

**F00743**

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

**DESCRIPTIVE REPORT**

Type of Survey: Navigable Area

Registry Number: F00743

**LOCALITY**

State(s): Oregon  
Washington

General Locality: Columbia River, WA and OR

Sub-locality: Woodland and Henrici Bar Anchorages

**2018**

CHIEF OF PARTY  
Michelle M. Levano, LTJG/NOAA

LIBRARY & ARCHIVES

Date:

**HYDROGRAPHIC TITLE SHEET**

**F00743**

**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): **Oregon Washington**

General Locality: **Columbia River, WA and OR**

Sub-Locality: **Woodland and Henrici Bar Anchorages**

Scale: **10000**

Dates of Survey: **08/07/2018 to 08/14/2018**

Instructions Dated: **07/27/2018**

Project Number: **S-N918-NRT3-18**

Field Unit: **Navigation Response Team 3**

Chief of Party: **Michelle M. Levano, LTJG/NOAA**

Soundings by: **Multibeam Echo Sounder**

Imagery by: **Multibeam Echo Sounder Backscatter**

Verification by: **Pacific Hydrographic Branch**

Soundings Acquired in: **meters at Columbia River**

**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 F00743

Project: S-N918-NRT3-18

Locality: Columbia River, WA and OR

Sublocality: Woodland and Henrici Bar Anchorages

Scale: 1:10000

August 2018 - August 2018

**Navigation Response Team 3**

Chief of Party: Michelle M. Levano, LTJG/NOAA

### A. Area Surveyed

This hydrographic survey was acquired in accordance with the requirements defined in the Project Instructions S-N918-NRT3-18 (Figure 1 and 2). This survey was conducted at the request to update the nautical charts for the anchorages on the Columbia River from the Columbia River Pilots (COLRIP) and the Columbia River Steamship Operators' Association, Inc. (CRSOA).

#### A.1 Survey Limits

Data were acquired within the following survey limits:

| Northwest Limit                      | Southeast Limit                       |
|--------------------------------------|---------------------------------------|
| 45° 53' 59.04" N<br>122° 48' 18.2" W | 45° 45' 36.05" N<br>122° 45' 43.89" W |

*Table 1: Survey Limits*

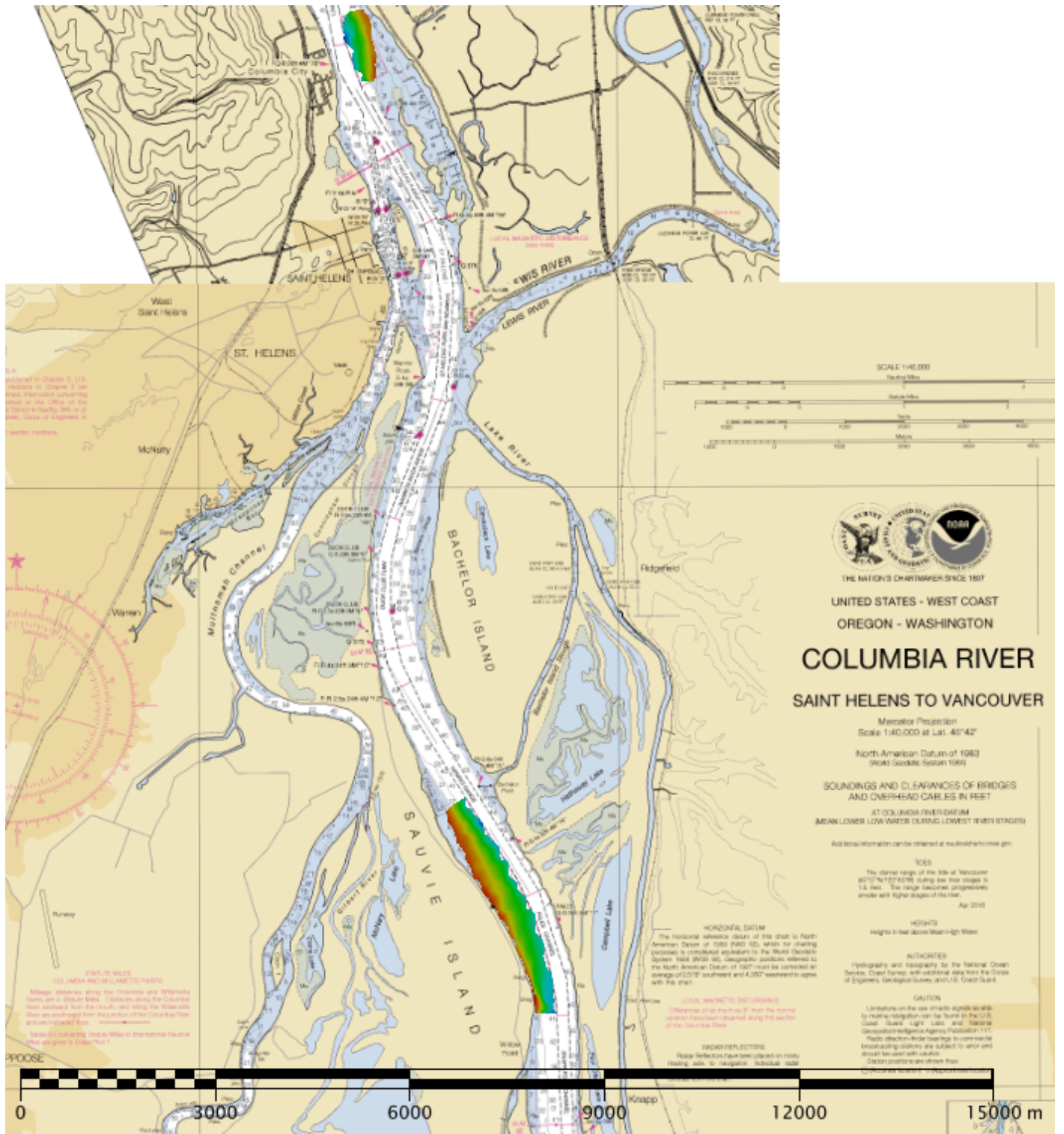


Figure 1: Overview of anchorage areas surveyed (Charts 18524, 18525).

F00743 Assigned Sheet Limits



Figure 2: F00743 assigned survey area (Charts 18524\_2, 18525).

Data were acquired to the survey limits in accordance with the requirements in the Project Instructions and the 2018 NOS Hydrographic Surveys Specifications and Deliverables (HSSD)

## A.2 Survey Purpose

The Columbia River Steamship Operators' Association, Inc. (CRSOA) and the Columbia River Pilots (COLRIP) requested that NOAA's Office of Coast Survey collect multibeam bathymetric data of the Columbia River anchorages. The Woodland anchorage to the north is adjacent to the cities of Columbia City and St Helens, Oregon. Local businesses include a pulp and paper mill and a large chemical factory with a pier on the north end of Columbia City. The Henrici anchorage upriver, is positioned directly next to two public beaches and the Ridgefield National Wildlife Refuge.

### A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired in F00722 meet multibeam echo sounder (MBES) coverage requirements for object detection, 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).

The surface was analyzed using HydrOffice QC Tools Grid QA feature. Density requirements for F00743 were achieved with at least 99.5% of surface nodes containing five or more soundings as required by HSSD Section 5.2.2.3 (Figure 3). The few nodes that did not meet density requirements are due to sparse data in the outer beams, especially near steep sand waves, slopes and rocky areas where acoustic shadowing occurred, and at the edges of the survey limits.

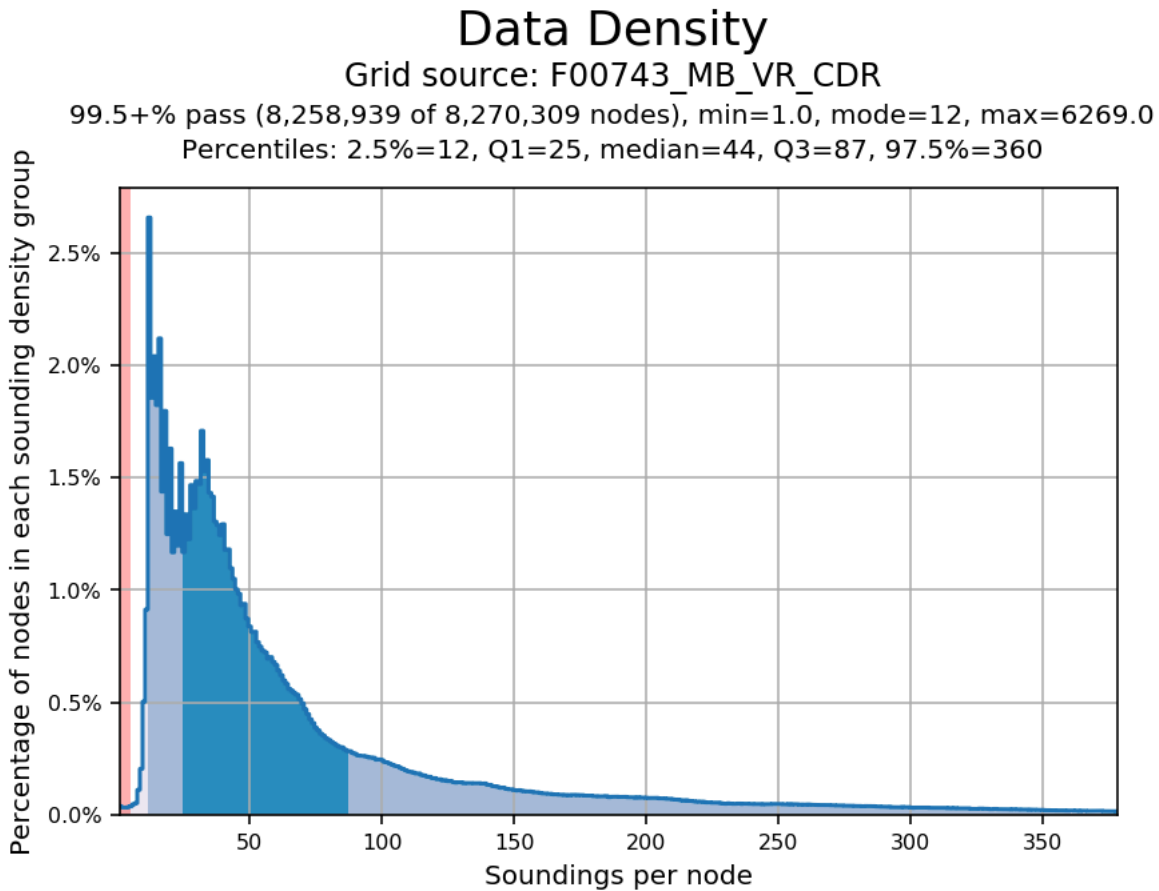


Figure 3: Pydro derived histogram plot showing HSSD object detection compliance of F00743 MBES within the finalized CUBE surface.

