H13367

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H13367

LOCALITY

State(s):	Indiana Michigan
General Locality:	Chicago, IL
Sub-locality:	Vicinity of Burns Waterway Harbor

2020

CHIEF OF PARTY
David J. Bernstein, CH, PLS, GISP

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Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13367**

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):	**Indiana Michigan**
General Locality:	**Chicago, IL**
Sub-Locality:	**Vicinity of Burns Waterway Harbor**
Scale:	**5000**
Dates of Survey:	**06/16/2020 to 08/12/2020**
Instructions Dated:	**03/27/2020**
Project Number:	**OPR-Y395-KR-20**
Field Unit:	**Geodynamics LLC**
Chief of Party:	**David J. Bernstein, CH, PLS, GISP**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Multibeam Echo Sounder Backscatter**
Verification by:	**Atlantic Hydrographic Branch**
Soundings Acquired in:	**meters at Low Water Datum 577.5 ft IGLD-1985 L Michigan,Huron**

Remarks:

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 WGS84 UTM 16N, Low Water Datum 577.5 ft IGLD-1985 L Michigan,Huron. All references to other horizontal or vertical datums in this report are applicable to the processed hydrographic data provided by the field unit.

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Descriptive Report to Accompany Survey H13367

Project: OPR-Y395-KR-20

Locality: Chicago, IL

Sublocality: Vicinity of Burns Waterway Harbor

Scale: 1:5000

June 2020 - August 2020

Geodynamics LLC

Chief of Party: David J. Bernstein, CH, PLS, GISP

A. Area Surveyed

Geodynamics LLC conducted a hydrographic survey in the assigned area of H13367 located in the vicinity of Burns Waterway Harbor, Indiana. Within H13367, all survey operations were conducted in accordance with the provided Statement of Work (SOW), Hydrographic Survey Project Instructions (PI), and the May 2020 National Ocean Service (NOS) Hydrographic Survey Specifications and Deliverables (HSSD). Any deviations from the aforementioned guidelines have been approved by the National Oceanographic and Atmospheric Administration (NOAA) Hydrographic Survey Division (HSD) Operations (OPS) branch and are documented in the survey correspondences.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
41° 47' 6.86" N 87° 11' 58.52" W	41° 37' 53.67" N 87° 1' 51.59" W

Table 1: Survey Limits

Data were acquired to the survey limits in accordance with the requirements listed in the PI and the HSSD.

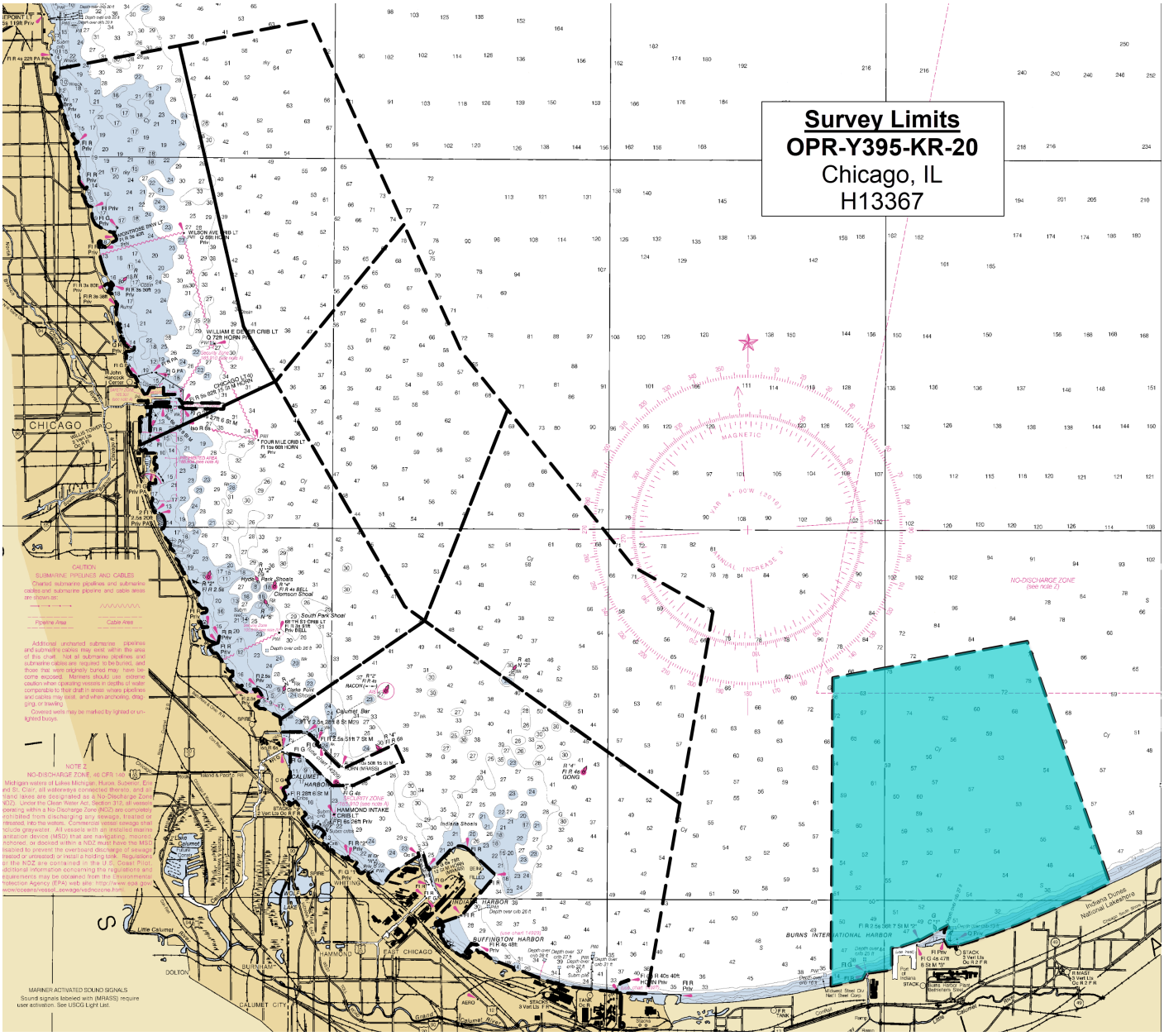


Figure 1: Overview of project survey limits, overlaid onto Chart 14905 with H13367 shown in blue

