H13634

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

DESCRIPTIVE REPORT

Type of Survey:	Basic Hydrographic Survey
Registry Number:	H13634

LOCALITY

State(s):	Washington
General Locality:	Grays Harbor
Sub-locality:	Grays Harbor

2022

CHIEF OF PARTY
LTJG Patrick Faha

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Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H13634**

INSTRUCTIONS: The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

State(s):	**Washington**
General Locality:	**Grays Harbor**
Sub-Locality:	**Grays Harbor**
Scale:	**10000**
Dates of Survey:	**06/22/2022 to 09/16/2022**
Instructions Dated:	**06/01/2022**
Project Number:	**S-N906-NRTSE-22**
Field Unit:	**NOAA Navigation Response Team - Seattle**
Chief of Party:	**LTJG Patrick Faha**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Side Scan Sonar**
Verification by:	**Pacific Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**

Remarks:

This survey is in conjunction with survey H13848 (OPR-N938-NRTSE-23) submitted under separate cover. They should be reviewed and considered as a package.

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 10N, MLLW. 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 H13634

Project: S-N906-NRTSE-22

Locality: Grays Harbor

Sublocality: Grays Harbor

Scale: 1:10000

June 2022 - September 2022

NOAA Navigation Response Team - Seattle

Chief of Party: LTJG Patrick Faha

A. Area Surveyed

The survey area is located at the entrance of Grays Harbor along the central west coast of Washington State in the ancestral waters of the Quinault and Queets tribes and descendants of five other coastal tribes: Quileute, Hoh, Chehalis, Chinook, and Cowlitz (http://www.quinaultindiannation.com/). Chehalis Indians had a very large settlement at what is today the location of Westport on the south side of the entrance to the bay. 'Ts-a-lis' is the lower Chehalis word for Westport, meaning “place of sand”. Early explorers pronounced the word “Chehalis.” (https://en.wikipedia.org/wiki/Grays_Harbor)

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
46° 57' 46" N 124° 11' 3" W	46° 54' 26" N 123° 58' 46" W

Table 1: Survey Limits

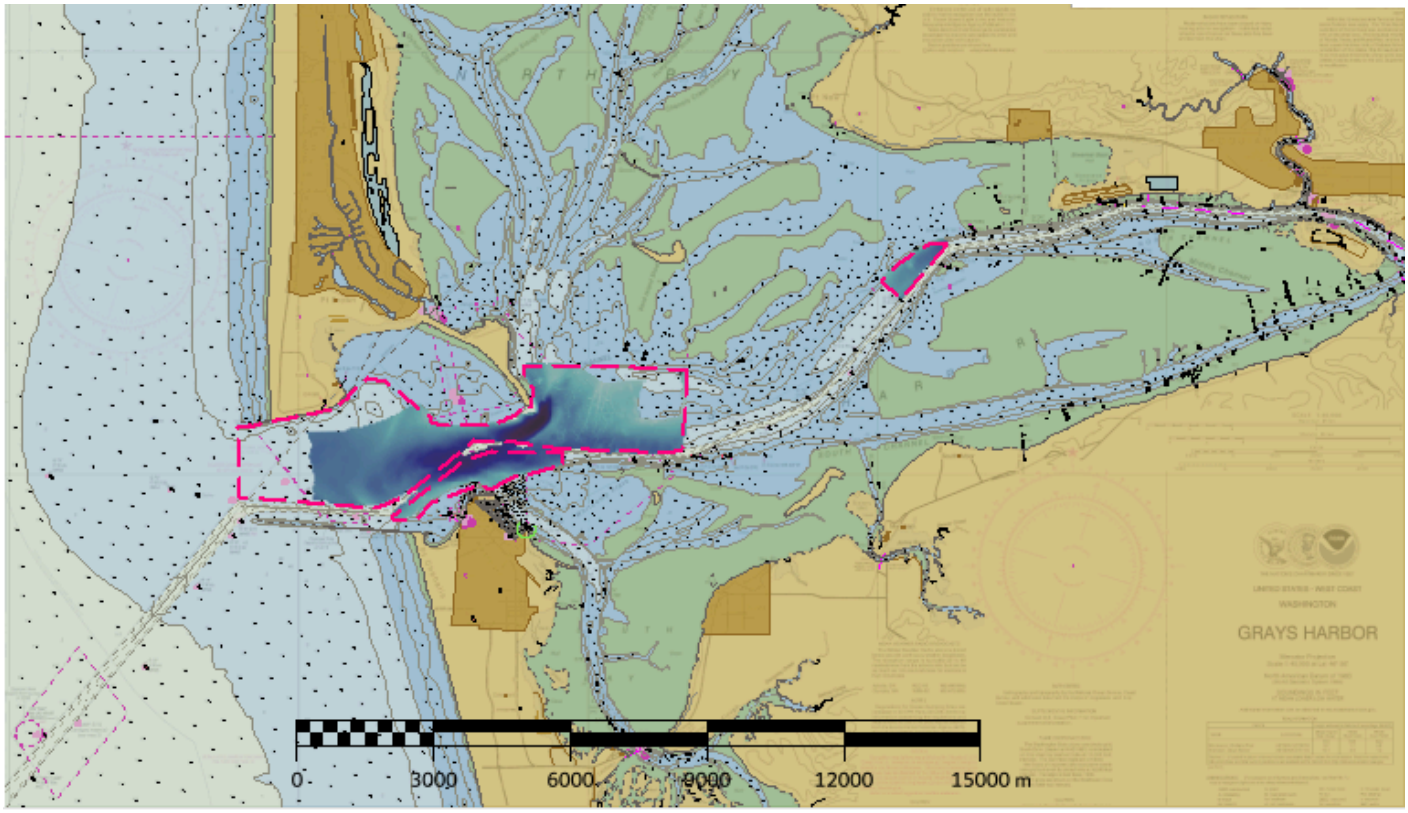


Figure 1: H13634 Sheet Limits on ENC US5WA60M

The surveys H13643 and H13848 were submitted at separate dates, but intended to be reviewed in combination, as a single survey. This proves challenging for a number of reasons, one of which is that there are two registry numbers that are in the records. In coordination with the HTL, it was decided to re-define the boundaries of H13634 and H13848, and to use bathymetry from both surveys within those two areas. A geographic North-South axis was defined, where all bathymetry from both H13634 and H13848 (MBES, SSS, MBAB) and features were split - the eastern portion being the new extents of H13634, and the western portion H13848. Because VR surfaces are not able to be segmented with surface extraction, new surfaces were created for H13634, meeting object detection requirements (50cm and 1m resolutions). H13848 surfaces remained 50cm and 1m.

Due to a long pause in H13634 survey dates (63 days between DN194 and 257) the H13634 bathymetry was also split into two separate surfaces, separated by dates. H13634 surfaces 1of6 and 4of6 cover survey dates DN173 to DN194, while surfaces 2of6 and 5of6 cover DN 257 to DN 259. This virtually eliminated grid tearing due to shifting sediment in the area, allowing the best possible bathymetry to be submitted to the NBS whose supersession rules can make meaningful differentiations based on acquisition dates. Finally, bathymetry from the same eastern extents of H13848 were also included, and renamed H13634 - specifically surfaces 3of6 and 6of6.

New surfaces required a lot of cleaning, and once fliers were removed, erode edges was employed on all surfaces to further reduce edge noise issues and represent best available bathymetry, especially considering H13848 data is set line spacing with SSS.

This is the final disposition of H13634 - all data in the eastern portion of the combined survey areas have been collected, and referred to as H13634, regardless of the survey of origin. All data from H13634 is adequate to supersede chart data. The remainder of the document should be read through the lens of this additional information.

Data was collected in the survey area over two years: 2022 and 2023. Separate survey registry numbers were assigned for the 2022 data (H13634; S-N906-NRTSE-22) and 2023 data (H13848;S-N938-NRTSE-23). While this report specifically covers H13634 it is recommended that the two surveys be reviewed and compiled as a unit. H13848 will be submitted with a DR Summary. H13848 was conducted as side scan with concurrent multibeam in an effort to cover shoal areas not adequately covered by 100% multbeam in 2022 with H13634.

Data were acquired to the survey limits in accordance with the requirements in the Project Instructions and the 2022 NOS Hydrographic Surveys Specifications and Deliverable (HSSD) with the exceptions noted below. In all inshore 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 safety of maneuvering the survey vessel in shallow non-navigationally significant areas.

Significant wave heights west of Green Buoy #9 prohibited safe operation seaward of it as did wave heights south of North Jetty. An area to the NE of the main survey area, inshore of the mouth and bar, had significant shoaling prohibiting efficient coverage with full multibeam during survey H13634 and was instead covered with a side scan with concurrent multibeam in 2023 under H13484. (Figure 2)

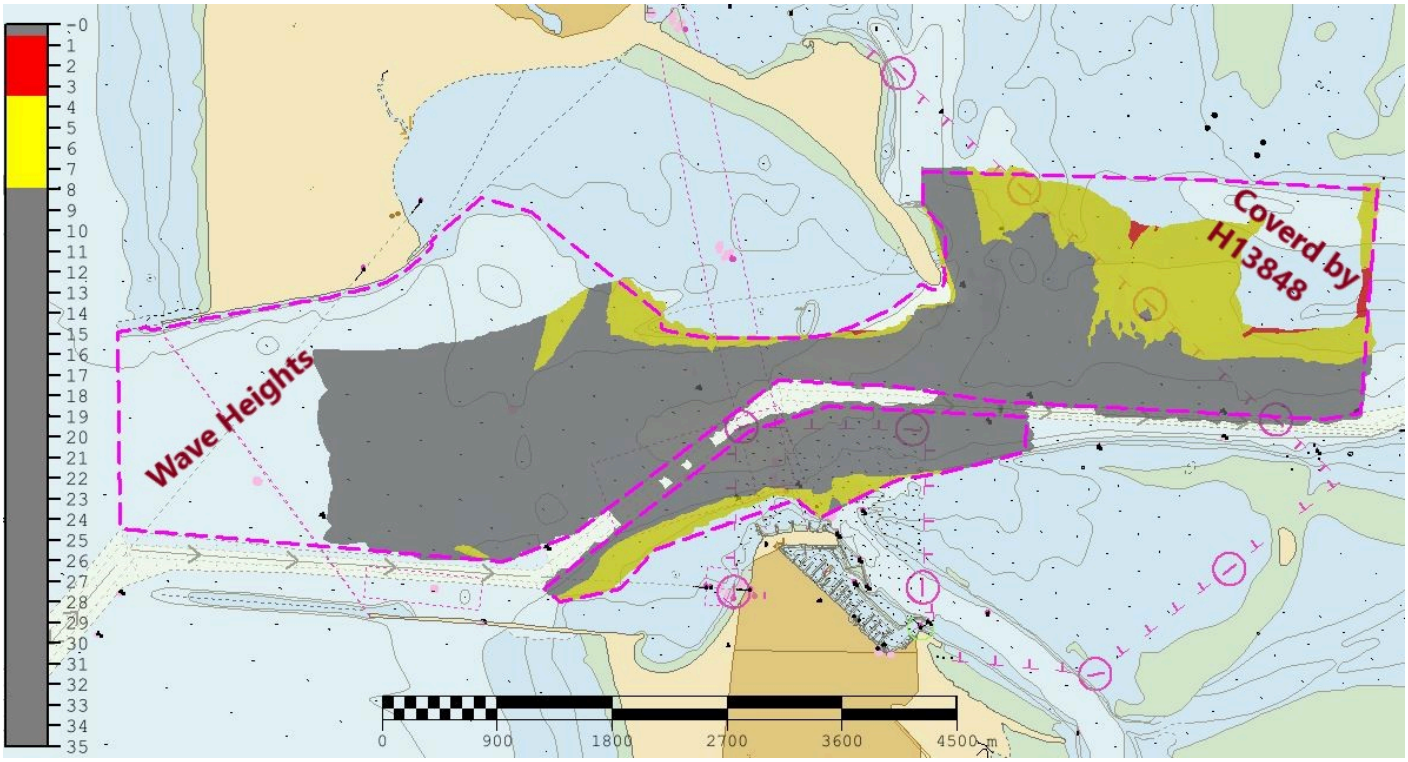


Figure 2: Inshore limits of the west portion of H13634.

