scientific 19plus CTD casts. Additionally, launches 2807 and 2808 are equipped with Klein 5000 SSS for side scan acquisition. 2302 utilizes the CEEPULSE single beam echo sounder and Garmin GLO for positioning.

B.2 Quality Control

B.2.1 Crosslines

Multibeam/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 6.00% of mainscheme acquisition.

Crosslines were collected, processed and compared in accordance with Section 5.2.4.3 of the HSSD. To evaluate crosslines, a surface using strictly mainscheme lines, and a surface using strictly crosslines were created. From these two surfaces, a difference surface (mainscheme - crosslines = difference surface) was generated (Figure 7), and is submitted in the Separates II Digital Data folder. Statistics show the mean difference between the depths derived from mainscheme and crosslines was -0.02 meters (with mainscheme being shoaler) and 95% of nodes falling within 0.25 meters (Figure 8).

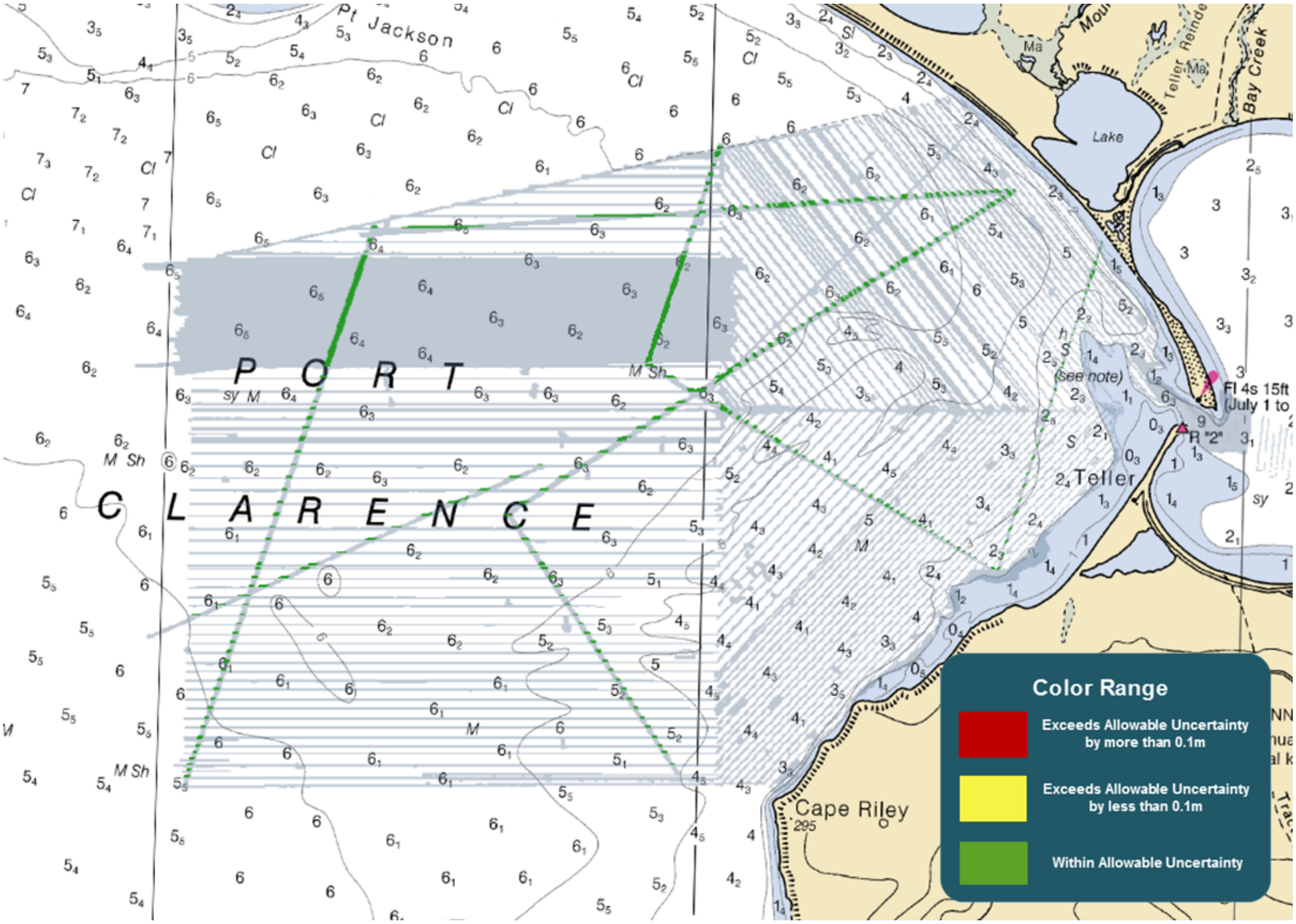


Figure 7: Depth diferences between H12798 mainscheme and crossline data as compared to NOAA allowable uncertainty standards for the associated depths.

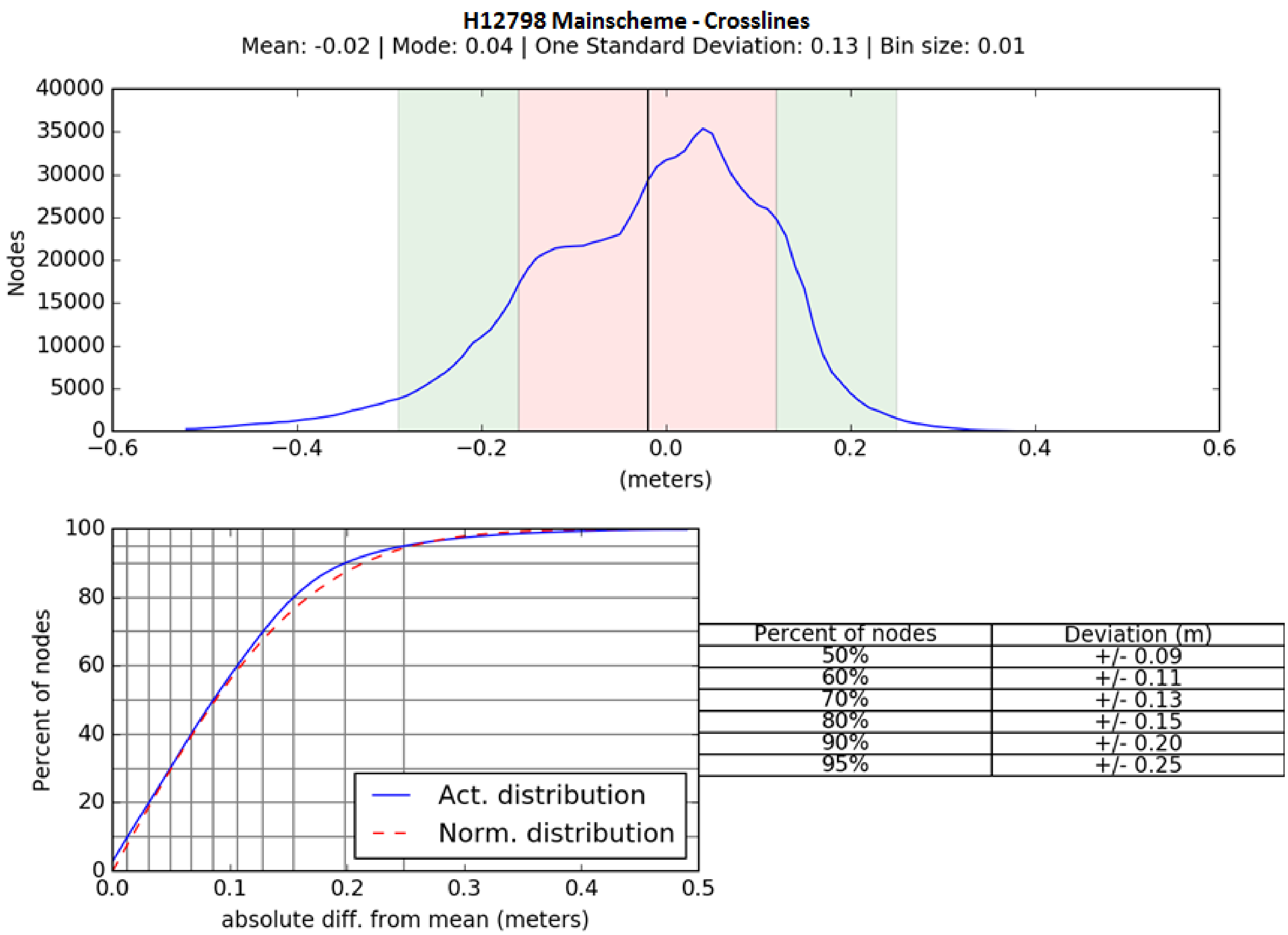


Figure 8: H12798 Crossline difference statistics.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via PMVD	0 meters	0.045 meters

Table 7: Survey Specific Tide TPU Values.

Real time uncertainty values were calculated by TCARI grid

Hull ID	Measured - CTD	Measured - MVP	Surface
S220	2 meters/second		.05 meters/second
280x	2 meters/second		0.5 meters/second
2302	2 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, ERZT, and Poor Man's VDatum (PMVD), real-time and post-processed uncertainty sources were also incorporated into the depth estimates of survey H12798. Real-time uncertainties were provided via EM710 and EM2040 MBES data, Applanix Delayed Heave RMS, and TCARI tides. 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. The CEEPulse SBES had not been formally accepted by NOAA, however details of the calibration and data verification procedures can be found in the DAPR.

B.2.3 Junctions

H12798 junctions with one adjacent survey from this project, H12800, and two surveys from prior projects, H12232 and H11274, as shown in Figure 9. Data overlap between H12798 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 H12798 are generally within the NOAA allowable uncertainty in their areas of overlap. For all junctions with H12798, a negative difference indicates H12798 was shoaler, and a positive difference indicates H12798 was deeper.