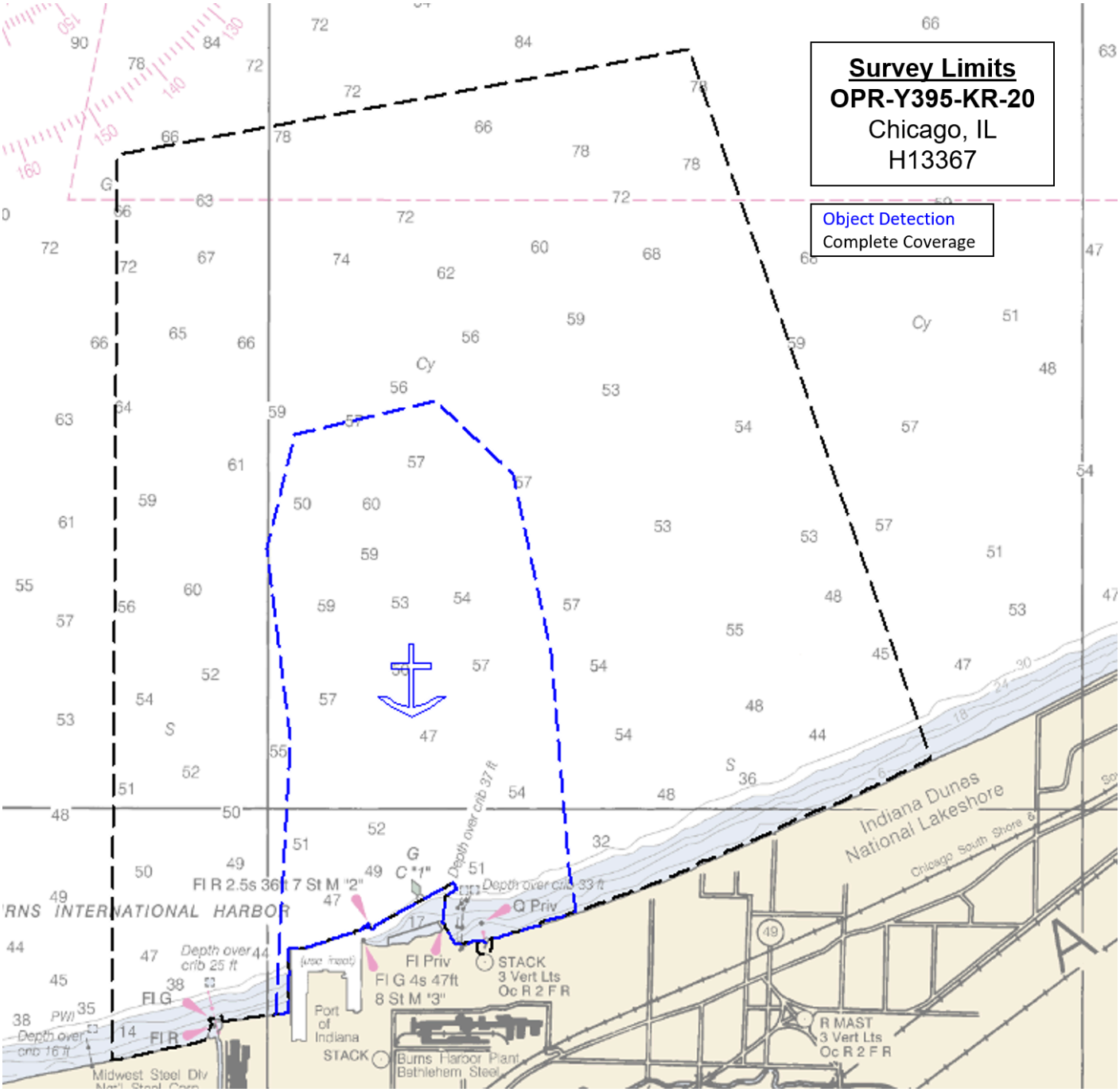


Figure 2: H13367 object detection (blue) and complete coverage (black) survey limits overlaid onto Chart 14905

A.2 Survey Purpose

This project is located in the most southern region of Lake Michigan, which includes the Chicago Harbor and much of the Indiana and Michigan shoreline. The Chicago Harbor, located in one of the largest cities in

the country, is the northern entrance to the Mississippi River and has a tremendous amount of local barge traffic moving commodities throughout the year.

Much of the survey area within the project limits has not been surveyed since the late 1940s, and many throughout the Lake Michigan community, including tug and barge operators and recreational boaters, have been forced to predict the hazards and depths associated with the area near shore.

This survey provides critical data for the updating of NOS nautical charting products and contributes to increased maritime safety near the Michigan, Indiana, and Illinois shoreline. Survey data from this project is intended to supersede all prior survey data in the common area.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Survey quality in H13367 meets or exceeds requirements set forth in the HSSD. Survey quality was assessed through visual inspection, the analysis of crosslines, and the utilization of QC Tools to assess uncertainty and density. For more information on methods and results of the survey data quality assessments for this survey, refer to section B.2 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 within the Project Reference File (PRF)-designated anchorage areas.	Object Detection Coverage
All waters outside the PRF-designated anchorage area.	Complete Coverage

Table 2: Survey Coverage

Object detection coverage was obtained in all waters within the designated anchorage areas in H13367 in accordance with HSSD 5.2.2.2. In all waters outside the designated anchorage area, complete coverage was obtained in accordance with HSSD 5.2.2.3. See Figure 3 for an overview of coverage.

All efforts were made to acquire survey data to the sheet limits or to the Navigable Area Limit Line (NALL), as defined in section 1.3.2 of the HSSD. In all areas where the 3.5 meter depth contour or the sheet limits were not met, the NALL was defined by the inshore limit of safe navigation for the survey vessel due to risks associated with maneuvering the vessel in shallow and/or hazardous areas. An example of such an area is shown in Figure 4.