## A.4 Survey Coverage

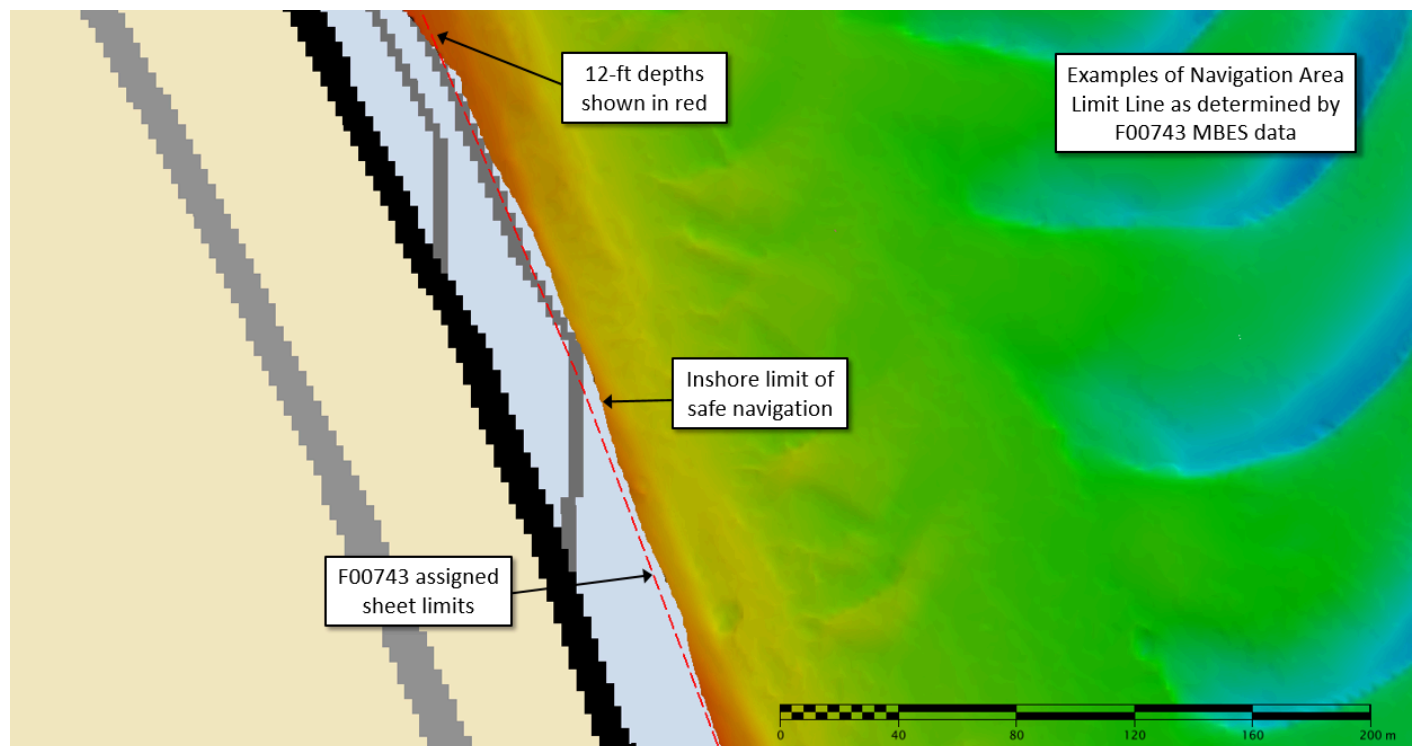
The following table lists the coverage requirements for this survey as assigned in the project instructions:

| Water Depth               | Coverage Required   |
|---------------------------|---|
| All waters in survey area | Object Detection Coverage (Refer to HSSD Section 5.2.2.2) |

*Table 2: Survey Coverage*

Object detection multibeam coverage was achieved within the limits of hydrography as defined in the project instructions with some exceptions (Figure 4). 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 proximity of a populated beach and safety concerns.

F00743 data was reviewed in CARIS HIPS and SIPs for holidays in accordance with Section 5.2.2.3 of the HSSD. 80 holidays were identified via HydrOffice QC Tools Holiday Finder tool. Upon hydrographer inspection, 77 of the identified holidays are within the survey limits and not along the edge of the survey. 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 high number of holidays is discussed in section B.5.2 of this report.



*Figure 4: Example of F00743 NALL determination*



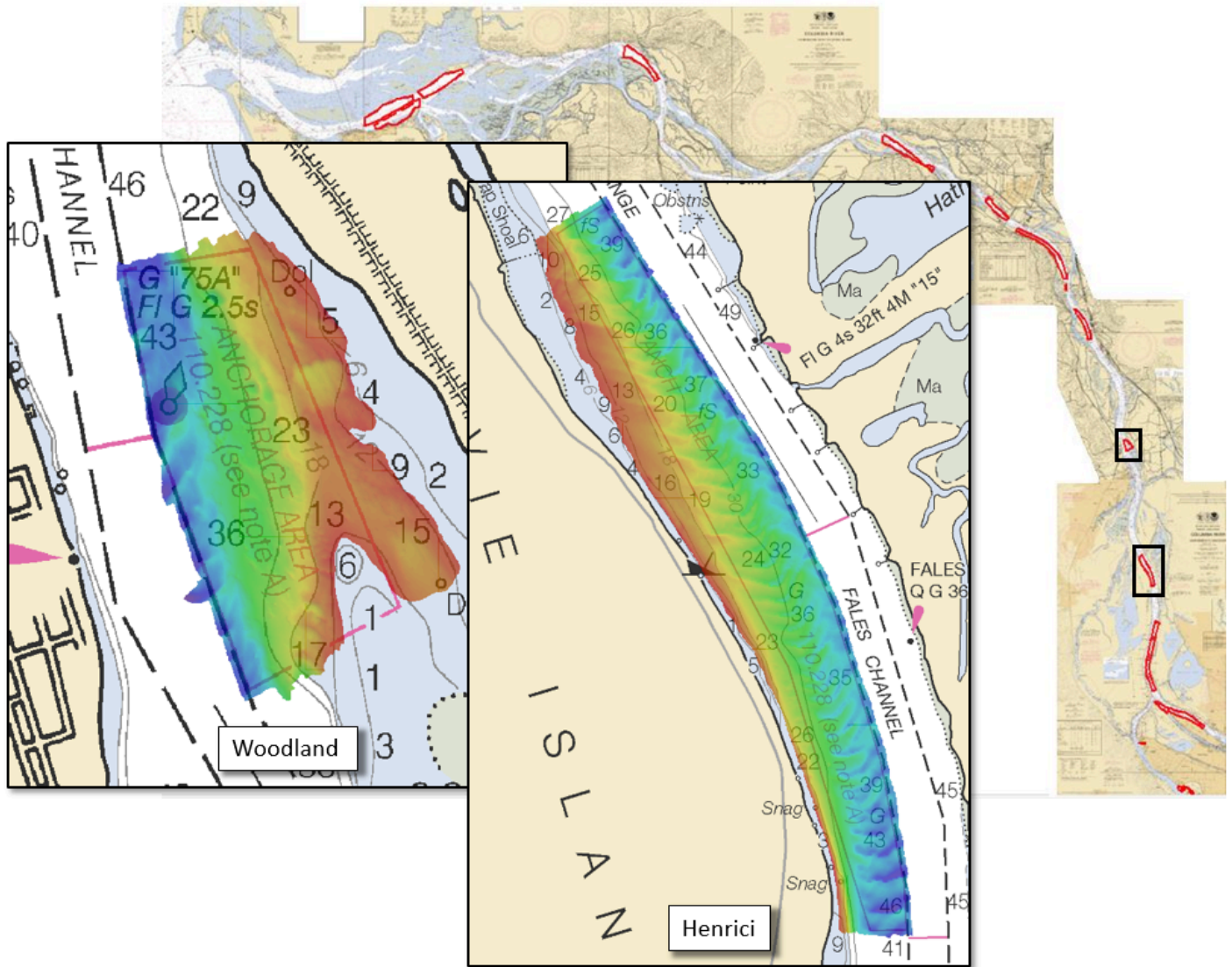


Figure 5: Survey coverage of F00743 compared to S-N918-NRT3-18 project overview.

### A.5 Survey Statistics

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

|   | <b>HULL ID</b>              | <i>S3006</i> | <i>2801</i> | <i>Total</i> |
|---|-----------------------------|--------------|-------------|--------------|
| <b>LNM</b>  | <b>SBES Mainscheme</b>      | 0            | 0           | 0            |
|   | <b>MBES Mainscheme</b>      | 58.49        | 0.057       | 58.547       |
|   | <b>Lidar Mainscheme</b>     | 0            | 0           | 0            |
|   | <b>SSS Mainscheme</b>       | 0            | 0           | 0            |
|   | <b>SBES/SSS Mainscheme</b>  | 0            | 0           | 0            |
|   | <b>MBES/SSS Mainscheme</b>  | 0            | 0           | 0            |
|   | <b>SBES/MBES Crosslines</b> | 4.61         | 0           | 4.61         |
|   | <b>Lidar Crosslines</b>     | 0            | 0           | 0            |
| <b>Number of Bottom Samples</b>                     |                             |              |             | 3            |
| <b>Number Maritime Boundary Points Investigated</b> |                             |              |             | 0            |
| <b>Number of DPs</b>                                |                             |              |             | 0            |
| <b>Number of Items Investigated by Dive Ops</b>     |                             |              |             | 0            |
| <b>Total SNM</b>                                    |                             |              |             | 0.63         |

*Table 3: Hydrographic Survey Statistics*

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

| <b>Survey Dates</b> | <b>Day of the Year</b> |
|---------------------|------------------------|
| 08/07/2018          | 219                    |
| 08/08/2018          | 220                    |



| <b>Survey Dates</b> | <b>Day of the Year</b> |
|---------------------|------------------------|
| 08/09/2018          | 221                    |
| 08/11/2018          | 223                    |
| 08/14/2018          | 226                    |

*Table 4: Dates of Hydrography*

## **B. Data Acquisition and Processing**

### **B.1 Equipment and Vessels**

Refer to the Data Acquisition and Processing Report (DAPR) titled S-N918-NRT3-18\_rev1 and S-N918\_NRT3-18\_RAINIER\_Launches 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:

|                |              |             |
|----------------|--------------|-------------|
| <b>Hull ID</b> | <i>S3006</i> | <i>2801</i> |
| <b>LOA</b>     | 34 feet      | 28 feet     |
| <b>Draft</b>   | 4 feet       | 3.6 feet    |

*Table 5: Vessels Used*



*Figure 6: NRT3 S3006*



*Figure 7: 2801 RA-4*

In conjunction with Navigation Response Team 3, NOAA Ship RAINIER provided launch RA-4 to assist with data collection on S-N918-NRT3-18. All data for survey F00743 was acquired by NRT-3 and RA-4. The vessels acquired multibeam depth soundings, sound speed profiles, and bottom samples.

