H12496

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12496

LOCALITY

State(s):	Alaska
General Locality:	North Coast of Kodiak Island
Sub-locality:	Entrance to Kizhuyak Bay

2012

CHIEF OF PARTY
Richard T. Brennan, CDR/NOAA

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Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H12496**

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

State(s):	**Alaska**
General Locality:	**North Coast of Kodiak Island**
Sub-Locality:	**Entrance to Kizhuyak Bay**
Scale:	**40000**
Dates of Survey:	**10/09/2012 to 10/25/2012**
Instructions Dated:	**07/02/2012**
Project Number:	**OPR-P136-RA-12**
Field Unit:	**NOAA Ship *Rainier***
Chief of Party:	**Richard T. Brennan, CDR/NOAA**
Soundings by:	**Multibeam Echo Sounder**
Imagery by:	**Multibeam Echo Sounder Backscatter**
Verification by:	**Pacific Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**

Remarks:

The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. All separates are filed with the hydrographic data. Notes in red were generated during office processing. The processing branch concurs with all information and recommendations in the DR unless otherwise noted. Page numbering may be interrupted or non-sequential. All pertinent records for this survey, including the Descriptive Report, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via http://www.ngdc.noaa.gov/.

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Descriptive Report to Accompany Survey H12496

Project: OPR-P136-RA-12

Locality: North Coast of Kodiak Island

Sublocality: Entrance to Kizhuyak Bay

Scale: 1:40000

October 2012 - October 2012

NOAA Ship *Rainier*

Chief of Party: Richard T. Brennan, CDR/NOAA

A. Area Surveyed

The project area is referred to as Sheet 2: Entrance to Kizhuyak Bay within the Project Instructions. The area is where Whale Passage, Kizhuyak Bay, and Marmot Bay meet in North Kodiak (Figure 1).

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
57° 56" 45' N 152° 47" 41.4' W	57° 48" 43' N 152° 47" 40' W