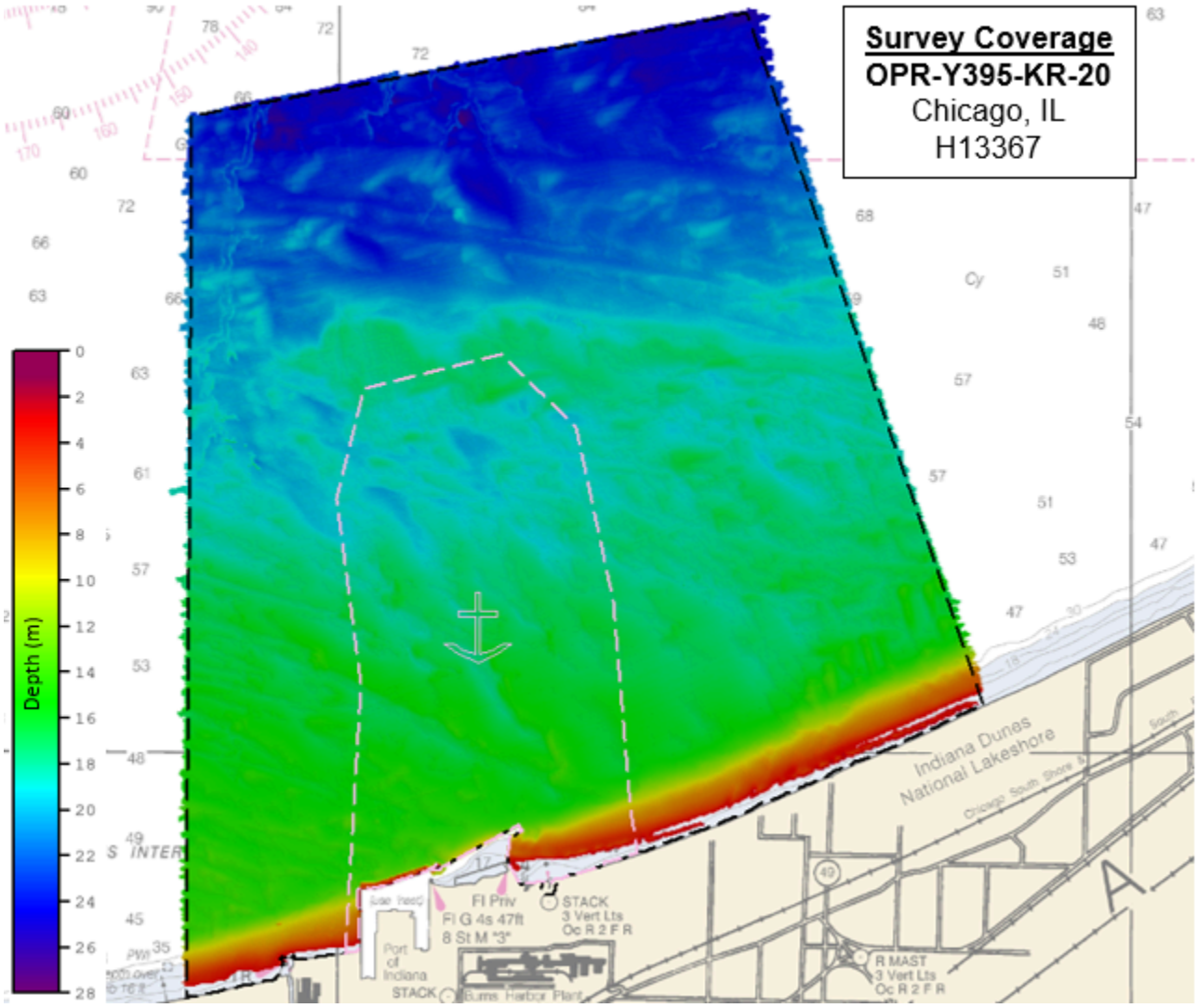


Figure 3: H13367 survey coverage overlaid onto Chart 14905

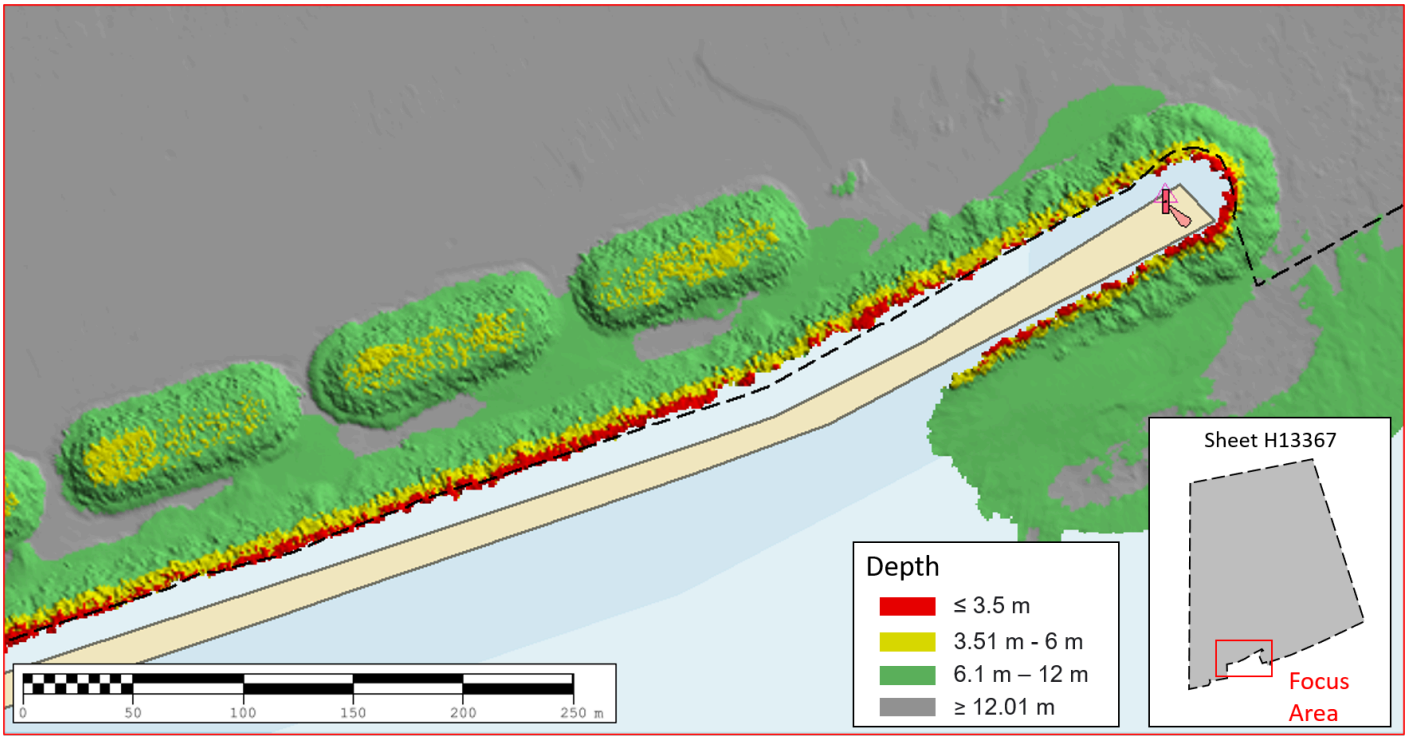


Figure 4: Area where NALL was defined by the inshore limit of safe navigation

A.6 Survey Statistics

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

	HULL ID	*R/V Benthos*	*R/V Chinook*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0	0.0
	MBES Mainscheme	856.16	442.49	1298.65
	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	0.0	0.0
	SBES/MBES Crosslines	45.91	16.03	61.94
	Lidar Crosslines	0.0	0.0	0.0
Number of Bottom Samples				7
Number Maritime Boundary Points Investigated				0
Number of DPs				0
Number of Items Investigated by Dive Ops				0
Total SNM				49.9

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
06/16/2020	168

Survey Dates	Day of the Year
06/17/2020	169
06/18/2020	170
06/19/2020	171
06/26/2020	178
06/27/2020	179
06/28/2020	180
07/06/2020	188
07/07/2020	189
07/08/2020	190
07/09/2020	191
07/11/2020	193
07/13/2020	195
07/14/2020	196
07/15/2020	197
07/17/2020	199
07/18/2020	200
07/20/2020	202
07/21/2020	203
07/25/2020	207
08/07/2020	220
08/09/2020	222
08/12/2020	225

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the OPR-Y395-KR-20 DAPR for a complete description of survey equipment and configurations, data acquisition procedures, data processing methods, quality control measures, and survey reporting methods. Additional information to supplement 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	*R/V Benthos*	*R/V Chinook*
LOA	9.14 meters	9.44 meters
Draft	0.61 meters	0.61 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 2040C	MBES
AML Oceanographic	BaseX2	Sound Speed System
AML Oceanographic	MicroX SV	Sound Speed System
Applanix	POS MV 320 v5	Positioning and Attitude System

Table 6: Major Systems Used

R/V Benthos and R/V Chinook utilized a dual-head Kongsberg EM 2040C multibeam system, a POS MV 320 v5 positioning and attitude system, an AML MicroX surface sound speed system, and an AML BaseX2 sound speed profiling system.