## B.1.2 Equipment

The following major systems were used for data acquisition during this survey:

| <b>Manufacturer</b> | <b>Model</b>  | <b>Type</b>                                 |
|---------------------|---------------|---|
| Kongsberg Maritime  | EM 2040C      | MBES  |
| Applanix            | POS MV 320 v5 | Positioning and Attitude System             |
| AML Oceanographic   | MicroX SVS    | Sound Speed System                          |
| YSI                 | CastAway-CTD  | Sound Speed System                          |
| Kongsberg Maritime  | EM 2040       | MBES  |
| Teledyne RESON      | SVP 70        | Sound Speed System                          |
| Sea-Bird Scientific | SBE 19plus    | Conductivity, Temperature, and Depth Sensor |
| Applanix            | POS MV 320 v4 | Positioning and Attitude System             |

*Table 6: Major Systems Used*

Equipment listed above was used on S3006 and RA-4.

## B.2 Quality Control

### B.2.1 Crosslines

Multibeam/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 7.87% of mainscheme acquisition.

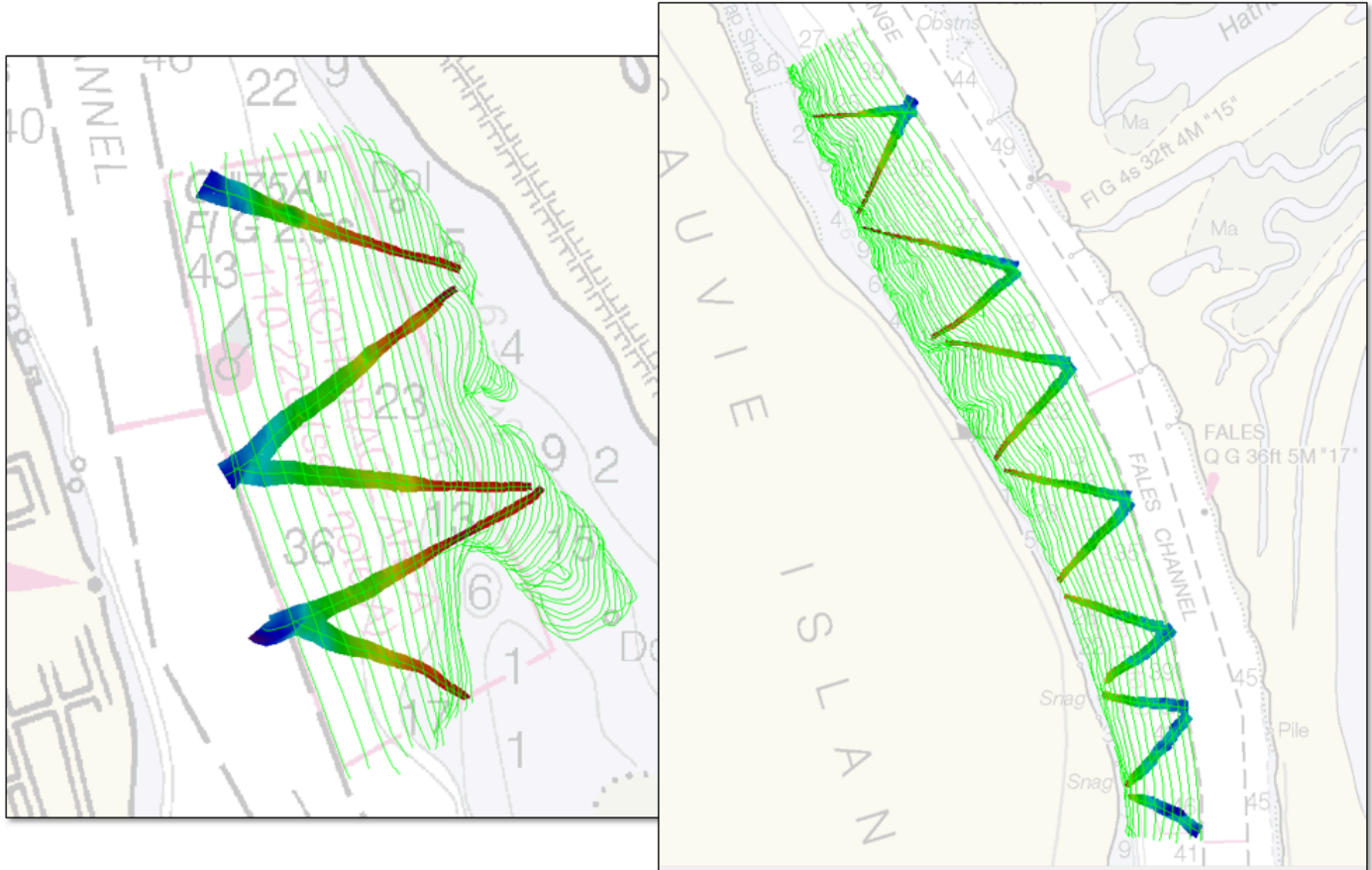
Multibeam crosslines were collected by S3006 across a variety of depth ranges, water masses, and survey dates with good spacial distribution (Figure 8).

Crosslines were collected, processed and compared in accordance with Section 5.2.4.2 of the HSSD. A Variable Resolution (VR) surface was created using only mainscheme lines, and a second VR surface was created of only crosslines. A difference surface was generated in Pydro Explorer's Compare Grids tool by subtracting the crossline only surface from the mainscheme surface (mainscheme- crosslines= difference surface), (Figure 9). From the difference surface, the following statistics were derived. The mainscheme only, crossline only, and difference surface are included in the submission of this survey as Digital Data.

In total, 99.5% of the total number of nodes pass the TVUmax test between F00743 mainscheme and crossline data (Figure 10). For F00743 respective depths, the difference surface was compared to IHO allowable Total Vertical Uncertainty (TVU) standards (Figure 11 and 12). The analysis was performed on



F00743 MBES data reduced to Columbia River Datum (CRD) using Ellipsoidally Referenced Survey (ERS) methods.



*Figure 8: F00743 crossline surface overlaid on mainscheme tracklines showing good temporal and geographic distribution.*

