

F00796

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

DESCRIPTIVE REPORT

Type of Survey: Support USCG

Registry Number: F00796

LOCALITY

State(s): Texas

General Locality: Galveston Bay, TX

Sub-locality: San Jacinto River at the I-10 bridge

2019

CHIEF OF PARTY
Dan Jacobs

LIBRARY & ARCHIVES

Date:

HYDROGRAPHIC TITLE SHEET

F00796

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): **Texas**

General Locality: **Galveston Bay, TX**

Sub-Locality: **San Jacinto River at the I-10 bridge**

Scale: **5000**

Dates of Survey: **09/24/2019 to 09/24/2019**

Instructions Dated: **09/22/2019**

Project Number: **S-K924-NRT4-19**

Field Unit: **NOAA Navigation Response Team - Galveston**

Chief of Party: **Dan Jacobs**

Soundings by: **Kongsberg Maritime EM 2040C (MBES)**

Imagery by: **EdgeTech 4125 (SSS)**

Verification by: **Pacific Hydrographic Branch**

Soundings Acquired in: **meters at Mean Lower Low Water**

Remarks:

NRT1's vessel, S3005 was used in the data collection for this survey as NRT4's vessel, S3008 experienced mechanical failure at the start of acquisition on Monday, September 23.

Any revisions to the Descriptive Report (DR) applied during office processing are shown in red italic text. The DR is maintained as a field unit product, therefore all information and recommendations within this report are considered preliminary unless otherwise noted. The final disposition of survey data is represented in the NOAA nautical chart products. All pertinent records for this survey are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via <https://www.ncei.noaa.gov/>. Products created during office processing were generated in NAD83 UTM 15N, MLLW. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

DESCRIPTIVE REPORT SUMMARY

A. Area Surveyed

This hydrographic survey was acquired in accordance with the requirements defined in the Project Instruction S-K924-NRT4-19. USCG requested a survey area 1000 meters north of the I-10 bridge to 1000 meters south of the Interstate 10 fixed bridge, on the San Jacinto River, vicinity of Houston, Texas. Areas of incomplete multibeam coverage occurred because of barges moored/rafted up to one another, tug boat operations or safety concerns for swift currents occurring near the river's banks.

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
29° 47' 56.4" N 95° 3' 32.4" W	29° 47' 6" N 95° 4' 4.8" W

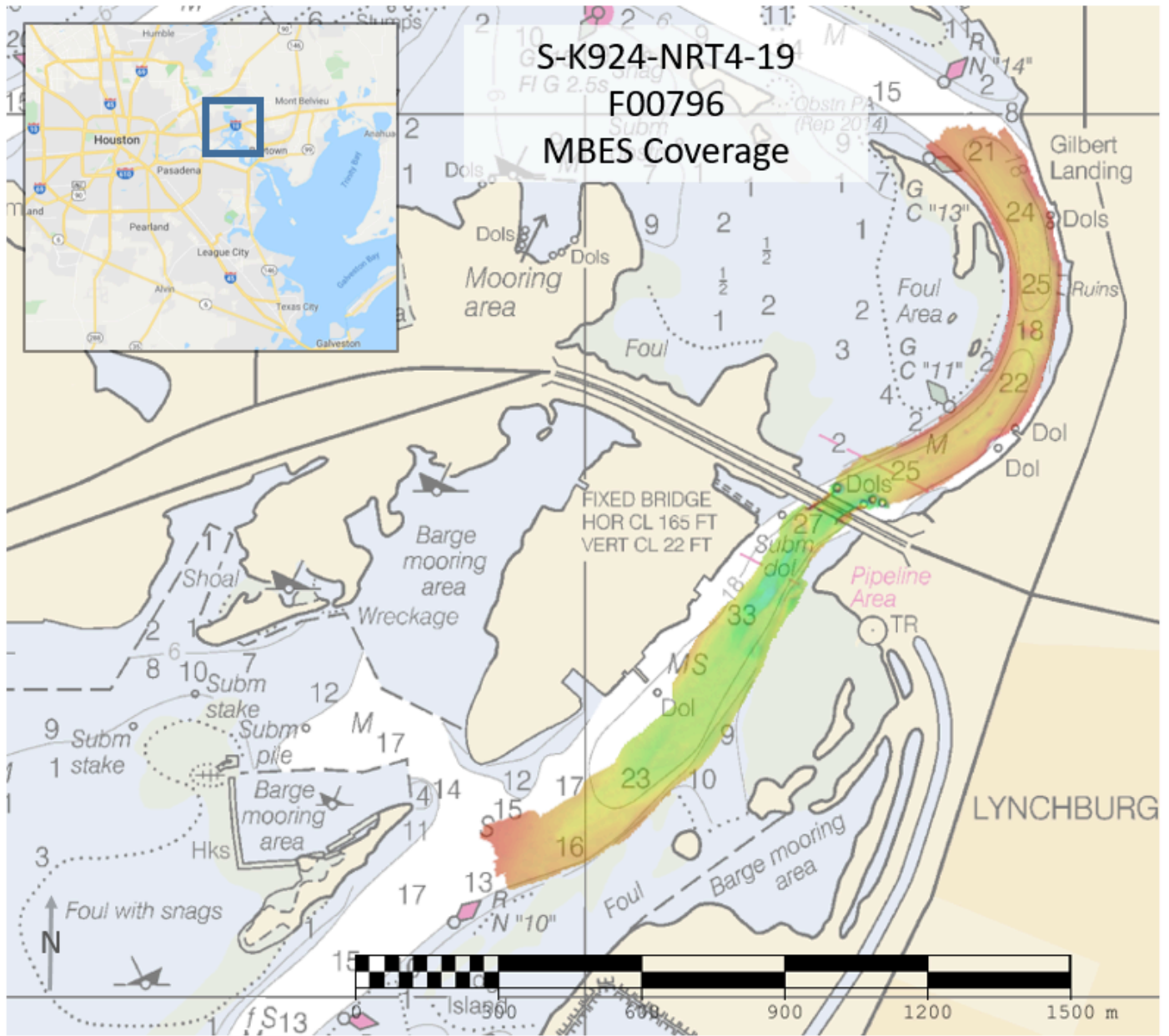


Figure 1: F00796 Area Surveyed with Object Detection Multibeam.

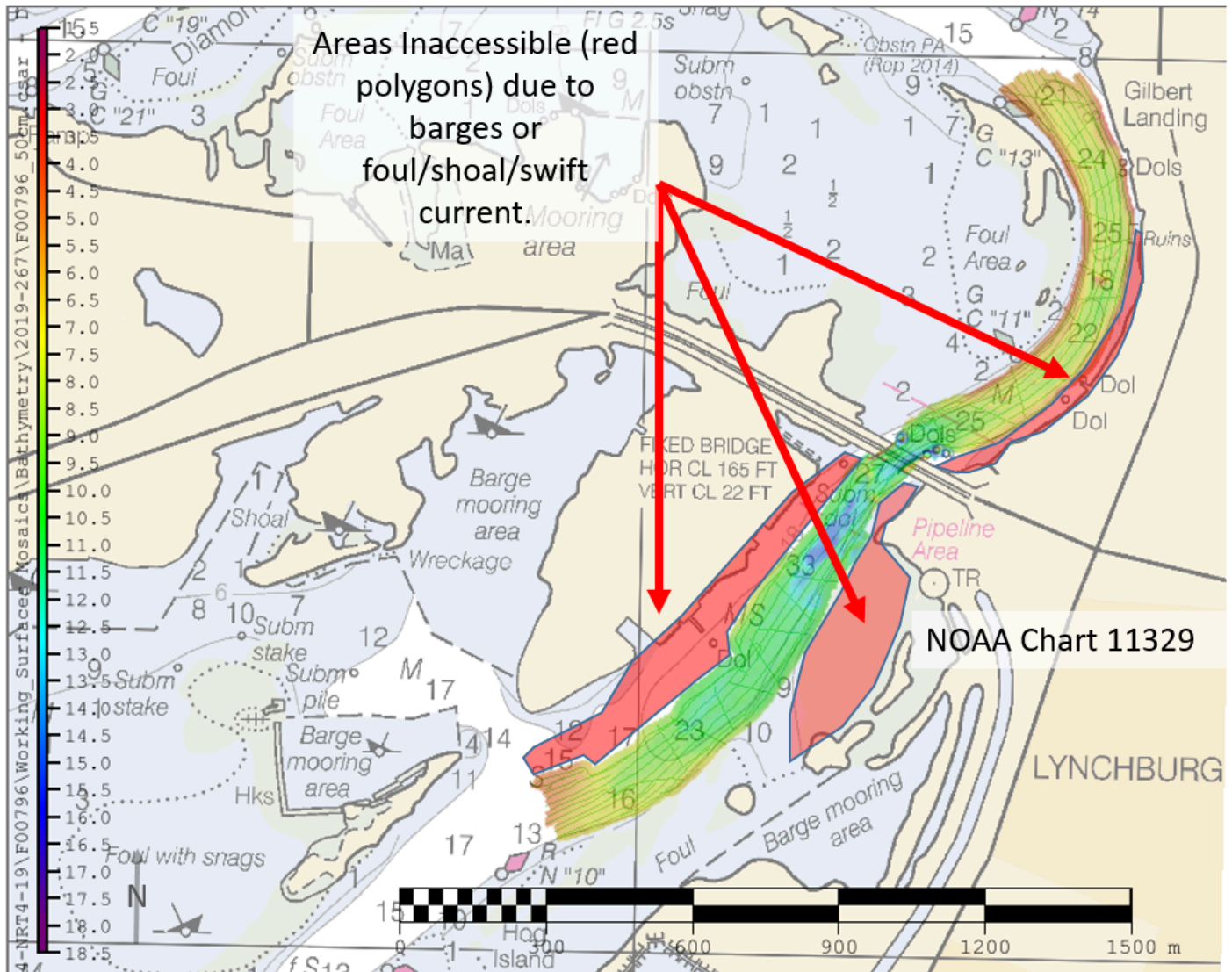


Figure 2: Main Areas of Incomplete Multibeam Coverage to NALL.