B.2 Quality Control

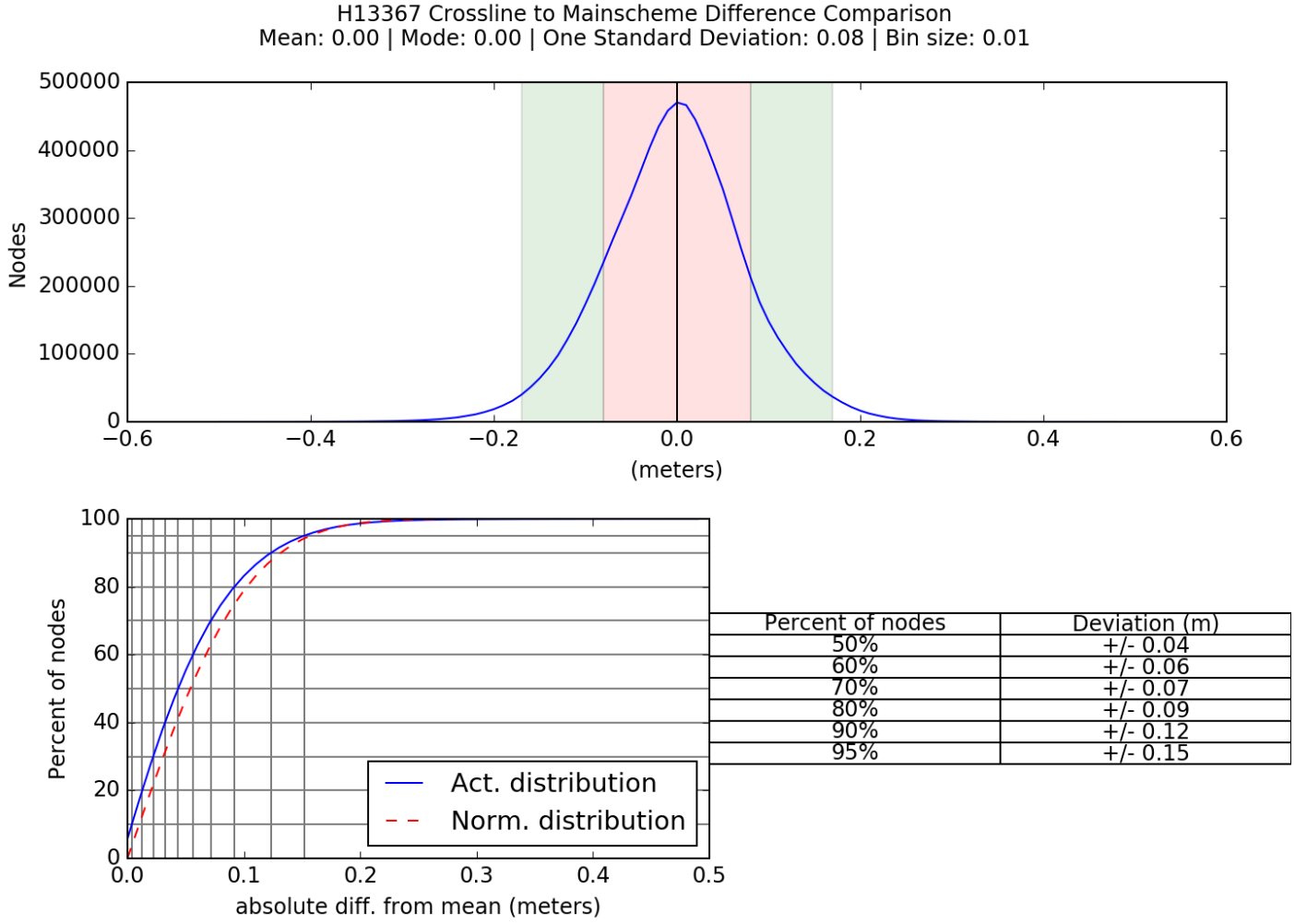
B.2.1 Crosslines

Multibeam crosslines acquired for H13367 totaled 4.77% of mainscheme acquisition.

H13367 crosslines were collected and analyzed in accordance with section 5.2.4.2 of the HSSD and guidance from the HSD OPS Project Manager (see DR Appendix II). Crosslines were evaluated in CARIS HIPS with a detailed visual inspection followed by a thorough statistical analysis. To conduct the statistical analysis, a 1 m CUBE surface was generated with strictly mainscheme data and another, separate 1 m CUBE surface was

generated with only crossline data. The mainscheme and crossline surfaces were analyzed using the Compare Grids tool in Pydro Explorer, which generated a difference surface and associated statistics. In addition to the direct statistics from the surface differencing, the tool assessed the difference surface statistics and computed the proportion of NOS total allowable vertical uncertainty (TVU) consumed by the mainscheme-to-crossline differences per surface node.

The statistical results of the difference comparison show 95% of nodes falling within +/- 0.15 meters, with a mean difference of 0 meters (Figure 5). Additionally, 99.5+% of the difference surfaces nodes met or exceeded TVU specifications, as described in section 5.1.3 of the HSSD. The complete results and associated images from the Compare Grids tool were submitted within the Crossline Comparison folder of the Survey Separates II.



Percent of nodes	Deviation (m)
50%	+/- 0.04
60%	+/- 0.06
70%	+/- 0.07
80%	+/- 0.09
90%	+/- 0.12
95%	+/- 0.15

Figure 5: H13367 crossline to mainscheme difference comparison

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.045 meters	0.0 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Surface
R/V Benthos	2.00 meters/second	N/A	0.05 meters/second
R/V Chinook	2.00 meters/second	N/A	0.05 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

All finalized CUBE surfaces were analyzed using the HydrOffice QC Tools Grid QA tool to assure 95% of the surface grid nodes meet TVU specifications. The results of the Grid QA tool determined all finalized CUBE surfaces met or exceeded the TVU specifications.

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

Sound Speed

The spatio-temporal variability in temperature of the water column created complex sound speed conditions throughout the survey. These complexities often created challenges for the field team and resulted in occasional refraction artifacts in the survey data and resultant surfaces, as shown in Figure 6.

The hydrographer made considerable efforts to reduce the impact of sound speed issues during acquisition. These efforts included increasing the frequency of casts, closely monitoring real-time swath "smiling" or "frowning", utilizing alerts for surface-to-profile sound speed deviations, observing the real-time standard deviation map display, and utilizing Sound Speed Manager to track spatial changes in surface sound speed along with profile location. Additional efforts in post-processing to minimize refraction artifacts included outer beam filtering, manual outer beam editing, and strategic application of sound speed profiles.

The convex or concave trend in the across-track sonar data, as a result of refraction, is most prevalent on the outer beams and is noticeable in the surface as a striped line-to-line artifact.