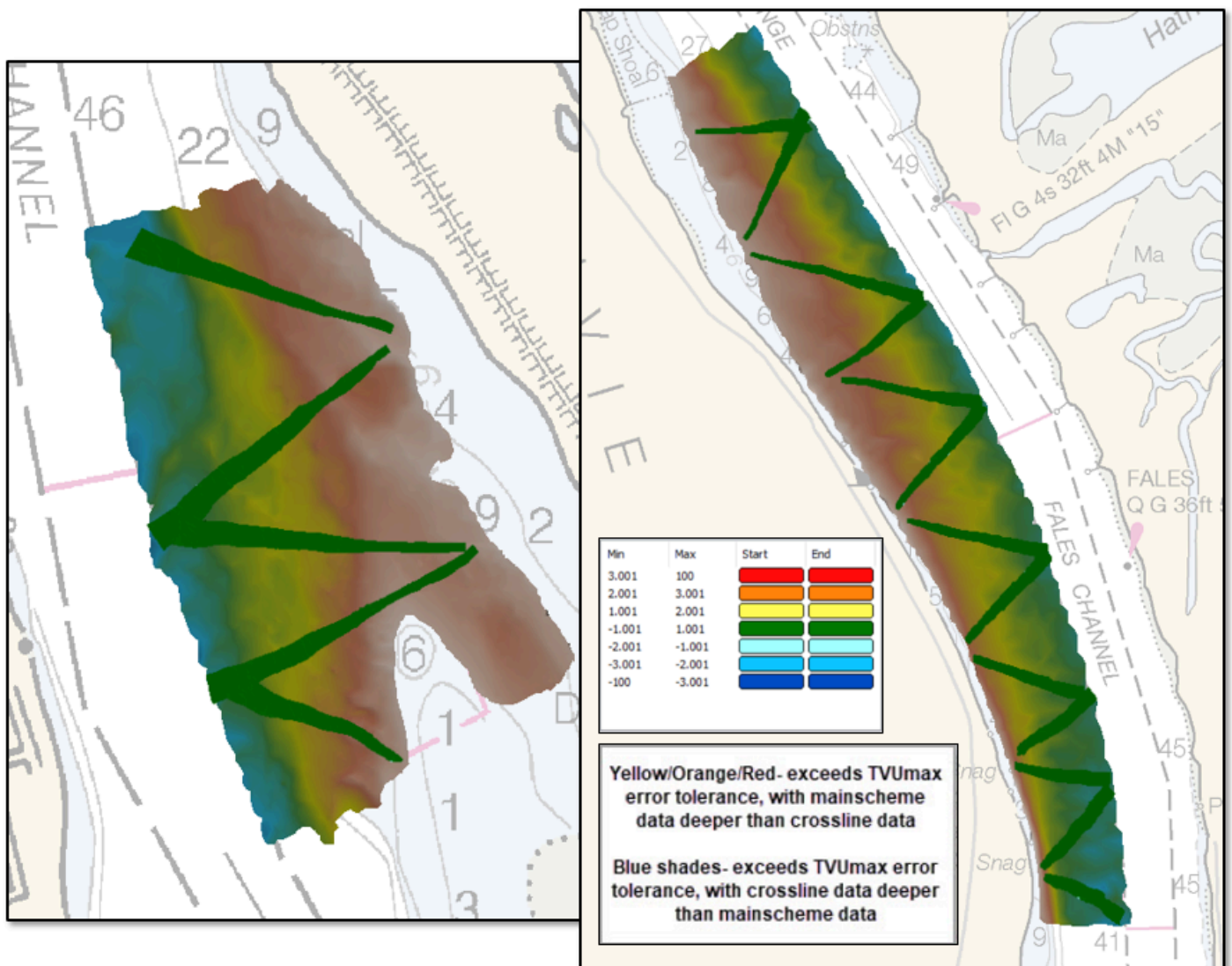


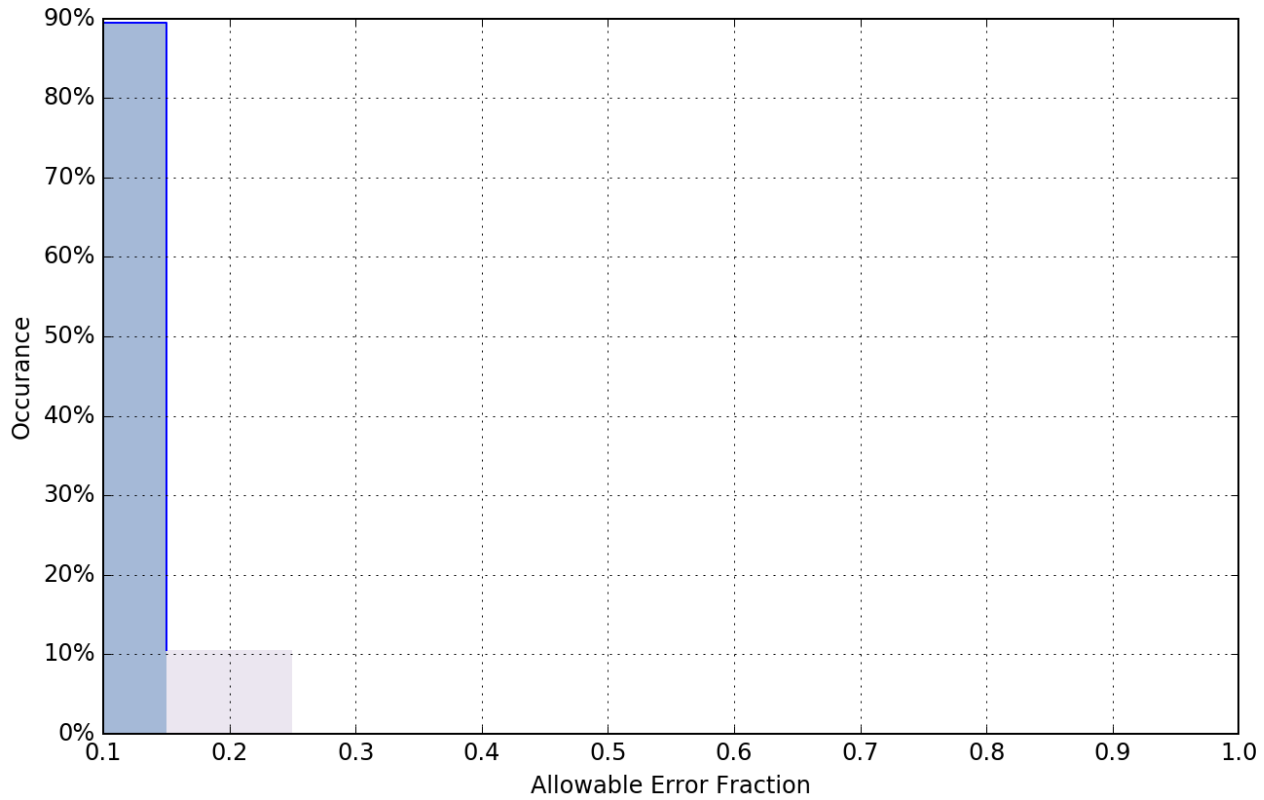
Figure 9: F00743 crossline TVU allowance surface overlaid on mainscheme MBES data. Positive values represent areas where mainscheme data is deeper than crossline data. Negative values represent areas where crossline data is deeper than mainscheme data.

## Comparison Distribution

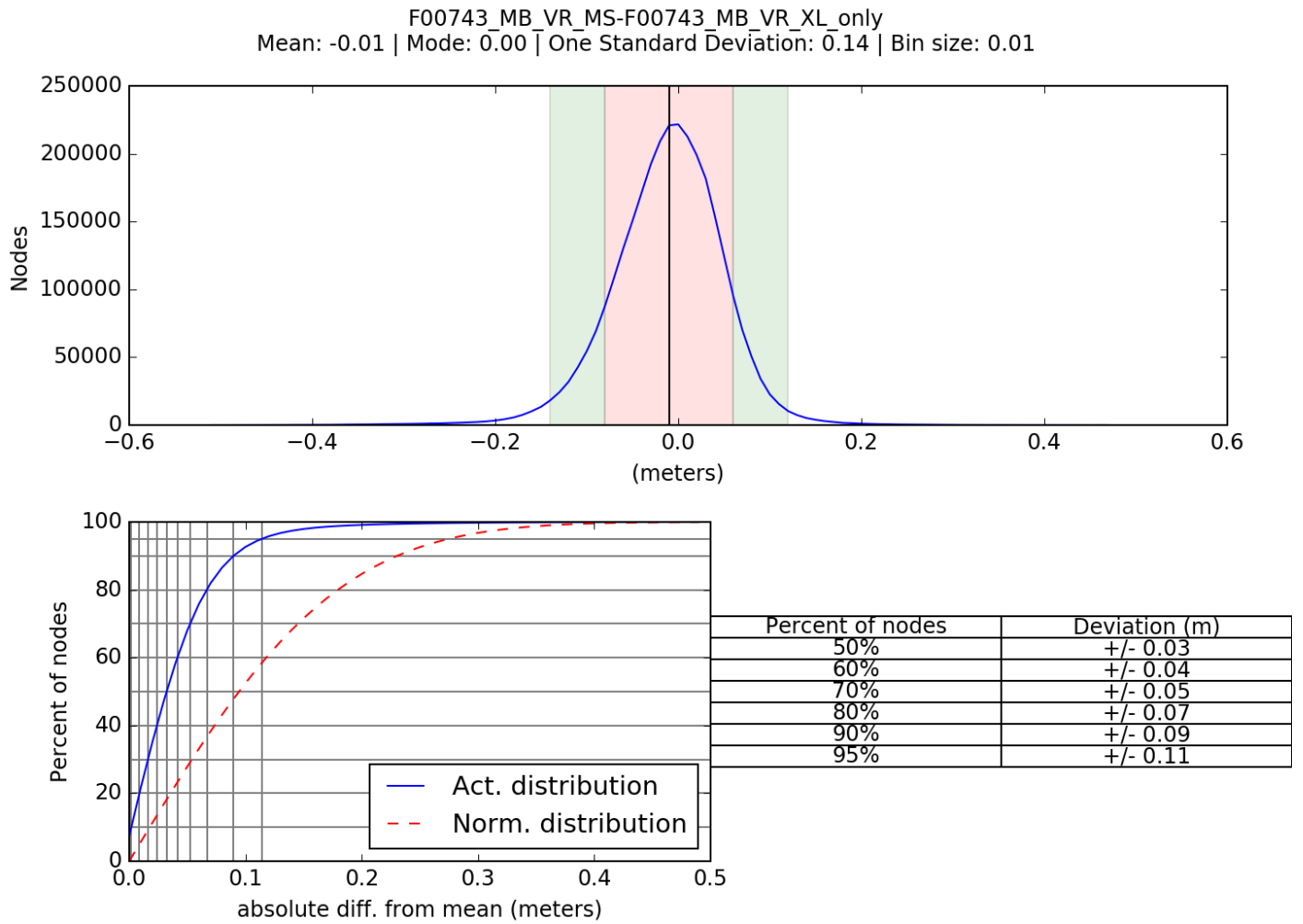
Per Grid: F00743\_MS\_Diff\_XL\_fracAllowErr.csar

99.5+% nodes pass (3001933), min=0.0, mode=0.1 mean=0.1 max=92.5

Percentiles: 2.5%=0.0, Q1=0.0, median=0.1, Q3=0.1, 97.5%=0.2



*Figure 10: Histogram plot utilizing the magnitude (absolute value) of the Allowable Error Fraction to show the indication of what percentage of the total number of comparisons pass the TVUmax test.*



*Figure 11: The statistic and distribution summary plot of the difference between F00743 mainscheme and crossline data.*



### Node Depth vs. Allowable Error Fraction

F00743\_MS\_Diff\_XL\_fracAllowErr.csar, total comparisons 3002027

Failed Stats [-inf,-1): min=-92.5, 2.5%=-90.7, mean=-10.1, Q1=-1.2, median=-1.1, Q3=-1.0, 97.5%=-1.0, max=-1.0

Failed Stats (+1,+inf): min=1.0, 2.5%=1.0, Q1=1.1, median=1.2, mean=1.2, Q3=1.3, 97.5%=1.7, max=2.2

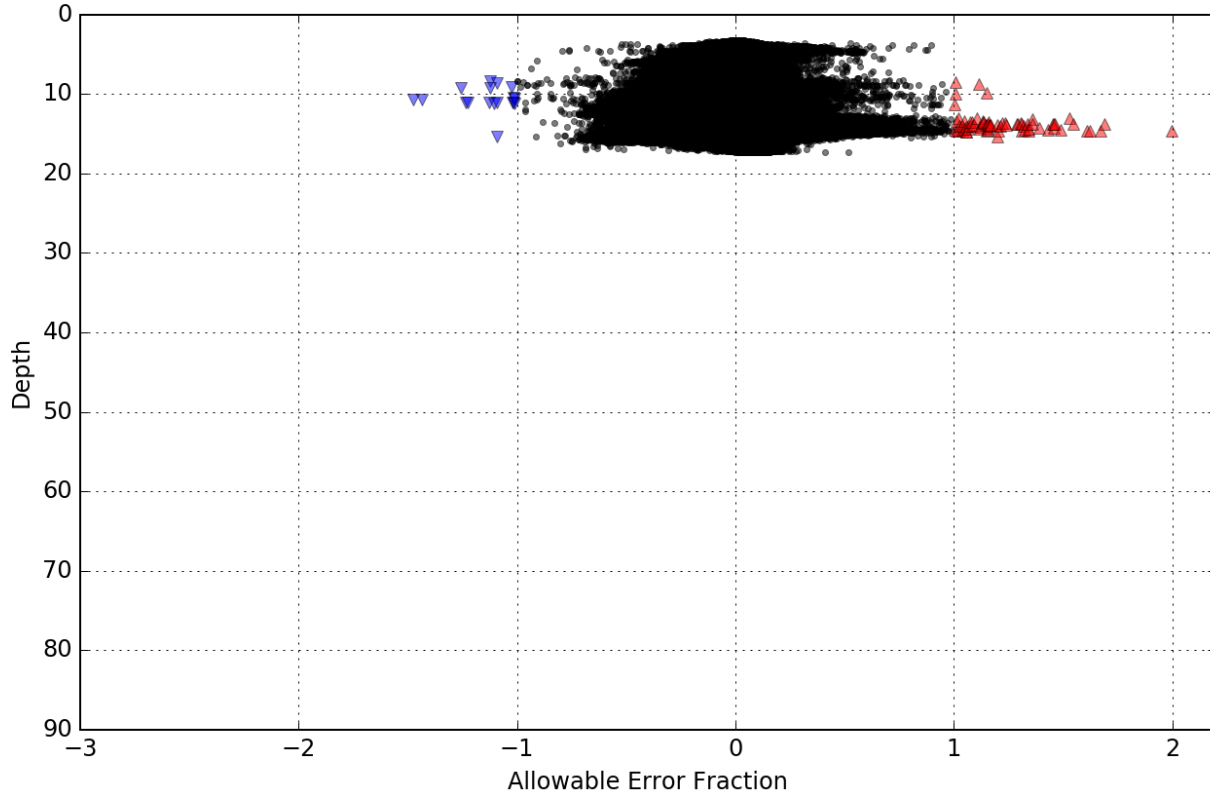


Figure 12: Node Depth vs Allowable Error Fraction graphic with values between and including +/- 1 representing passing comparisons.

#### B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

| Method         | Measured   | Zoning      |
|----------------|------------|-------------|
| ERS via VDATUM | 0.0 meters | 0.12 meters |

Table 7: Survey Specific Tide TPU Values.

| <b>Hull ID</b> | <b>Measured - CTD</b> | <b>Measured - MVP</b> | <b>Surface</b>     |
|----------------|-----------------------|-----------------------|--------------------|
| S3006          | 1.0 meters/second     | N/A meters/second     | 0.15 meters/second |
| 2801           | 3.0 meters/second     | N/A meters/second     | 0.5 meters/second  |

*Table 8: Survey Specific Sound Speed TPU Values.*

Total Propagated Uncertainty (TPU) values for F00743 were derived from a combination of fixed values for equipment and vessel characteristics, as well as field assigned values for sound speed uncertainties. The uncertainty for the VDatum model was provided to the field unit. A visual inspection of the Uncertainty layer revealed the areas of higher uncertainty occurred in the outer beams, over sand waves, and shifting bottom types.