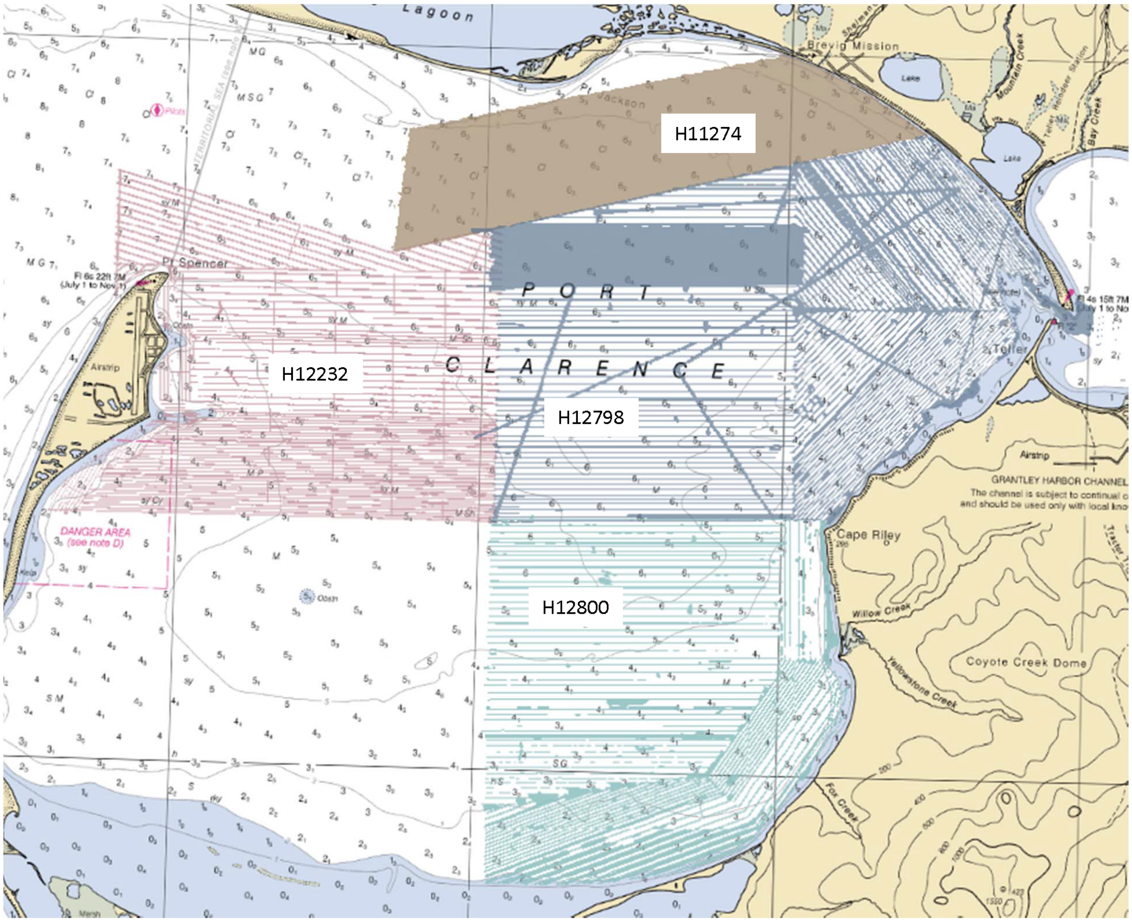


Figure 9: Overview of H12798 junction surveys.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12232	1:40000	2010	NOAA Ship FAIRWEATHER	W
H11274	1:40000	2005	Terrasond, Ltd.	N
H12800	1:40000	2017	NOAA Ship FAIRWEATHER	S

Table 9: Junctioning Surveys

H12232

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface from H12798 and the surface from H12232 (Figure 10). The statistical analysis of the difference surface shows a mean of 0.0 m with 95% of all nodes having a maximum deviation of +/-0.2 m, as seen in Figure 11. It was found that 99.5% of nodes are within NOAA allowable uncertainty.

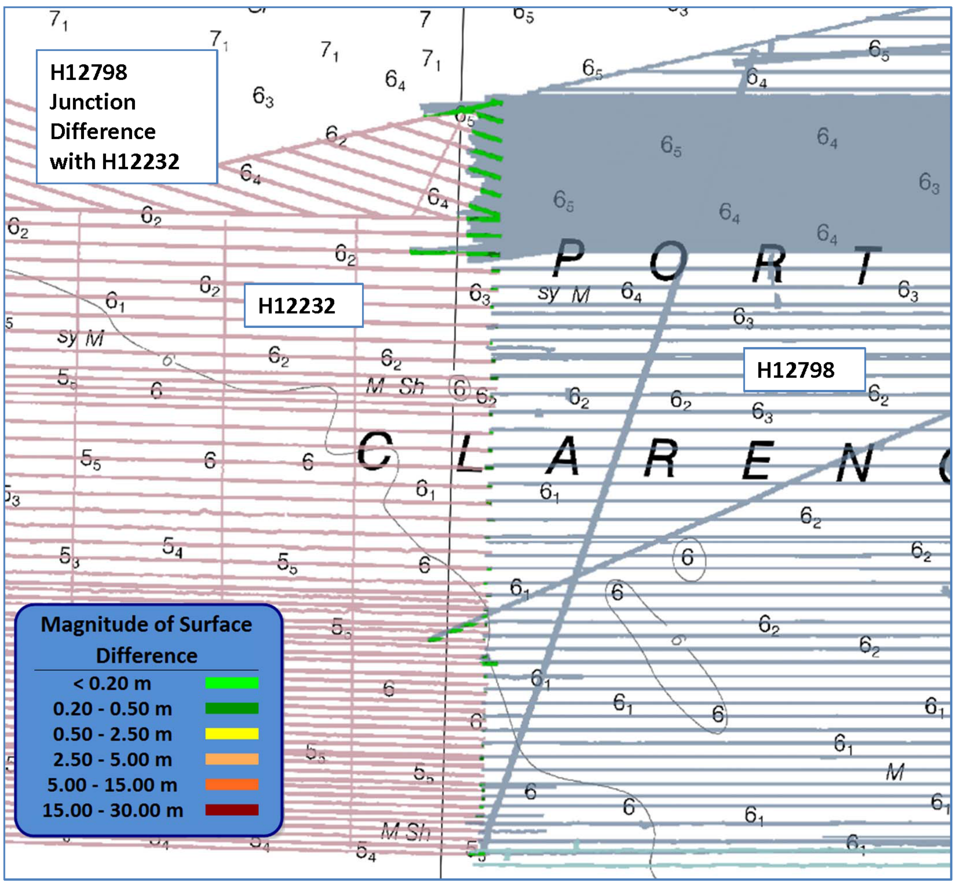
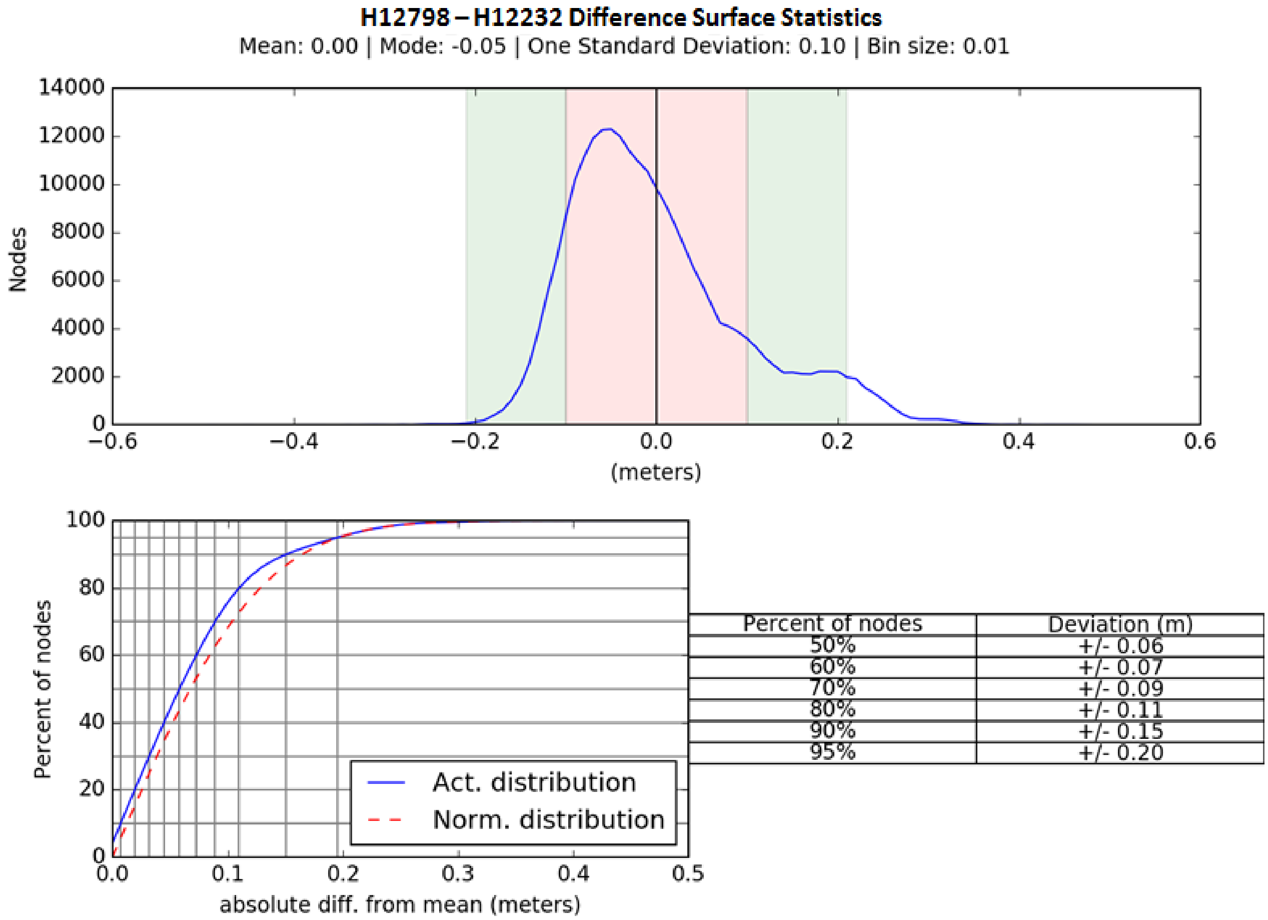


Figure 10: Difference surface between H12798 (grey) and junctioning survey H12232 (red).