Table 1: Survey Limits

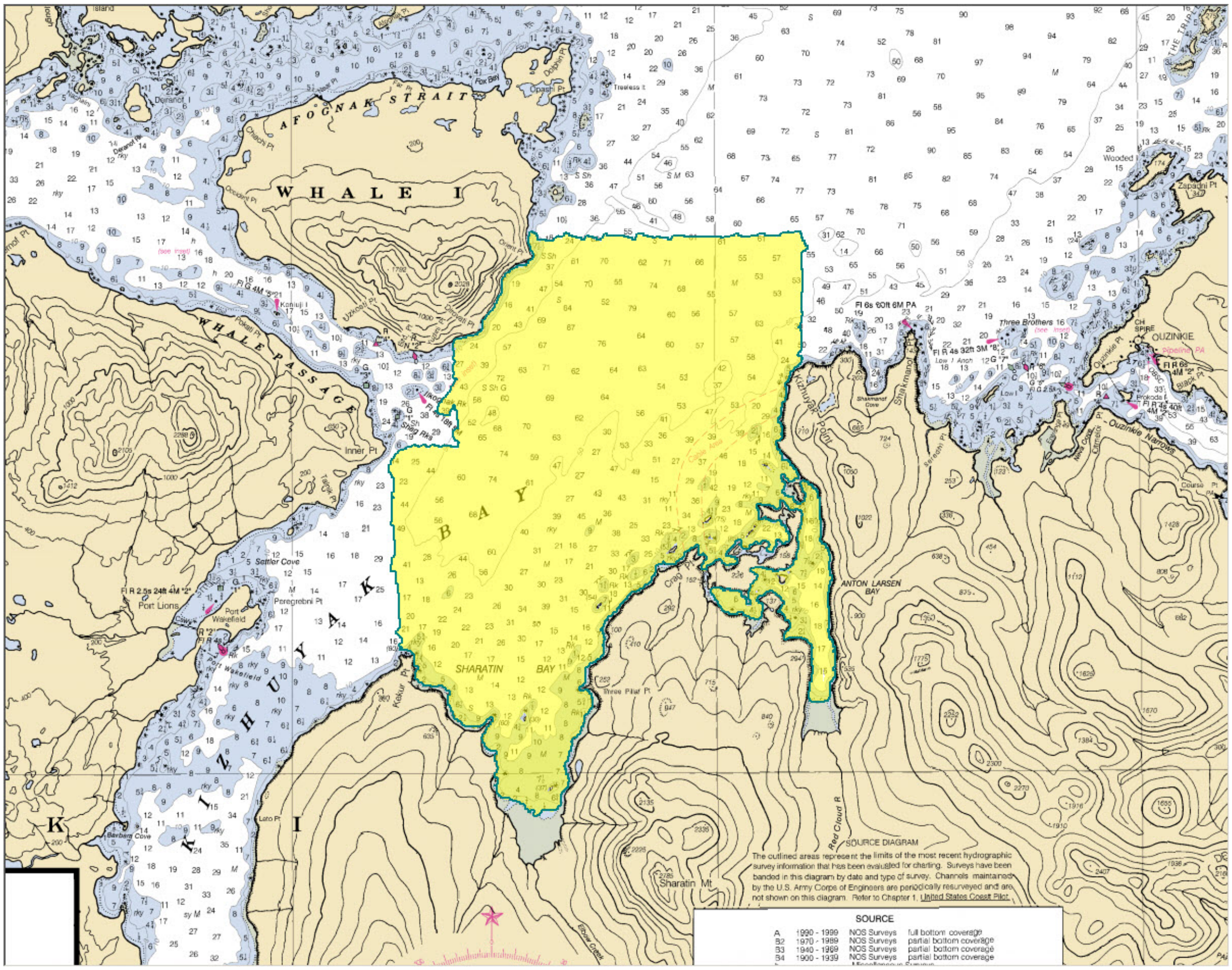


Figure 1: H12496 survey limits.

Survey limits were acquired in accordance with the requirements in the Project Instructions and the Hydrographic Surveys Specifications and Deliverables Manual (HSSDM).

A.2 Survey Purpose

The purpose of this project is to provide contemporary surveys to update National Ocean Service (NOS) nautical charting products, which will support Kodiak's large fishing fleet and increasing levels of passenger vessel traffic.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired on survey H12496 met complete multibeam coverage requirements, including the 5 soundings per node data density requirements outlined in section 5.2.2.2 of the HSSDM (Figure 2). Overall, 98.6% of the data satisfies data density requirements.

Low density occurred primarily where data was acquired using the tilted (34-degrees) Reson 8125 mounted on Launch 2803 (RA-3) which can only be operated in a equi-angular mode (Figure 4). In spite of the low density, all data was retained for charting, per the recommendations of the Hydrographic Survey Division (see Supplemental Correspondence - 8125 density.jpg).