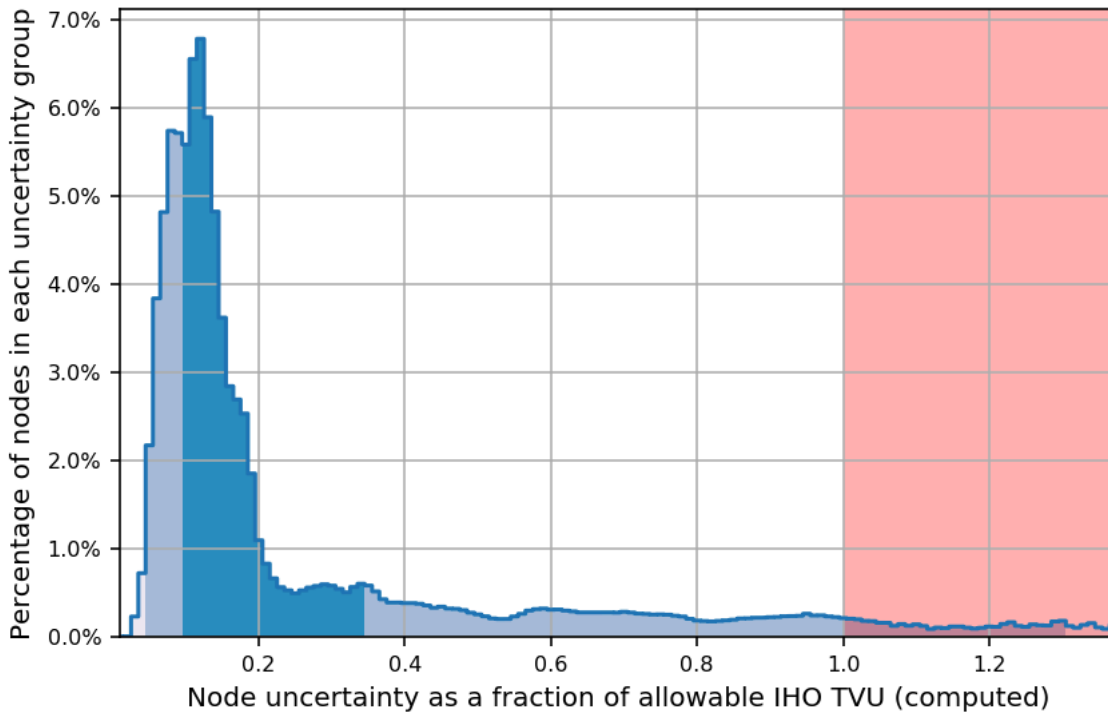
In addition to the usual a priori estimates of uncertainty provided via device models for vessel motion, ERS, real time and post processed uncertainty sources were also incorporated into the depth estimates of F00743. Real-time uncertainties from the Kongsberg 2040C MBES sonars were incorporated and applied during post processing. Uncertainties associated with vessel roll, gyro, and navigation were applied real-time. F00743 utilized kinematic (RTK) positioning service. The recorded delayed heave Applanix files included an estimate of the heave uncertainty and were applied during post processing. All of the aforementioned uncertainties were applied in CARIS. F00743 is an ellipsoidally referenced survey (ERS) and the tidal component was accomplished via separation model. The surface was analyzed using the HydrOffice QC Tools Grid QA feature to determine compliance with specifications. Overall, 93% of nodes within the surface meet NOAA Allowable Uncertainty specifications for F00743 (Figure 13).

## Uncertainty Standards

Grid source: F00743\_MB\_VR\_CDR

93% pass (7,727,199 of 8,270,309 nodes), min=0.01, mode=0.12, max=6.58

Percentiles: 2.5%=0.05, Q1=0.10, median=0.14, Q3=0.34, 97.5%=1.30



*Figure 13: Pydro derived histogram plot showing HSSD uncertainty standards compliance of F00743 finalized VR surface*

### B.2.3 Junctions

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**

There were no other factors that affected corrections to soundings.

**B.2.7 Sound Speed Methods**

Sound Speed Cast Frequency: At least once every 4 hours.

Sound Velocity Profiles (SVP) casts were taken at least once every four hours with sufficient frequency, density, depth and accuracy as outlined in section 5.2.3.3 of the 2018 HSSD (Figure 14). The SVP casts were applied to the MBES lines in CARIS using the "nearest in distance within time of 4 hours" method.

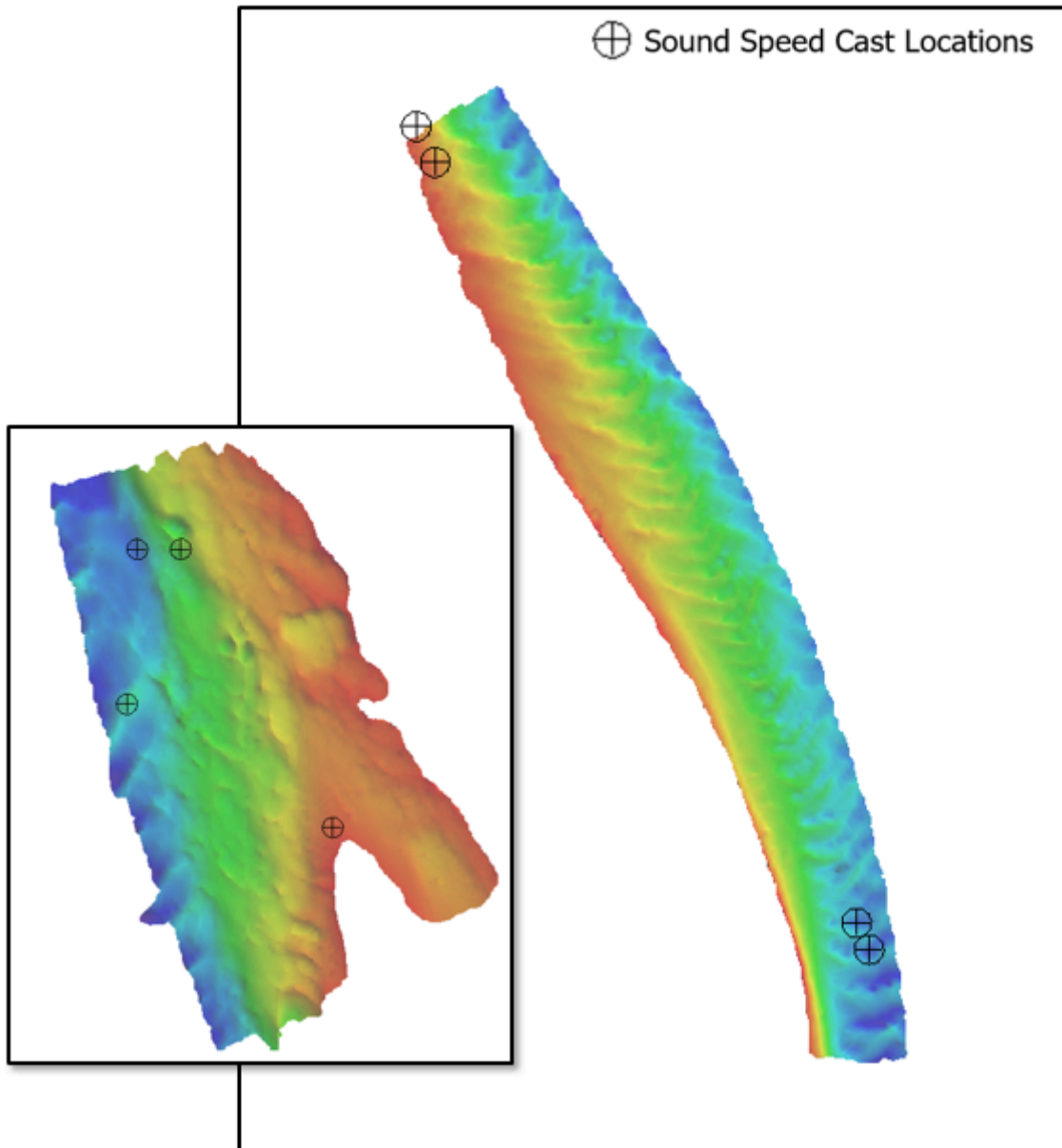


Figure 14: F00743 Sound speed cast locations.

### B.2.8 Coverage Equipment and Methods

All equipment and survey methods were used as detailed in the DAPR.

## 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 is logged as .all file for delivery to NOAA's Pacific Hydrographic Branch. NOAA's Navigation Response Branch field units are waived from producing backscatter mosaics for the 2018 field season. All equipment and survey methods were used as detailed in the DAPR.

### 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 | 10.4.1  |

*Table 9: Primary bathymetric data processing software*

The following Feature Object Catalog was used: NOAA Profile V\_5\_8.

#### 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          |
|------------------------|-------------------------|---------------------|--------------------------|-------------------|------------------|
| F00743_MB_VR_CDR       | CARIS VR Surface (CUBE) | Variable Resolution | 1.5 meters - 18.0 meters | NOAA_VR           | Object Detection |
| F00743_MB_VR_CDR_Final | CARIS VR Surface (CUBE) | Variable Resolution | 1.5 meters - 18.0 meters | NOAA_VR           | Object Detection |

*Table 10: Submitted Surfaces*

The survey was carried out to meet the Object Detection MBES Coverage requirements as defined by Section 5.2.2 of the 2018 Hydrographic Survey Specifications and Deliverables.

Due to hydrographer oversight, the two anchorages in F00743 were analyzed in the field under complete coverage standards rather than object detection. Of the 80 object detection holidays determined by Pydro Explorer QC Tools 2, nearly all are coverage caps that occur between survey lines due to ship handling and acquisitions settings and occur at the 0.5 meter surfaces. 56 of these holidays are in less than 5 meters of water (Figure 15 ). For the remaining holidays in over 5 meters of water, the majority of them are coverage gaps that occur between survey lines due to driving and acquisition settings or are relative to sand wave location (Figure 16). None of these holidays are near any charted or surveyed Dangers to Navigation (DToNs), and the hydrographer recommends that this survey be processed and compiled to object detection standards.