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.07
70%	+/- 0.09
80%	+/- 0.11
90%	+/- 0.15
95%	+/- 0.20

Figure 11: Difference surface statistics between H12798 and H12232 (1 meter surface).

<u>H11274</u>

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface from H12798 and the surface from H11274. The statistical analysis of the difference surface shows a mean of -0.49 m with 95% of all nodes having a maximum deviation of +/-0.26 m, as seen in Figure 13. It was found that 95% of nodes are within NOAA allowable uncertainty. Tide correctors are a likely explanation for the 0.49 m difference but since the junction surveys have no GPS ellipsoidal values associated with their soundings this could not be verified.

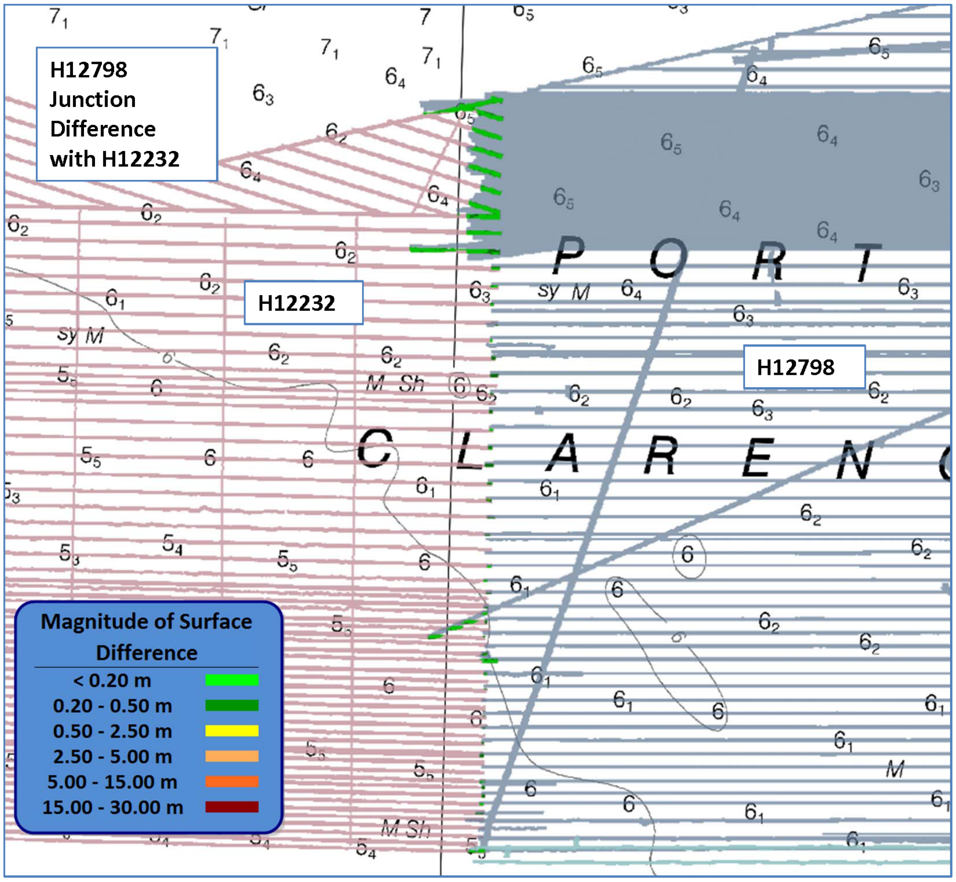
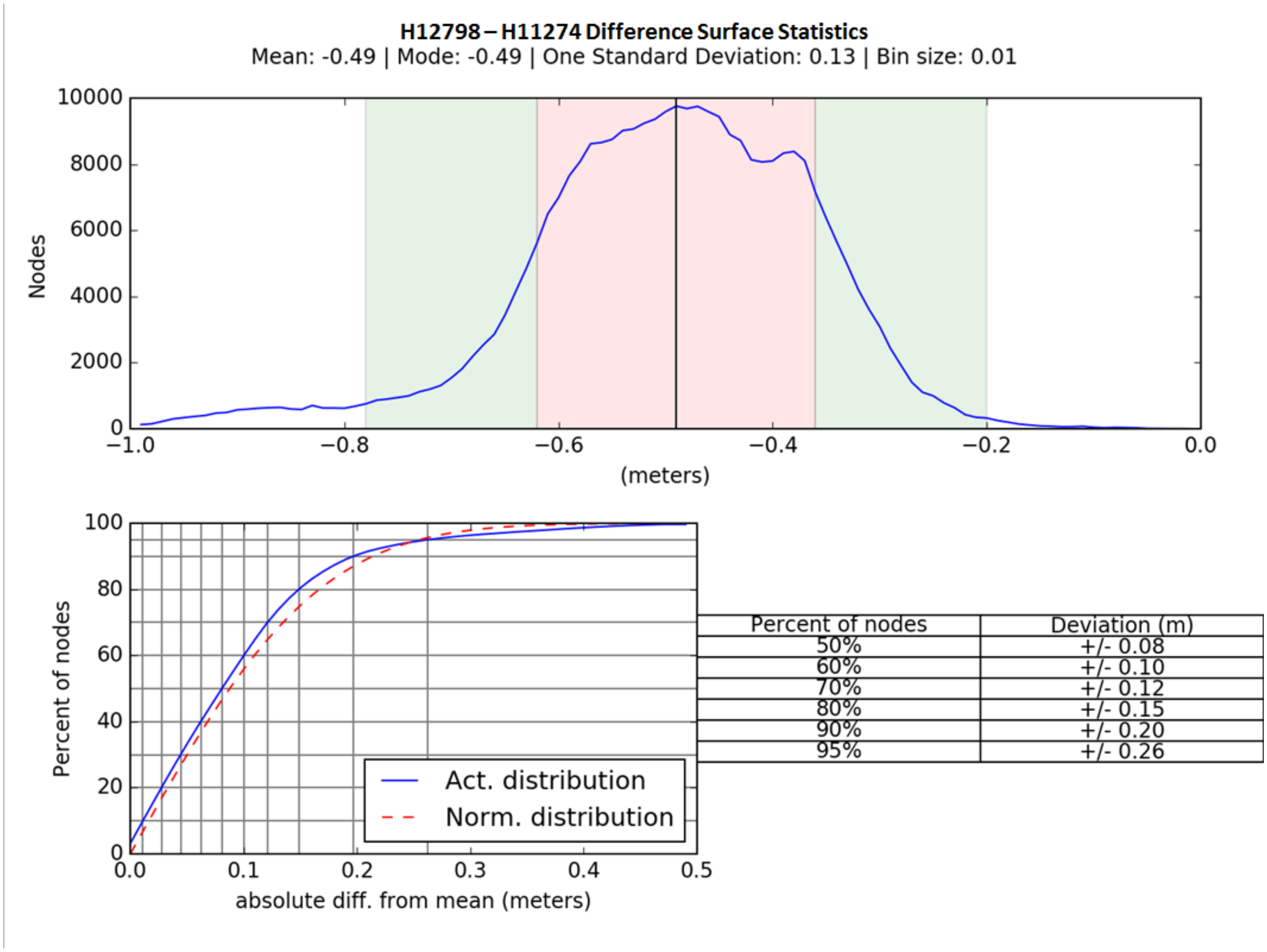


Figure 12: Difference surface between H12798 (grey) and junctioning survey H11274 (brown).



Percent of nodes	Deviation (m)
50%	+/- 0.08
60%	+/- 0.10
70%	+/- 0.12
80%	+/- 0.15
90%	+/- 0.20
95%	+/- 0.26

Figure 13: Difference surface statistics between H12798 and H11274 (1 meter surface).

<u>H12800</u>

Surface differencing in CARIS HIPS and SIPS was used to assess junction agreement between the surface from H12798 and the surface from H12800. The statistical analysis of the difference surface shows a mean of -0.04 m with 95% of all nodes having a maximum deviation of +/-0.09 m, as seen in Figure 15. It was found that 99.5% of nodes are within NOAA allowable uncertainty.