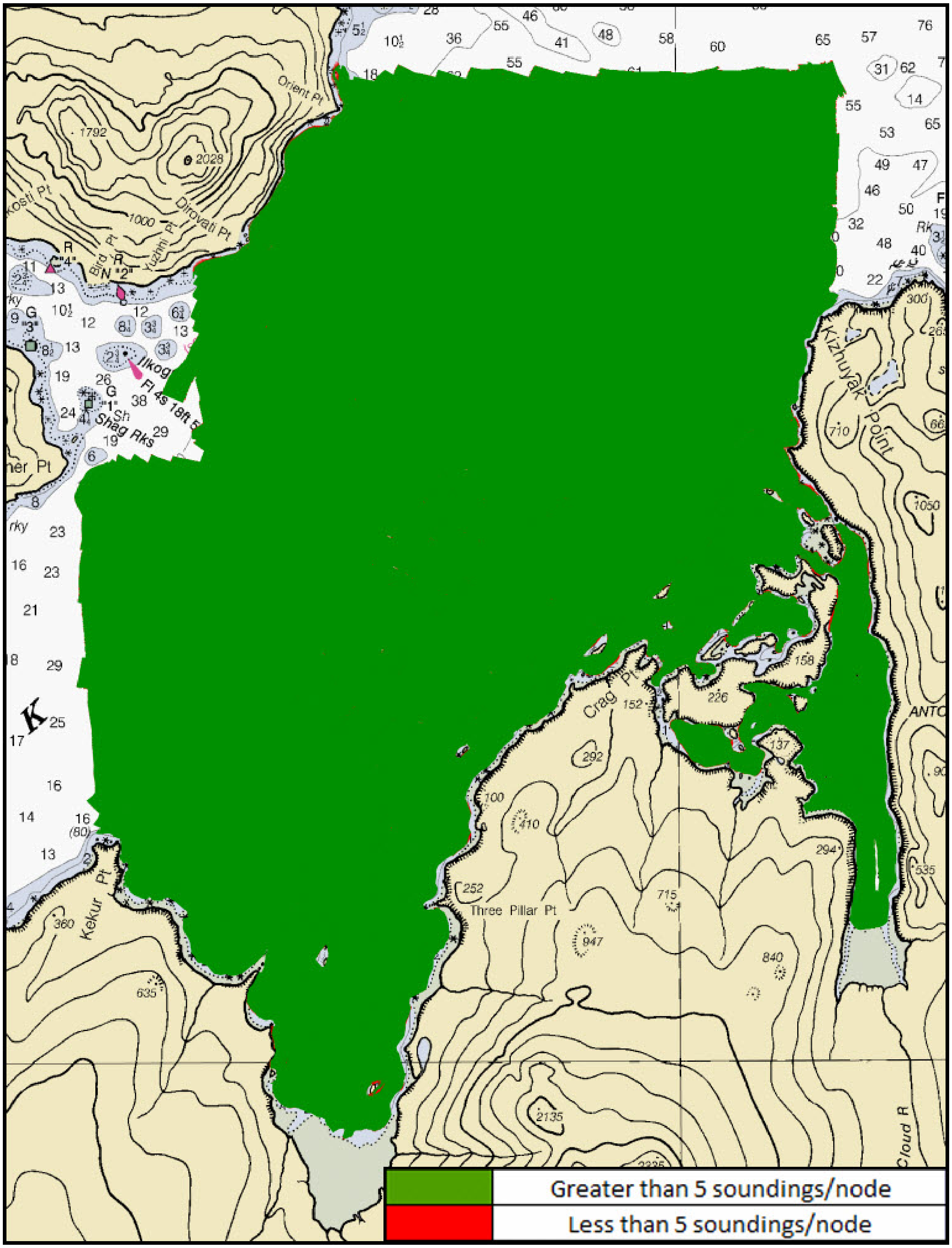


Figure 2: H12496 data density.

Resolution	Depth range	Number of nodes	Fewer than five soundings per node	Percent of nodes with greater than five soundings per node
1m	0 - 20m	9,899,990	219,101	97.8%
2m	18 - 40m	3,706,196	2,792	99.9%
4m	36 - 80m	1,210,975	2,059	99.8%
8m	72 - 160m	737,548	539	99.9%
	TOTAL:	15,554,709	224,491	**98.6%**
	TOTAL (by area):	91,303,446	297,709	**99.7%**

Figure 3: Summary table showing the percentage of nodes satisfying the 5 node sounding density requirements, sub-divided by the appropriate depth ranges. Note: The final row has a unit of square meters, and sums the number of different resolution nodes into a common unit of area.