A.2 Survey Purpose

The primary purpose of this project is to provide contemporary hydrographic data to update NOAA's nautical charting products to improve the safety of maritime traffic.

A.3 Survey Quality

The survey is partially adequate to supersede previous data.

Survey data from this project, in conjunction with H13848 (S-N938-NRTSE-23) is intended to supersede all prior survey data in the common area. Data acquired in H13634 by itself may not meet all multibeam echo sounder (MBES) coverage requirements for object detection, as required by the HSSD. Additional information provided about crosslines (Section B.2.1), NOAA allowable uncertainty (Section B.2.2.)

The surface was analyzed using the HydrOffice QC Tools Grid QA feature (Figure 3). Density requirements for H13634 were achieved with at least 99.5% of surface nodes containing five or more soundings as required by HSSD Section 5.2.2.3. The few nodes that did not meet density requirements are due to sparse data in the outer beams, especially near steep sand waves where acoustic shadowing occurred, and at the edges of the survey limits.

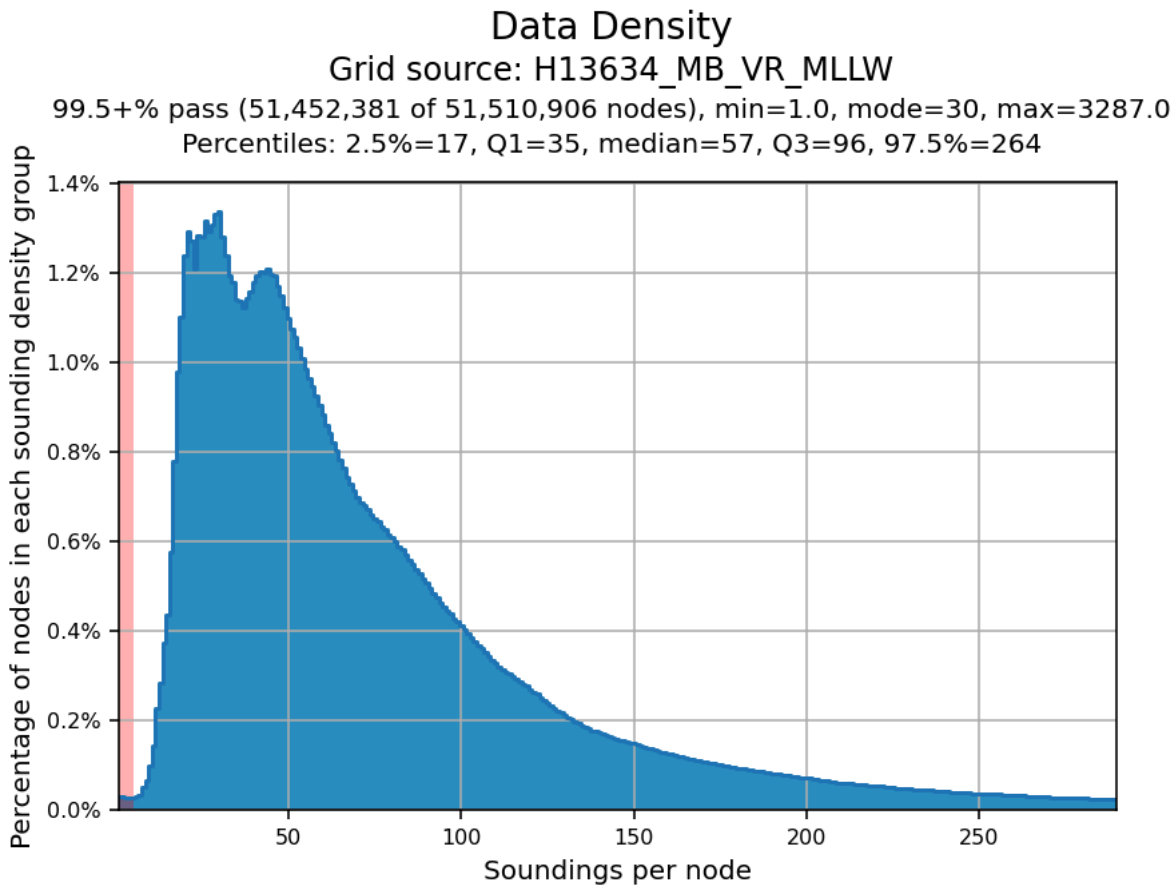


Figure 3: Pydro derived histogram plot showing HSSD object detection compliance for H13634 MBES within the finalized CUBE surface.

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

Data were acquired for H13634 in accordance with the requirements in the Project Instructions and the 2022 NOS HSSD (Figure 4) with the exceptions noted bellow.

H13634 data were reviewed in CARIS HIPS and SIPS for holidays in accordance with Section 5.2.2.3 of the HSSD. HydrOffice QC Tools Holiday Finder tool identified 1034 holidays. 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. Bio-fouling and frequent sonar blowouts led to a large number of holidays for H13634 (See Section B.2.5). The number of holidays and the lack of coverage in shoal areas led to the decision to re-survey the area in 2023 with sidescan and concurrent multibeam.

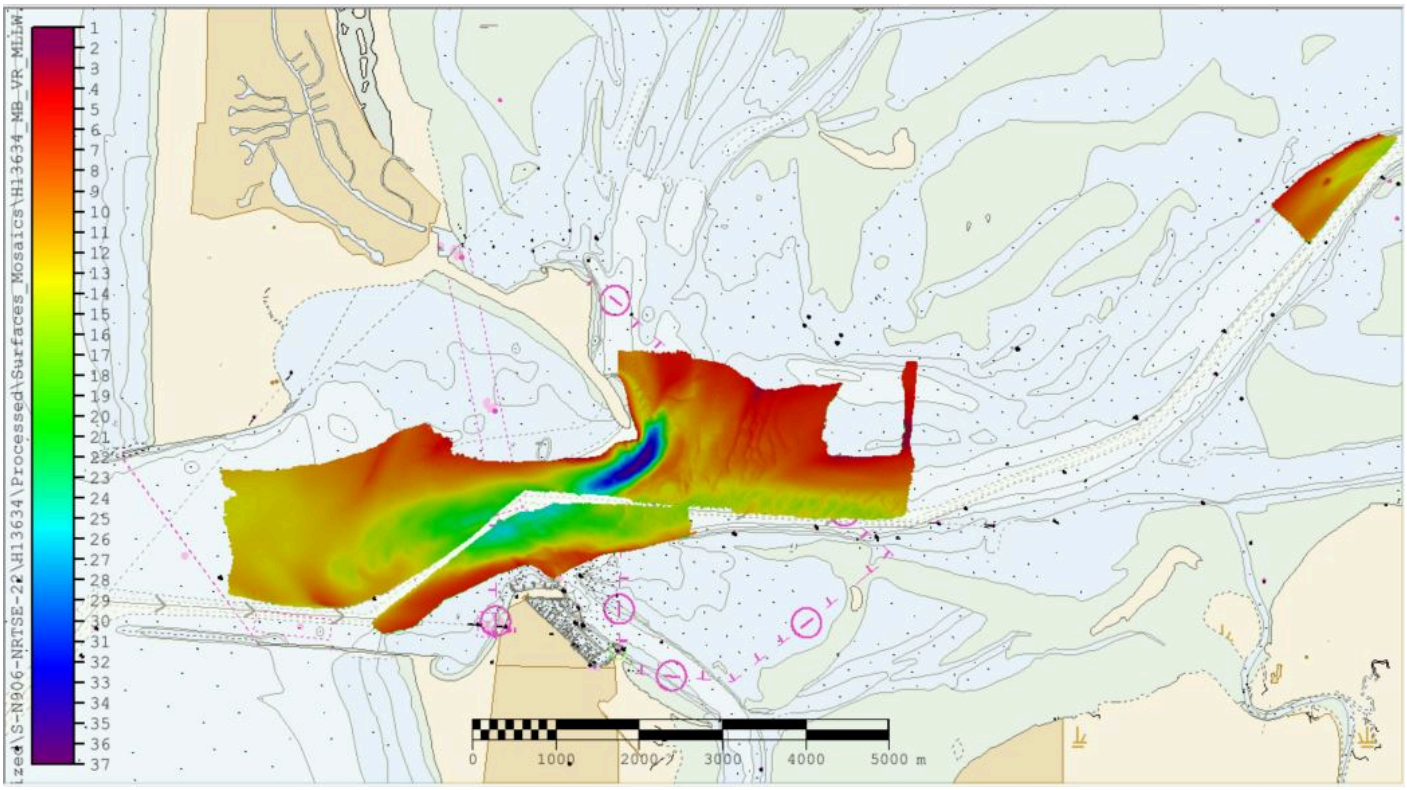


Figure 4: H13634 on US5WA60M

A.6 Survey Statistics

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

	HULL ID	*S3006*	*Total*
LNM	**SBES Mainscheme**	0.0	0.0
	MBES Mainscheme	312.5293	312.5293
	Lidar Mainscheme	0.0	0.0
	SSS Mainscheme	0.0	0.0
	SBES/SSS Mainscheme	0.0	0.0
	MBES/SSS Mainscheme	0.0	0.0
	SBES/MBES Crosslines	8.8668	8.8668
	Lidar Crosslines	0.0	0.0
Number of Bottom Samples			0
Number Maritime Boundary Points Investigated			0
Number of DPs			0
Number of Items Investigated by Dive Ops			0
Total SNM			4.0

Table 3: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
06/22/2022	173
06/23/2022	174

Survey Dates	Day of the Year
06/24/2022	175
06/25/2022	176
06/26/2022	177
06/27/2022	178
06/29/2022	180
06/30/2022	181
07/01/2022	182
07/13/2022	194
09/14/2022	257
09/15/2022	258
09/16/2022	259

Table 4: Dates of Hydrography

This survey was collected initially from 06/22/2022 to 09/16/2022.