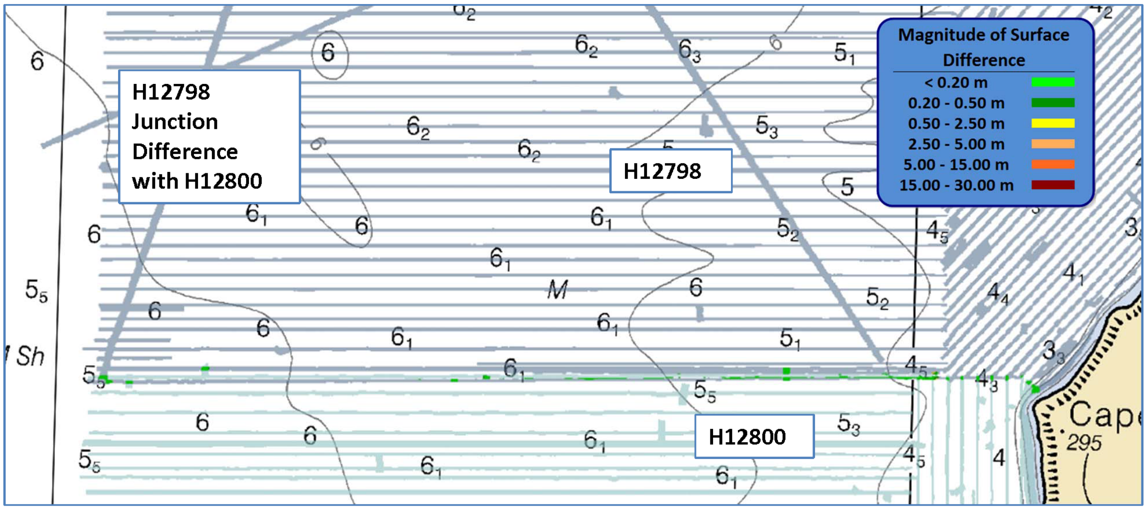
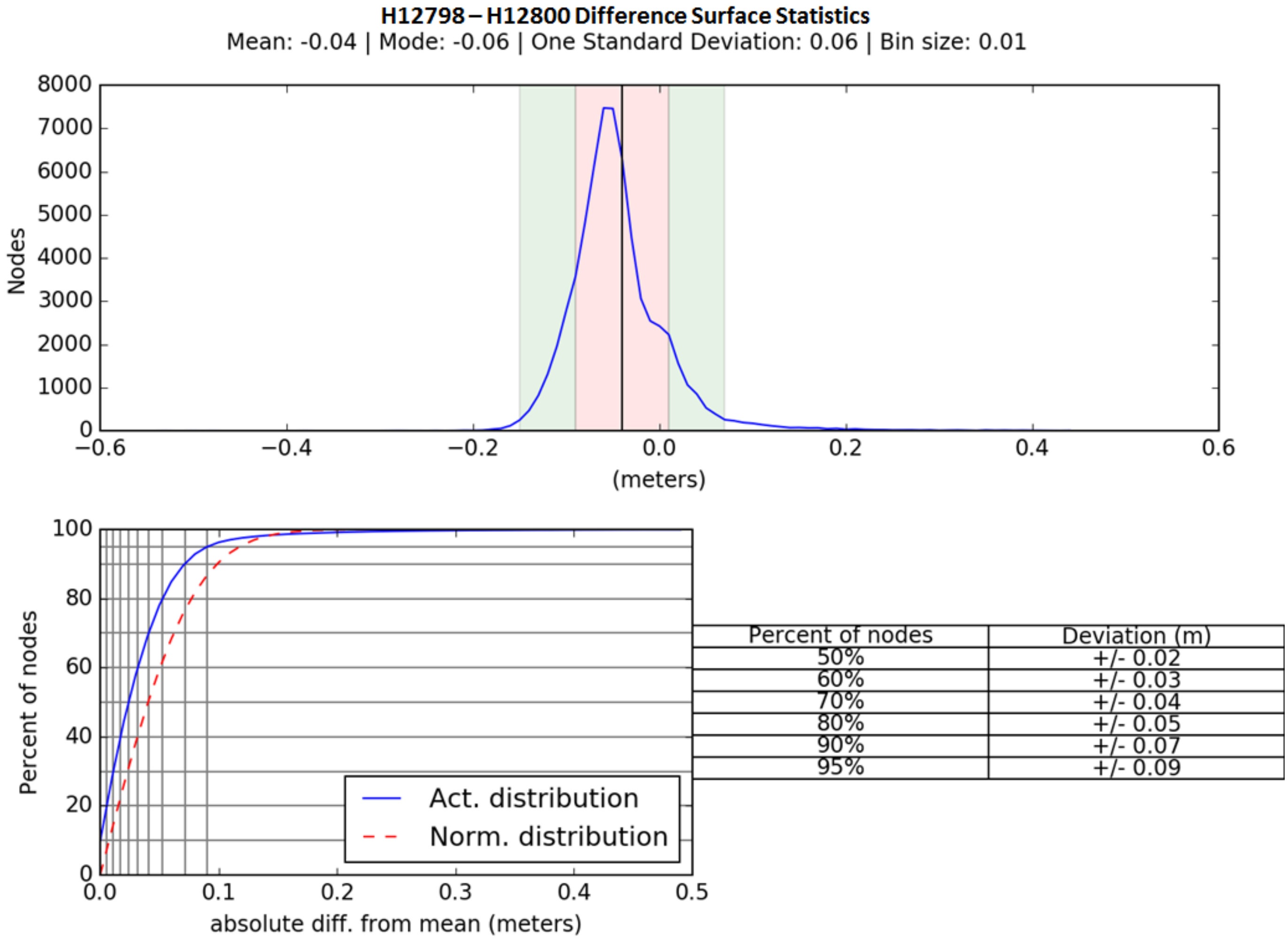


Figure 14: Difference surface between H12798 (grey) and junctioning survey H12800 (blue).



Percent of nodes	Deviation (m)
50%	+/- 0.02
60%	+/- 0.03
70%	+/- 0.04
80%	+/- 0.05
90%	+/- 0.07
95%	+/- 0.09

Figure 15: Difference surface statistics between H12798 and H12800 (1 meter surface).

B.2.4 Sonar QC Checks

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

B.2.5 Equipment Effectiveness

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

B.2.6 Factors Affecting Soundings

There were no other factors that affected corrections to soundings.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Casts were conducted at a minimum of one every four hours during 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. Casts were conducted at least once per week for SBES acquisition, and more frequently where possible. 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 MBES Holidays

H12798 data were reviewed in CARIS HIPS and SIPS for holidays in accordance with Section 5.2.2.3 of the HSSD. 75 holidays which meet the 3 by 3 node definition were identified via Pydro 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. Although numerous apparent holidays were flagged by Holiday Finder, all were examined and determined to be from areas where adjoining coverage filled the gap (e.g., a holiday in the one meter MBES surface was covered by SSS coverage) as shown in Figure 16, or from gaps in the 1 m coverage at depths shallower than 4 m (Figure 17).

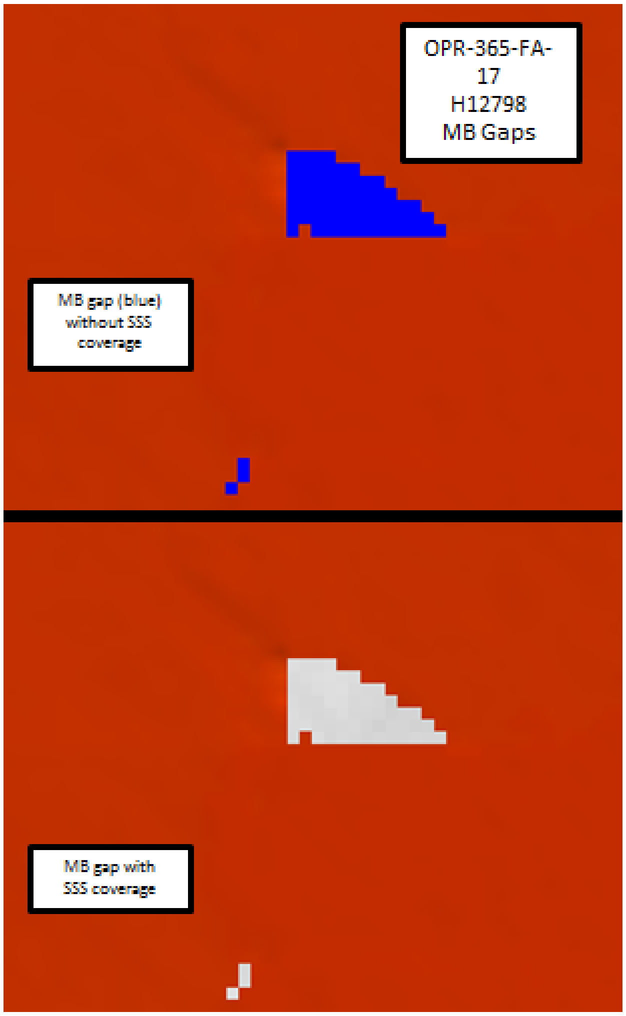


Figure 16: H12798 gap in MBES coverage filled with SSS coverage.

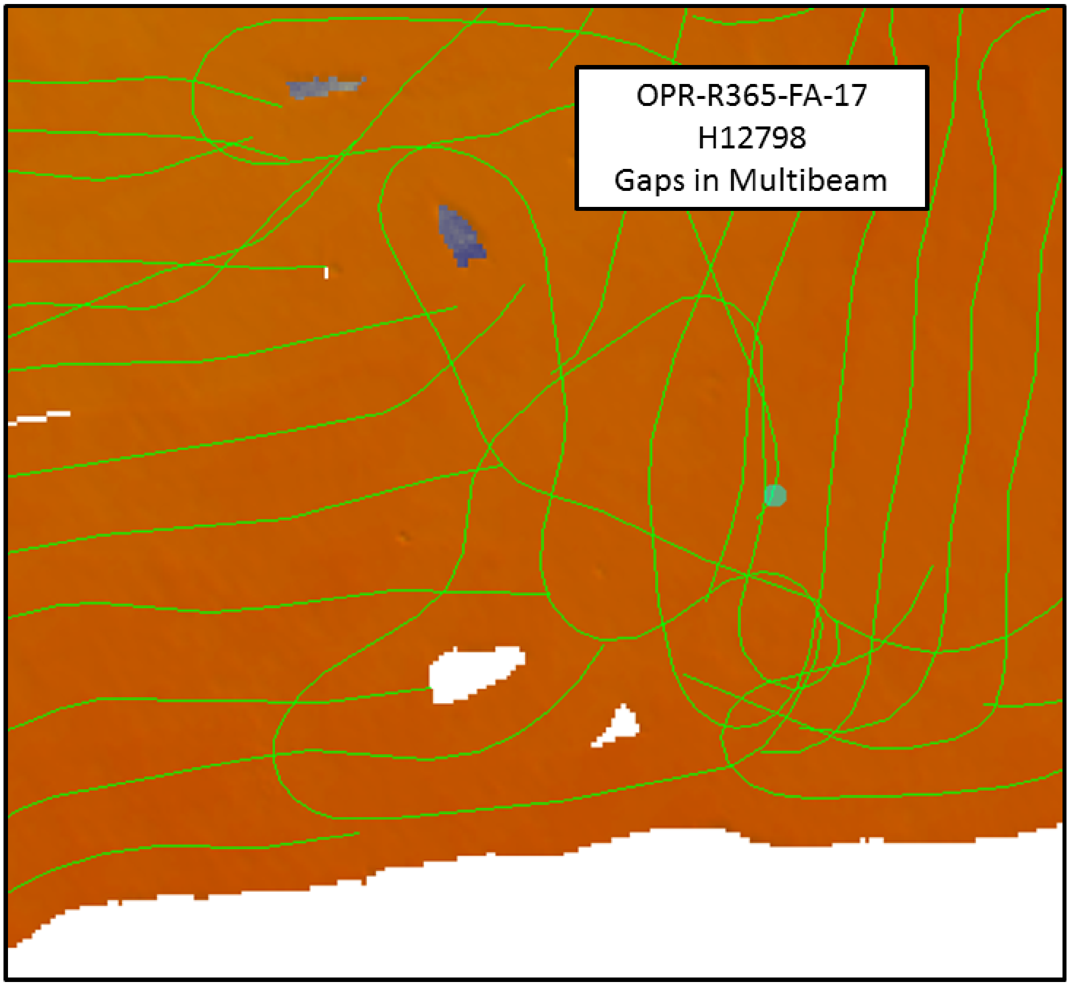


Figure 17: H12798 gaps in MBES coverage at depths less than 4 m.