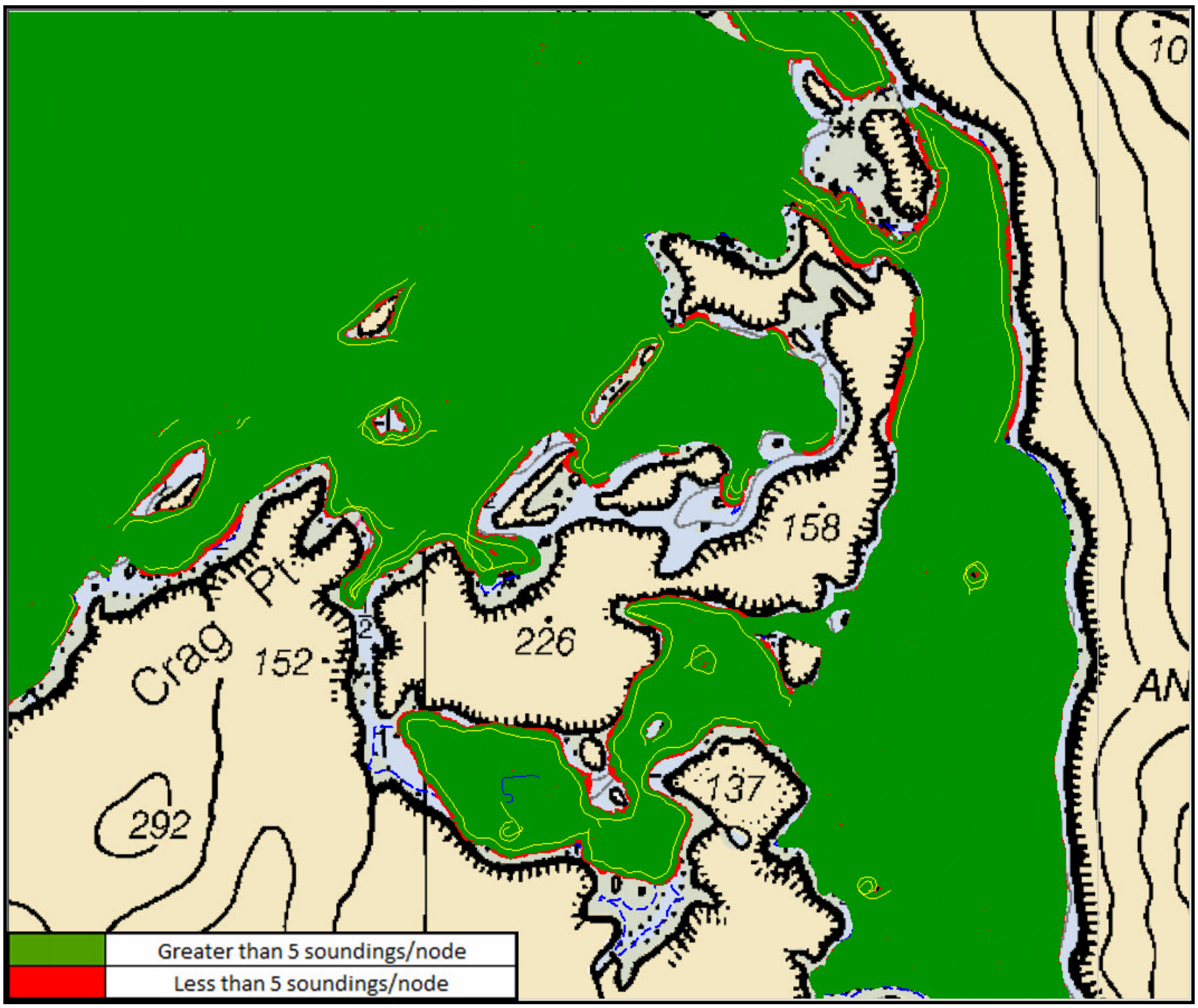


Figure 4: H12496 Reson 8125 low density data.

Email correspondence is appended to this report. In addition, data is sufficient to supersede charted data in the common area. No soundings for charting were selected from red areas shown in Figure 4.