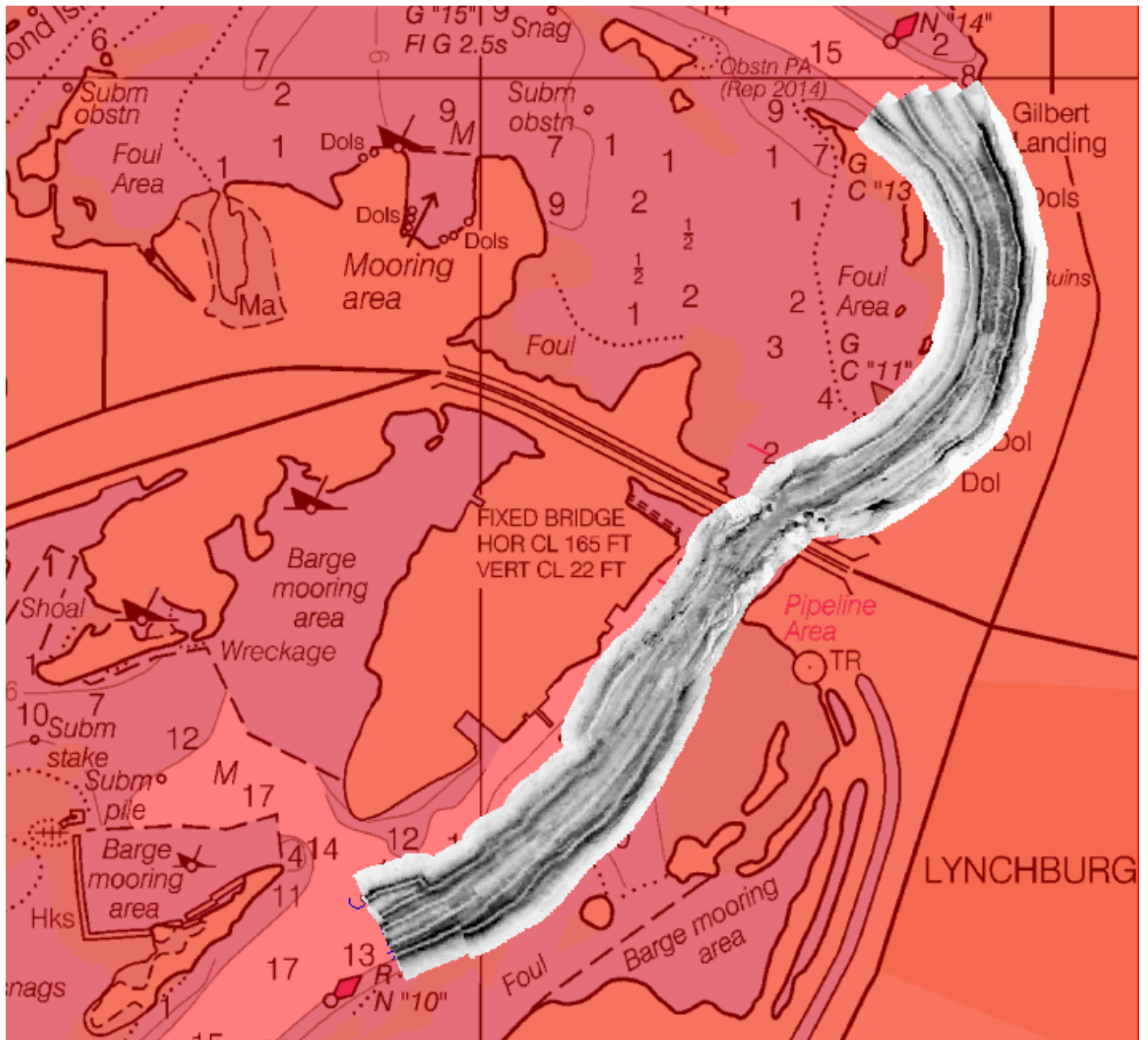


Figure 3: 200% Side Scan Imagery (50m Range Scale) was collected concurrently with Multibeam for this Object Detection Survey.

B. Survey Purpose

During the major flooding event following Tropical Storm Imelda, a barge on the San Jacinto River allided with the I-10 bridge in the vicinity of Houston, TX. The bridge sustained significant damage, particularly in the shoals, Northwest corner, outside of the navigable waterway. Additionally, some damage was also observed in the navigable waterway, underneath the bridge where sections of concrete were cracked or visibly missing from the bridge's concrete pillars. A section of protective fendering had also become

uncoupled from the bridges western pillars underneath and adjacent to the navigation channel. USCG Waterways requested a survey of the San Jacinto River in the vicinity of the I-10 bridge to identify debris and potential damage to the bridge structures below the waterline.

C. Intended Use of Survey

The survey is partially adequate to supersede previous data.

The survey IS recommended for charting although coverage to the 3.5 meter curve was not attained in all reaches of the survey area. Areas missed were inaccessible due to barges moored/rafted up to one another, tug boat operations and swift currents occurring near the shoreline which precluded safe boat operations. Please reference the Uncertainty section of this report for specific data quality information.

The navigable waterway underneath the interstate will require new bathymetry at the conclusion of salvage and construction activities presently occurring to the bridge. Most survey soundings over the sunken fendering at this location have been rejected in subset editor since the hazard is known and being remedied. A 1.78 meter sounding was designated on the shoalest point of this fendering to preserve the least depth in the finalized grid. Bridge abutments in the waterway were also rejected. Additional information on this matter can be found in the Results and Recommendations section of this report.

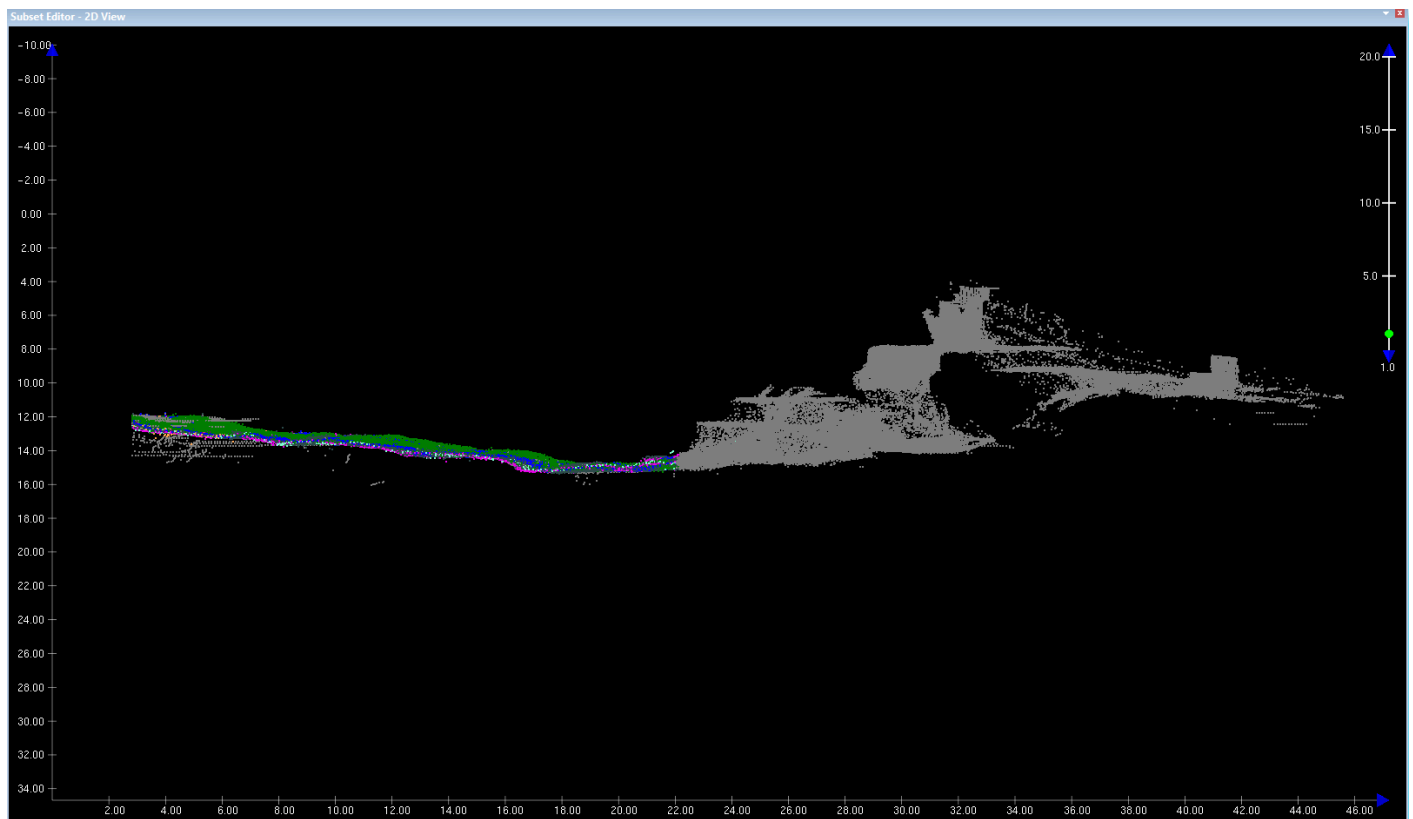


Figure 4: Rejected soundings (grey), over sunken fendering and bridge abutments underneath Interstate 10 bridge.