B.2.10 SSS Holidays

The H12798 SSS mosaic was reviewed manually in CARIS HIPS and SIPS for gaps. All gaps that were greater than two pixels by two pixels (4 square meters) were identified and filled in with multibeam data. Figure 18 illustrates an example of such a gap.

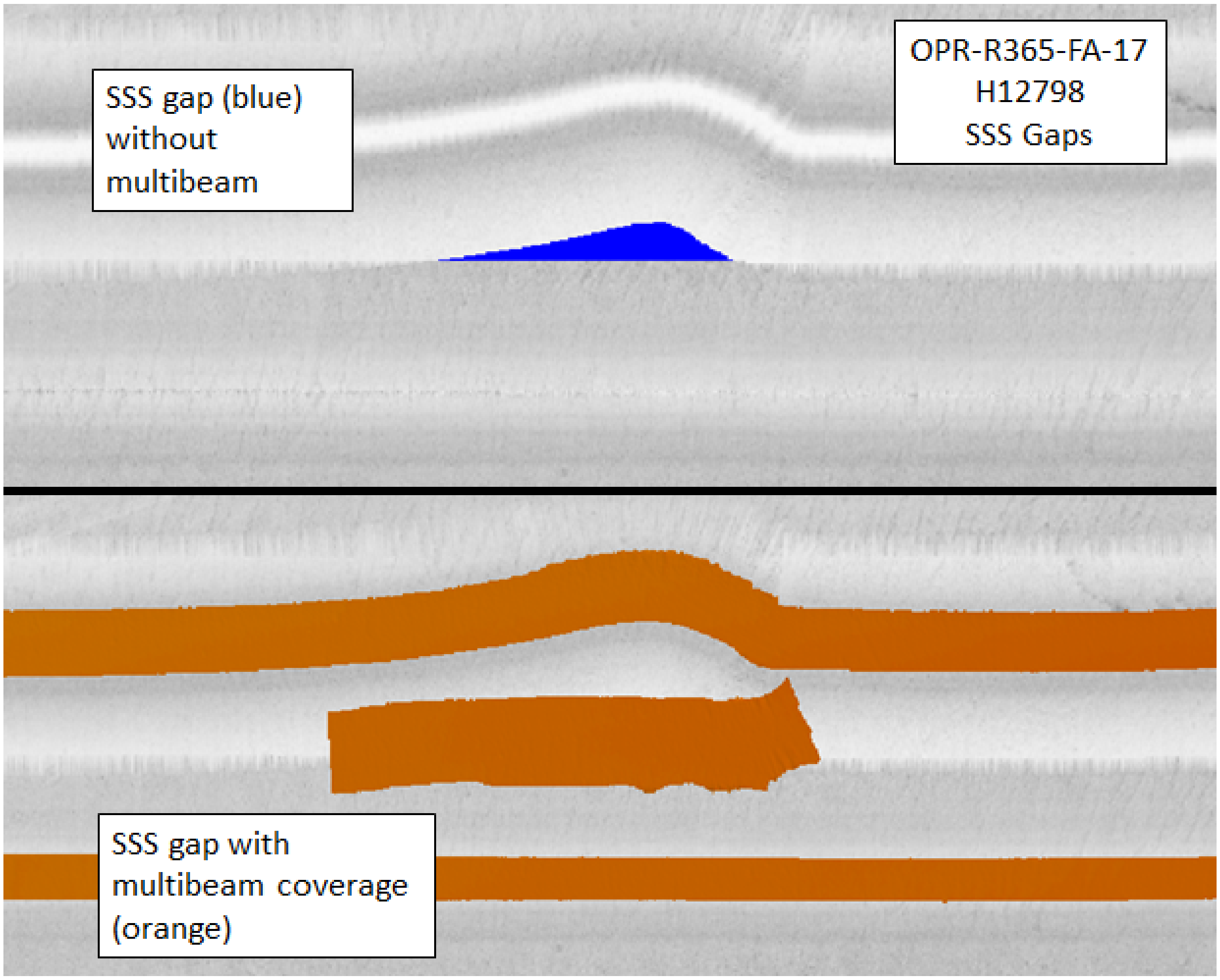


Figure 18: H12798 gap in SSS coverage with MBES coverage.

B.2.11 NOAA Allowable Uncertainty

The surface was analyzed via Pydro QC Tools Grid QA feature to determine the percentage of surface nodes that meet specifications. Overall, 99.5% of nodes meet NOAA allowable uncertainty standards for H12798. For a graphical representation of uncertainty compliance, see the Standards and Compliance Review located in Appendix II.

B.2.12 Density

The surface was analyzed via Pydro QC Tools Grid QA feature to determine the percentage of surface nodes that meet specifications. Overall, 99% of nodes meet density requirement standards for H12798. For a graphical representation of density compliance, see the Standards and Compliance Review located in Appendix II.

B.2.13 Single Beam

The majority of coverage within Grantley Harbor was acquired using the CEEPULSE single beam echo sounder mounted on launch FA 2302. SBES was used because much of Grantley Harbor is too shallow to use Fairweather's normal MBES equipped launches (280x) safely. FA 2302 is not equipped with a system for measurement of heave, and systematic dynamic draft measurements were not conducted due to time constraints. Comparisons between SBES data and adjacent MBES data are within NOAA allowable uncertainty and support its inclusion in this survey, as detailed in the DAPR.
SBES data in Grantley Harbor tends to become noisy in depths less than 2.5 m (see Figure 19). This is likely due to the prevalence of sea grass in shallower waters in the area. This noisy data was fully rejected where a reliable bottom could not be determined through inspection of the soundings. The CEEPULSE does not provide an echogram recording for further analysis of the returns.

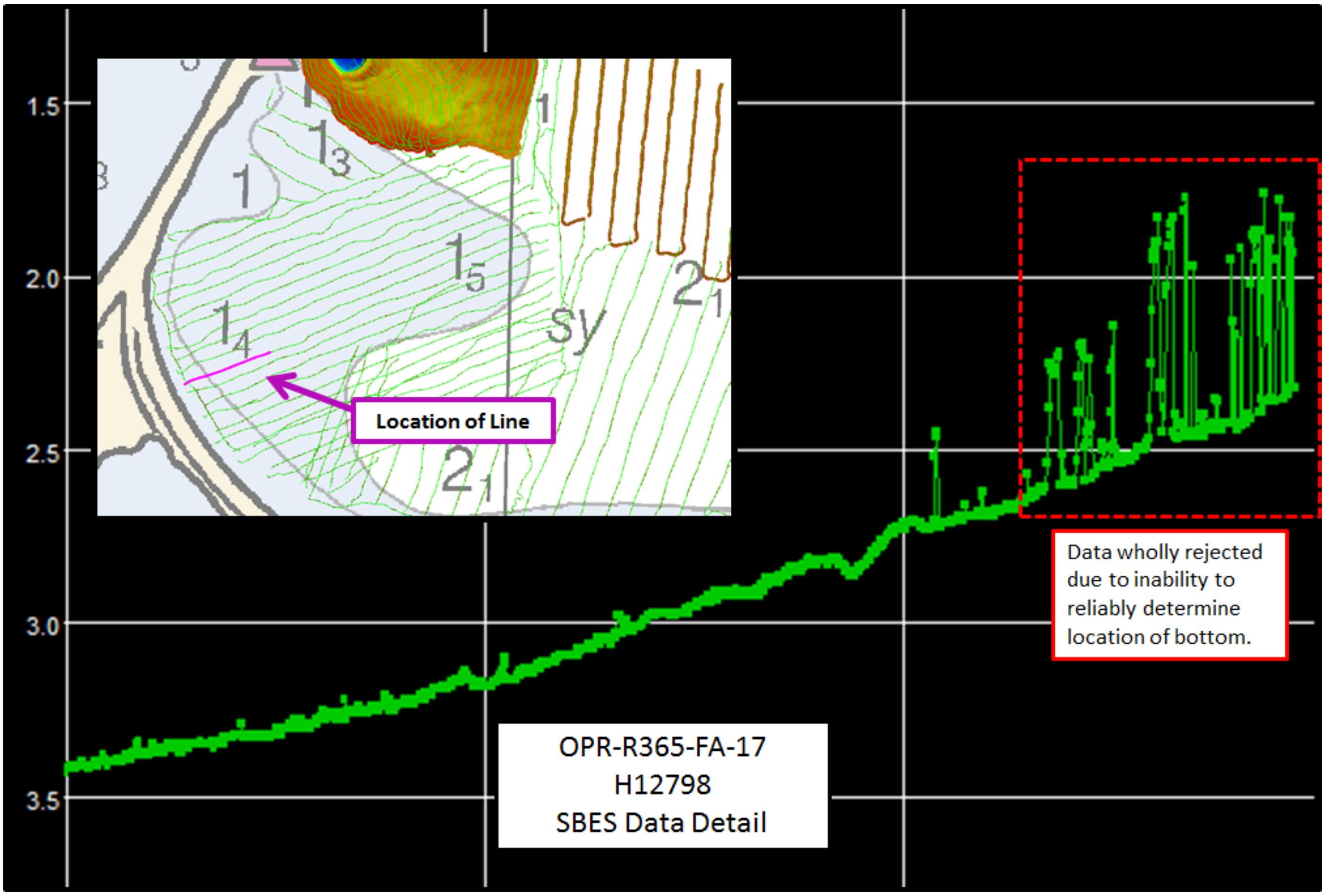


Figure 19: SBES data becoming noisy at shallow depths.