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the Data Acquisition and Processing Report (DAPR) for a complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods. Additional information to supplement sounding and survey data, and any deviations from the DAPR are discussed in the following sections.

B.1.1 Vessels

The following vessels were used for data acquisition during this survey:

Hull ID	*S3006*
LOA	34.0 feet
Draft	4.0 feet

Table 5: Vessels Used

Figure 5: S3006 in Puget Sound

B.1.2 Equipment

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

Manufacturer	Model	Type
Kongsberg Maritime	EM 2040C	MBES
Applanix	POS MV 320 v5	Positioning and Attitude System
AML Oceanographic	MicroX SV	Conductivity, Temperature, and Depth Sensor
SonTek	CastAway-CTD	Conductivity, Temperature, and Depth Sensor

Table 6: Major Systems Used

The equipment was installed on S3006. The vessel is equipped with POS MV v5 system for positioning and attitude, Kongsberg EM 2040C for MBES, AML Oceanographic MicroX SVS surface sound speed sensor, and YSI CastAway-CTD casts.

B.2 Quality Control

B.2.1 Crosslines

Multibeam crosslines were collected by S3006 across a variety of depth ranges and water masses. Crosslines were collected, processed and compared in accordance with Section 5.2.4.2 of the HSSD. A Variable Resolution (VR) surface was created of only mainscheme lines, and a second VR surface was created of only crosslines (Figure 6). A difference surface was generated with Pydro tool 'Compare Grids' by subtracting the crossline only surface from the mainscheme surface (mainscheme- crosslines= difference surface), from which statistics were derived. Statistics show the mean difference between the depths derived from mainscheme data and crossline data was -0.01 meters and 95% of nodes falling within 0.48 meters (Figure 7).

For the respective depths, the difference surface was compared to the allowable NOAA uncertainty standards (Figure 8). In total, 98% of the depth differences between H136343 mainscheme and crossline data were within allowable NOAA uncertainties (Figure 9). The coloring represents areas where the TVUmax error tolerance is exceeded; red, orange and yellow colors represent areas where mainscheme data is deeper than crossline data; the blue shades represent where crossline data is deeper than mainscheme data. The analysis was performed on H13634 MBES data reduced to MLLW using ERS methods. The largest differences occur in areas of shifting sandwaves.

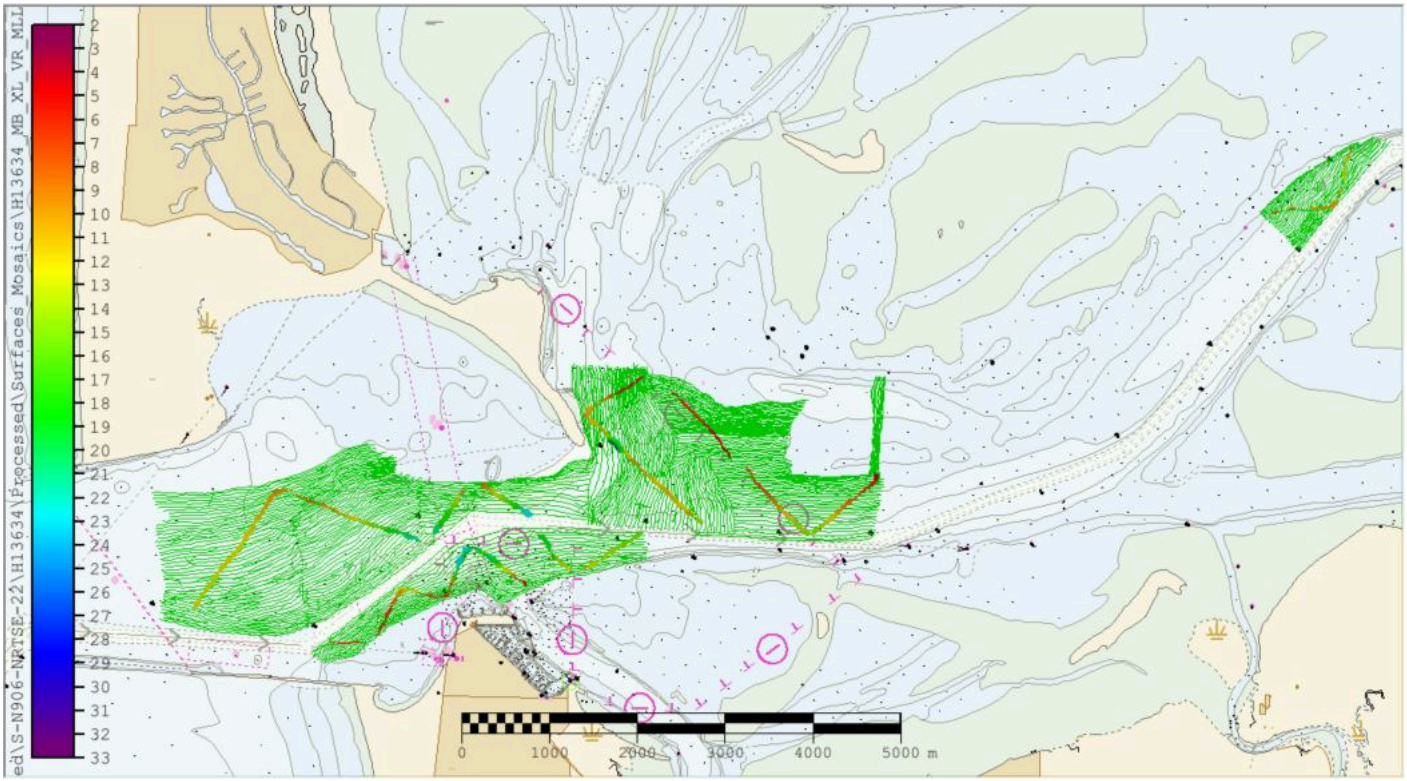
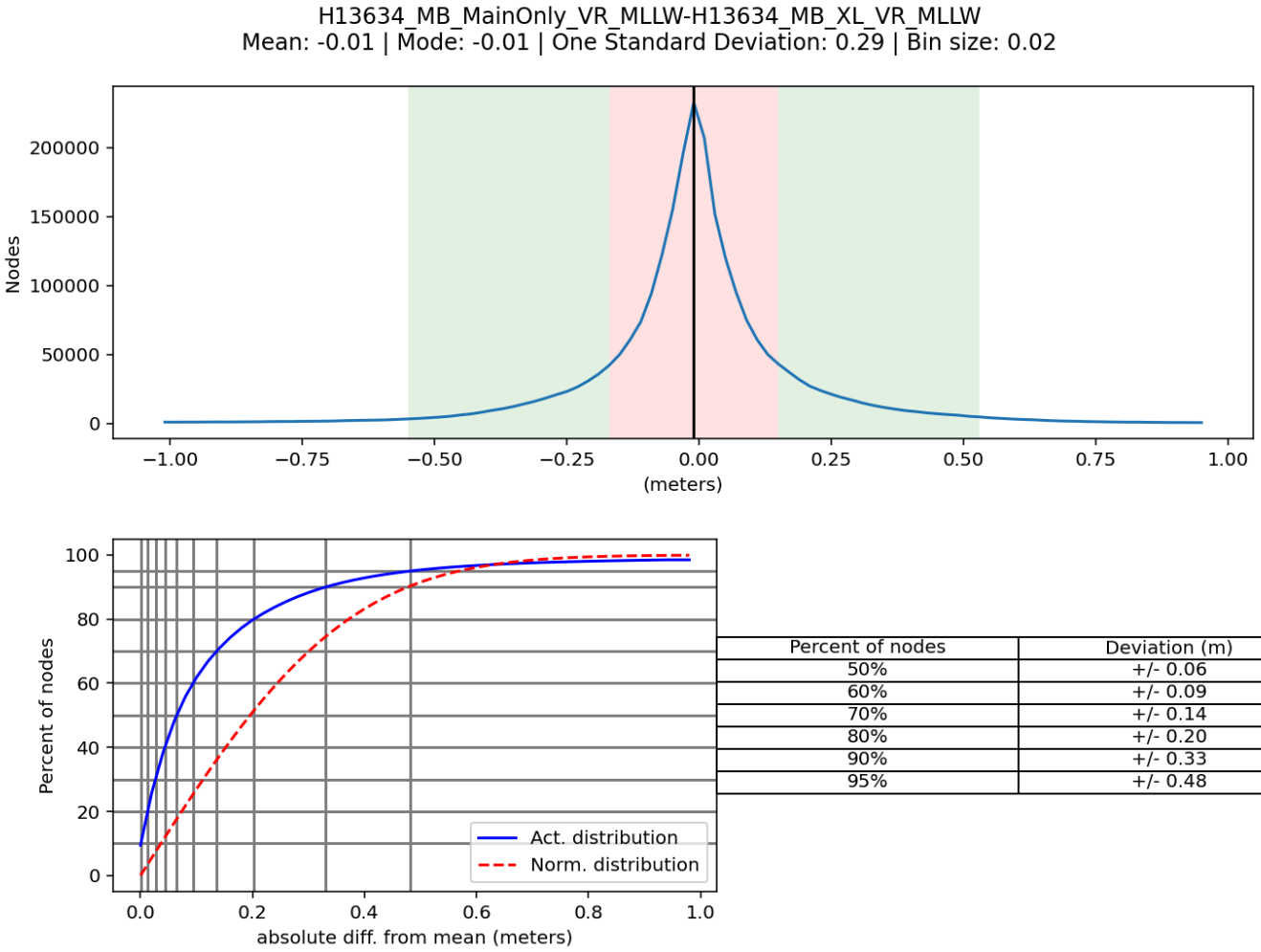


Figure 6: H13634 Crosslines



Percent of nodes	Deviation (m)
50%	+/- 0.06
60%	+/- 0.09
70%	+/- 0.14
80%	+/- 0.20
90%	+/- 0.33
95%	+/- 0.48

Figure 7: The statistics and distribution summary plot of the difference between H13634 mainscheme and crossline data.