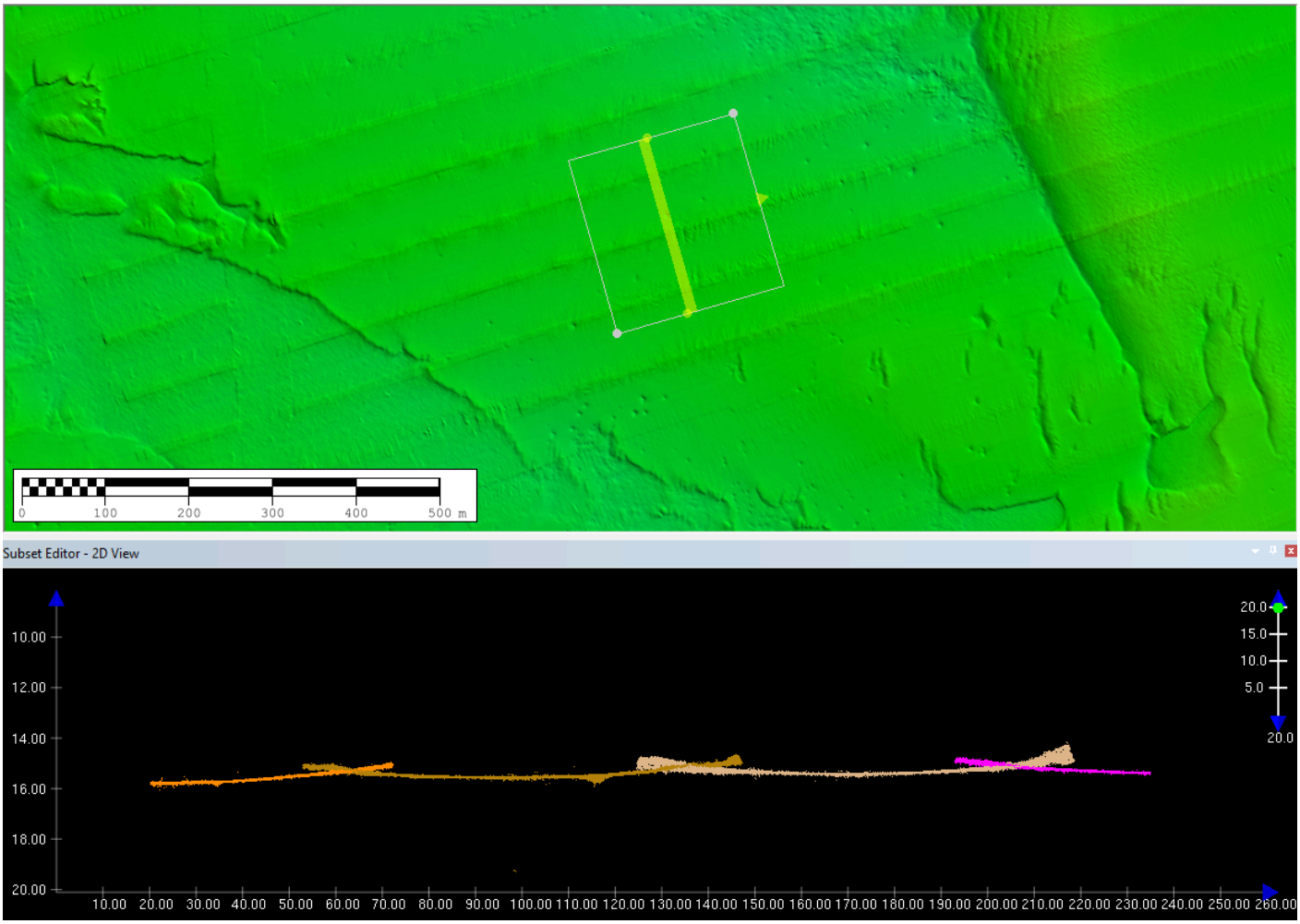


Figure 6: H13367 surface artifacts as a result of refraction in the sounding data

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Sound speed casts were acquired at least once every four hours. Casts were often conducted more frequently (~every two hours) than this time interval because of the dynamic water properties in the survey area.

Surface sound speed was compared in real-time to the current sound speed profile. When the comparison differed by more than 2 m/s, a new sound speed profile was acquired. Additionally, QPS Qinsy and Kongsberg SIS provided a real-time visual assessment of data quality (standard deviation grids, bathymetric grids, swath views), aiding the hydrographer in determining when a new cast was required.

For more detailed information on sound speed methods, refer to the DAPR.

B.2.8 Coverage Equipment and Methods

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

B.2.9 Density

All finalized CUBE surfaces were analyzed using HydrOffice QC Tools Grid QA tool to assure data met the required density specifications. The 1 m and 2 m complete coverage surfaces both had 99.5+% of surface nodes containing at least five or more soundings. The 1 m object detection surface had 99.5+% of surface nodes containing at least five or more soundings while the 50 cm object detection surface had 98% of surface nodes with five or more soundings. All surfaces exceeded the specifications required by sections 5.2.2.2 and 5.2.2.3 of the HSSD.

B.2.10 Holidays

All CUBE surfaces were analyzed using HydrOffice QC Tools Holiday Finder to determine if the surface contained holidays, as described in sections 5.2.2.2 and 5.2.2.3 of the HSSD. The tool scanned the CUBE surfaces to identify any holidays and generated an S-57 file to represent the locations of holidays.

In the 50 cm object detection CUBE surface, all holidays identified were outside the sheet limits. In the 1 m object detection CUBE surface, there were no holidays identified.

In the 1 m complete coverage CUBE surface, all holidays identified were outside of the sheet limits or inshore of the NALL (Figure 7). In the 2 m complete coverage CUBE surface, there were no holidays identified.

Another method of holiday evaluation was to visually pan the CUBE surfaces to identify holidays. The hydrographer would often alter the surface display (color ranges, symbology, shading) to help identify coverage gaps. The results reflected the same outcome as the tool.

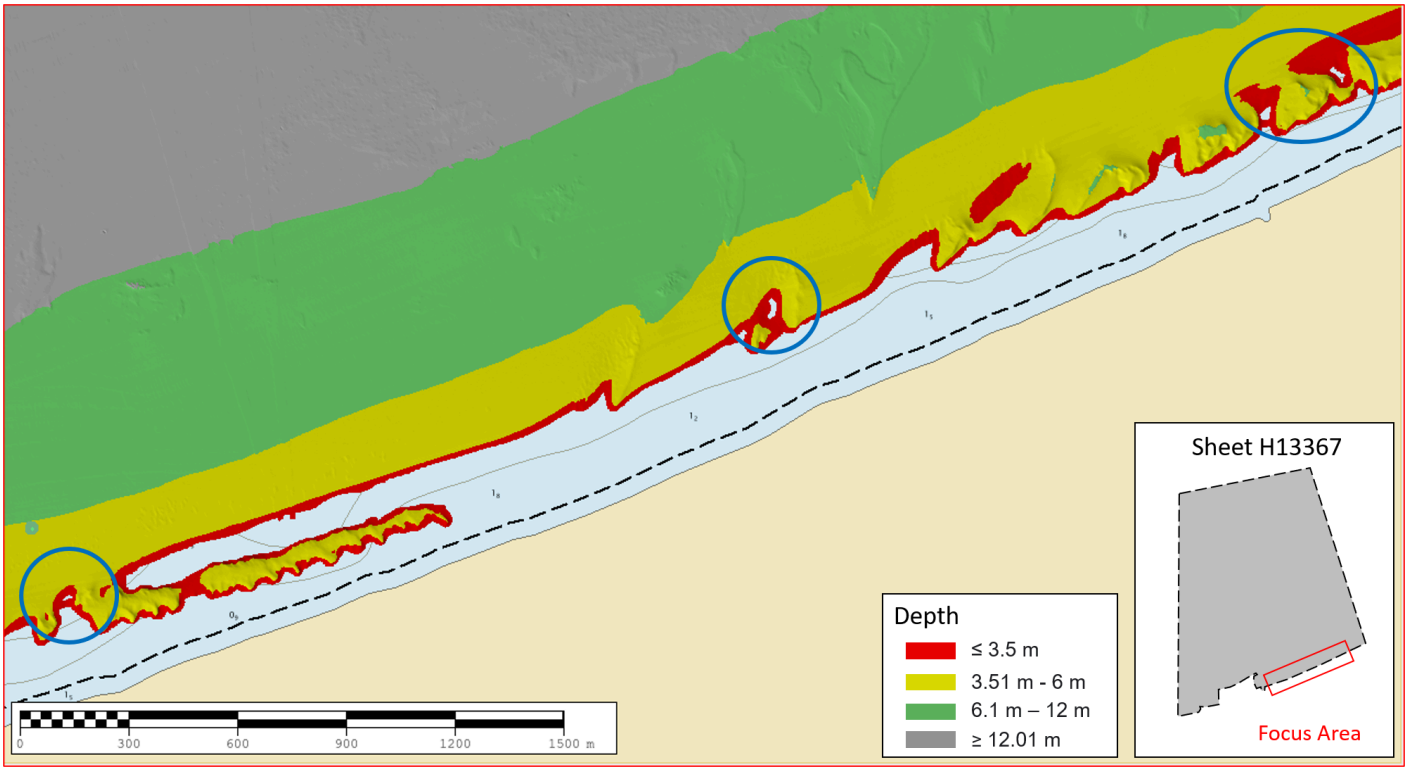


Figure 7: H13367 1 m complete coverage surface showing areas identified as holidays within the NALL

B.2.11 Flier Finder

In addition to visual inspection, all CUBE surfaces were analyzed using HydrOffice QC Tools Flier Finder tool to assure data does not contain fliers (anomalous data as defined by QC Tools flier finding algorithms #2-6). While the Flier Finder tool flags surface fliers meeting a set criteria, it will also flag real surface features that meet the same criteria. This was especially prevalent around hard structures and high-slope areas along the shoreline. Spurious soundings flagged by Flier Finder were cleaned until only the remaining flagged fliers were deemed valid aspects of the surface.