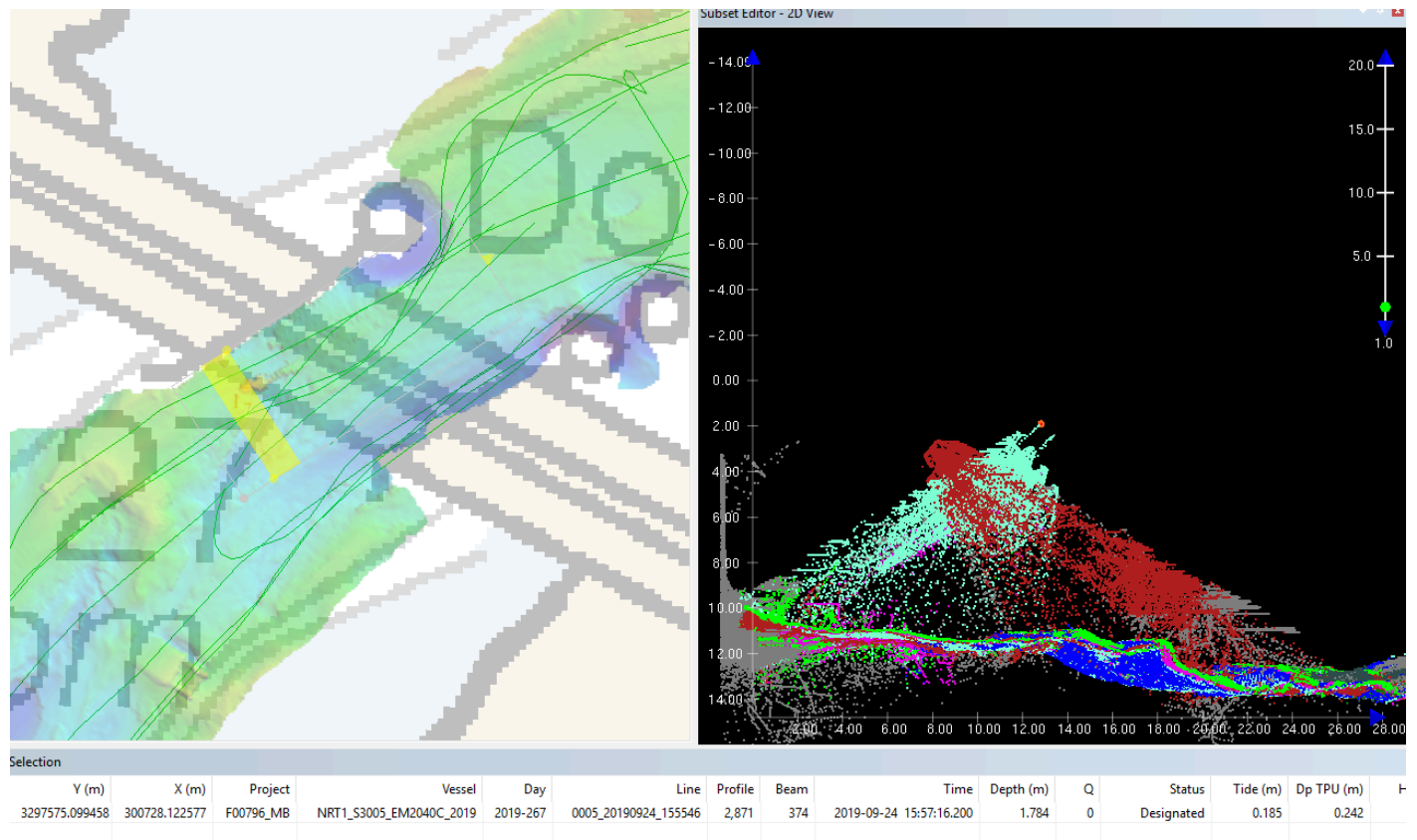


Figure 5: Designated 1.78 meter sounding, shoalest point of detached bridge fendering.

D. Data Acquisition and Processing

F00796 is an object detection survey per the project instructions. The criteria was to originally be met IAW HSSD_2019, Section 5.2.2.2 implementing "Option B" where Multibeam Echosounder data were collected concurrently with 200 percent Side Scan Sonar imagery. However, after the survey team had ran several survey lines it became apparent that 100 percent object detection multibeam "Option A" might possibly be attained for most or all of the survey area. The team did continued to log side scan imagery in the event that conditions became disadvantageous for this method. Consequently, F00796 survey satisfied HSSD object detection coverage requirements, Option A for the majority of this rapid response survey. Areas of incomplete multibeam coverage to the NALL occurred because of barges moored/rafted up to one another, tug boat operations or safety concerns for swift currents occurring near the shoreline. Please reference NRT1's 2019 Data Acquisition and Processing Report for a complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods.

CARIS 11.1 was implemented in the processing all data. Please reference the DAPR, included with this project for additional information.

F00796 100 percent and 200 percent side scan mosaics were created at a resolution of 1 meter. Bridge fendering aside, no significant contacts were noted in this imagery. The mosaics are included in the Surfaces_Mosaics folder. In the graphic below, side scan lines are highlighted/selected in CARIS denoting their use in the creation of the 100 percent mosaic.

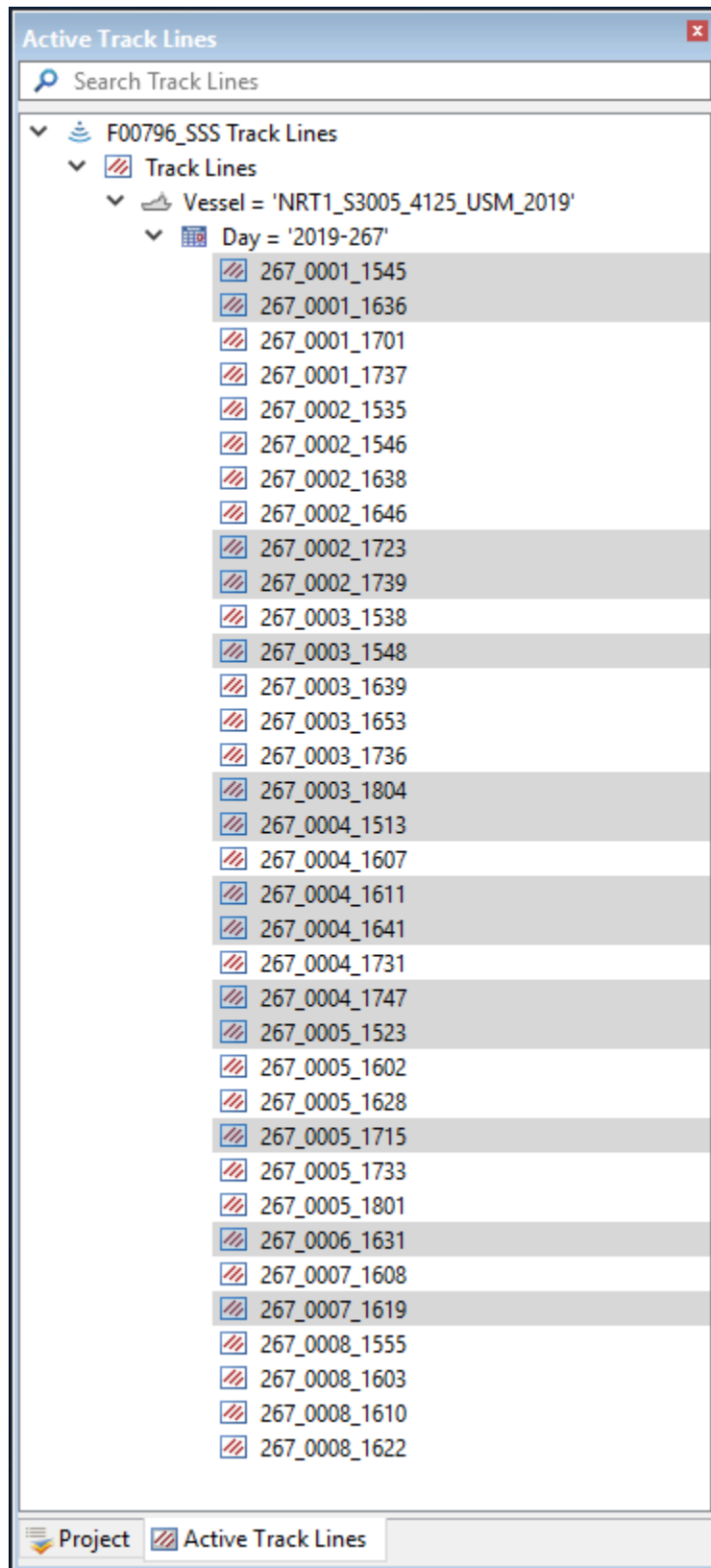


Figure 6: Side scan lines used for 100 percent (selected) vs 200 percent coverage mosaics

SAR: The field states incorrectly that no significant contacts were noted in the imagery beside the bridge fendering. During review, the survey bathymetry and imagery revealed 13 additional uncharted features in the surveyed extents: 12 OBSTRN objects and one WRECKS object.