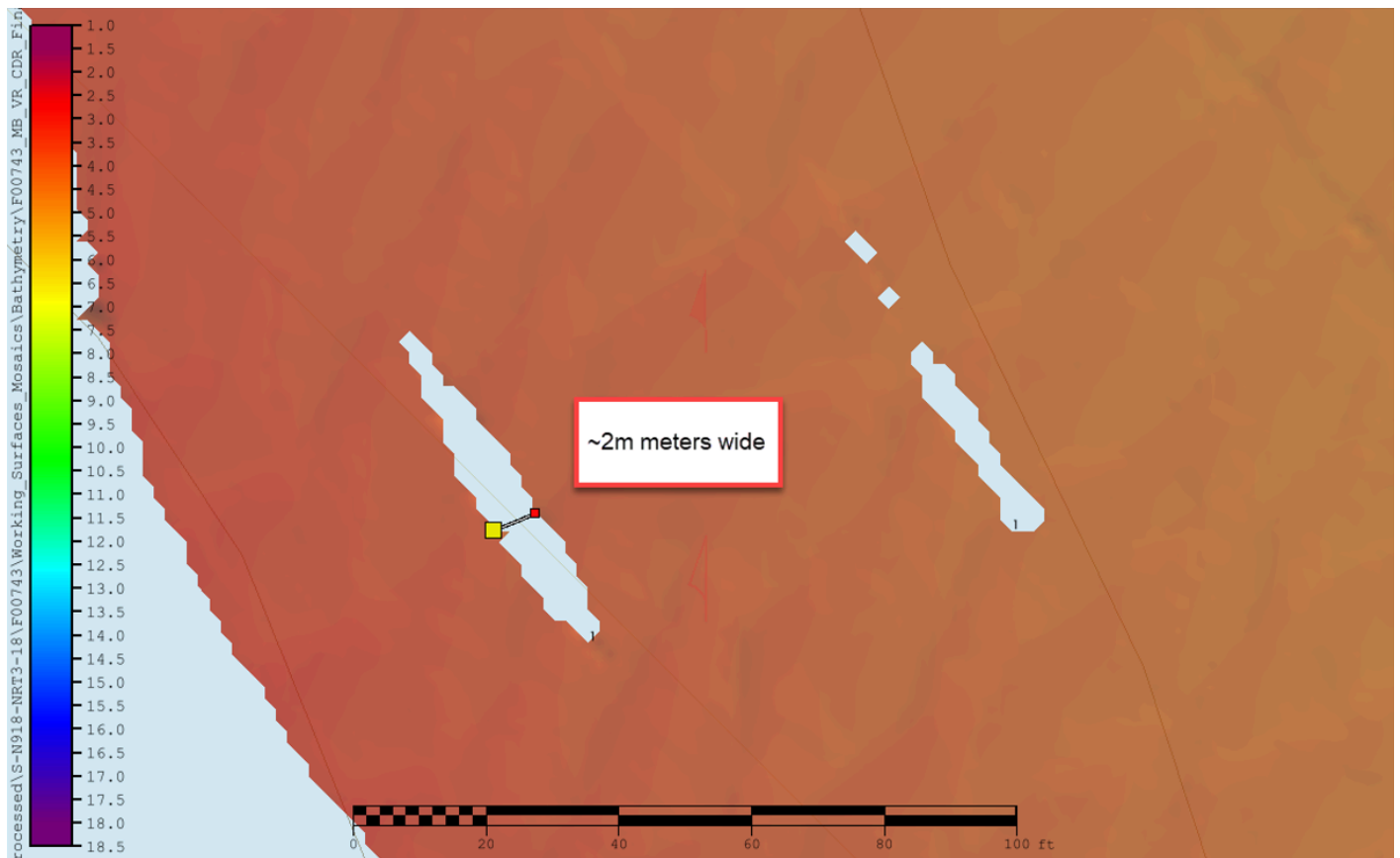


Figure 15: Holidays present in less than 5 meter depths.

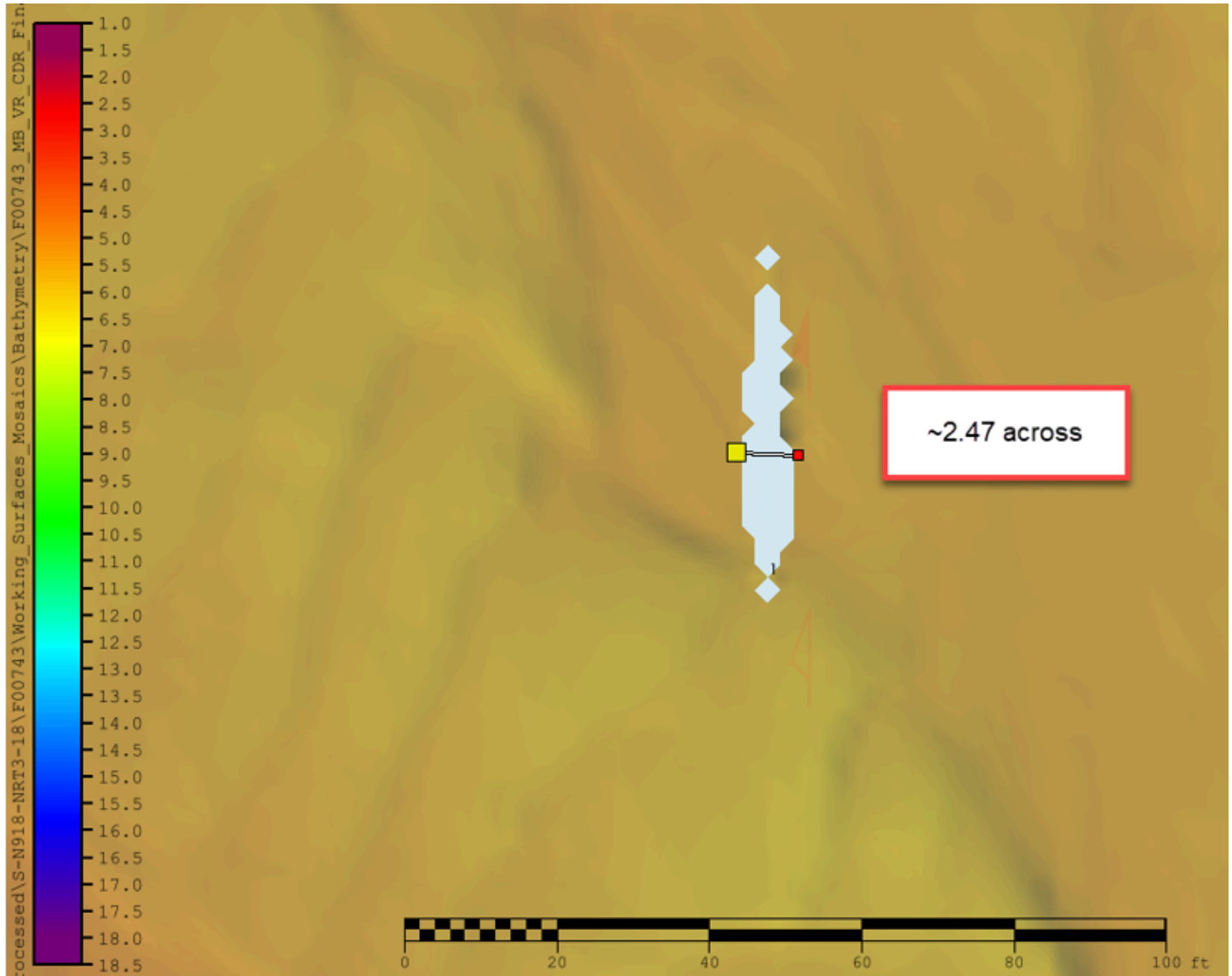


Figure 16: Holiday in over five meter depths near sand waves.

## C. Vertical and Horizontal Control

Field installed tide and GPS stations were not utilized for this survey. There is no HVCR report included with the submission of F00743.

### C.1 Vertical Control

The vertical datum for this project is Columbia River.

ERS Methods Used:



ERS via VDATUM

Ellipsoid to Chart Datum Separation File:

NAD83-mllwCRD\_Geoid09.csar

Sounding elevations relative to the ellipsoid were collected through Ellipsoidal Referenced Survey (ERS) with post-processing of the daily logged POSpac data to create a statistical best estimate of trajectory (SBET) file, as detailed in the DAPR, All of F00743 meets HSSD vertical accuracy requirements.

## C.2 Horizontal Control

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

The projection used for this project is Projected UTM 10N.

Precise Positioning-Real Time Extended (PP-RTX) processing methods were used in Applanix POSpac MMS 8.3 software to produce SBETs for post-processing horizontal correction. All of F00743 meets HSSD horizontal accuracy requirements.

## D. Results and Recommendations

### D.1 Chart Comparison

The chart comparison was made using a CARIS sounding and contour layer derived from the finalized VR surface. The contours and sounders were overlaid on the chart and compared for general agreement and to identify areas of significant change.

#### D.1.1 Electronic Navigational Charts

The following are the largest scale ENC's, which cover the survey area:

| ENC      | Scale   | Edition | Update Application Date | Issue Date | Preliminary? |
|----------|---------|---------|-------------------------|------------|--------------|
| US5OR13M | 1:40000 | 58      | 12/17/2018              | 11/08/2018 | NO           |
| US5OR14M | 1:40000 | 52      | 12/17/2018              | 11/08/2018 | NO           |

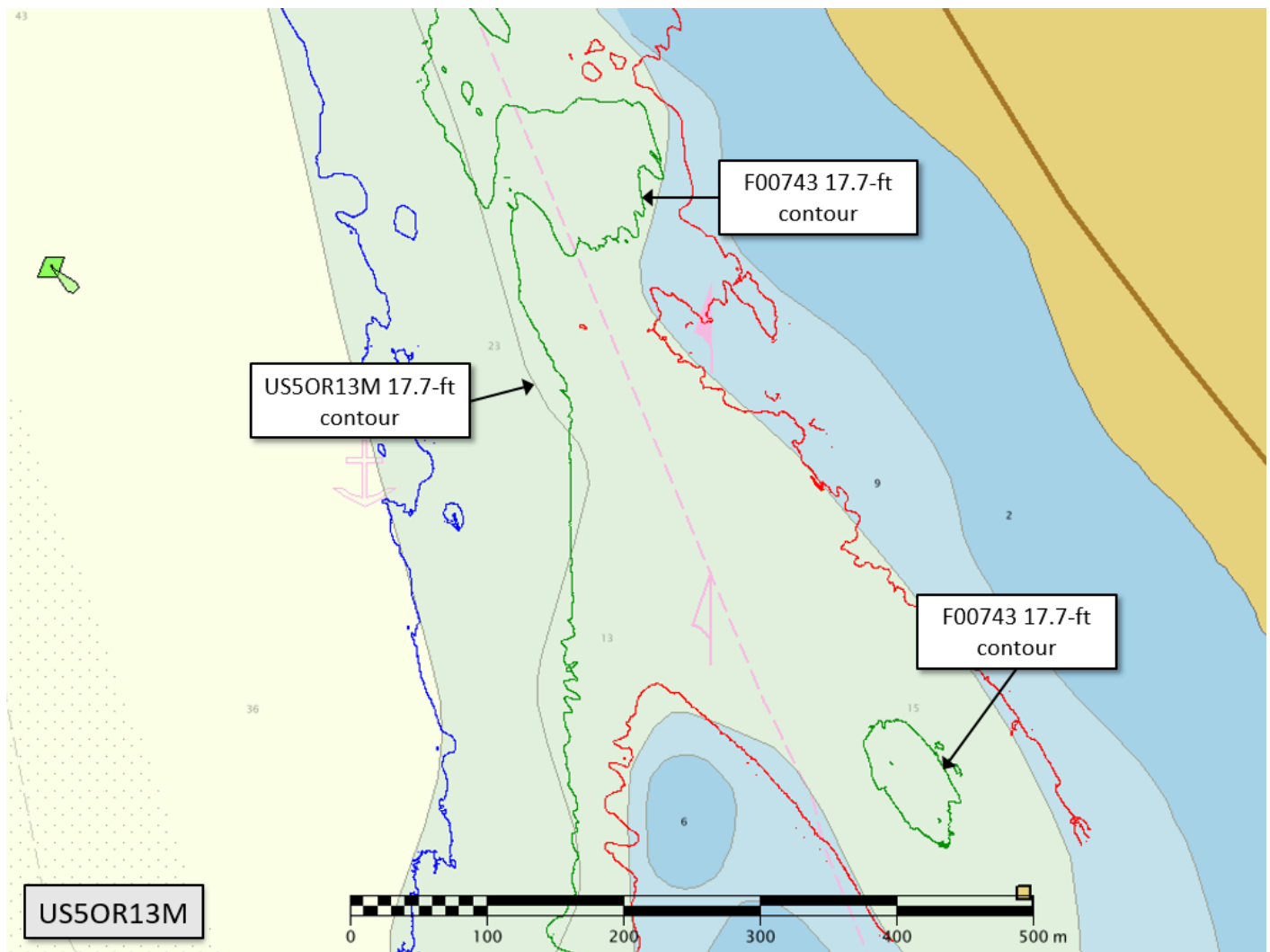
*Table 11: Largest Scale ENC's*

US5OR13M

ENC US5OR13M stretches along the Columbia River from Crims Island, OR just northwest of Longview, WA to St Helens, Oregon near the Woodland anchorage of F00743. Contoured depths of ENC US5OR13M that apply to F00743 are 5.9, 11.8, 17.7, and 29.9 feet.