A.4 Survey Coverage

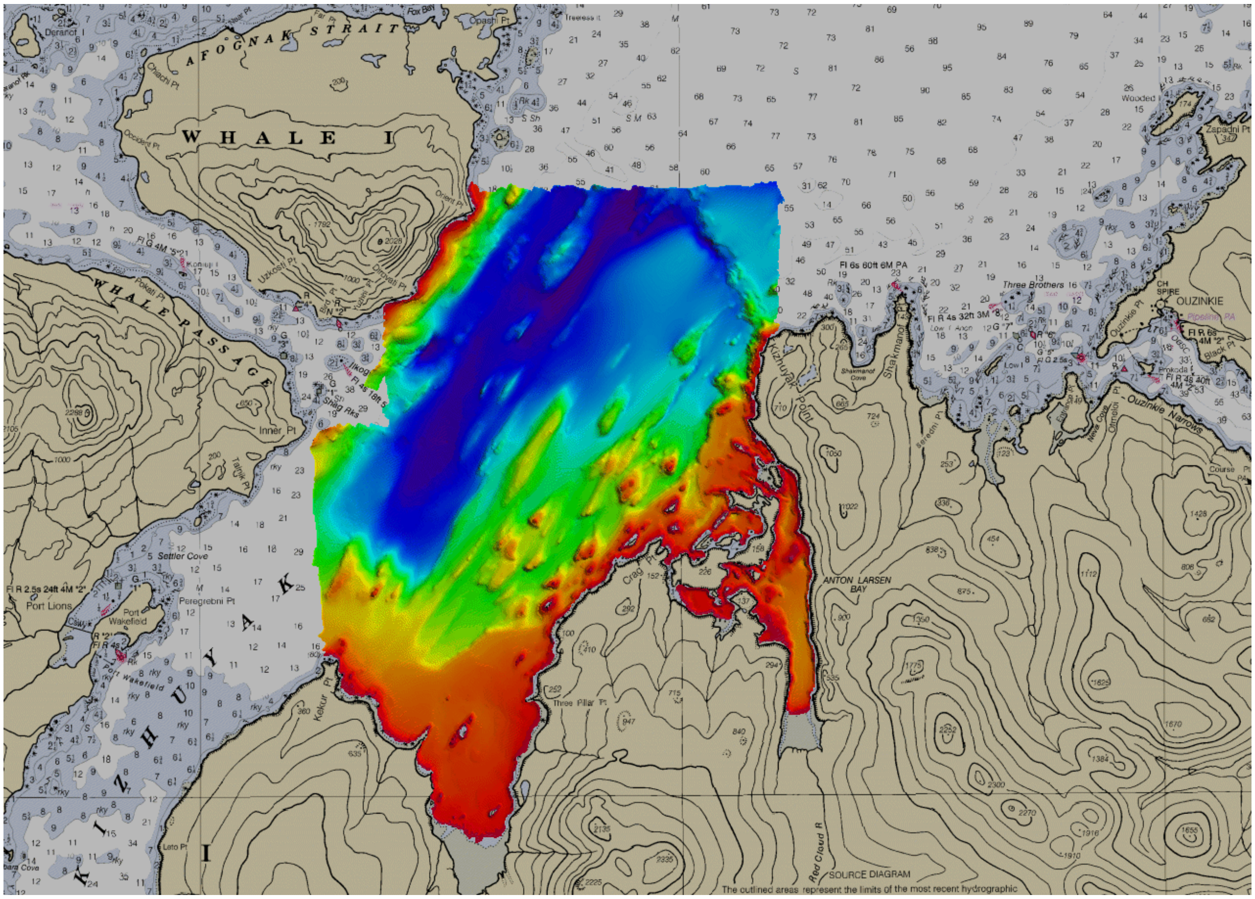


Figure 5: Acquired survey coverage overlaid on Chart 16594.

Complete multibeam echosounder (MBES) coverage was achieved within the limits of hydrography as specified in the Project Instructions with the following exceptions:

Multibeam coverage did not reach the survey limits or the 4-meter contour in seven locations (Figure 6). In several of these cases, the 4-meter contour was thought to be surveyed but shifted slightly deeper after application of final tides.

A small holiday exists on the northern edge of survey H12496 but is completely covered by H12495 data (Figure 7).

Three holidays exist on the northwest edge of the survey along Whale Island where a combination of sea state and proximity to shore made it unsafe to approach.

Additionally, environmental factors affecting surface sound velocity measurements caused data to fail to meet specification for allowable uncertainty and therefore was rejected (Figure 8). The decision to reject data that failed allowable uncertainty was made several months after departing the survey area and therefore was never reacquired. This data was located in the southern portion of Anton Larsen Bay and created a 600 by 50 meter holiday. See B.2.6.1 - Surface Sound Velocity.