E. Uncertainty

Multibeam crosslines acquired for F00796 totaled 2003 meters or 11.5 percent of mainscheme lines (17481 meters) thus exceeding the HSSD object detection requirement of 4 percent. A 50 cm crossline surface was compared to a mainscheme 50cm surface via the Pydro Compare Surfaces script; both were found to be in excellent agreement with each other. 95.5 percent or more nodes passed the allowable error fraction. The analysis was performed on MBES data reduced to MLLW using ellipsoidally referenced RTX SBET methods. Please refer to the folder named Crossline_Comparisons for all analysis outputs.

In addition to the usual a priori estimates of uncertainty, additional, realtime uncertain sources were also incorporated into the depth estimates of this survey. Real-time uncertainties from the Kongsberg MBES sonar and POS MMS (delayed heave) were recorded and applied during post-processing. Likewise, the post-processed uncertainties associated with vessel roll, pitch, yaw and position were applied in CARIS HIPS using SBET/RTX files (smrmsg file) generated with POSpac software. The finalized 50cm grid's uncertainty was calculated using "greater of the two" of uncertainty and standard deviation in CARIS 11.1.

Initially, only 88 percent of the nodes passed total vertical uncertainty error fraction vs the 95 percent requirement using Pydro's QC Tool, version 3.1.1. After some investigating, an erroneous standard deviation value (1.000) for MRU alignment was discovered in S3005's hydrographic vessel file. An HSTB suggested value of 0.1 yielded a 99.5 percent pass for the reprocessed, finalized surface's grid nodes. Please reference this project's Correspondence Folder for more information on this matter.

F00796's object detection, multibeam coverage density exceeded the minimum "95 percent of all nodes shall be populated with at least 5 soundings" requirement, paragraph 5.2.2.2 of the 2019 HSSD . The finalized 50cm surface passed this threshold at 99.5 percent using Pydros Grid QA v5 tool. Please reference histogram plots, below.

F00796 Crossline Comparison

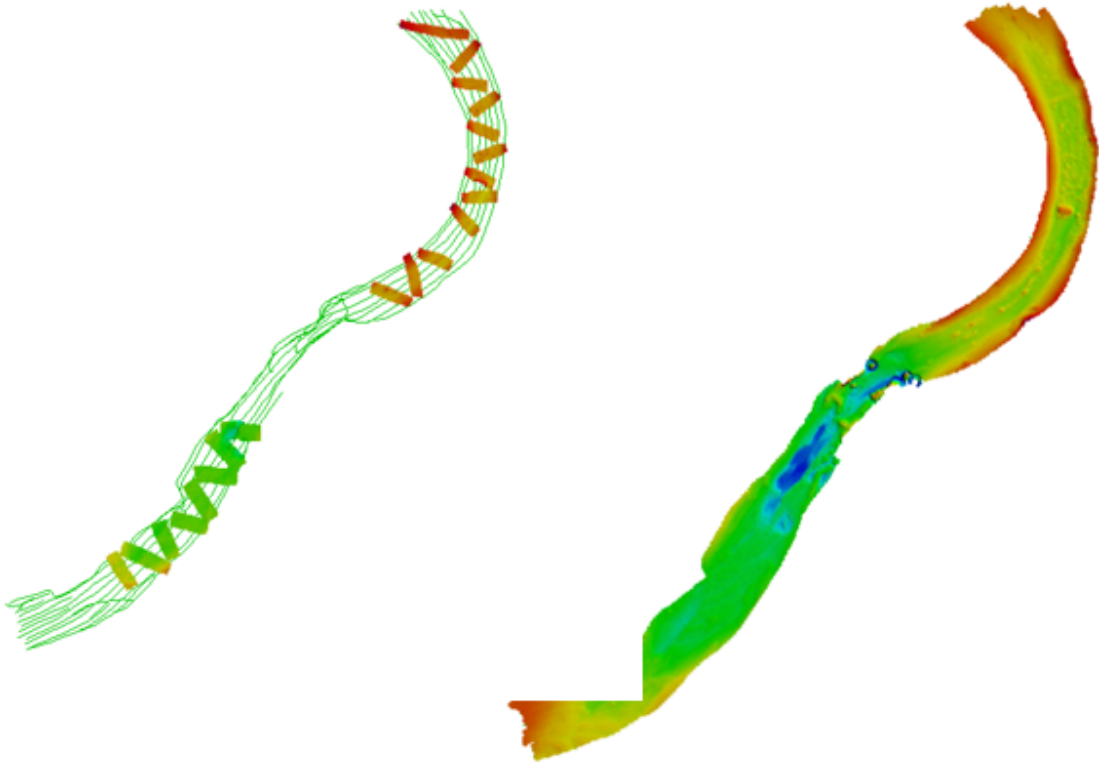


Figure 7: 50cm crossline surface compared to 50cm mainscheme surface, F00796.

Comparison Distribution

Per Grid: F00796_MB_50cm_MLLW_NO_XLs-F00796_MB_50cm_MLLW_Crosslines_fracAllowErr.csar

99.5+% nodes pass (252959), min=0.0, mode=0.1 mean=0.1 max=11.3

Percentiles: 2.5%=0.0, Q1=0.0, median=0.1, Q3=0.1, 97.5%=0.3

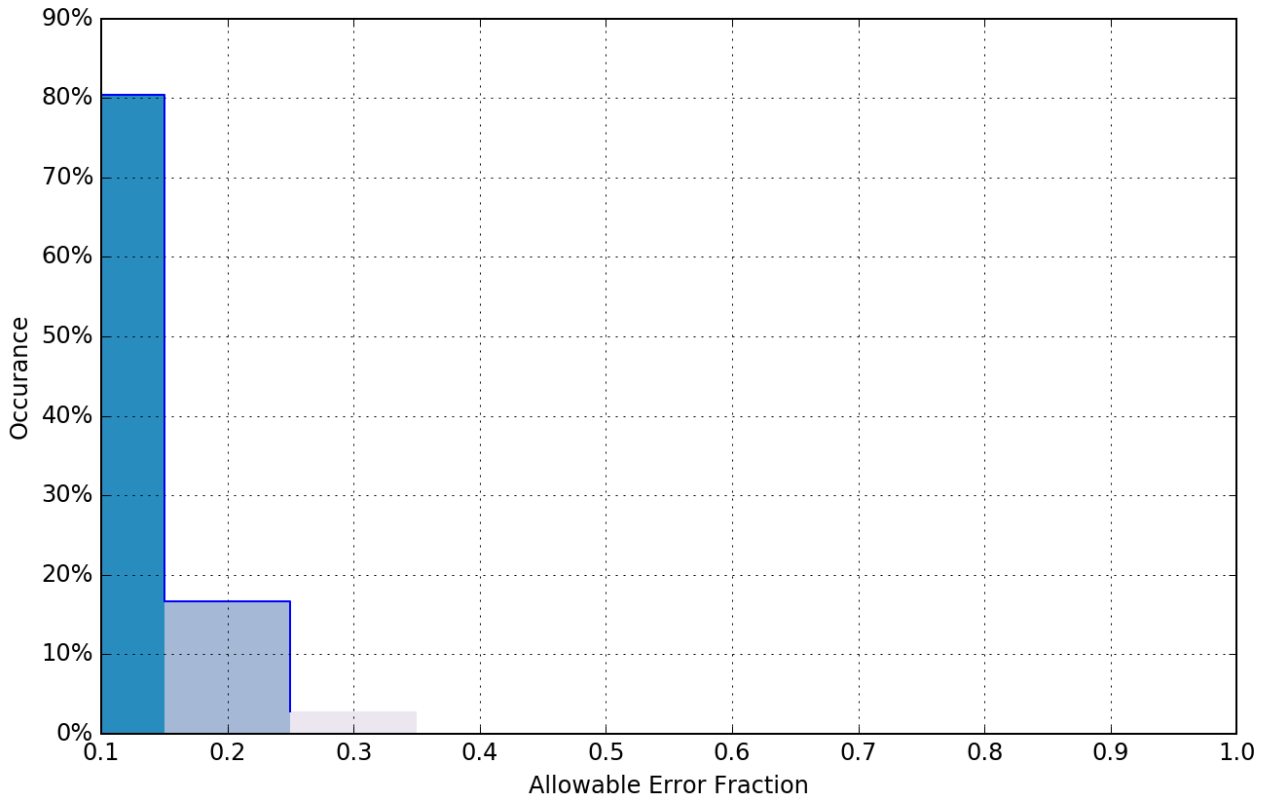


Figure 8: Comparison distribution between crosslines and mainscheme lines invoking Pydro's Compare Surfaces utility.