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 collected and stored within the .ALL files from vessels utilizing Kongsberg MBES systems.

Although no processing or analysis of backscatter was required, backscatter data were processed for quality assurance purposes in QPS FMGT. Additionally, mosaics were created to assure the coverage and quality of the backscatter (Figure 8). Hydrographers in the field monitored backscatter intensities in real-time and made efforts to collect quality backscatter without hindering bathymetric data quality. Refer to the DAPR for more information on backscatter data acquisition and processing procedures.

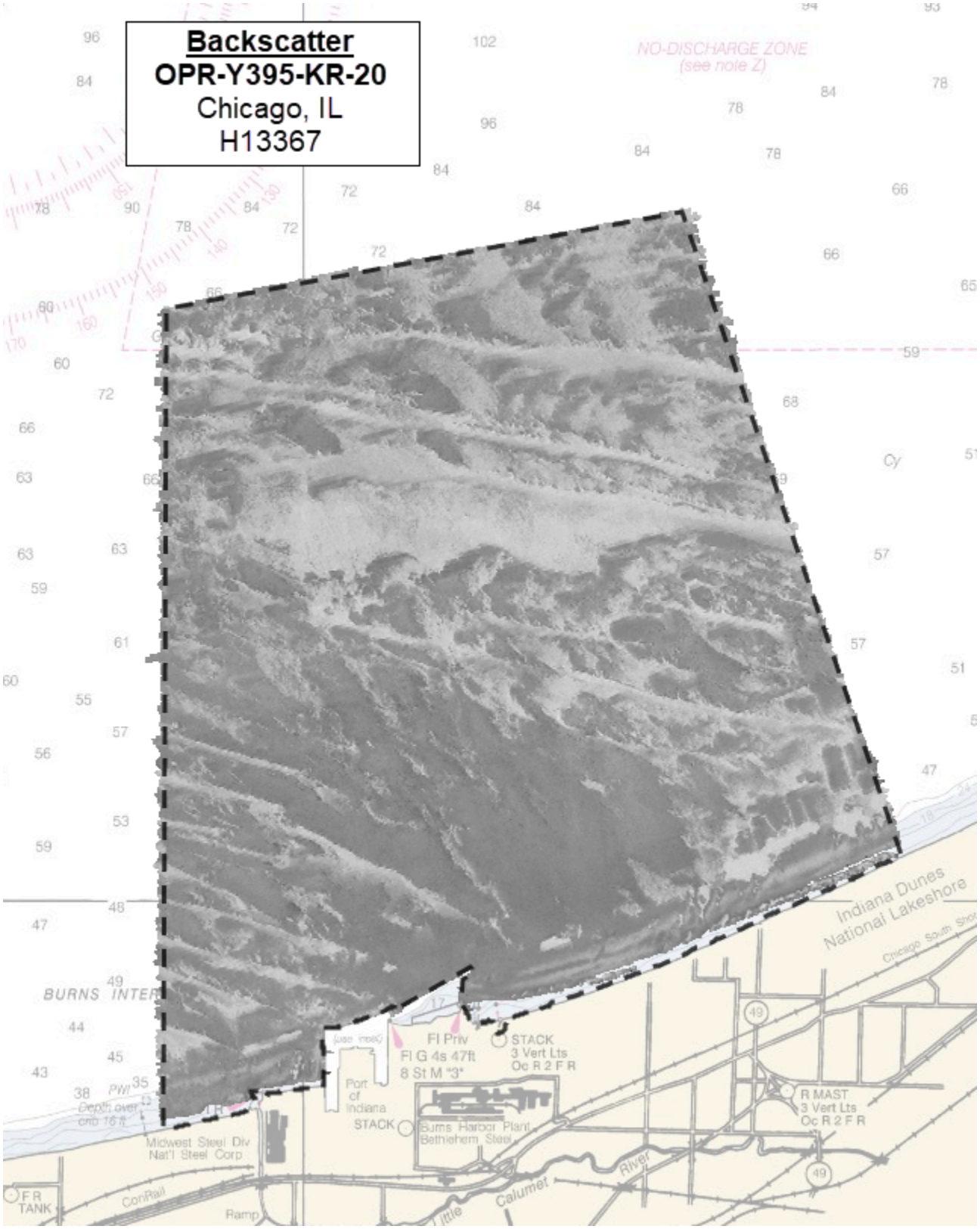


Figure 8: H13367 backscatter

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	10.4.22

Table 9: Primary bathymetric data processing software

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

Manufacturer	Name	Version
QPS	FMGT	7.9.3

Table 10: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Profile Version 2020.

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
H13367_MB_1m_LWD_1of4_Final	CARIS Raster Surface (CUBE)	1 meters	1.06 meters - 20.0 meters	NOAA_1m	Complete MBES
H13367_MB_2m_LWD_2of4_Final	CARIS Raster Surface (CUBE)	2 meters	18.0 meters - 27.02 meters	NOAA_2m	Complete MBES
H13367_MB_50cm_LWD_3of4_Final	CARIS Raster Surface (CUBE)	0.5 meters	1.04 meters - 20.0 meters	NOAA_0.5m	Object Detection

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H13367_MB_1m_LWD_4of4_Final	CARIS Raster Surface (CUBE)	1 meters	18.0 meters - 20.44 meters	NOAA_1m	Object Detection
H13367_MB_1m_LWD_1of4	CARIS Raster Surface (CUBE)	1 meters	1.06 meters - 27.48 meters	NOAA_1m	Complete MBES
H13367_MB_2m_LWD_2of4	CARIS Raster Surface (CUBE)	2 meters	1.11 meters - 27.02 meters	NOAA_2m	Complete MBES
H13367_MB_50cm_LWD_3of4	CARIS Raster Surface (CUBE)	0.5 meters	1.04 meters - 20.69 meters	NOAA_0.5m	Object Detection
H13367_MB_1m_LWD_4of4	CARIS Raster Surface (CUBE)	1 meters	1.06 meters - 20.44 meters	NOAA_1m	Object Detection

Table 11: Submitted Surfaces

All surfaces submitted are in compliance with object detection and complete coverage MBES requirements per sections 5.2.2.2 and 5.2.2.3 of the HSSD.

Note: Gridded surfaces no longer match what is reported in DR Section B.5.2: Surfaces due to Branch processing.

B.5.3 Designated Soundings

H13367 contains designated soundings in accordance with section 5.2.1.2.3 of the HSSD. These designated soundings were created to facilitate feature management and best represent the least depths over features in the Final Feature File (FFF). In the finalized CUBE surfaces, the CARIS HIPS Apply Designated Soundings function ensured designated sounding depths are retained in the finalized surfaces.

C. Vertical and Horizontal Control

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

C.1 Vertical Control

The vertical datum for this project is Low Water Datum 577.5 ft IGLD-1985 L Michigan,Huron.

ERS Datum Transformation

The following ellipsoid-to-chart vertical datum transformation was used:

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	OPR-Y395-KR-20_100m_ITRF2014-LWD_IGLD85_geoid12b.csar

Table 12: ERS method and SEP file

Real-time positional data were corrected with G2+ Global Navigation Satellite System (GNSS) satellite corrections provided by the Fugro Marinestar Satellite-Based Augmentation System (SBAS). To improve the accuracy of the real-time data, real-time position and attitude data were post-processed using Applanix POSPac Mobile Mapping Solution (MMS) software. Trimble CenterPoint RTX correction methods were used to create Smoothed Best Estimate of Trajectory (SBET) files, which were applied to the survey data in CARIS HIPS. The provided separation model was then utilized to bring the data from ellipsoid heights to chart datum.