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 system. All backscatter were processed by the field unit via Fledermause FMGT 7.7.4. All mosaics and .gsf files have been submitted digitally to the Pacific Hydrographic Branch. See Figure 20 for a complete mosaic.

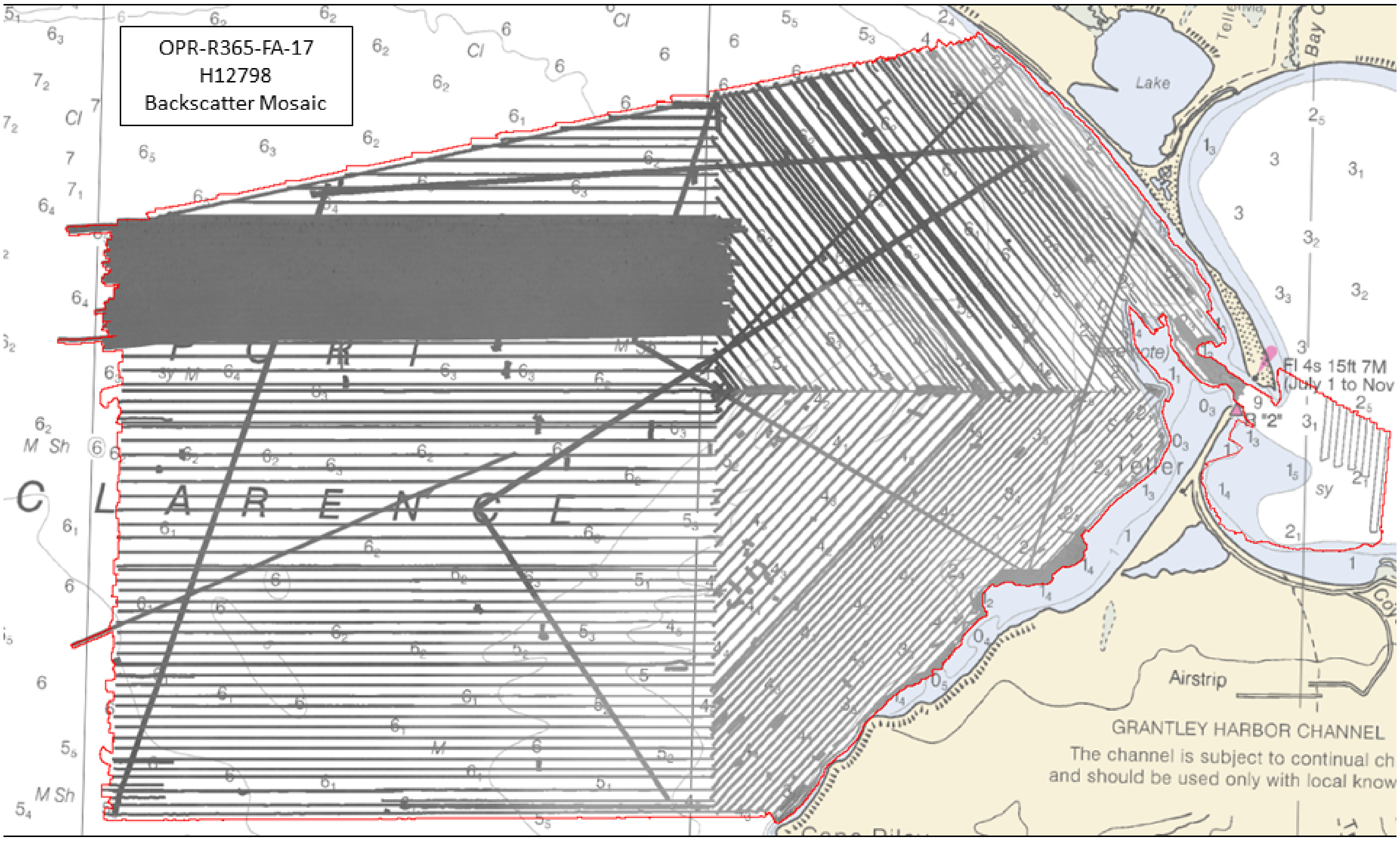


Figure 20: H12798 Backscatter mosaic

There was no backscatter requirement for this project. Therefore no mosaics or .gsf files were submitted to the Processing branch. Backscatter products were generated by the SAR reviewer at the processing Branch.

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	10.3.3

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	7.7.4

Table 11: Primary imagery data processing software

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

Manufacturer	Name	Version
Teledyne CARIS	HIPS and SIPS	10.3.3

Table 12: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Extended Attribute Files version 5.6..

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**
H12798_MB_1m_MLLW_Final	CARIS Raster Surface (CUBE)	1 meters	0.4 meters - 43.9 meters	NOAA_1m	Complete MBES
H12798_MB_1m_MLLW	CARIS Raster Surface (CUBE)	1 meters	0.4 meters - 43.9 meters	NOAA_1m	Complete MBES
H12798_VB_4m_MLLW	CARIS Raster Surface (CUBE)	4 meters	1.1 meters - 7.1 meters	NOAA_4m	MBES TracklineSBES Set Line Spacing
H12798_SSS_1m	SSS Mosaic	1 meters	-	N/A	100% SSS

Table 13: Submitted Surfaces

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surfaces in Survey H12798. This surface has 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. Additionally, the depth bound of the 1 m surface was extended beyond 20 m due to both the limited areas of deeper soundings within the survey limits and the ability to still meet density requirements. The waiver for this extension can be found in Appendix II.

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 multiple times for this surface, reducing the flier height value for each consecutive run. This allowed Flier Finder to accurately and quickly identify gross fliers, but as the flier height was reduced the effectiveness of the tool diminished. At this point, the hydrographer ceased using the tool and returned to manual cleaning.

The waiver document is appended at the end of this report.The SSS surfaces in the DR is not named the same as the actual SSS mosaic. The submited grid is named: H12798_SSS_1m_100.csar

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying HVCR.

C.1 Vertical Control

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

Traditional Methods Used:

TCARI

The following National Water Level Observation Network (NWLON) stations served as datum control for this survey:

Station Name	Station ID
Nome, Norton Sound, AK	946-8756
Village Cove, AK	946-4212
Red Dog Dock, AK	949- 1094

Table 14: NWLON Tide Stations

File Name	Status
9491094.tid	Predicted
9464212.tid	Predicted
9468756.tid	Predicted

Table 15: Water Level Files (.tid)

File Name	Status
R365FA2017.tc	Final

Table 16: Tide Correctors (.zdf or .tc)

A request for final approved tides was sent to N/OPS1 on 09/06/2017. The final tide note was received on 09/15/2017.

Initial reduction of acquired data to MLLW was accomplished via traditional tidal means using the Tidal Constituent And Residual Interpolation (TCARI) grid provided by HSD-OPS. Following the successful application of SBETs and computation of an Ellipsoidally Referenced Zone Tide (ERZT) separation model, ERS methods were used for reducing data to MLLW. After final tides were received, the final TCARI grids were applied to the data and used for reducing features to MLLW. The final reducer for SBES data is TCARI verified tides.

<u>ERS Methods Used:</u>

ERS via Poor Mans VDATUM

<u>Ellipsoid to Chart Datum Separation File:</u>

R365FA2017_PMVD_EPSG6332_NAD83_MLLW_Composite.csar

ERS methods were used as the final means of reducing MBES data for H12798 to MLLW for submission. Data were initially reduced via traditional tidal means until an ERZT separation model could be calculated. This empirically derived model was then checked for consistency and compared to the Poor Man's VDatum (PMVD) separation model provided with the Project Instructions. The PMVD separation model was then vertically shifted such that the average difference between these two separation models is zero. This vertical shift de-biases the PMVD separation model, correcting for local offsets that cannot be effectively modeled by the PMVD. In areas where the PMVD model did not have sufficient coverage such as near shore areas, the ERZT separation model was appended to the PMVD model creating the composite ERZT/PMVD separation model listed above and used to reduce H12798 to MLLW.

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD83).

The projection used for this project is UTM Zone 03 North.

The following PPK methods were used for horizontal control:

Single Base

Vessel kinematic data were post-processed using Applanix POSPac processing software and Single Base 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. Single base data was not available for DN220 through DN 222 due to a base station malfunction (see section 3.3.1).

For further details regarding the processing and quality control checks performed, see the H12798 POSPAC Processing Logs spreadsheet located in the Separates folder. See also the OPR-R365-FA-17 Horizontal and Vertical Control Report (HVCR), submitted under separate cover.

The following user installed stations were used for horizontal control:

HVCR Site ID	Base Station ID
9273 A	9677

Table 17: User Installed Base Stations

C.3 Additional Horizontal or Vertical Control Issues

C.3.1 RTX

Vessel kinematic data were post-processed via Applanix POSPac RTX for DN220, DN221, and DN222 to account for the period of time that the user-installed base station was inoperative.
Trajectory (SBET) and associated error (RMS) data were applied to the MBES data for these dates in CARIS HIPS and SIPS. A maximum vertical offset of approximately 0.3 m exists between data corrected via SBETs processed by RTX methods and data corrected via SBETs processed by Single-Base methods (Figure 21). All offsets were found to be within the NOS standards for Total Vertical Uncertainty (TVU) described in Section 5.1.3 of the HSSD.