The contours derived from F00743 show discrepancies primarily between the charted and surveyed 17.7 contour on US5OR13M which show deeper water near shore (Figure 17).

Soundings derived from F00743 generally agreed with those charted on ENC US5OR13M.



*Figure 17: The F00743 derived 17.7-ft contour (in green) shows several discrepancies between the survey data and the chart.*

## US5OR14M

ENC US5OR14M covers an area from St Helens, OR to the southern end of Sauvie Island, and includes the Multnomah Channel, a distributary of the Willamette River. Contoured depths of US5OR14M that apply to F00743 are 5.9, 11.8, 17.7, and 29.9 feet.

F00743 derived contours generally follow the charted contours but do show that depths on the Henrici anchorage are slightly deeper than what is charted. Significant sand waves can be seen all through the surveyed data (Figure 18).

Soundings derived from F00743 agreed with those charted on US5OR14M within 1-4 ft.

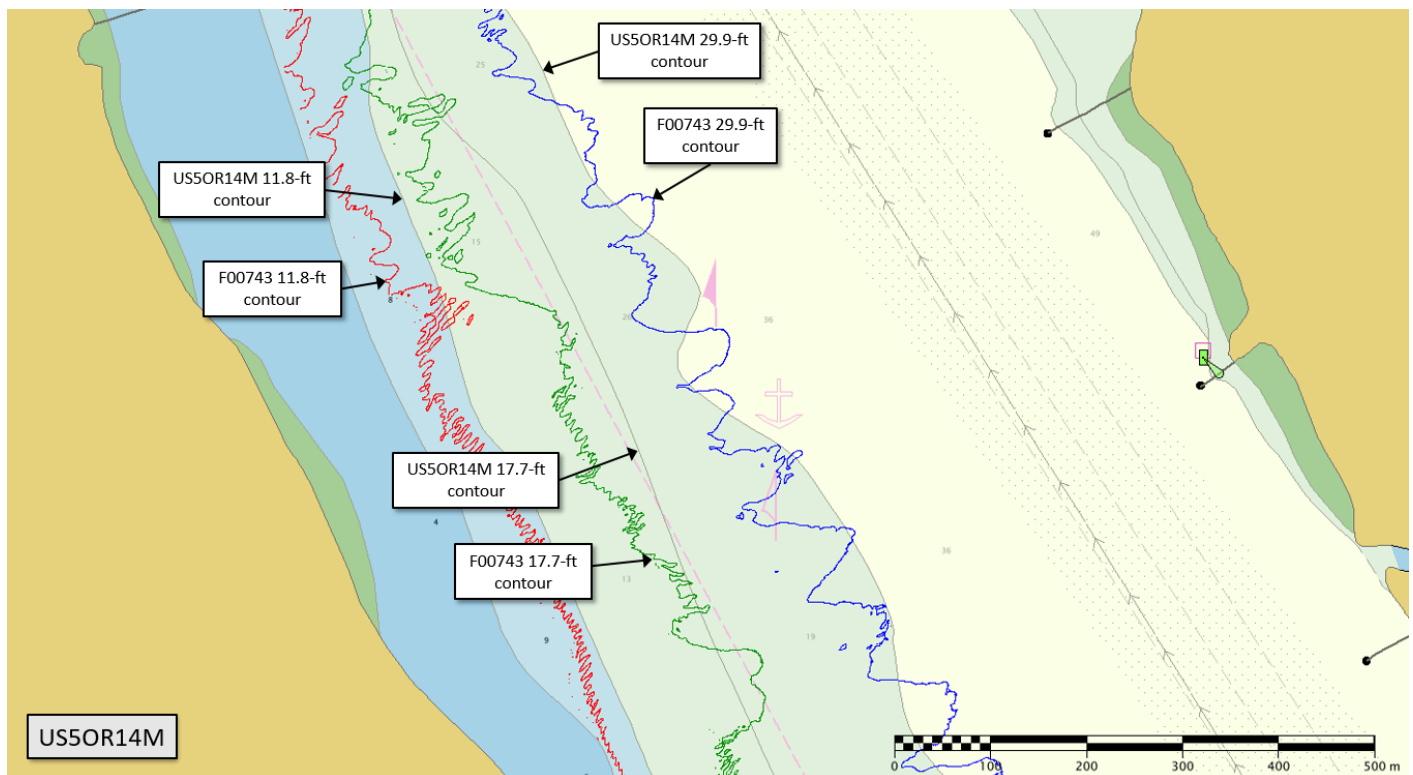


Figure 18: F00743 derived contours showing slightly greater depths compared with the US5OR14M contours, and large sand waves are present throughout.

### 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**

Two Dangers to Navigation (Dton) were identified in the F00743 survey area and submitted to Marine Chart Division's (MCD) Nautical Data Branch. Refer to the F00743\_DTON\_Report submitted in the Appendix of this survey for location and description of the dangers.

**D.1.6 Channels**

The western and eastern portions of the Woodland and Henrici anchorages respectively, include the maintained channel of the river. Soundings from F00743 data found the channel depths to be greater or equal to the stated depths on the chart (Figure 19).

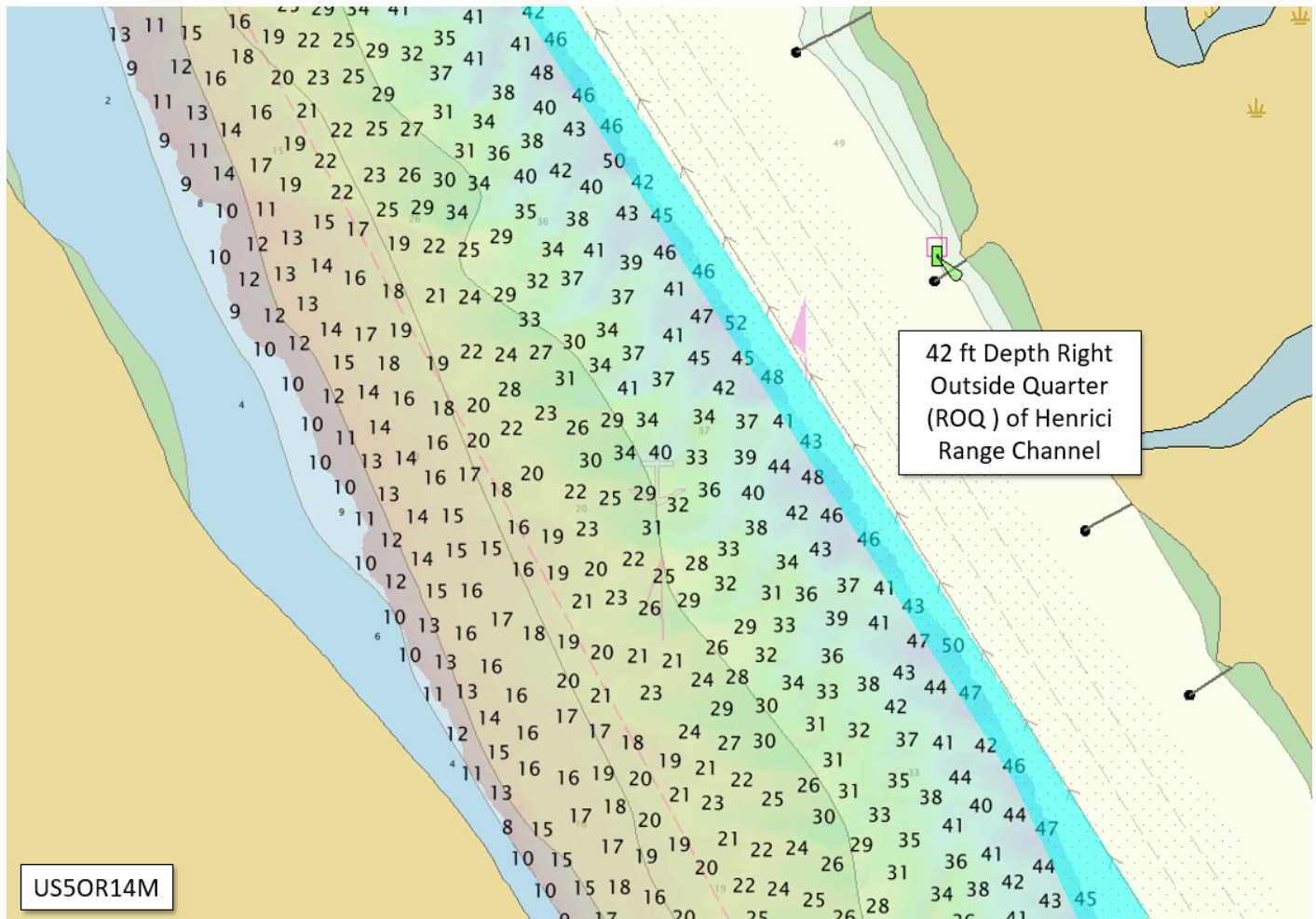


Figure 19: 42 ft depth section of maintained channel (in blue) with F00743 soundings (in black).

### D.1.7 Bottom Samples

Three bottom samples were conducted in the assigned location. Each attempt was successful. There are no drop camera images submitted with these bottom samples. Refer to the results included in the F00743 Final Feature File submitted with this report.

## D.2 Additional Results

### D.2.1 Shoreline

NRT-3 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 using

the Composite Source File (CSF) and Project Preference File (PRF). Shoreline verification procedures for F00743 conform to those detailed in the DAPR.

### **D.2.2 Prior Surveys**

Surveys H11857 and H11858 were conducted from 2008 -2009 in the same area but comparison between H11857, H11858 and F00743 was not conducted.

### **D.2.3 Aids to Navigation**

One aid to navigation was assigned and investigated. One buoy with light was observed serving its intended purpose and on station, but the light characteristic was not seen due to daylight. Due to hydrographer oversight, an image was not retained of the AtoN and associated light.