C.2 Horizontal Control

The horizontal datum for this project is World Geodetic System (WGS) 1984.

The projection used for this project is Universal Transverse Mercator (UTM) Zone 16.

The following PPK methods were used for horizontal control:

- RTX

Real-time position and attitude data were post-processed using the Applanix POSPac MMS software. Post-processed corrections were implemented with Trimble’s CenterPoint RTX service to create SBET files.

RTK

Real-time position and attitude data were corrected with G2+ GNSS satellite corrections provided by the Fugro Marinestar SBAS.

D. Results and Recommendations

D.1 Chart Comparison

A comparison was performed in CARIS between H13367 and the ENCs listed in Table 13 of section D.1.1. Soundings and contour layers were generated from the 1 m CUBE surface and overlaid onto the ENCs to visually assess differences between the surveyed depths and charted depths. Depth comparisons can be seen in Figures 9 and 10. In addition to a detailed visual inspection in CARIS, all charted depths were downloaded from NOAA's ENC Direct to GIS application as a shapefile and differenced with the nearest surveyed depth from H13367 in ESRI ArcPro. A statistical analysis of the difference comparison is shown in Figure 11. The surveyed depths from H13367 generally agree with the charted depths from the ENCs within the survey area, with a mean difference of 0.34 m.

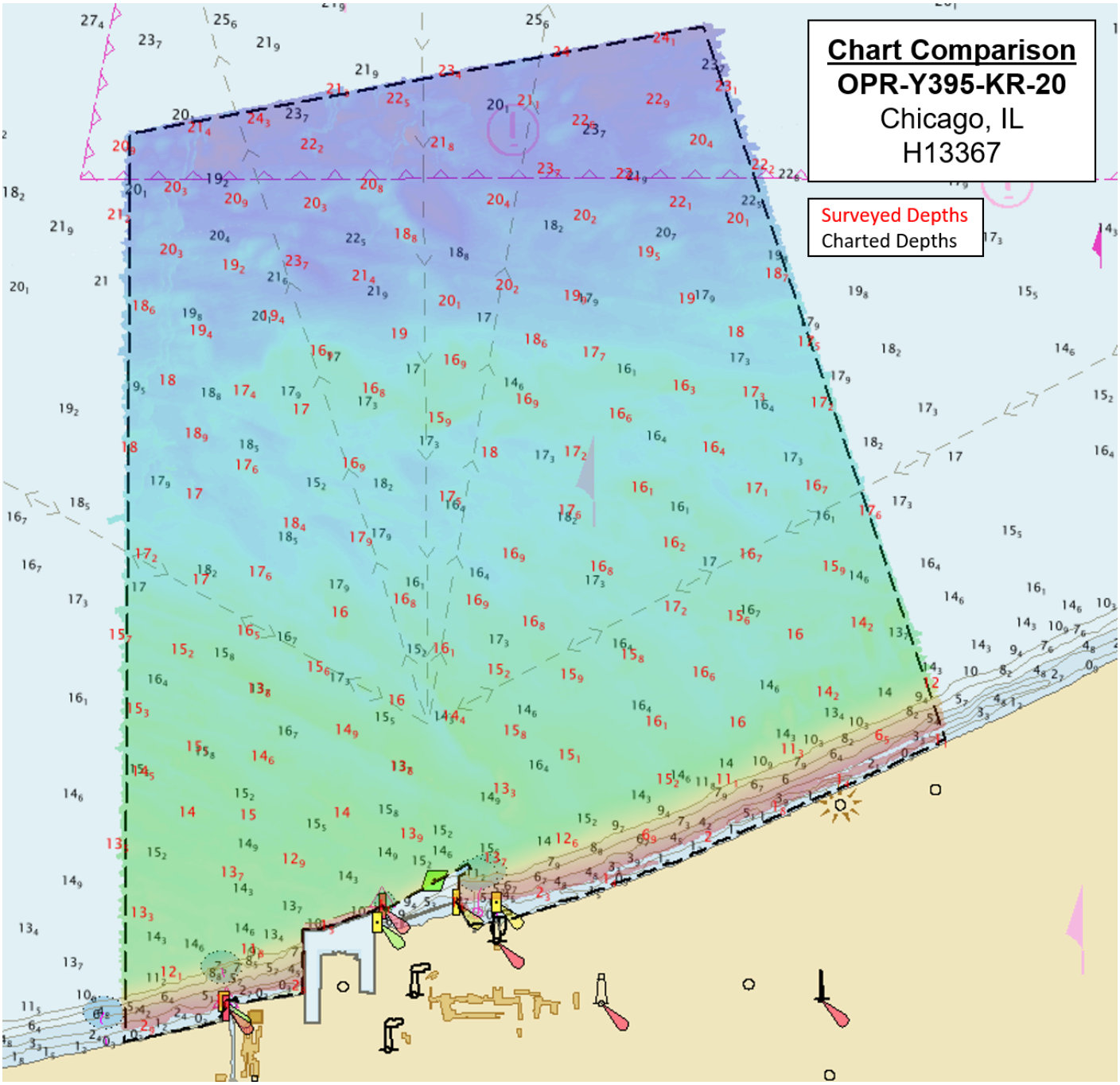


Figure 9: H13367 overview of surveyed depths overlaid onto ENC US4IN11M and US4IN01M