Uncertainty Standards

Grid source: F00796_MB_50cm_MLLW_Final

99.5+% pass (992,472 of 992,542 nodes), min=0.47, mode=0.49, max=1.92

Percentiles: 2.5%=0.48, Q1=0.48, median=0.49, Q3=0.49, 97.5%=0.54

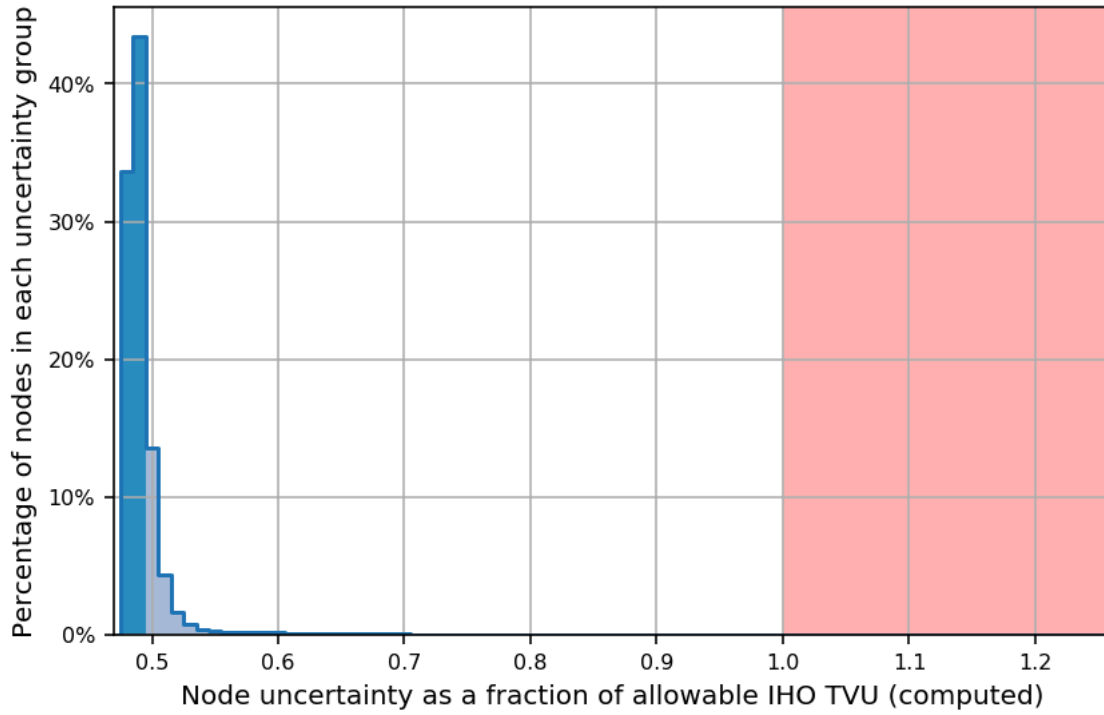


Figure 9: F00796 Finalized 50cm Surface, TVU Compliance

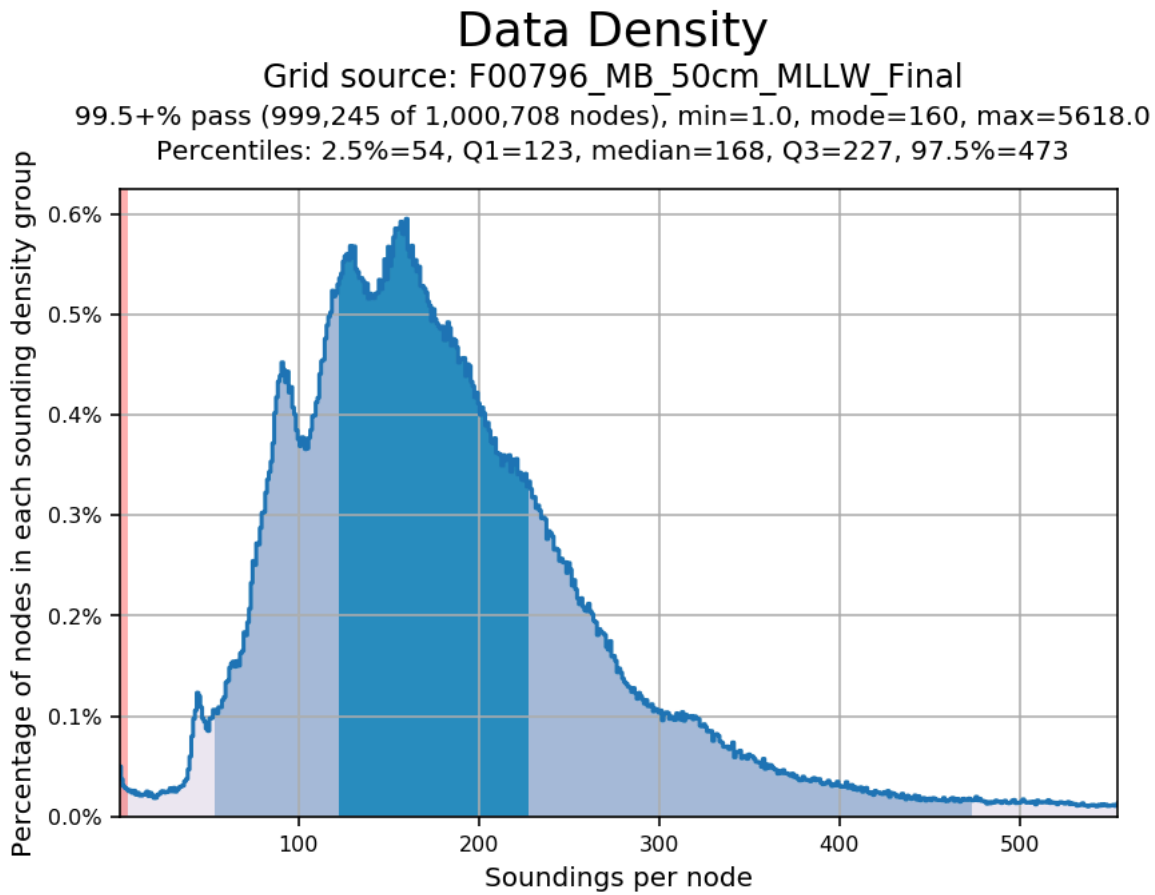


Figure 10: F00796 Finalized 50cm Surface, Density Compliance

F. Results and Recommendations

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

ENC	Scale	Edition	Update Application Date	Issue Date
US5TX56M	1:10000	38	06/06/2019	09/22/2019

The following surfaces and/or BAGs were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
F00796_MB_50cm_MLLW	CARIS Raster Surface (CUBE)	0.5 m	1.895 m - 17.986 m	NOAA_0.5m	Object Detection
F00796_MB_50cm_MLLW_Final	CARIS Raster Surface (CUBE)	0.5 m	1.784 m - 17.986 m	NOAA_0.5m	Object Detection
F00796_SSSAB_1m_400kHz_1of2	SSS Mosaic	1 m	2 m - 20 m	NOAA_1m	100% SSS
F00796_SSSAB_1m_400kHz_2of2	SSS Mosaic	1 m	2 m - 20 m	NOAA_1m	200% SSS

There are no feature investigation requirements for this project per F00796 Project Instructions. At the time of survey, a known 150 foot section of fender wales (fendering) had detached from the Interstate 10 Bridges pillars, southwestern side. It extended 55 feet into the western side of the navigable waterway underneath the bridge and showed a preliminary least depth of approximately 28 feet where surrounding depths measured 40 feet. No DtoN for this feature was submitted because 1.) USGC was aware of this hazard and had initiated a "broadcast to mariners" action the previous day; 2.) a maintenance crew was already on-scene, working from a utility boat alongside the hazard; 3.) and safety buoys had been sunk in the affected area to cordon off vessel traffic. The dolphins on the north side of the bridge suffered substantial damage yet were shown to be correctly positioned. See images, below. All vessel movements through this area required mandatory coordination with the USCG Vessel Traffic Service (VTS) Houston/Galveston on the day of survey. Findings for this day's survey were reported out to all interested parties including NRB Branch Chief and USCG Waterways Coordinator LCDR Timothy Tilghman. Please reference the Supplemental Survey Records Correspondence folder. Fender wales aside, no other significant concrete debris or other obstructions were evident along the bottom of the navigable channel in the area surveyed.

Edge Fliers exist in vicinity of the bridge despite ten separate iterations of manually rejecting noise and deeper soundings on a 50cm grid. Several hundred edge fliers existed at the start but by the fourth round of cleaning it became evident that 60 or so remaining would not delete but shift position by several meters. In total, 10 hours were spent addressing these fliers implementing a half meter "slice" in CARIS 11.1s Subset Editor concurrently with Pydros Flier Finder v8 tool. The default filter settings for this tool were not changed (Distance 1.0 node and Delta Z 0.01 meters). Despite NRT4's best effort to clean and smooth these edges in a shoal-biasing fashion, 52 edge fliers still remain. Additionally, one Gaussian Curvature flier (#2 category) remains as a result of designating a sounding over the least depth of the sunken fendering. Fliers of #3,#4,#5 categories were successfully corrected to zero instances or did not exist.

The 18 foot contour will require adjustment approximately 375 meters north of the bridge and on the eastern bank of the river. Minor shoaling at that location encroaches into the 18 foot contour, approximately 1 mm at survey scale. Correspondence with PHB regarding this shoal can be found in the correspondence folder. Additionally, a survey sounding was designated to preserve a least depth of 4.8 meters (15.7 feet) atop an 18

foot charted sounding located 525 meters north of the bridge and in the middle of the channel. See graphics, below.

Survey soundings are significantly deeper than charted soundings and contours for the reach south of the interstate bridge. Survey depths of 22 feet and deeper exist in nearly all of the 50cm coverage. Tug and barge operations, barges at anchor and barges rafted to one another, alongside precluded coverage to the NALL in this heavily industrialized waterway. Graphic of the survey soundings vs charted soundings and contours shown below.

No holidays in the finalized 50 cm grid were discovered implementing Pydros Holiday Finder version 4 tool.

All ATONs located within the survey area were verified to be correctly positioned and serving their intended purpose.