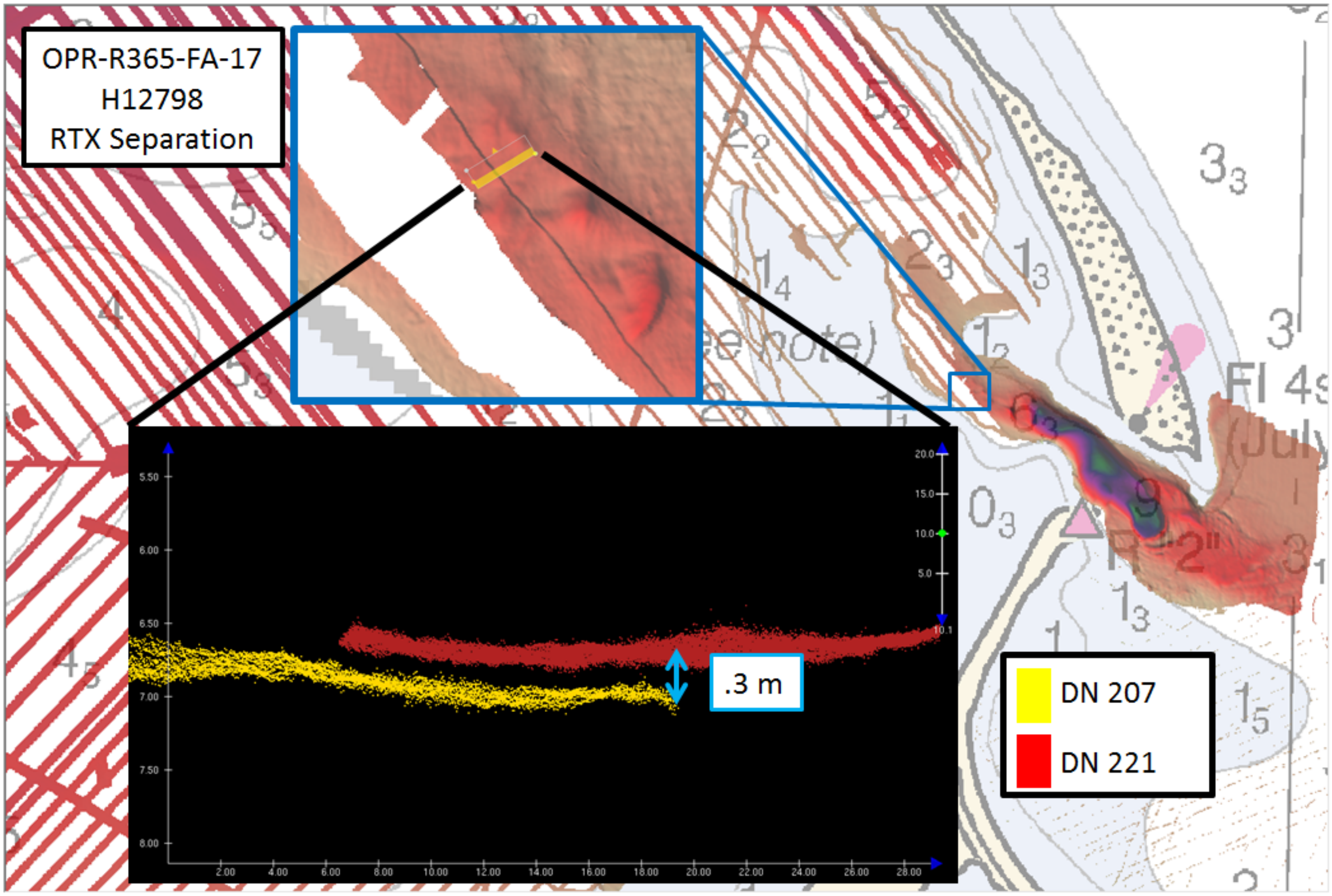


Figure 21: H12798 RTX separation.

C.3.2 WAAS

During real-time acquisition S220 and launches 2808, 2806 and 2807 received correctors from the Wide Area Augmentation System (WAAS) for increased accuracies similar to USCG DGPS stations. WAAS and SBETs were the sole methods of correcting position data for H12798 as no DGPS stations were available for realtime horizontal control.

D. Results and Recommendations

D.1 Chart Comparison

A manual comparison was performed between survey H12798 and ENC US4AK81M, the largest scale chart, using CARIS HIPS and SIPS sounding layer derived from the 1 m combined surface. The soundings were overlaid on the chart to assess differences between the surveyed soundings and the charted depths and contours.

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?
US4AK81M	1:100000	12	04/27/2016	07/27/2017	NO

Table 18: Largest Scale ENCs

US4AK81M

Soundings from H12798 are in a general agreement with charted depths and contours on ENC US4AK81M, with most of the depths agreeing to 1 fathom (Figure 22).

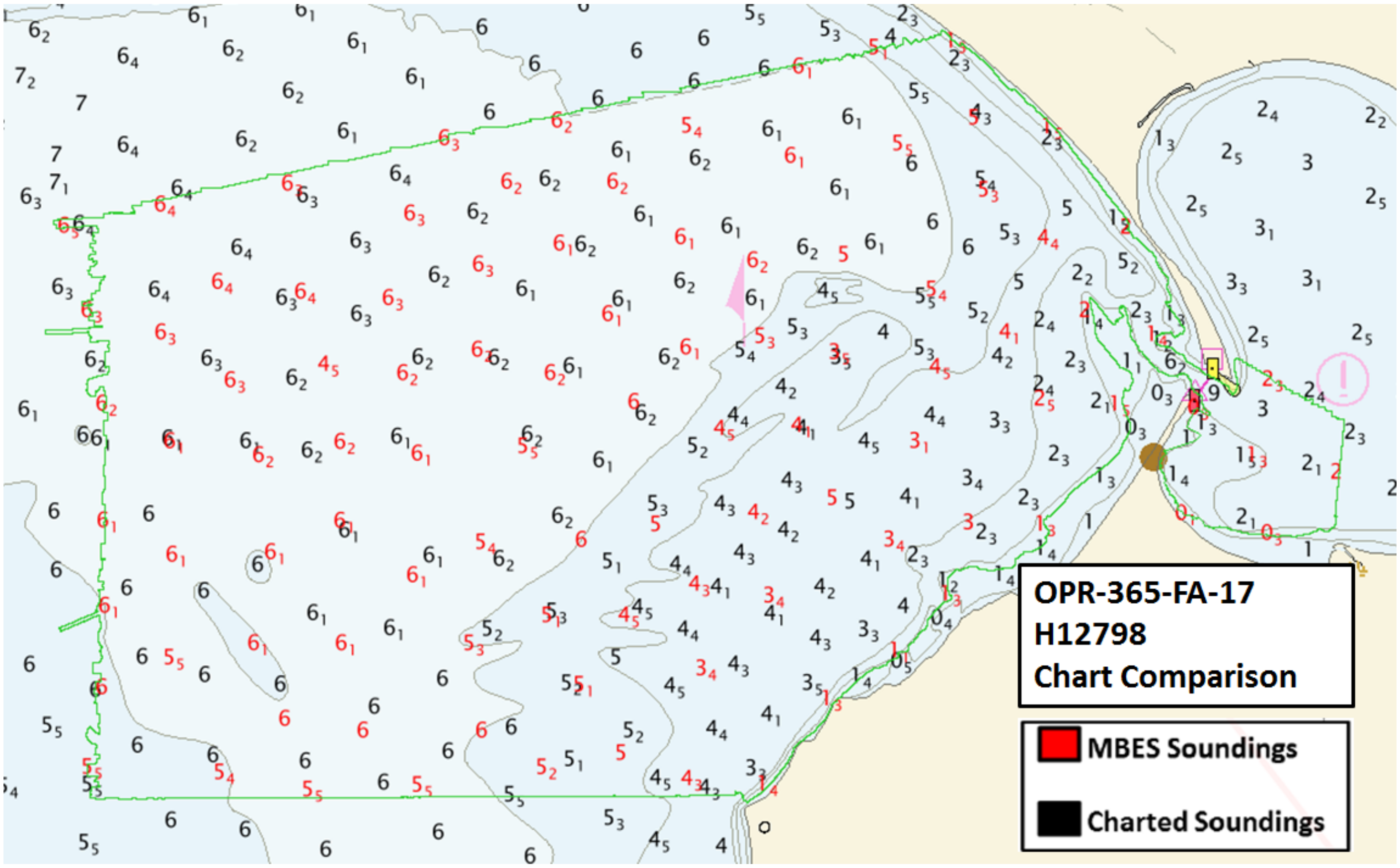


Figure 22: Comparison between H12798 soundings and ENC US4AK81M.

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

No charted features exist for this survey.

D.1.4 Uncharted Features

No uncharted features exist for this survey.

D.1.5 Shoal and Hazardous Features

No shoals or potentially hazardous features exist for this survey.

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

Five bottom samples were acquired in accordance with the Project Instructions for survey H12798. All bottom samples were entered in the H12798 Final Feature File. See Figure 23 for a graphical overview of sample locations.

Figure 23: H12798 bottom samples.

D.2 Additional Results

D.2.1 Shoreline

No assigned shoreline features for verification existed within the limits of H12798.

D.2.2 Prior Surveys

No prior survey comparisons exist for this survey.

D.2.3 Aids to Navigation

The day shapes, beacon and light at the entrance to Grantley Harbor are on station and serving their intended purpose.

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

Abnormal seafloor and/or environmental conditions were not observed 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

Multiple medium sized vessels and barges were seen entering Grantley harbor, and are known to beach in Teller. For this reason a more systematic survey of Grantley Harbor is recommended.