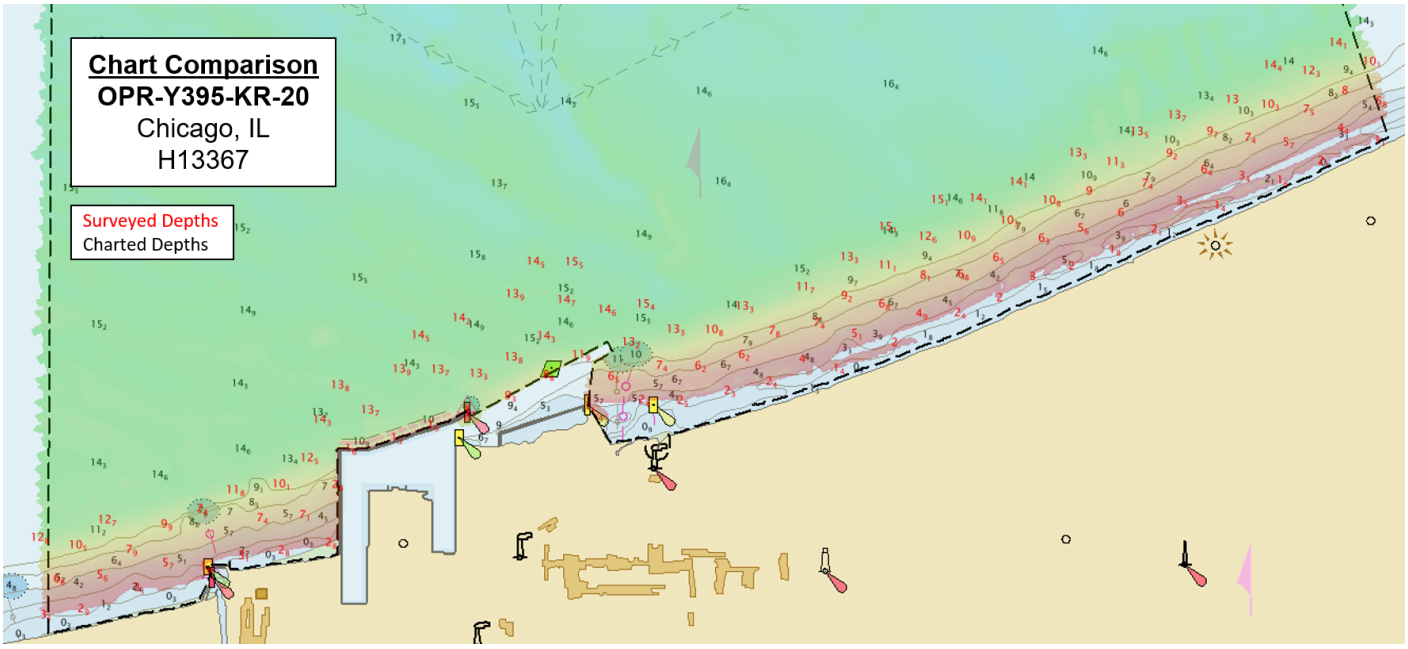


Figure 10: H13367 inshore overview of surveyed depths overlaid onto ENC US4IN11M

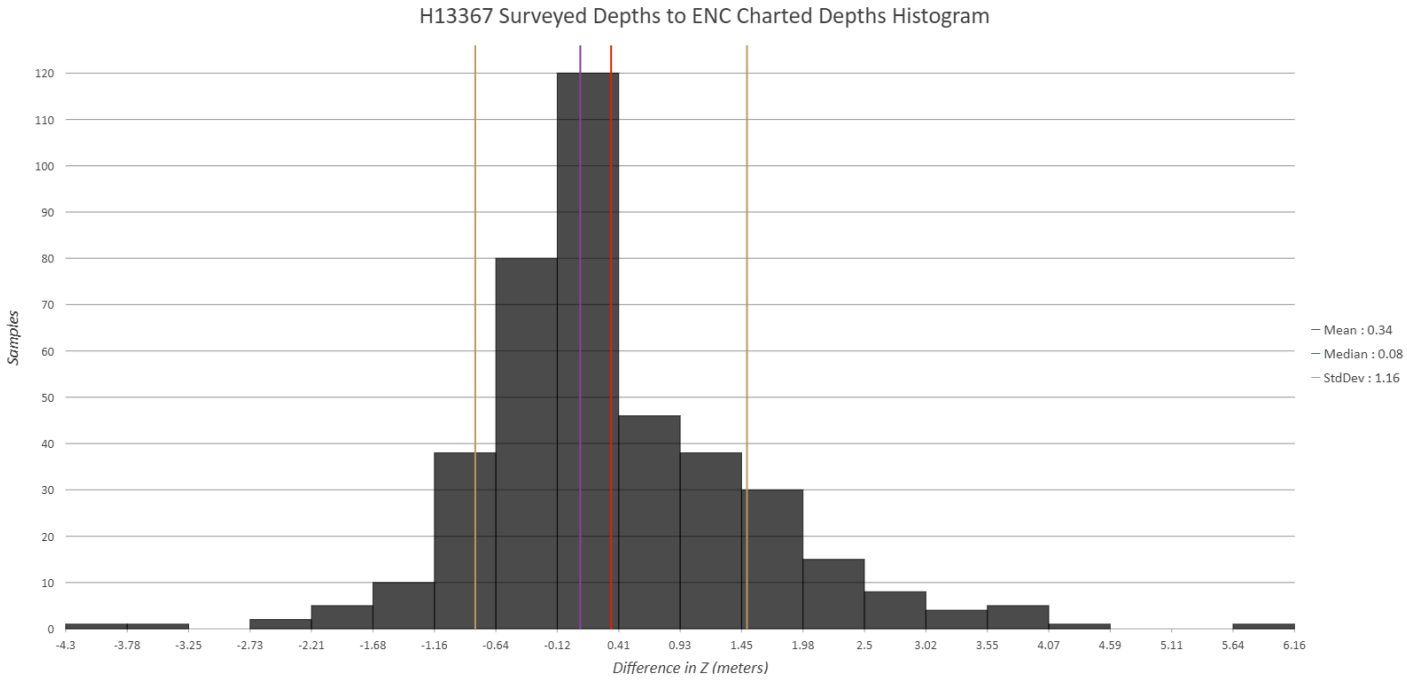


Figure 11: H13367 statistical analysis of surveyed depths to charted depths

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
US4IN01M	1:120000	13	03/06/2018	07/23/2020
US4IN11M	1:60000	2	03/05/2018	08/06/2020
US5IN01M	1:15000	1	02/15/2017	08/15/2019
US5IN11M	1:15000	15	10/17/2018	10/30/2020

Table 13: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

There were three Dangers to Navigation (DtoNs) reported in H13367 that were added to the FFF with special feature type as “DTON”. Refer to the FFF for the remarks and recommendations for each feature. The DtoNs were submitted in the following DtoN report: H13367 DtoNs #1 - #3. It should be noted that least depths and positions may have changed slightly for some DtoNs after the data were further post-processed.

D.1.3 Charted Features

There were 19 assigned charted features within H13367 and are detailed in the FFF in accordance with section 7.3 of the HSSD. One assigned obstruction with Special Feature Type as 'Unverified Charted Feature' was disproved during survey operations and is detailed as such in the FFF.

D.1.4 Uncharted Features

There were 29 new features found in H13367 have been added to the Final Feature File (FFF) and are detailed in accordance with section 7.3 of the HSSD.

D.1.5 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.2 Additional Results

D.2.1 Aids to Navigation

During survey operations, a charted buoy, Burns Harbor Shoal Buoy 1, was observed in H13367. This buoy was not included in the CSF and was pulled from the most up to date ENC US5IN11M to be included in the FFF with a description as 'Retain' (FOID 17851). All other Aids to Navigation within the survey area are detailed in the FFF in accordance with section 7.3 of the HSSD.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

Seven bottom samples were acquired in accordance with section 7.2.3 of the HSSD and are described completely in the FFF. Backscatter data were used to modify bottom sample locations from what was originally assigned in the Project Reference File (PRF). See DR Appendix II Supplemental Survey Records Correspondence for the correspondence with the HSD OPS Project Manager regarding the modification of the bottom sample locations.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

There were nine uncharted submerged pipelines that were visible as exposed or unburied within H13367. The exposed pipelines are detailed in the FFF and were reported in accordance with section 1.7 of the HSSD and guidance from the HSD OPS Project Manager (see DR Appendix II Supplemental Survey Records Correspondence). An indiscernible object, resembling a snag or line, which appears to be attached to an exposed pipeline, was found in the MBES data and is included in the FFF as an obstruction with a description as 'New' (FOID 00168). All other assigned charted pipelines are detailed in the FFF in accordance with section 7.3 of the HSSD.

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 or Environmental Conditions

No abnormal seafloor or environmental conditions exist for this survey.

D.2.9 Construction and Dredging

No present or planned construction or dredging exist within the survey limits.

D.2.10 New Survey Recommendations

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

D.2.11 ENC Scale Recommendations

No new ENC scales 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	2020-11-23
Horizontal and Vertical Control Report	2020-11-23
Coast Pilot Report	2020-11-02

Approver Name	Approver Title	Approval Date	Signature
David J. Bernstein, CH, PLS, GISP	Chief of Party	12/14/2020	

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	Continuously Operating Reference Station
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
ERTDM	Ellipsoidally Referenced Tidal Datum Model
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

Acronym	Definition
HSSD	Hydrographic Survey Specifications and Deliverables
HSTB	Hydrographic Systems Technology Branch
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
NALL	Navigable Area Limit Line
NTM	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
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
RTX	Real Time Extended
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
TPU	Total Propagated Uncertainty
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDF	Zone Definition File