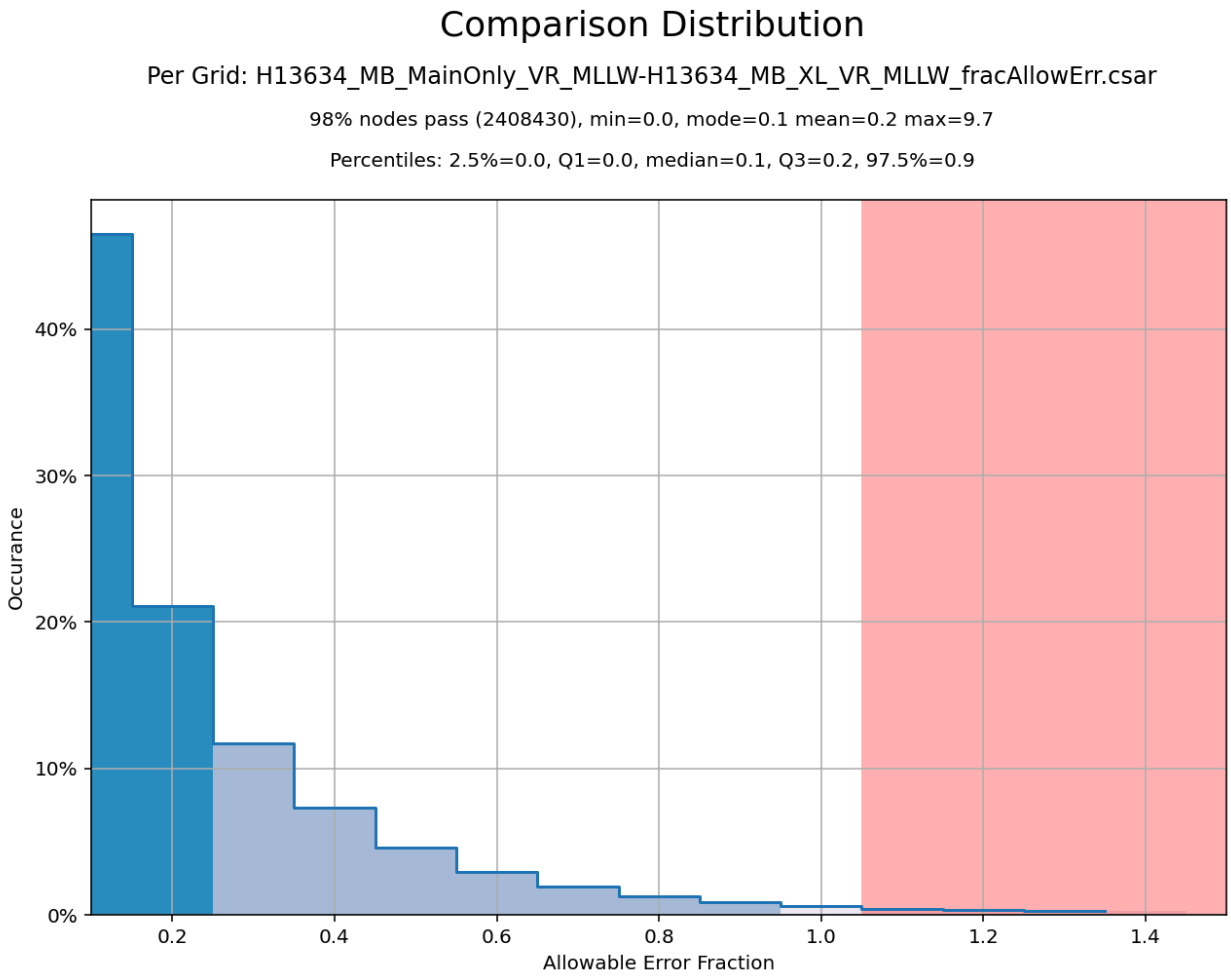


Figure 8: Histogram plot utilizing the magnitude of the Allowable Error Fraction to show the indication of what percentage of the total number of comparisons pass the TVU max test for H13634.

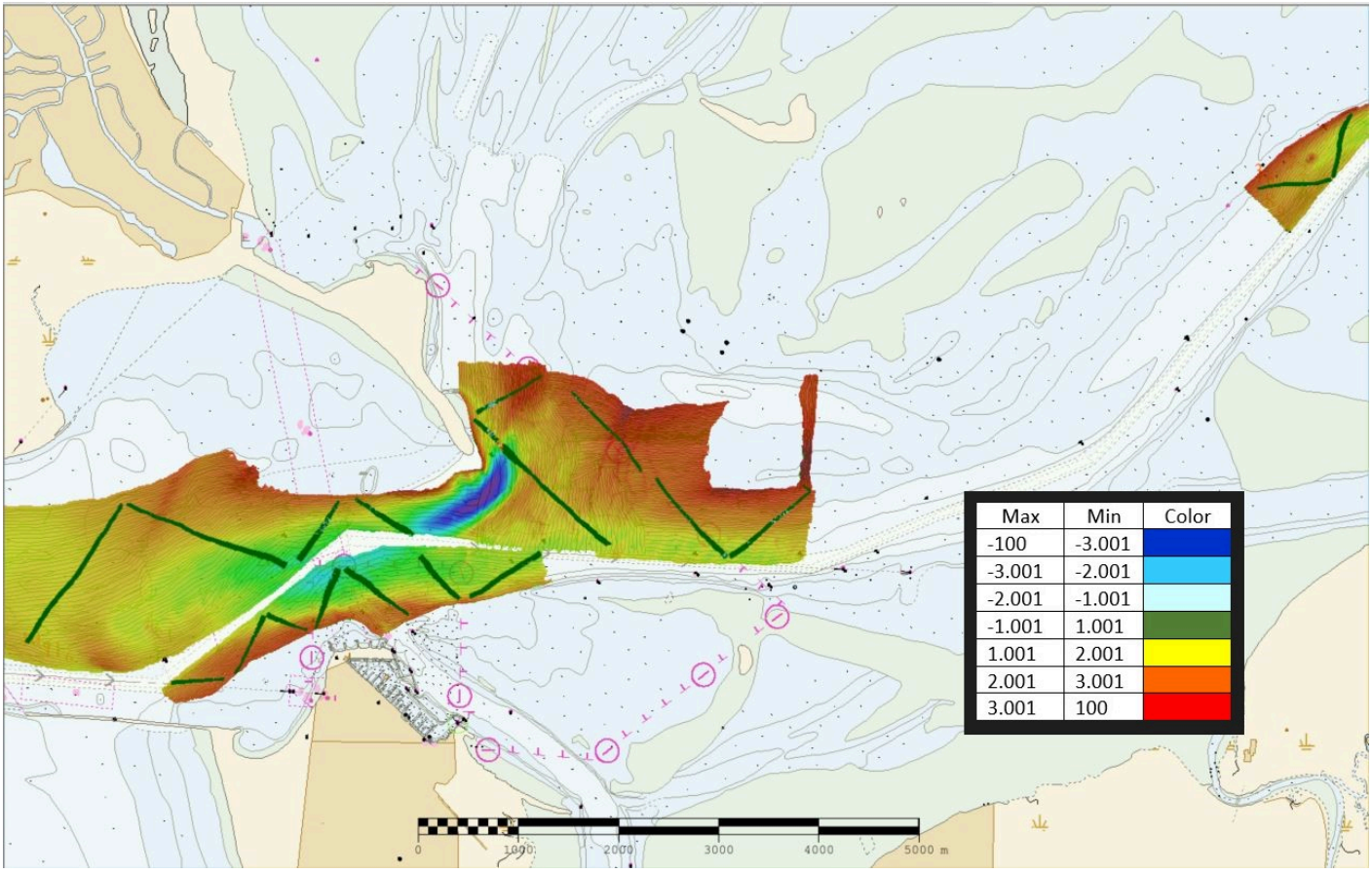


Figure 9: Depth differences between H13634 mainscheme and crossline data as compared to NOAA allowable uncertainty standards for the associated depths.

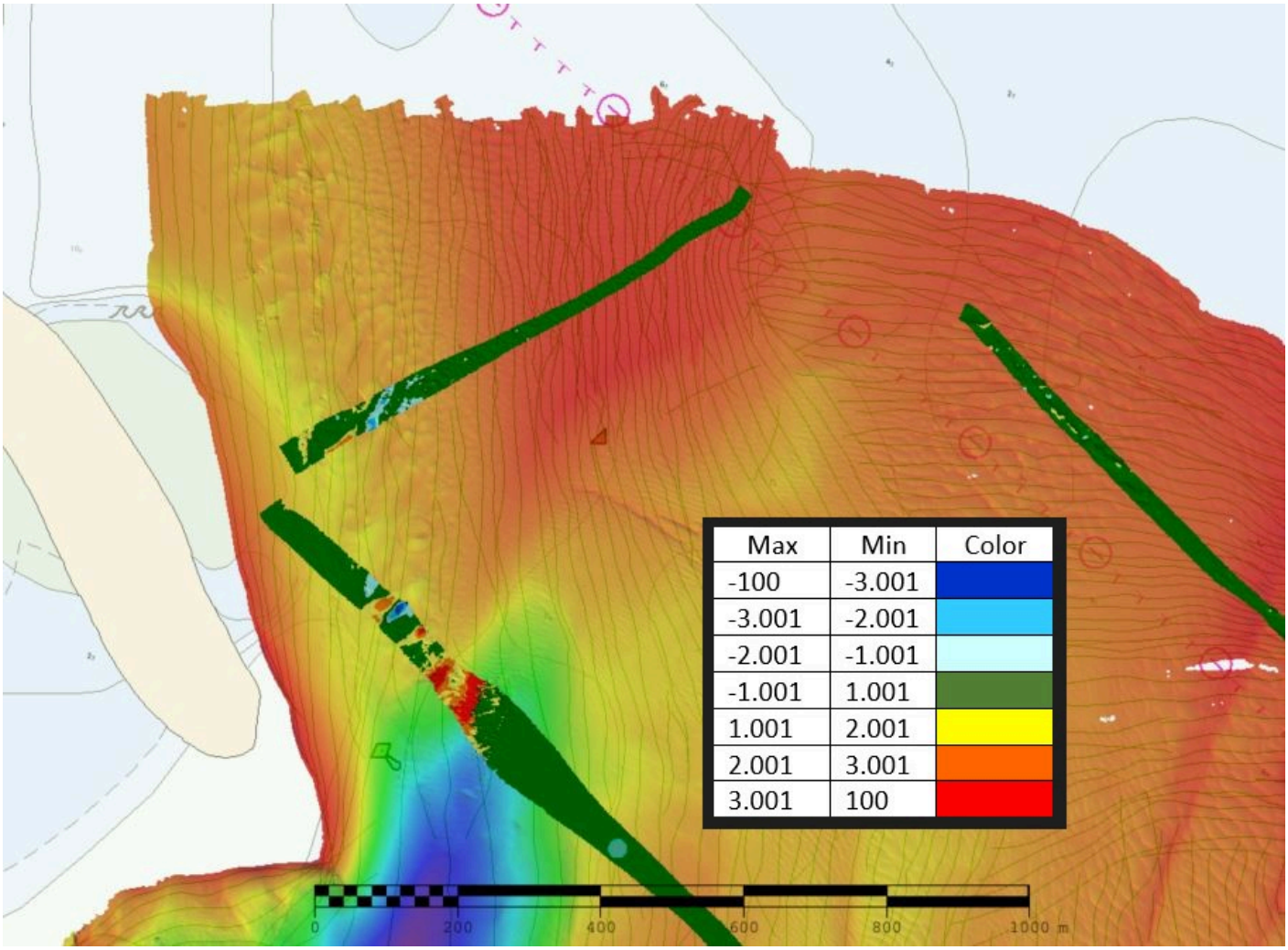


Figure 10: Area of shifting sand showing higher difference between crossline and mainscheme data.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via VDATUM	0.0 meters	0.226 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
S3006	4.0 meters/second	0 meters/second	0 meters/second	0.5 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

Total Propagated Uncertainty (TPU) values for H13634 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.