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 and Specifications Deliverables Manual, 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 Mark Van Waes	Chief of Party	02/02/2017	VAN WAES.MARK.1240076329 2018.02.02 15:05:00 -08'00'
LT Damian Manda	Field Operations Officer	02/02/2017	MANDA.DAMIAN.CURTIS.139661066 0 2018.02.02 13:16:33 -08'00'
HCST Sam Candio	Chief Survey Technician	02/02/2017	Digitally signed by CANDIO.SAMUEL.LOUIS.1515897743 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=CANDIO.SAMUEL.LOUIS.1515897743 Date: 2018.02.02 12:43:01 -08'00'
ENS Peter Siegenthaler	Sheet Manager	02/02/2017	Digitally signed by SIEGENTHALER.PETER.ROBERT.1523757500 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=NOAA, cn=SIEGENTHALER.PETER.ROBERT.1523757500 Date: 2018.02.02 12:40:22 -08'00'

Peter Siegenthaler - NOAA Federal <peter.siegenthaler@noaa.gov>

Fwd: Likely Early Completion of Port Clarence Sheets

2 messages

OPS Fairweather <ops.fairweather@noaa.gov> Tue, Aug 22, 2017 at 12:21 PM
To: Peter Siegenthaler - NOAA Federal <peter.siegenthaler@noaa.gov>

ENS Siegenthaler,

Can you prepare a survey plan for the area outlined in the attached image? I realize it is a very rough (and distorted) delineation, but this is basically the area behind the spit up to the notch where Coyote Creek comes in and up to the edge of the sheet limits at the entrance passage.

Plan to survey the deeper area (right near the channel) with full MBES, the area < 2 fa with single beam (set line spacing, maybe make one at 30 m and one at 50 m, oriented into shore), and possibly the area 2 - 3 fa with sidescan lines at 50 m range scale.

Very Respectfully,

LT Damian Manda

Operations Officer
NOAA Ship *Fairweather*
1010 Stedman Street
Ketchikan, Alaska 99901

Ship Cell: 907.254.2842
Iridium: 808.659.0054
OPS.Fairweather@noaa.gov

---------- Forwarded message ----------
From: **Corey Allen - NOAA Federal** <corey.allen@noaa.gov>
Date: Mon, Aug 14, 2017 at 5:33 AM
Subject: Re: Likely Early Completion of Port Clarence Sheets
To: OPS Fairweather <ops.fairweather@noaa.gov>
Cc: Jacklyn James <jacklyn.c.james@noaa.gov>, CO Fairweather <co.fairweather@noaa.gov>, "ChiefST.Fairweather" <chiefst.fairweather@noaa.gov>, Hannah Marshburn - NOAA Federal <hannah.marshburn@noaa.gov>

Manda,
Thanks for the proactive notification of your progress on the Port Clarence project. All of your proposed options sound reasonable, but here are few options/ideas from HSD Ops' perspective.

Weather permitting, FA has the privilege to depart Nome on the 28th and immediately head south to Kodiak.

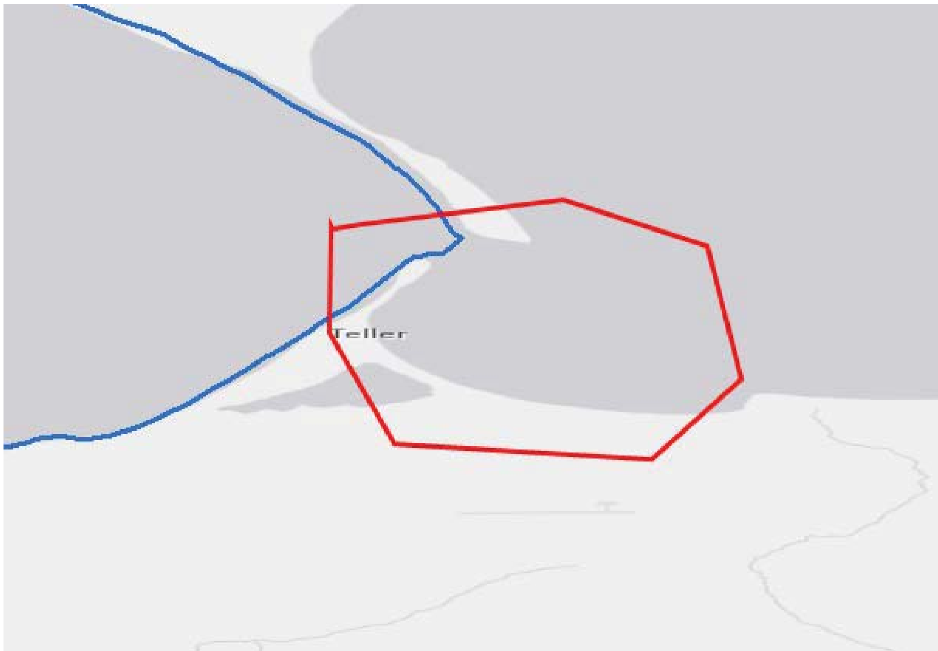
That said, with any remaining time within this leg, I would prioritize the following and leave the decision at the operational discretion of FA.

1. Per attached picture, FA could expand survey inside into Grantley Harbor behind the Teller spit. Vitus Marine has identified this as an area they frequently land for fuel deliveries. I can investigate obtaining additional zoning coverage from CO-OPS if FA is interested in expanding into this area.

2. Weather and safety permitting, any additional time on Yukon would be valuable to either further ensonify the main channel, per AIS, or potentially surveying the alternate approaches (there appeared to be one branching off to the north on the AIS).

3. Expansion within the corridor.

Additional survey of the F/V Destination is not a priority unless you have received a request from USCG.



On Mon, Aug 14, 2017 at 2:26 AM, OPS Fairweather <ops.fairweather@noaa.gov> wrote:

> HSD-OPS,
>
> I just got an out of office reply from Jacklyn to my weekly update, so I thought I would pass this up the chain.
>
> While some poor weather has delayed us a bit, it is still likely that we will finish the Port Clarence sheets before the end of this leg, and still have some days at the beginning of the next leg on this project. We have some ideas on how to spend the time (prioritizing AIS areas of the corridor, a possible revisit to F/V Destination site, ~2 days of additional Yukon mapping), but it would be helpful to get some guidance on focusing any extra time.
>
> Very Respectfully,
>
> **LT Damian Manda**
>
> Operations Officer
> NOAA Ship *Fairweather*
> 1010 Stedman Street
> Ketchikan, Alaska 99901
>
> Ship Cell: 907.254.2842
> Iridium: 808.659.0054
> OPS.Fairweather@noaa.gov
>
> On Mon, Aug 7, 2017 at 2:52 PM, OPS Fairweather <ops.fairweather@noaa.gov> wrote:
>
>> Jacklyn,
>>
>> I anticipate, weather dependent, that we can finish our assigned survey areas within Port Clarence (H12798, H12799, H12800) within this leg, probably within 2 weeks. I have solicited more exact time estimates from the sheet managers and will pass them along, but wanted to put this on your radar. This would leave us with about 10 days of extra time to allocate. My original estimate that I provided on July 23 was longer, but our productivity has been greatly accelerated by the lack of significant refraction and calmer weather that allowed the use of longer range scales on the SSS.
>>
>> If we are able to complete the Port Clarence surveys early, where would HSD-OPS like us to focus our efforts? I do not think that running the corridor repeatedly would be the most effective use of our time, although we could take some time to fill in the additional areas to the north and south that have not been addressed during our transits.
>>
>> Very Respectfully,
>>
>> **LT Damian Manda**
>>
>> Operations Officer

> NOAA Ship *Fairweather*
> 1010 Stedman Street
> Ketchikan, Alaska 99901
>
> Ship Cell: 907.254.2842
> Iridium: 808.659.0054
> OPS.Fairweather@noaa.gov

--
J. Corey Allen
Team Lead, Operations Branch
Hydrographic Surveys Division
Office of Coast Survey, NOAA
Corey.Allen@noaa.gov
240.533.0037 (Office)
301.717.7271 (Cell)
Click here for information on our planned survey activities?

OPS Fairweather <ops.fairweather@noaa.gov> Sun, Oct 29, 2017 at 6:24 PM
To: Peter Siegenthaler - NOAA Federal <peter.siegenthaler@noaa.gov>

Grantley harbor survey info.

Very Respectfully,

LT Damian Manda

Operations Officer
NOAA Ship *Fairweather*
1010 Stedman Street
Ketchikan, Alaska 99901

Ship Cell: 907.254.2842
Iridium: 808.659.0054
OPS.Fairweather@noaa.gov

---------- Forwarded message ----------
From: **Corey Allen - NOAA Federal** <corey.allen@noaa.gov>
[Quoted text hidden]

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Office of Marine and Aviation Operations
NOAA Ship *Fairweather* (S220)
1010 Stedman Street, Ketchikan, Alaska 99901

January 30, 2018

MEMORANDUM FOR: Jacklyn James
Project Manager, OPR-R365-FA-17
Hydrographic Surveys Division Operations Branch

FROM: Commander Mark Van Waes, NOAA
Commanding Officer, NOAA Ship *Fairweather*

SUBJECT: Waiver Request – Extended depth range for bathymetry surface

Fairweather requests a waiver for sheet H12798 in project OPR-R365-FA-17 with respect to the Complete Coverage multibeam surface depth range requirements in HSSD 5.2.2.3. It is requested that the submitted 1 m resolution surface have an extended depth range of 0-30 meters.

Justification

A small area of this survey has depths greater than the HSSD specified 1 m resolution surface limit of 20 meters, but creating a separate surface for these areas would add unnecessary processing time and complexity. Extending the maximum depth to 30 m includes these areas, which meet density requirements at the higher resolution, with 100% of the nodes deeper than 20 m containing 5 or more soundings.

Decision

Waiver is: __________ Granted __________ Denied

cc: Chief, HSD OPS
OPS, FA
HCST, FA

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

APPROVAL PAGE

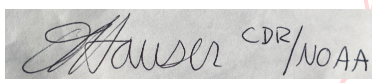
H12798

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

- H12798_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12798_GeoImage.pdf

The survey evaluation and verification has been conducted according current OCS Specifications.



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2019.02.14 14:51:52 -08'00'

Approved:____

CDR Olivia Hauser, NOAA
Chief, Pacific Hydrographic Branch