Figure 11: Maintenance Crew Remedies Detached Fender Fence. Picture is facing west.

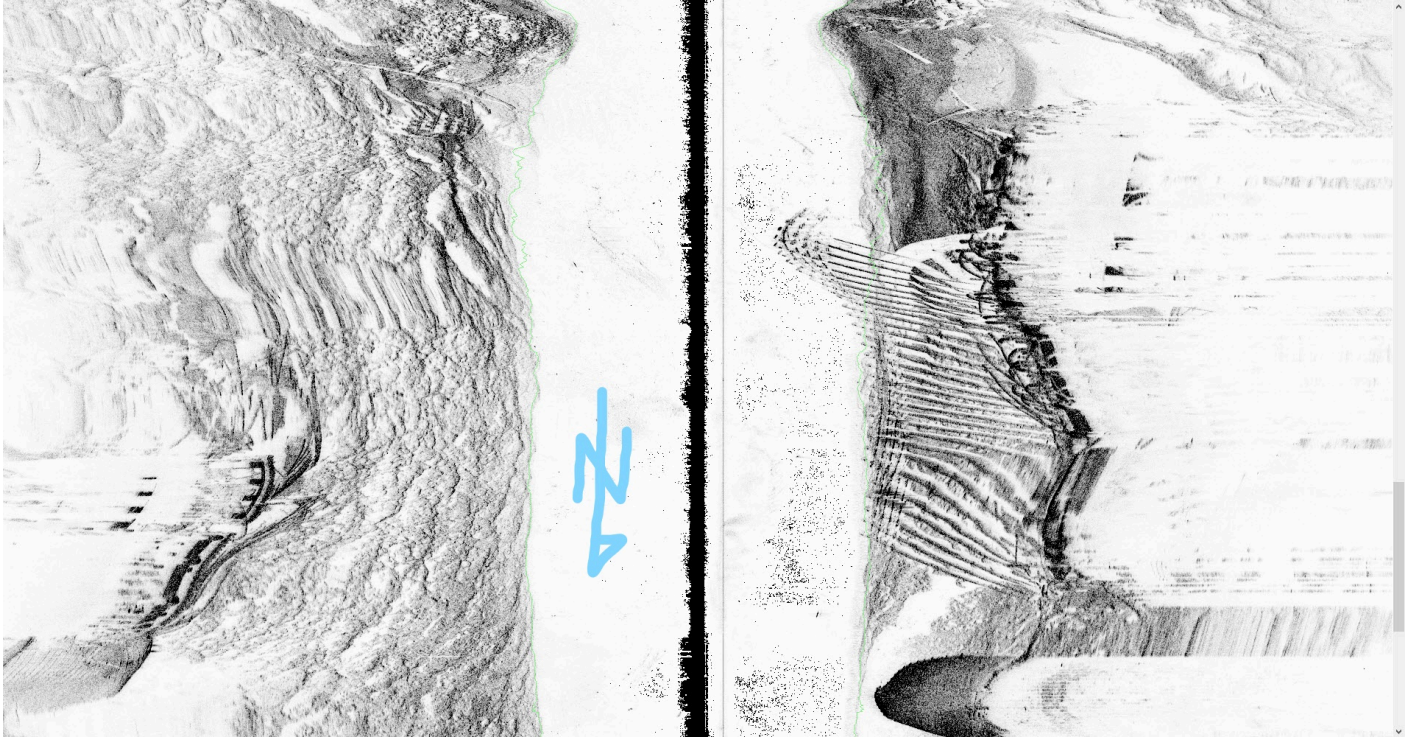


Figure 12: SSS Imagery, Detached Fendering, 50m Range Scale.

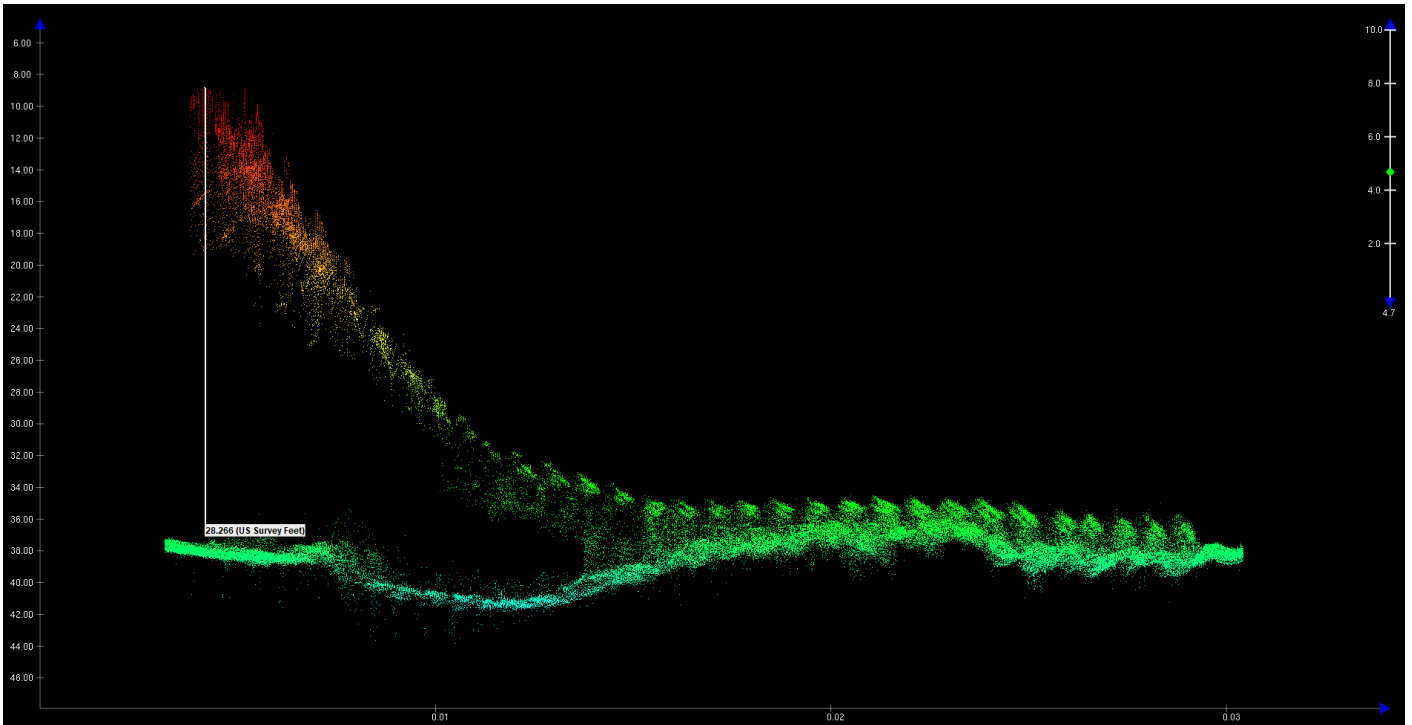


Figure 13: 2D Multibeam Imagery, Detached Fendering.



Figure 14: Damaged Dolphin, Northeast side of bridge. Picture is facing Southeast.



Figure 15: Cracked Bridge Pillar, Northeast side of bridge. Picture is facing South.



Figure 16: Department of Transportation Inspectors, Interstate 10 Bridge, Westbound Segment. Picture facing Southeast.