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 H13634. 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. H13634 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. H13634 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, 99.5% of nodes within the surface meet NOAA Allowable Uncertainty specifications for H13634. (Figure 11)

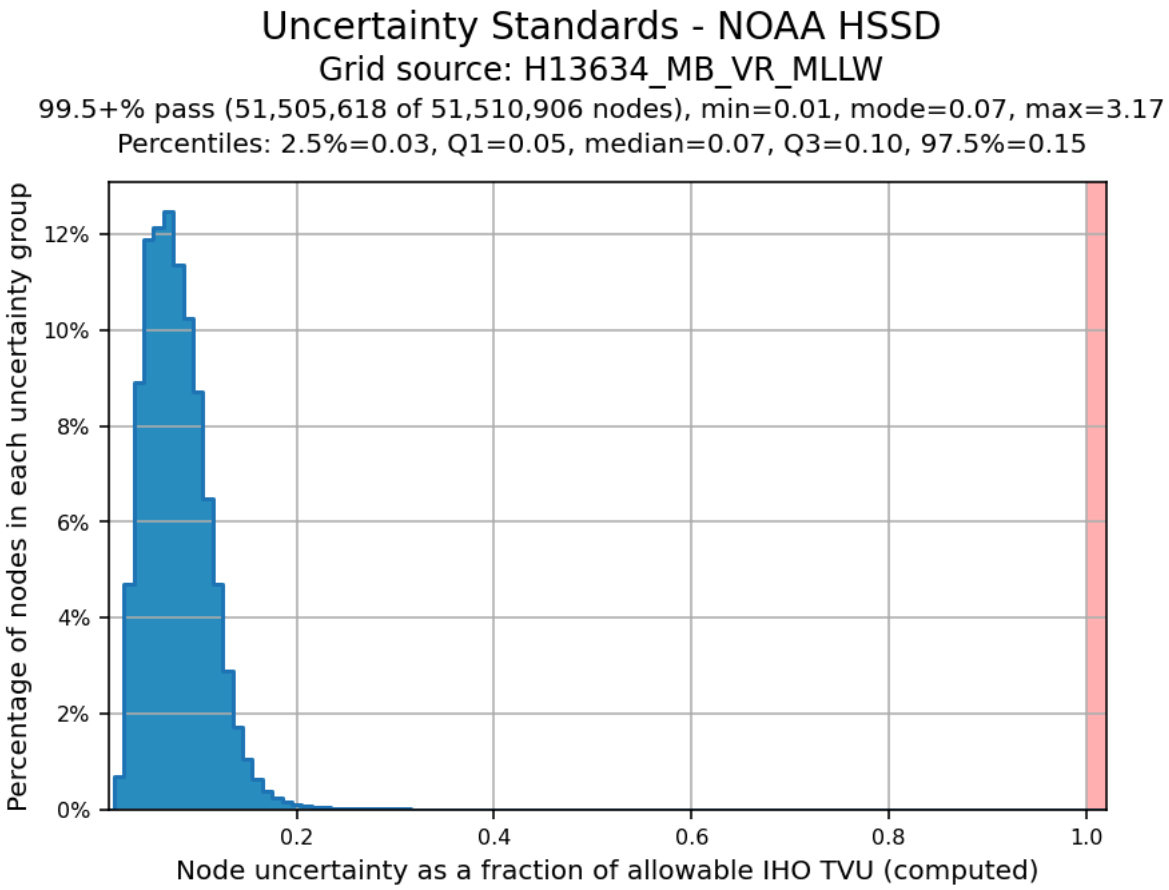


Figure 11: H13634 Node Uncertainty as a fraction of Allowable.

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

Bio-fouling on Sonar Head

Data collected at the start of survey in summer 2022 appeared excessively noisy. This was initially attributed to the rough sea state in the area, however after a particularly calm day the boat was hauled out and the sonar head inspected. Significant bio-fouling was noted on the sonar head and subsequently removed. Pitting on the hull was also noted at the time leading to the boat being hauled out for repair and contributing to the gaps in time for data collection (see Section B.2.6 - Sandwave Movement). Significant cleaning of the data was required to remove the noise created by the bio-fouling and subsequently resulted in large number of data gaps in surfaces.

B.2.6 Factors Affecting Soundings

Crab Pots and Currents

In addition to data gaps mentioned above from bio-fouling, additional data gaps were created during data acquisition due to difficultly running lines around the large number of crab-pots and strong currents, particularly in the area east of the mouth entrance. Normally attempts to re-collect the data would be made made prior to leaving the area for extended amounts of time however the maintenance required on the hull prevented a timely re-collection of data over all the data gaps. Attempts to recollect over the data gaps were made months after initial collection which leads to the next issue encountered: sandwaves.

Sandwave Movement

As noted above, unexpected maintenance to the hull of S3006 caused data collection to be broken up over time. Initial collection in June-July followed by additional collection in September 2022. Sandwaves were readily apparent in the initial data collection and sediment transport was very notable in areas where the September data overlaps the earlier data. Stepping is noticeable in the surface where this data overlaps. Most of the the difference in depth is around or less than 1m but an inshore area SW of the Northern point of the entrance has a difference of around 6 m (Figure 12,13). It is recommended that changeable sandwave areas be charted.

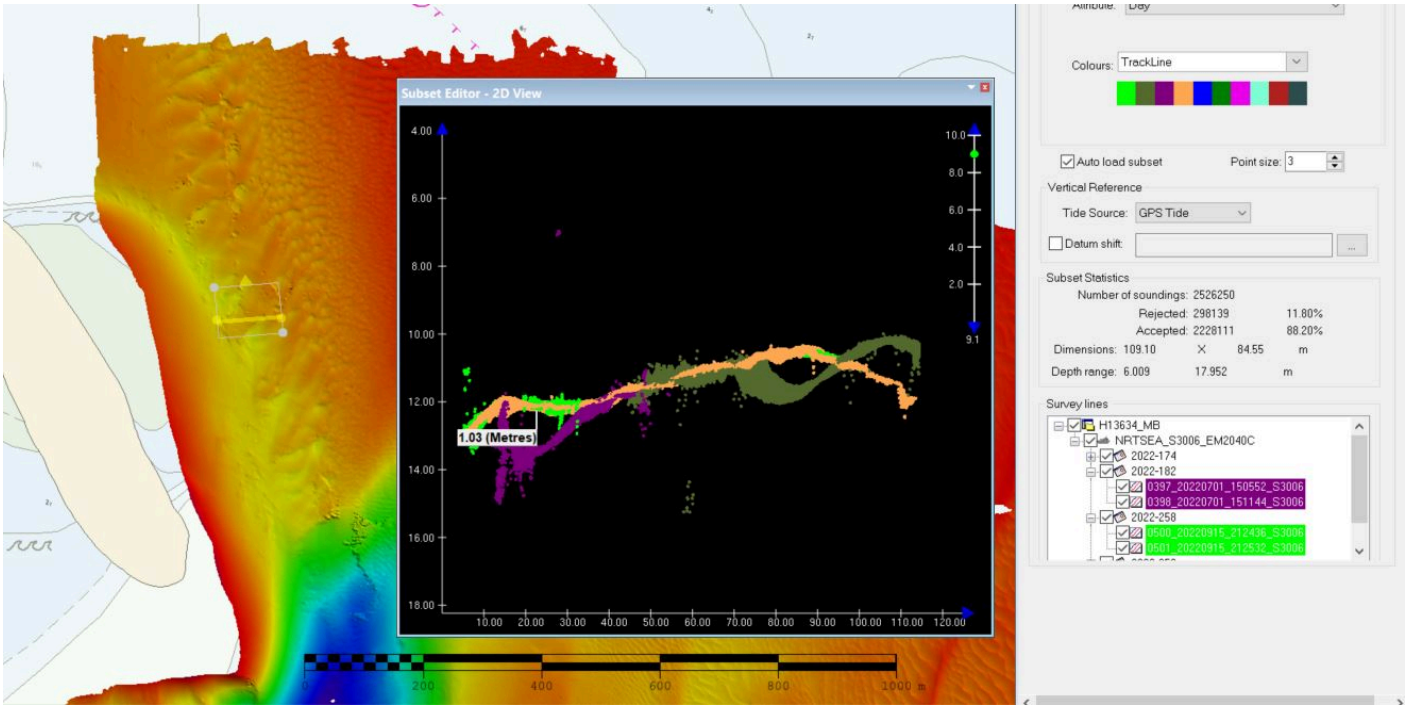


Figure 12: Shifting sandwaves visible in the surface and subset editor for data collected between July and September.