### **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**

Large sand waves occur in a significant portion of the survey area. Most waves are within 1-2 1/2 meters high and run perpendicular to the water flow of the river (Figure 20).

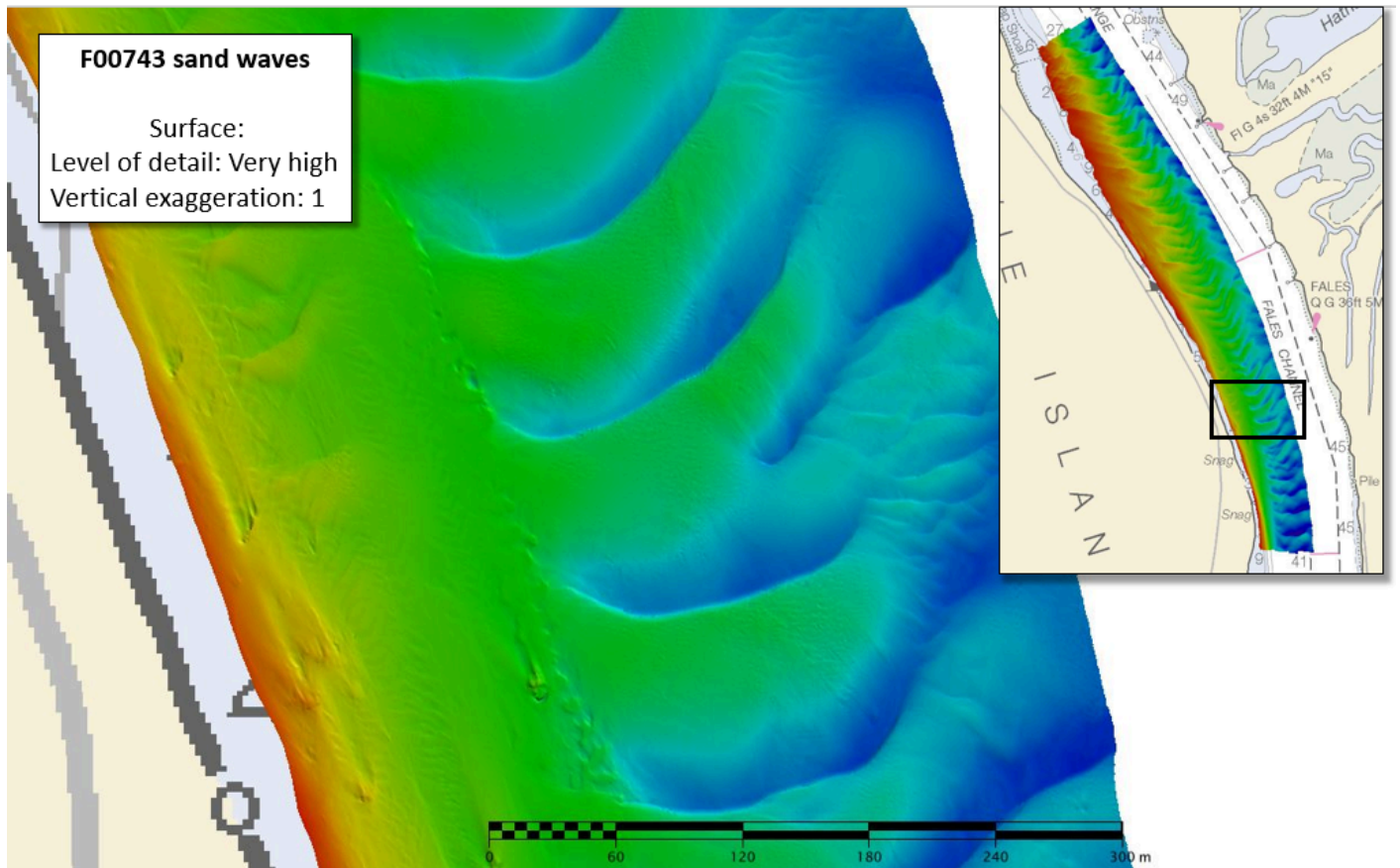


Figure 20: Sand waves present in F00743 survey area.

### 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.

| Report Name                            | Report Date Sent |
|--|------------------|
| Data Acquisition and Processing Report | 2019-03-14       |
| Coast Pilot Report                     | 2018-12-17       |

| Approver Name                    | Approver Title | Approval Date | Signature  |
|----------------------------------|----------------|---------------|--|
| Michelle M. Levano,<br>LTJG/NOAA | Chief of Party | 05/03/2019    | <br>Digitally signed by<br>LEVANO.MICHELLE.MARIE.151664<br>5888<br>Date: 2019.04.30 15:56:40 -0700'   |
| PST Timothy Wilkinson            | Hydrographer   | 05/03/2019    | <br>WILKINSON.TIMOTHY.DAVID<br>.1383074440<br>Digitally signed by<br>WILKINSON.TIMOTHY.DAVID.1383074440<br>Date: 2019.05.01 09:52:17 -0700' |



## F. Table of Acronyms

| <b>Acronym</b> | <b>Definition</b>                                   |
|----------------|---|
| <b>AHB</b>     | Atlantic Hydrographic Branch                        |
| <b>AST</b>     | Assistant Survey Technician                         |
| <b>ATON</b>    | Aid to Navigation                                   |
| <b>AWOIS</b>   | Automated Wreck and Obstruction Information System  |
| <b>BAG</b>     | Bathymetric Attributed Grid                         |
| <b>BASE</b>    | Bathymetry Associated with Statistical Error        |
| <b>CO</b>      | Commanding Officer                                  |
| <b>CO-OPS</b>  | Center for Operational Products and Services        |
| <b>CORS</b>    | Continually Operating Reference Station             |
| <b>CTD</b>     | Conductivity Temperature Depth                      |
| <b>CEF</b>     | Chart Evaluation File                               |
| <b>CSF</b>     | Composite Source File                               |
| <b>CST</b>     | Chief Survey Technician                             |
| <b>CUBE</b>    | Combined Uncertainty and Bathymetry Estimator       |
| <b>DAPR</b>    | Data Acquisition and Processing Report              |
| <b>DGPS</b>    | Differential Global Positioning System              |
| <b>DP</b>      | Detached Position                                   |
| <b>DR</b>      | Descriptive Report                                  |
| <b>DTON</b>    | Danger to Navigation                                |
| <b>ENC</b>     | Electronic Navigational Chart                       |
| <b>ERS</b>     | Ellipsoidal Referenced Survey                       |
| <b>ERZT</b>    | Ellipsoidally Referenced Zoned Tides                |
| <b>FFF</b>     | Final Feature File                                  |
| <b>FOO</b>     | Field Operations Officer                            |
| <b>FPM</b>     | Field Procedures Manual                             |
| <b>GAMS</b>    | GPS Azimuth Measurement Subsystem                   |
| <b>GC</b>      | Geographic Cell                                     |
| <b>GPS</b>     | Global Positioning System                           |
| <b>HIPS</b>    | Hydrographic Information Processing System          |
| <b>HSD</b>     | Hydrographic Surveys Division                       |
| <b>HSSD</b>    | Hydrographic Survey Specifications and Deliverables |

| <b>Acronym</b> | <b>Definition</b>                                  |
|----------------|--|
| <b>HSTP</b>    | Hydrographic Systems Technology Programs           |
| <b>HSX</b>     | Hypack Hysweep File Format                         |
| <b>HTD</b>     | Hydrographic Surveys Technical Directive           |
| <b>HVCR</b>    | Horizontal and Vertical Control Report             |
| <b>HVF</b>     | HIPS Vessel File                                   |
| <b>IHO</b>     | International Hydrographic Organization            |
| <b>IMU</b>     | Inertial Motion Unit                               |
| <b>ITRF</b>    | International Terrestrial Reference Frame          |
| <b>LNM</b>     | Linear Nautical Miles                              |
| <b>MBAB</b>    | Multibeam Echosounder Acoustic Backscatter         |
| <b>MCD</b>     | Marine Chart Division                              |
| <b>MHW</b>     | Mean High Water                                    |
| <b>MLLW</b>    | Mean Lower Low Water                               |
| <b>NAD 83</b>  | North American Datum of 1983                       |
| <b>NAIP</b>    | National Agriculture and Imagery Program           |
| <b>NALL</b>    | Navigable Area Limit Line                          |
| <b>NM</b>      | Notice to Mariners                                 |
| <b>NMEA</b>    | National Marine Electronics Association            |
| <b>NOAA</b>    | National Oceanic and Atmospheric Administration    |
| <b>NOS</b>     | National Ocean Service                             |
| <b>NRT</b>     | Navigation Response Team                           |
| <b>NSD</b>     | Navigation Services Division                       |
| <b>OCS</b>     | Office of Coast Survey                             |
| <b>OMAO</b>    | Office of Marine and Aviation Operations (NOAA)    |
| <b>OPS</b>     | Operations Branch                                  |
| <b>MBES</b>    | Multibeam Echosounder                              |
| <b>NWLON</b>   | National Water Level Observation Network           |
| <b>PDBS</b>    | Phase Differencing Bathymetric Sonar               |
| <b>PHB</b>     | Pacific Hydrographic Branch                        |
| <b>POS/MV</b>  | Position and Orientation System for Marine Vessels |
| <b>PPK</b>     | Post Processed Kinematic                           |
| <b>PPP</b>     | Precise Point Positioning                          |
| <b>PPS</b>     | Pulse per second                                   |

| <b>Acronym</b> | <b>Definition</b>                            |
|----------------|--|
| <b>PRF</b>     | Project Reference File                       |
| <b>PS</b>      | Physical Scientist                           |
| <b>PST</b>     | Physical Science Technician                  |
| <b>RNC</b>     | Raster Navigational Chart                    |
| <b>RTK</b>     | Real Time Kinematic                          |
| <b>SBES</b>    | Singlebeam Echosounder                       |
| <b>SBET</b>    | Smooth Best Estimate and Trajectory          |
| <b>SNM</b>     | Square Nautical Miles                        |
| <b>SSS</b>     | Side Scan Sonar                              |
| <b>SSSAB</b>   | Side Scan Sonar Acoustic Backscatter         |
| <b>ST</b>      | Survey Technician                            |
| <b>SVP</b>     | Sound Velocity Profiler                      |
| <b>TCARI</b>   | Tidal Constituent And Residual Interpolation |
| <b>TPE</b>     | Total Propagated Error                       |
| <b>TPU</b>     | Topside Processing Unit                      |
| <b>USACE</b>   | United States Army Corps of Engineers        |
| <b>USCG</b>    | United Stated Coast Guard                    |
| <b>UTM</b>     | Universal Transverse Mercator                |
| <b>XO</b>      | Executive Officer                            |
| <b>ZDA</b>     | Global Positioning System timing message     |
| <b>ZDF</b>     | Zone Definition File                         |

APPROVAL PAGE

F00743

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.

Approved: \_\_\_\_\_  
**Commander Olivia Hauser, NOAA**  
Chief, Pacific Hydrographic Branch