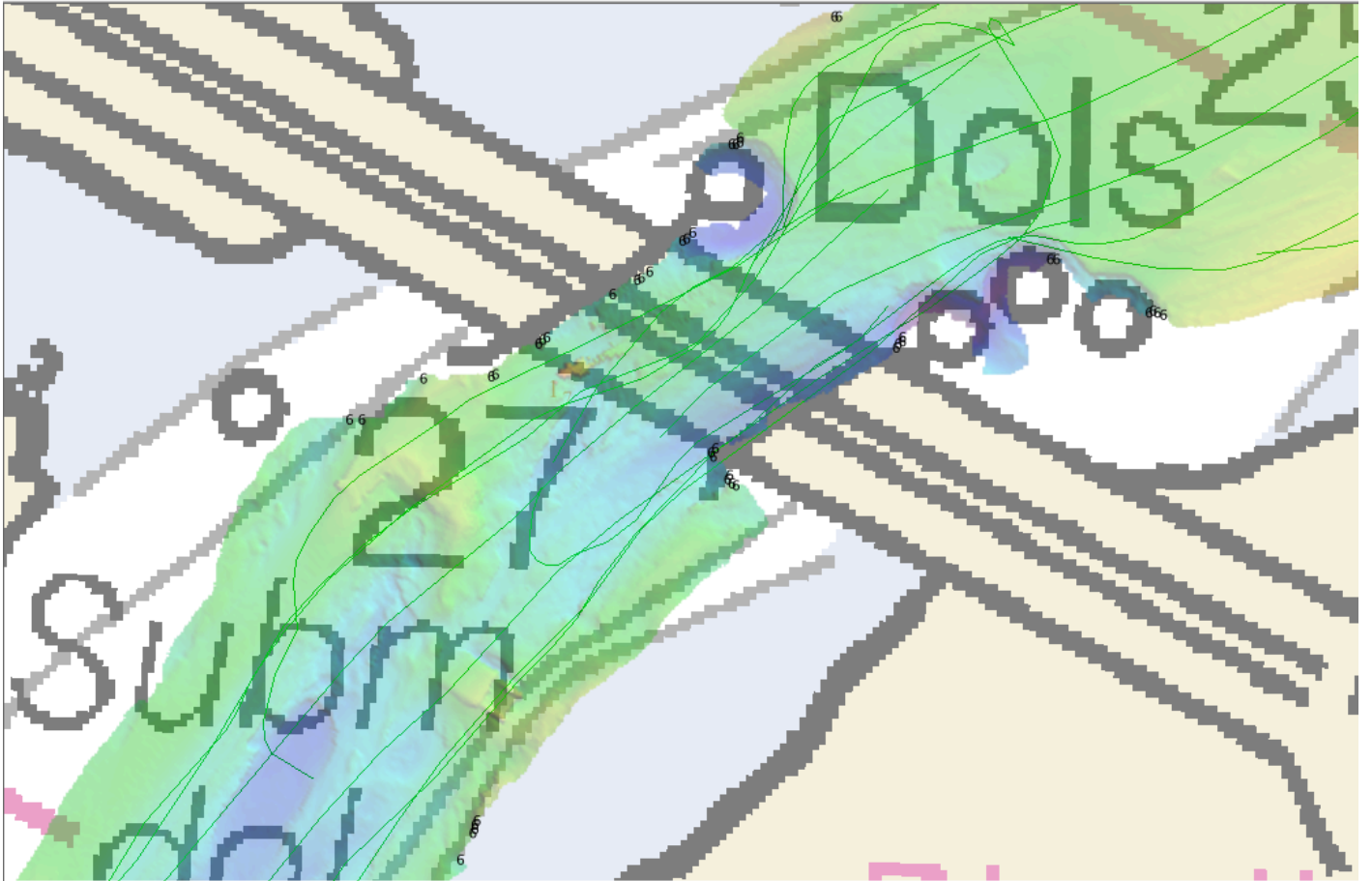


Figure 17: Edge Fliers, Remaining.

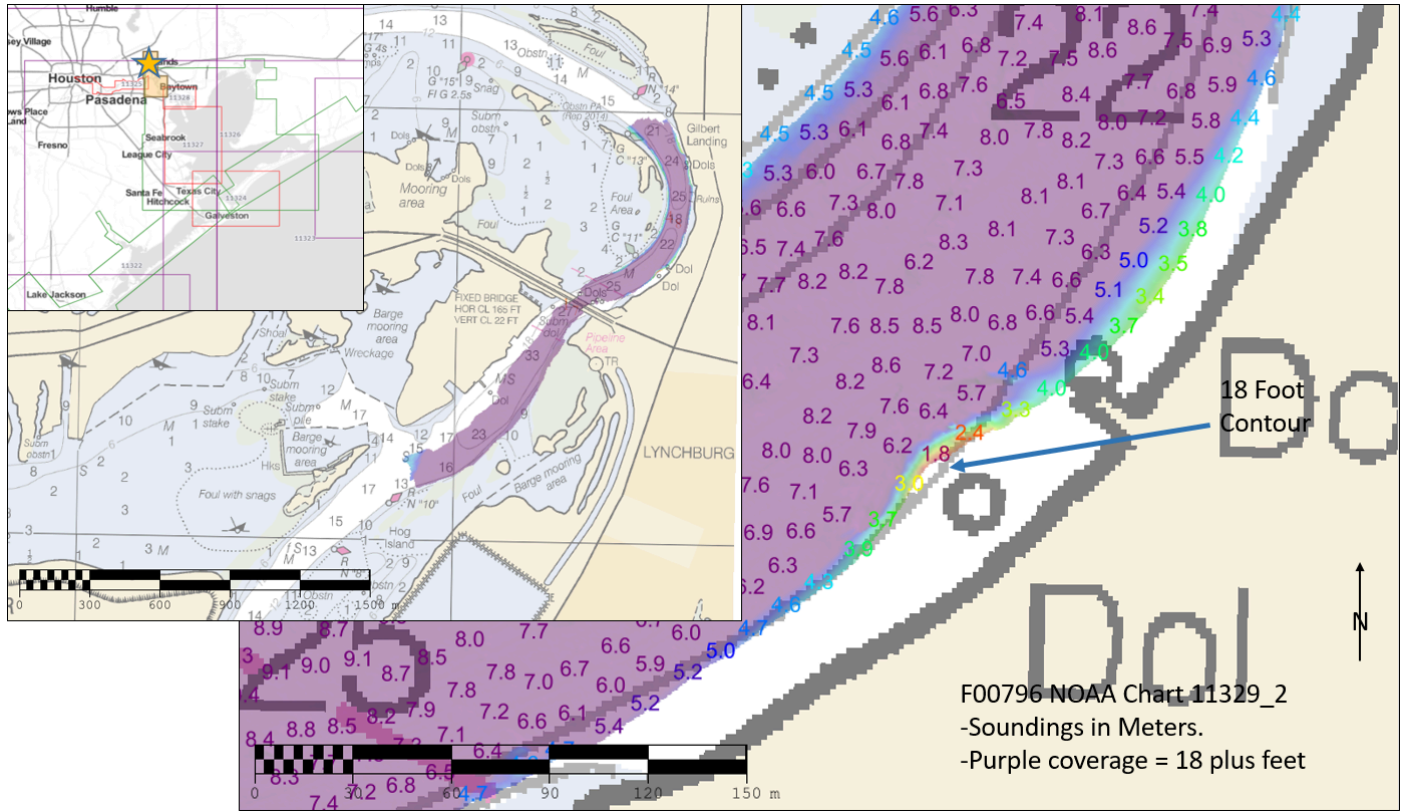
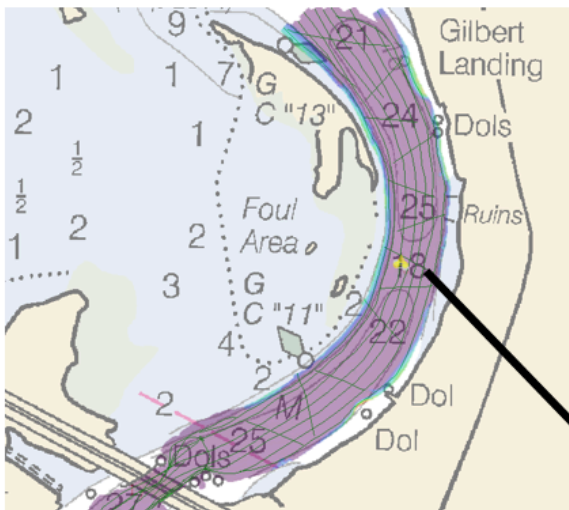


Figure 18: 18 foot contour adjustment, Chart 11329_2.



4.8 meter designated survey sounding atop charted 18 foot charted (11329_2) sounding

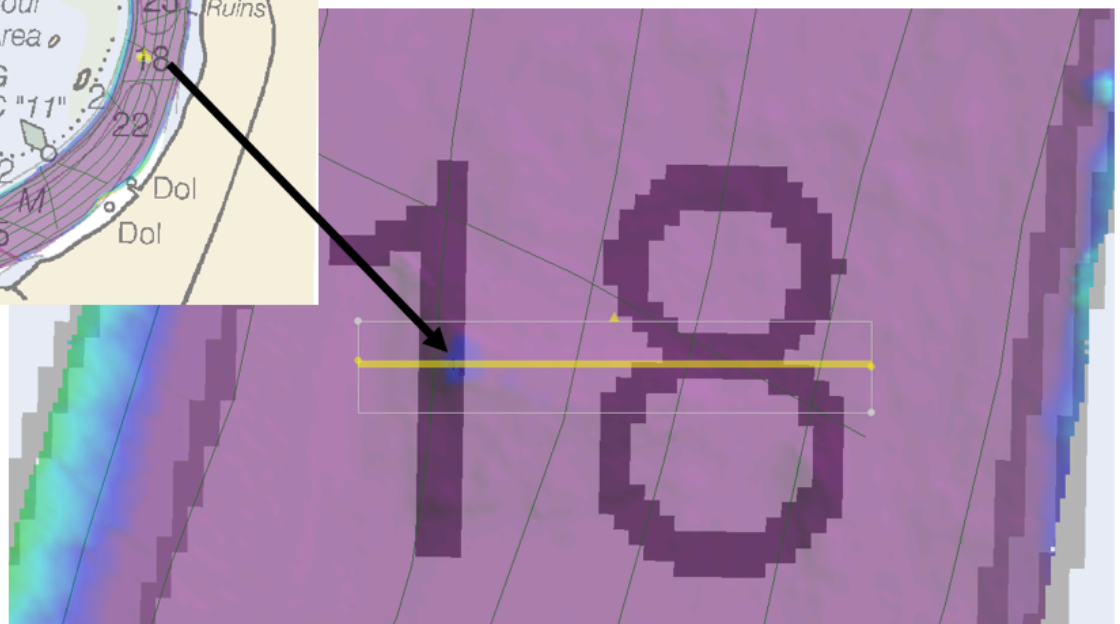


Figure 19: 15.7 foot survey sounding found atop charted (11329_2) 18 foot sounding. Survey coverage (purple) indicates 18 feet and deeper.