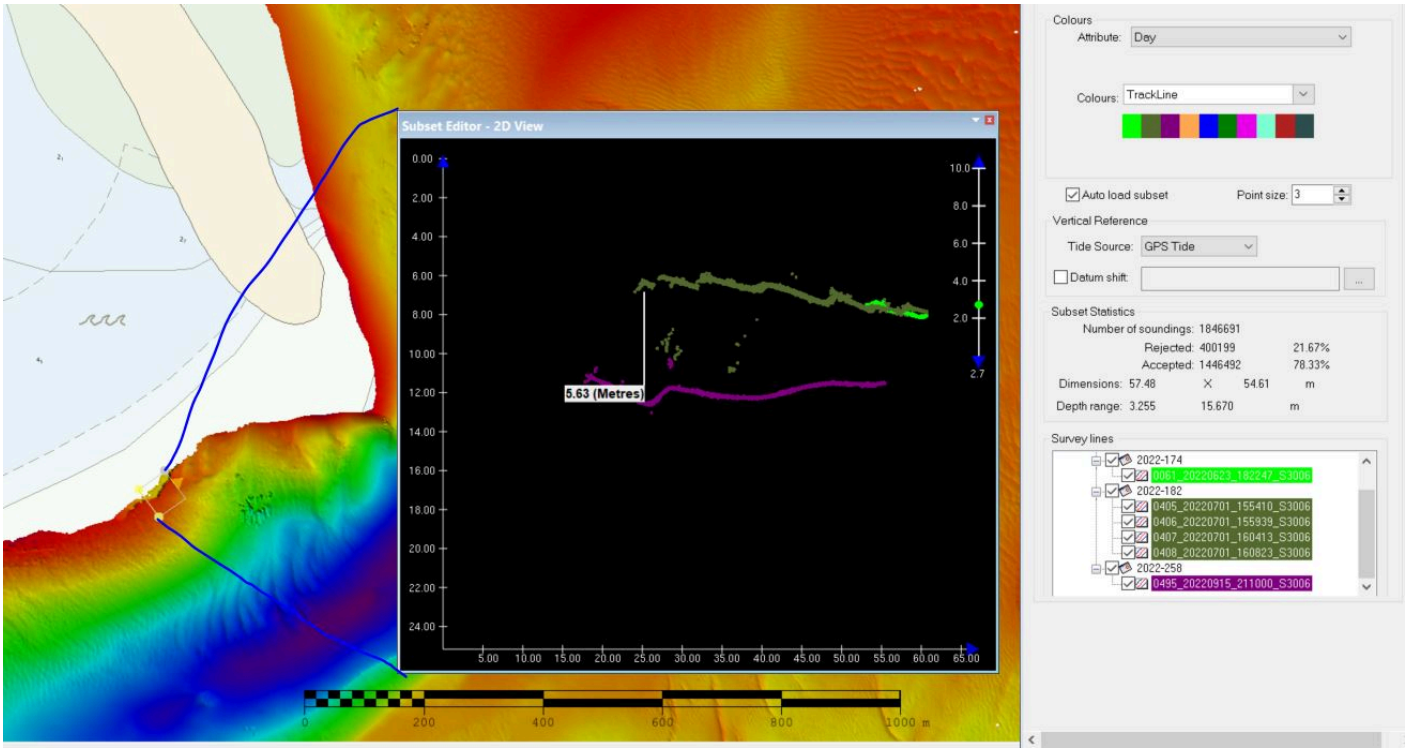


Figure 13: Largest difference apparent in data collected in July compared to data collect in September.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Every four hours

Casts were conducted at a minimum of one every four hours during acquisition. Casts were conducted more frequently when there was a change in surface sound speed greater than four meters per second. (Figure 14). SVP casts were applied to the MBES lines in CARS using the “nearest in distance within time of 4 hours” method. All sound speed methods were used as detailed in the DAPR.

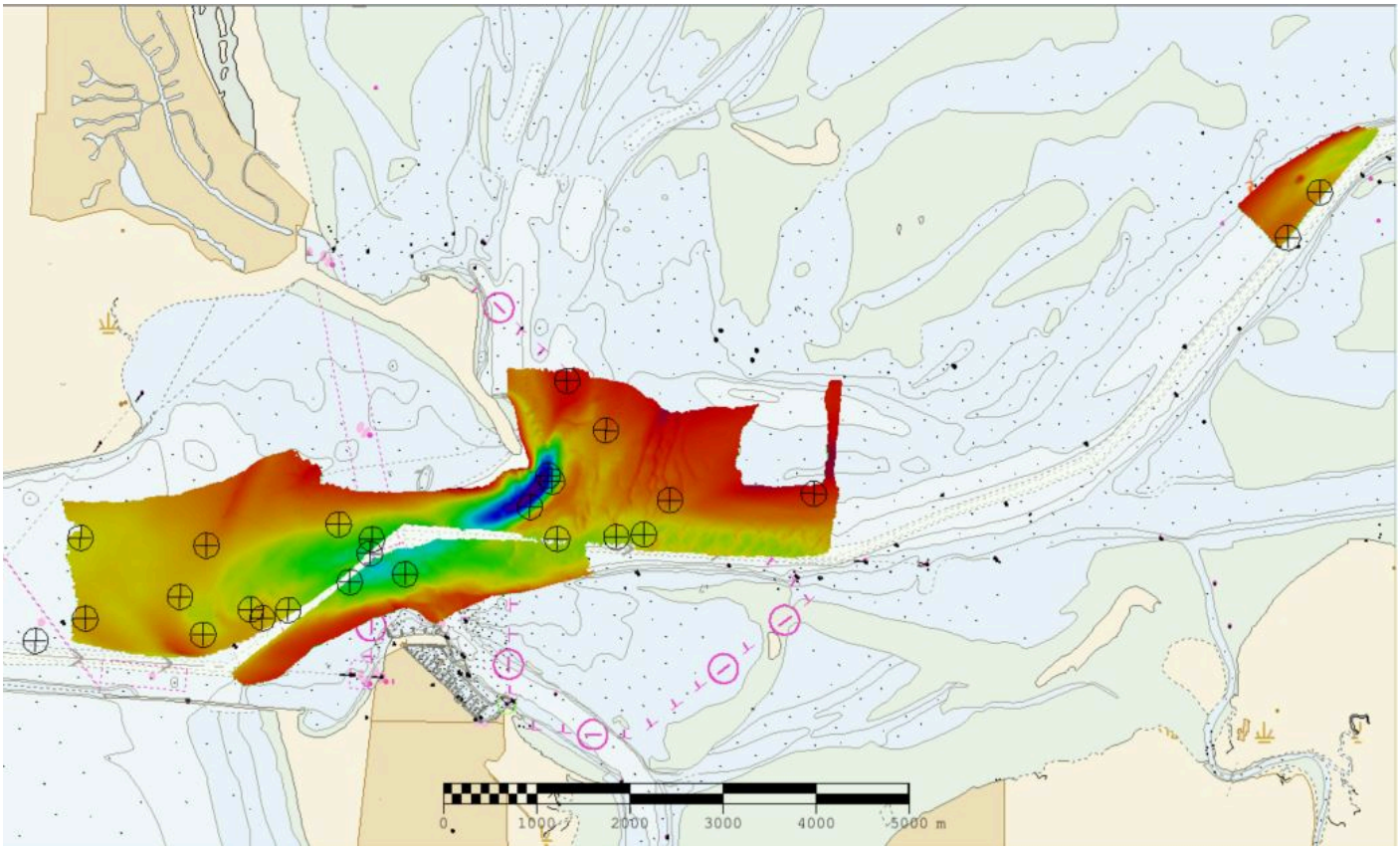


Figure 14: Sound speed cast locations.

B.2.8 Coverage Equipment and Methods

As previously noted, due to the factors affecting the initial data collection, data was reacquired in the survey area in 2023 under registry number H13848; S-N938-NRTSE-23. It is recommended that the two surveys be reviewed and compiled as a unit.

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

The following calibrations were conducted after the initial system calibration discussed in the DAPR:

Calibration Type	Date	Reason
Patch Test	2022-08-16	Multibeam re-installation

Table 9: Calibrations not discussed in the DAPR.

The hull repair necessitated the removal and subsequent re-installation of the multi beam sonar. A patch test was conducted and reference surface collected at the Shilshole Bay reference surface location prior to additional data collection. Patch test values and reference surface matched previous and calibration values were maintained as reported in DAPR.

B.4 Backscatter

Raw backscatter data is logged as .all file during acquisition. Backscatter for this survey was processed in FMGT V7.10.2. The following lines did not processes in FMGT and are not included in the final mosaic: 0399_20220701_151936_S3006; 0427_20220915_160439_S3006.

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 and SIPS	11.4.22

Table 10: Primary bathymetric data processing software

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

Manufacturer	Name	Version
QPS	Fledermaus	7.10.2

Table 11: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Extended Attribute Files Version 2022..

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
H13634_MB_VR_MLLW_Final	CARIS VR Surface (CUBE)		1.74 meters -	NOAA_VR	Object Detection
H13634_MB_VR_MLLW	CARIS VR Surface (CUBE)		1.94 meters -	NOAA_VR	Object Detection

Table 12: Submitted Surfaces

The NOAA CUBE parameters defined in the HSSD were used for the creation of all CUBE surfaces for H13634. The surfaces have been reviewed where noisy data, or "fliers," are incorporated into the gridded solutions causing the surface to be shoaler or deeper than the true sea floor. Where these spurious soundings cause the gridded surface to be shoaler or deeper than the reliably measured seabed by greater than the maximum allowable Total Vertical Uncertainty at that depth, the noisy data have been rejected by the hydrographer and the surface recomputed. With the default settings in HydrOffice Flier Finder, 24 'fliers' remain in the finalized surface. All the remaining fliers are on areas affected by sandwave movement and do not represent actual fliers (Figure 15) (See Section B.2.6). Significantly more 'fliers' are noted if "noisy edges' is selected in HydroOffice Flier Finder. Iterative attempts were made to clean the data at the margins

to remove remaining fliers but due to the inherent sparseness of data at these edges and Caris processing, Flier Finder still flags soundings at these margins. Despite this, the hydrographer feels the data is adequate to supersede charted.

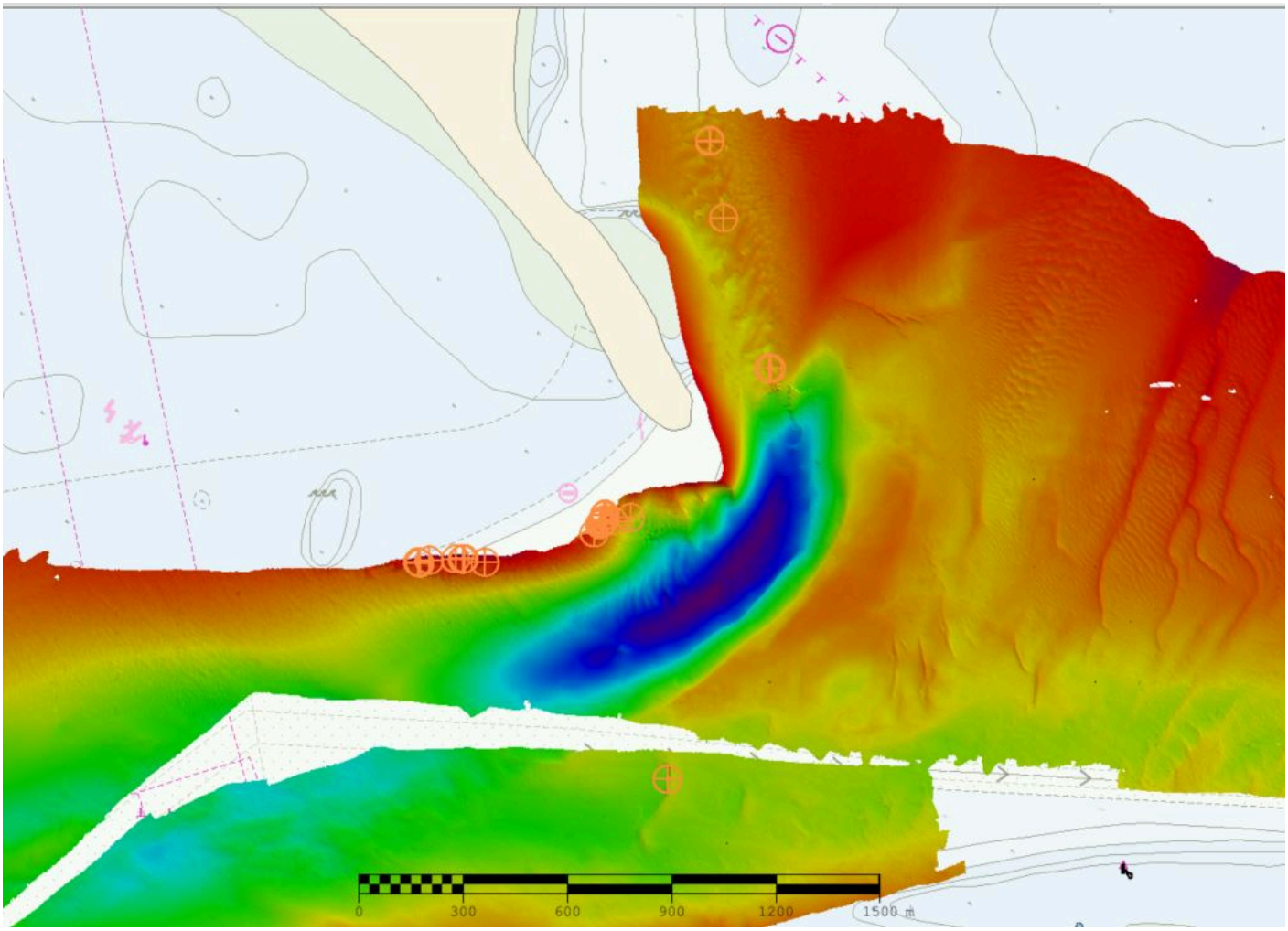


Figure 15: Fliers shown in orange over areas surface is affected by sandwaves.

B.5.3 Designated Soundings

H13634 contains 7 designated soundings in accordance with HSSD Section 5.2.1.2.3. Designated soundings were selected to accurately represent the seafloor and correlate to submerged addressed features included in the Final Feature File (FFF). (Note the submitted FFF contains additional submerged features identified and marked by designated soundings in survey H13848.)

C. Vertical and Horizontal Control

Per Section 8.1.6.2 of the 2022 Field Procedures Manual, no Horizontal and Vertical Control Report has been generated for H13634

C.1 Vertical Control

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

ERS Datum Transformation

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

Method	Ellipsoid to Chart Datum Separation File
ERS via VDATUM	S-N906-NRTSE-22_VDatum_100m_NAD83-MLLW_geoid12b.csar

Table 13: ERS method and SEP file

Elliposidal Referenced Survey (ERS) methods were used as the final means of reducing H13634 to MLLW for submission. VDatum separation model was provided with the project instructions. Sounding elevations relative to the ellipsoid were post-processed with the daily logged POSPac data to create a best statistical estimate of trajectory (SBET) file, as detailed in the DAPR. All of H13634 meets HSSD vertical accuracy requirements.

C.2 Horizontal Control

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 10.

RTK

Precise Positioning-SmartBase and RTX processing methods were used in Applanix POSpac MMS 8.8 software to produce SBETs for post-processing horizontal correction. All of H13545 meets HSSD horizontal accuracy requirements.

D. Results and Recommendations

D.1 Chart Comparison

A comparison was performed between survey H13634 and US5WA60M. The contours and soundings were overlaid on the charts to assess differences between the surveyed soundings and charted depths. ENCs were compared by extracting all soundings from the chart for general agreement and to identify areas of significant change. In general there is significant shifting of contours and sounding within the survey area due to the changeable nature of the seabed and currents in the area. Most contours shifted shoreward of charted.

Data from H13634, in conjunction with H13848 should supersede charted data.

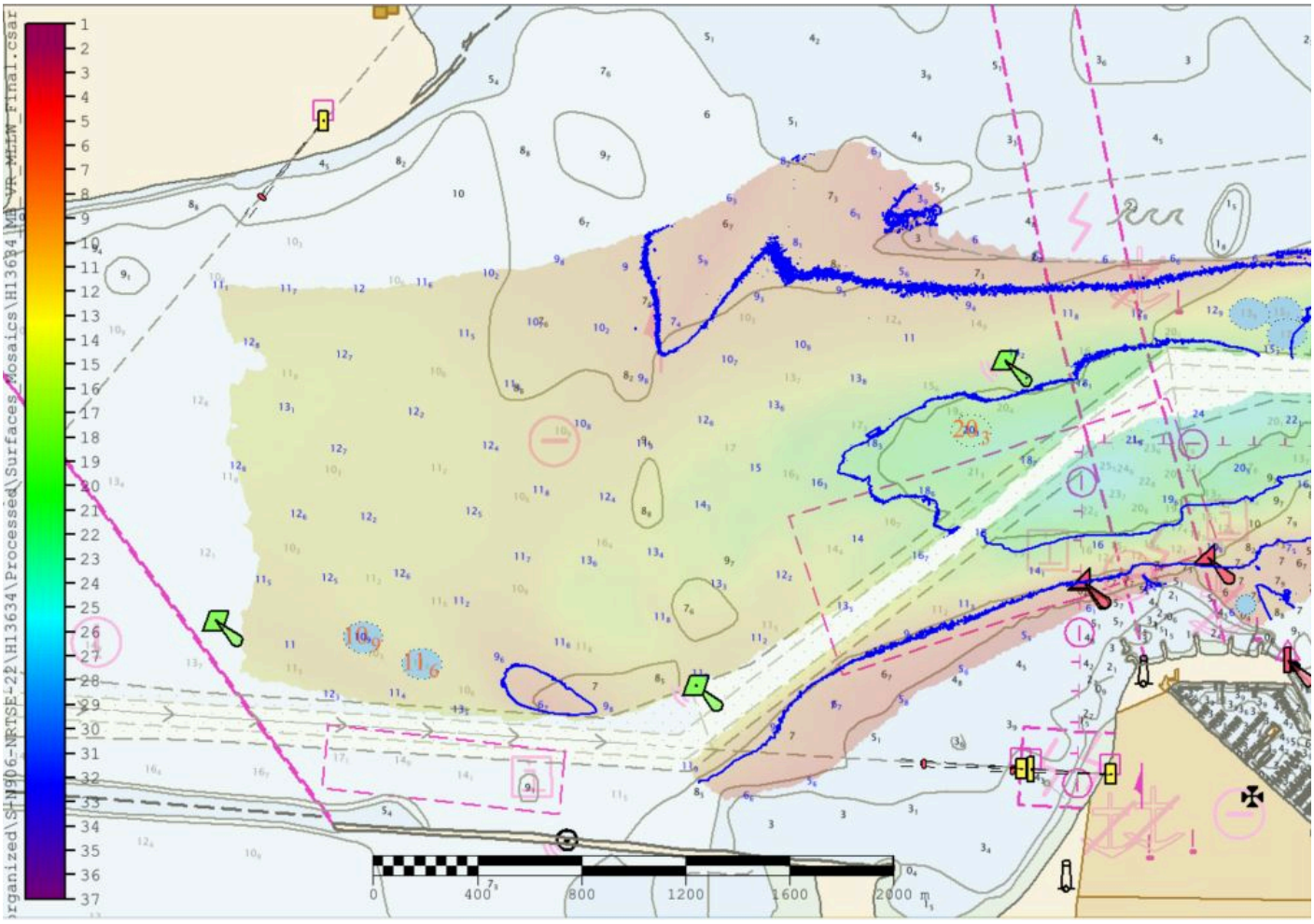


Figure 16: Survey contours and soundings in blue overlain on ENC US5WA60M showing shifting of contours.

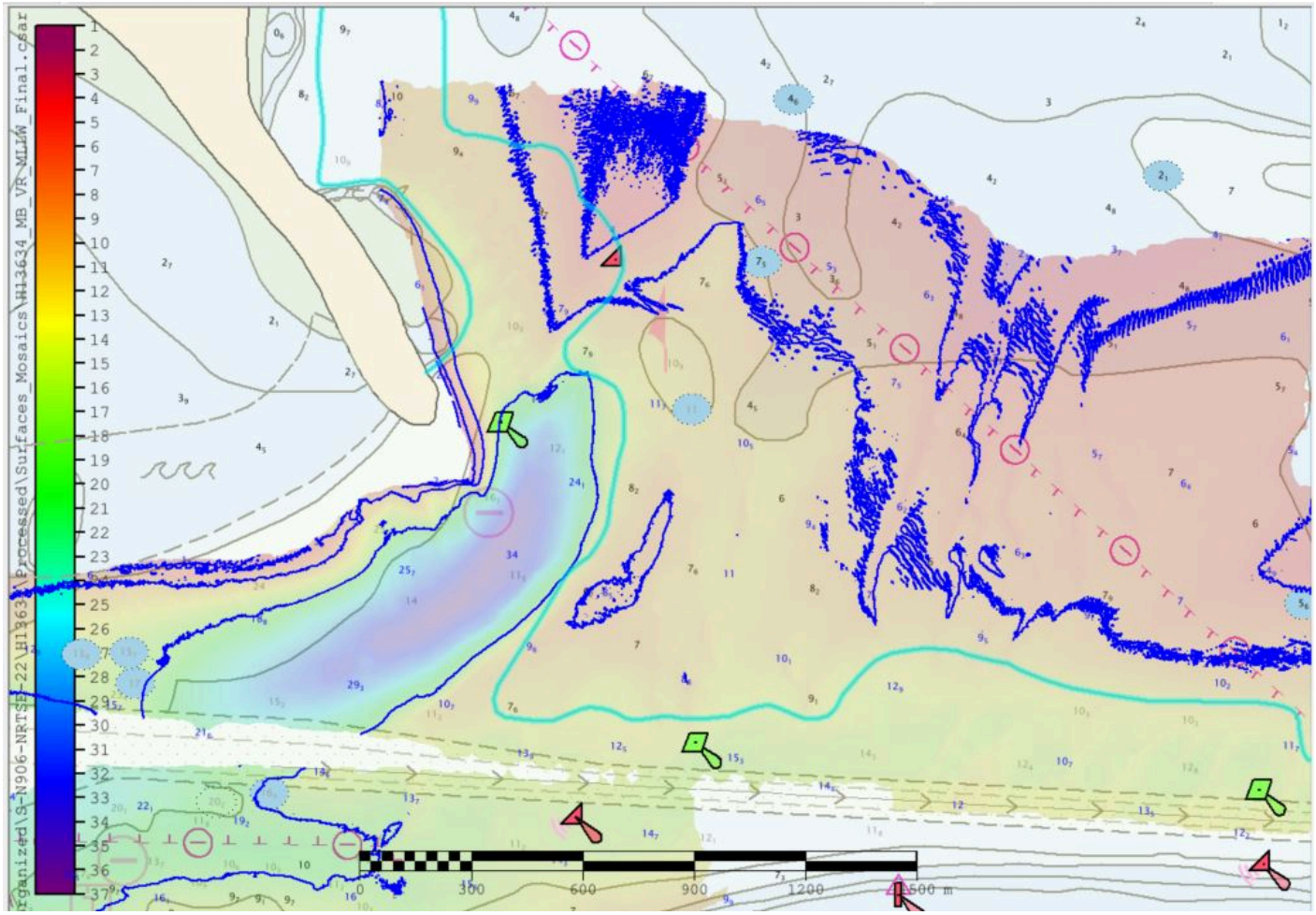


Figure 17: Survey contours and soundings in blue overlain on ENC US5WA60M showing shifting of contours.