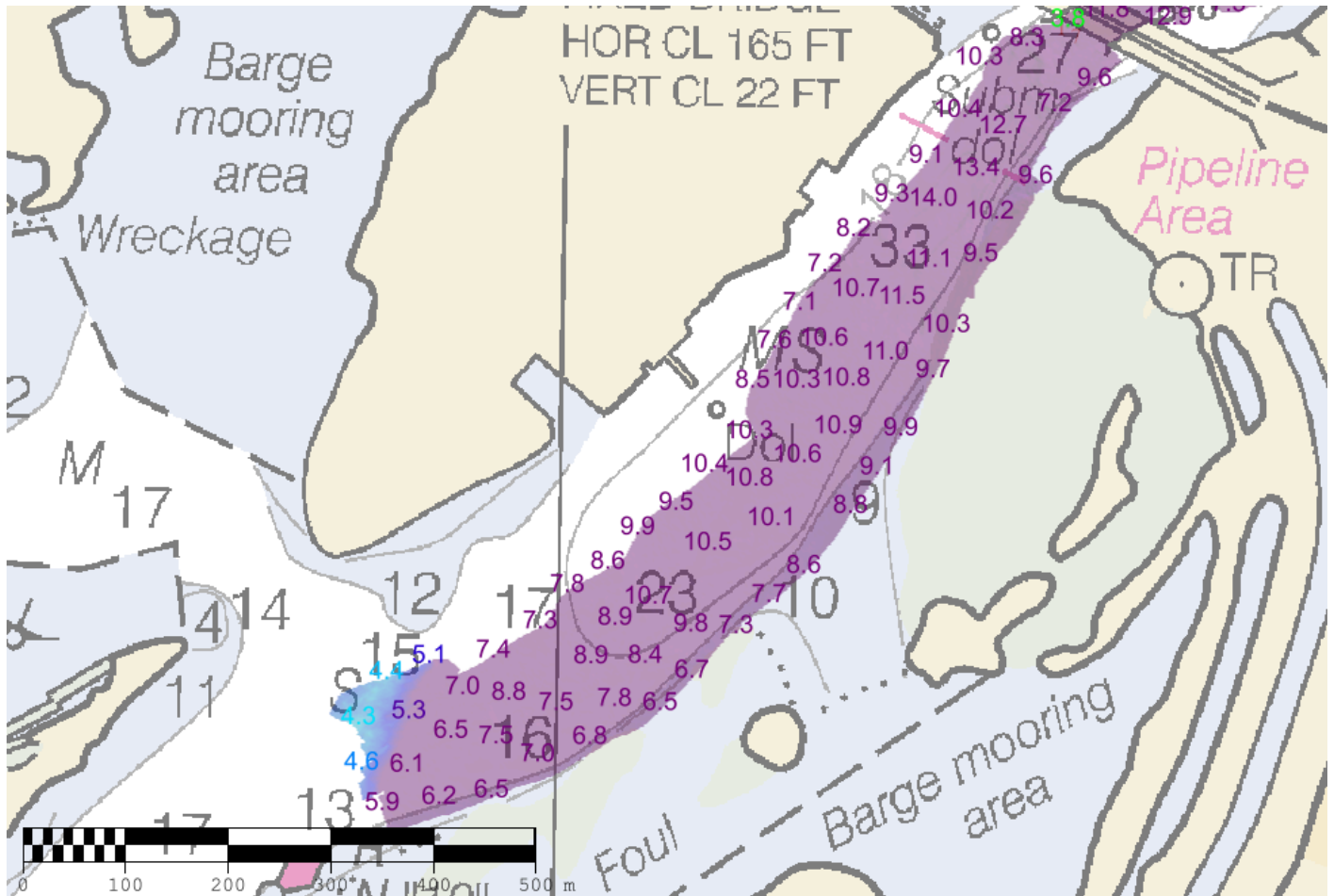


Figure 20: Southern portion of F00796 coverage and survey soundings vs chart 11329_2. Survey soundings in dark purple. Survey coverage (purple) indicates 18 feet and deeper.

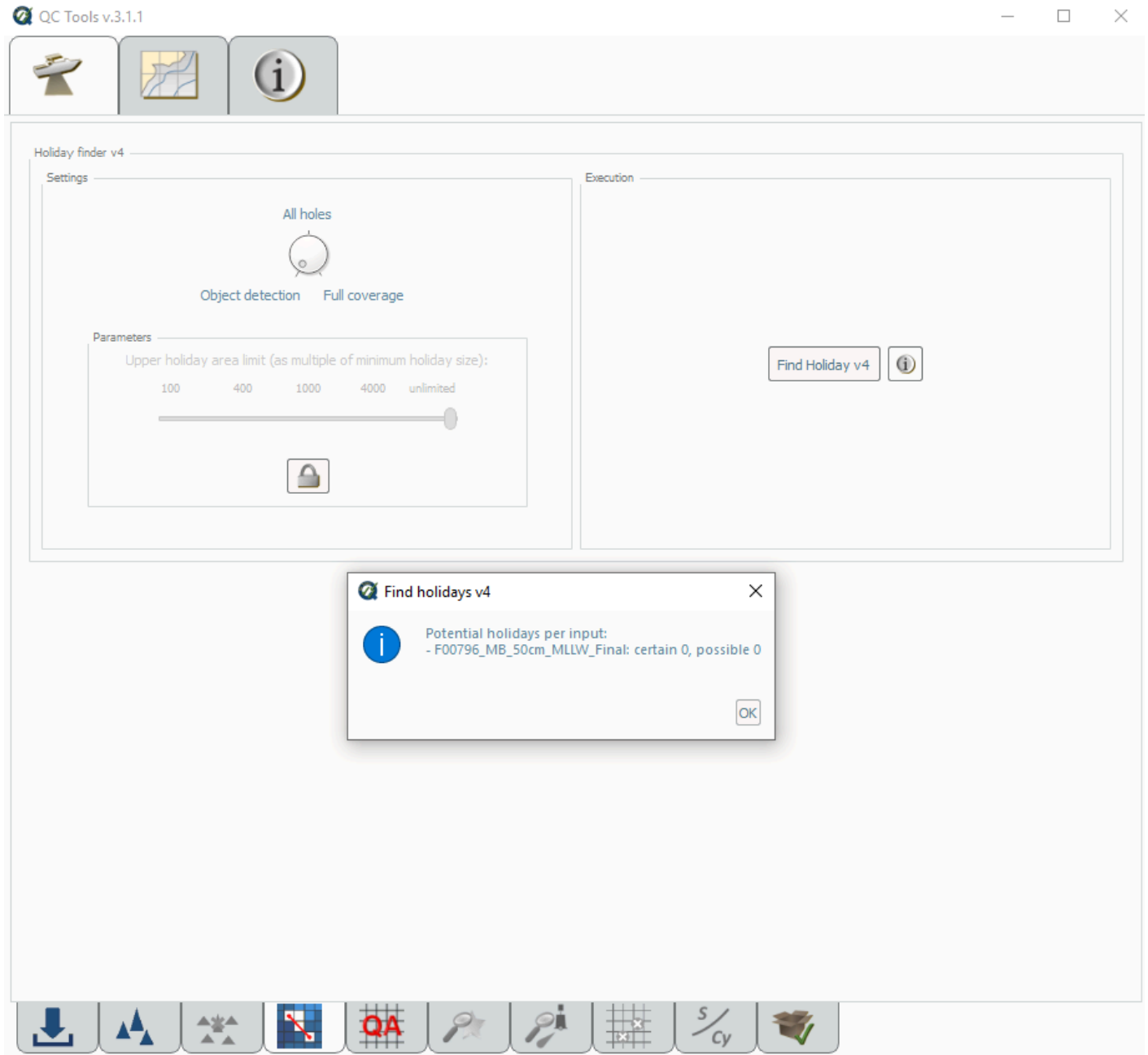


Figure 21: No Holidays exist, F00796 50 cm finalized grid.

SAR: The field incorrectly states "Fender wales aside, no other significant concrete debris or other obstructions were evident along the bottom of the navigable channel in the area surveyed." In fact, thirteen OBSTRN features and one WRECKS feature were found and developed for submission to MCD in review. One of these obstructions should be re-surveyed for a chart update. This particular obstruction's least depth is 1.784m in a depth area identified as providing 6 to 18m of depth, below the I-10 bridge. Unfortunately, there has been no confirmation that salvage operations in 2019 removed this ruined fendering and the conservative approach will need to be to chart it until it is definitively disproven.

G. Vertical and Horizontal Control

The vertical datum for this project is Mean Lower Low Water. The vertical control method used was VDatum.

The vertical datum for this project is Mean Lower Low Water (MLLW). Soundings were reduced from NAD83 to MLLW using VDatum file "S-K924-NRT4-19_VdatumLimits_100m_NAD83-MLLW_geoid12b.csar" located in survey's "Water_Levels" folder. The vertical uncertainty for this model was 12.3341 cm and was applied in Charlene v3.1.5.

The horizontal datum for this project is North American Datum of 1983 (NAD 83). The projection used for this project is Universal Transverse Mercator (UTM) Zone 15.

The horizontal datum for this project is North American Datum 1983. The projection used for this survey is Projected UTM 15 North.

H. Additional Results

NRT1s DAPR

Note this survey will use Navigation Response Team 1s DAPR. NRT1's vessel, S3005 and sonar systems were used for data collection on this response survey. However, NRT1s DAPR pdf and DAPR Title Sheet bear the name "NRT4" in adherence to the naming convention prescribed by the 2019 HSSD, Chapter 8.1

I. Approval

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 Survey Summary 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, Standing and 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 Survey Summary Report.

Approver Name	Title	Date	Signature
Dan Jacobs	NRT4 Team Lead	10/29/2019	JACOBS.DAN. L.1151633478 <small>Digitally signed by JACOBS.DAN.L.1151633478 Date: 2019.11.18 08:55:36 -06'00'</small>

APPROVAL PAGE

F00796

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
- 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: _____

James Miller

Chief (acting), Pacific Hydrographic Branch