D.1.1 Electronic Navigational Charts

The following are the largest scale ENCs, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date
US5WA60M	1:40000	30	11/24/2021	05/13/2022

Table 14: Largest Scale ENCs

D.1.2 Shoal and Hazardous Features

Shifting sandy shoals are present in the area and should be updated per H13634 and H13848 data. No immediate Dangers to Navigation (DTON) were identified or reported.

D.1.3 Charted Features

No features were assigned in CSF. Charted features exist for this survey and are included int the FFF.

D.1.4 Uncharted Features

The submitted Final Feature File (FFF) contains new features from both H13634 and H131848 identify by SORIND and SORDAT. The combined FFF contains 27 new Obstructions and 29 retained charted features (mostly ATONs).

D.1.5 Channels

Channels exist within the area but were excluded from survey limits

D.2 Additional Results

D.2.1 Aids to Navigation

ATONs exist in the survey area and all are on station serving their intended purpose.

D.2.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.2.3 Bottom Samples

No bottom samples were required for this survey.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

No additional 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 or Environmental Conditions

Shifting sandwaves are present throughout the survey area. It is recommended that changeable sandwave areas are charted in accordance with H13634 and H13848 data.

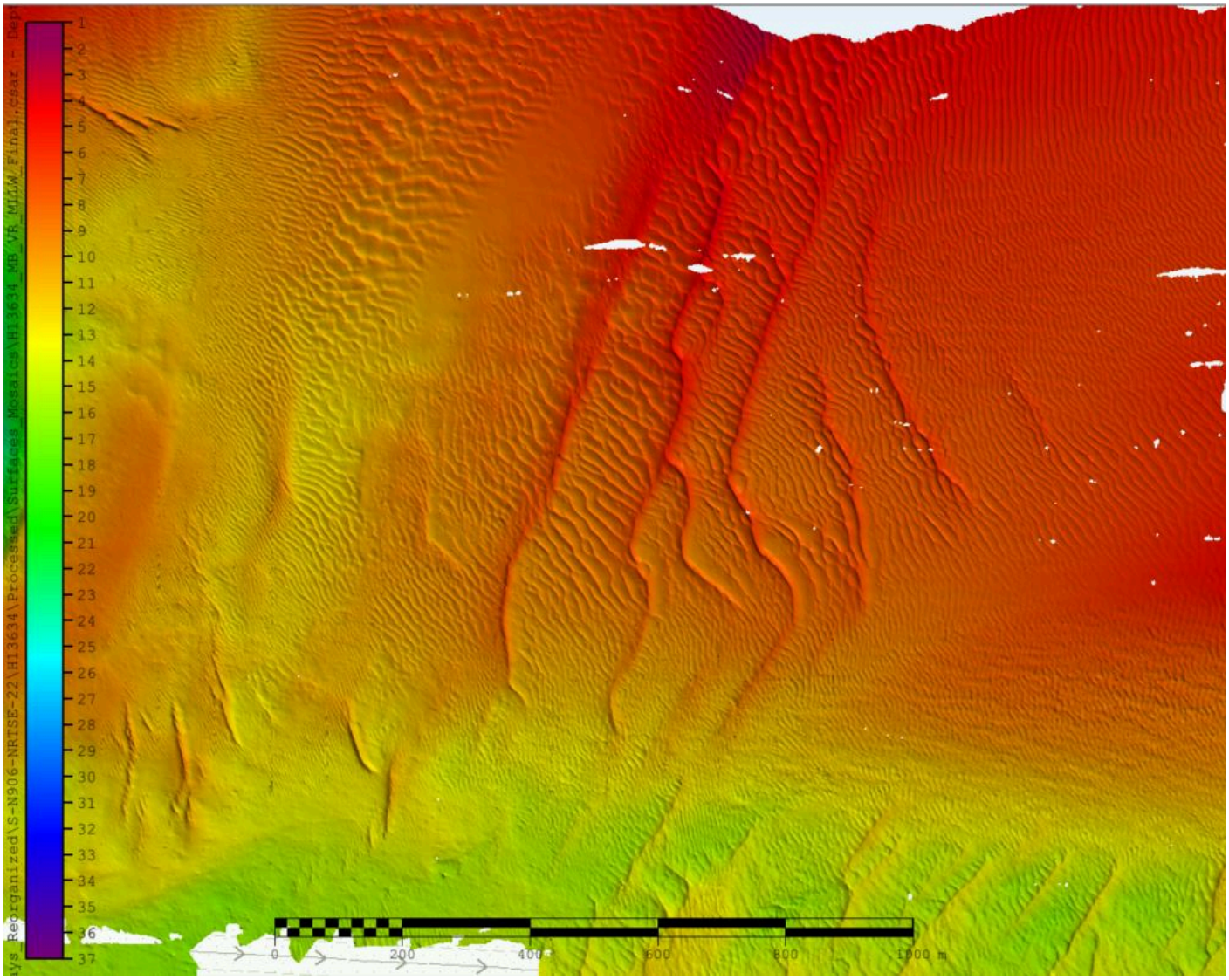


Figure 18: Detail showing the extensive sandwaves, vertical exaggerated (3).

D.2.9 Construction and Dredging

There was active dredging happening in Crossover Channel near the the NE assigned section of survey. Changes in depth (~1m) were noted in along this section between lines collected on DN194 and DN259.

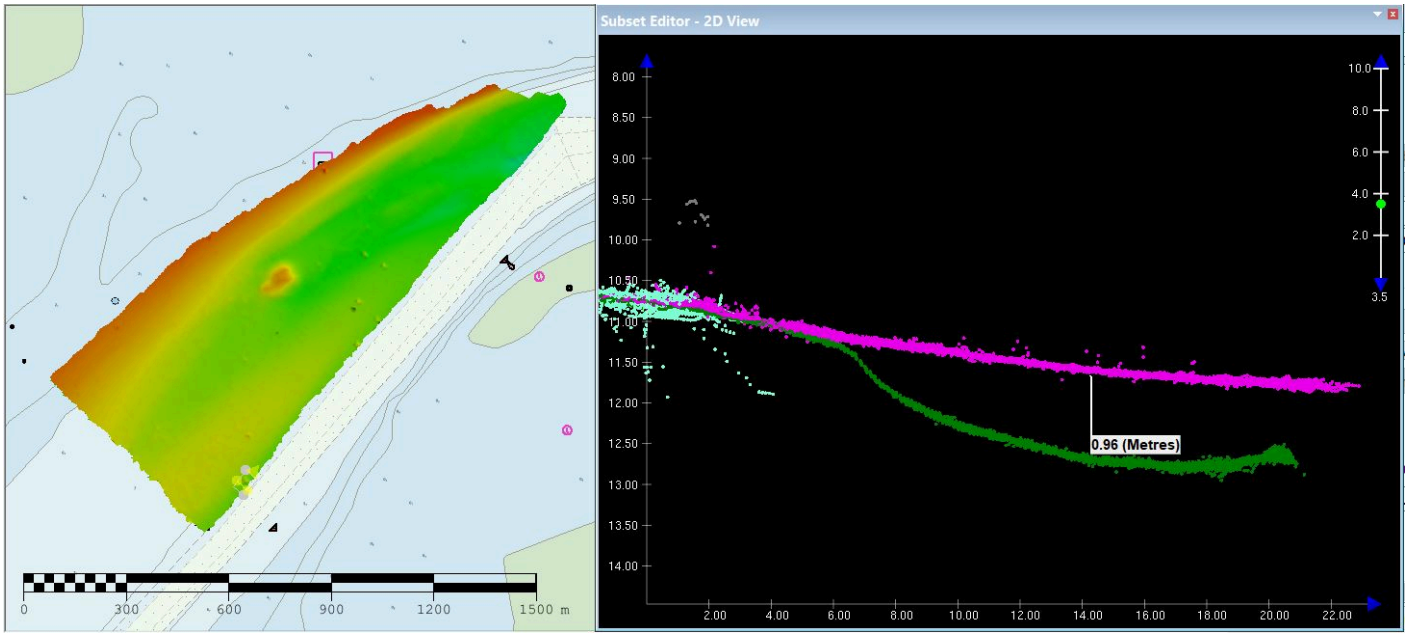


Figure 19: Dredging noted in data collected on DN194 and DN259.

D.2.10 New Survey Recommendations

Due to the changeable nature of the seafloor in the area, it is recommended (and will likely be requested) that this area is surveyed on frequent schedule.

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.

Approver Name	Approver Title	Approval Date	Signature
Patrick Faha LTJG/NOAA	Chief of Party	02/29/2024	FAHA.PATRICK.THOMAS.1549418305 Digitally signed by FAHA.PATRICK.THOMAS.1549418305 Date: 2024.02.29 14:32:34 -08'00'
Annemieke Raymond	Sheet Manager	02/29/2024	RAYMOND.ANNEMIEKE.SMITH.1365883048 Digitally signed by RAYMOND.ANNEMIEKE.SMITH.1365883048 Date: 2024.02.29 14:51:14 -08'00'

F. Table of Acronyms

Acronym	Definition
AHB	Atlantic Hydrographic Branch
AST	Assistant Survey Technician
ATON	Aid to Navigation
AWOIS	Automated Wreck and Obstruction Information System
BAG	Bathymetric Attributed Grid
BASE	Bathymetry Associated with Statistical Error
CO	Commanding Officer
CO-OPS	Center for Operational Products and Services
CORS	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