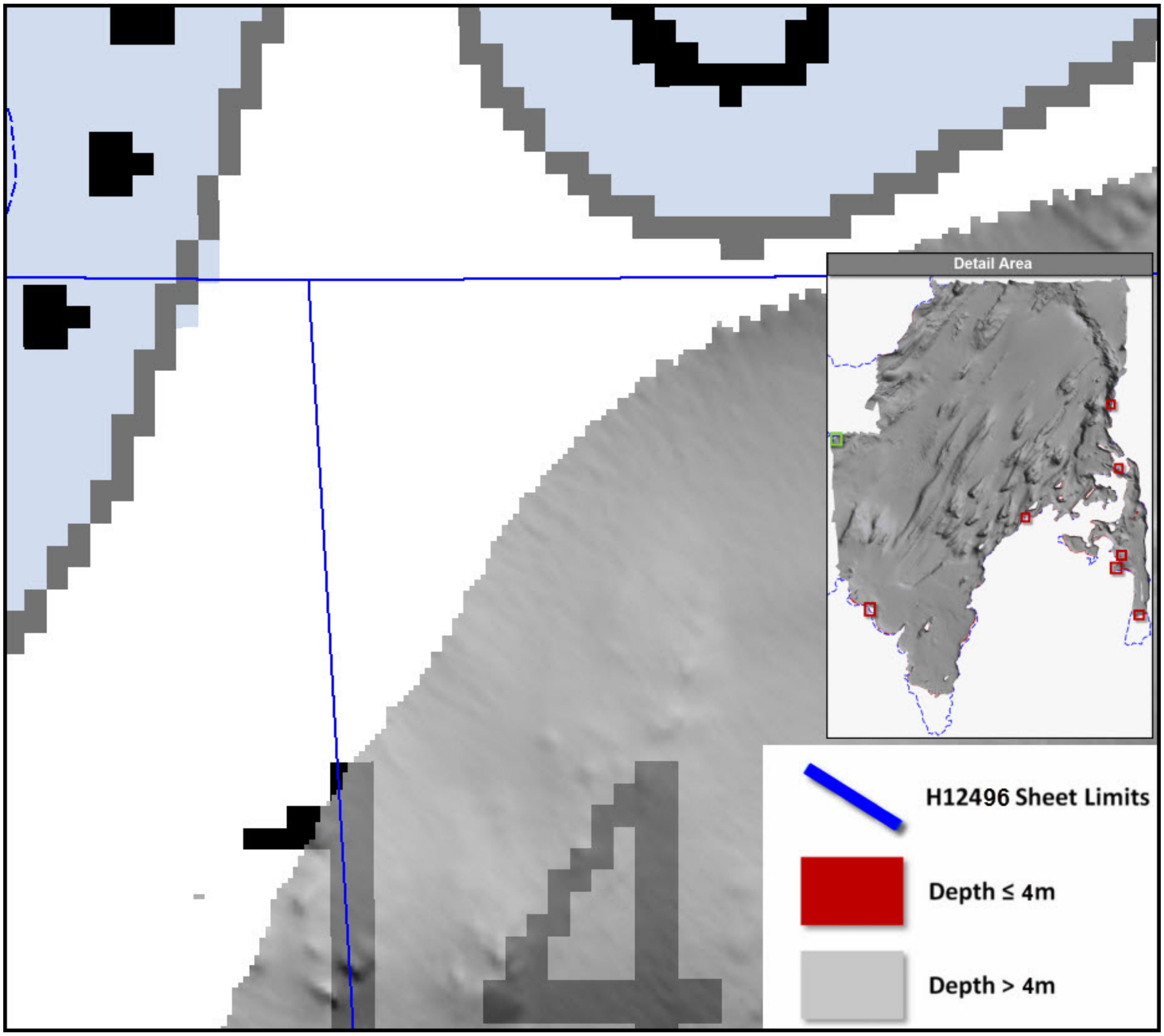


Figure 6: Area where multibeam coverage did not reach survey limits nor the 4-meter contour. Six other locations are shown in the detail area map (red boxes).

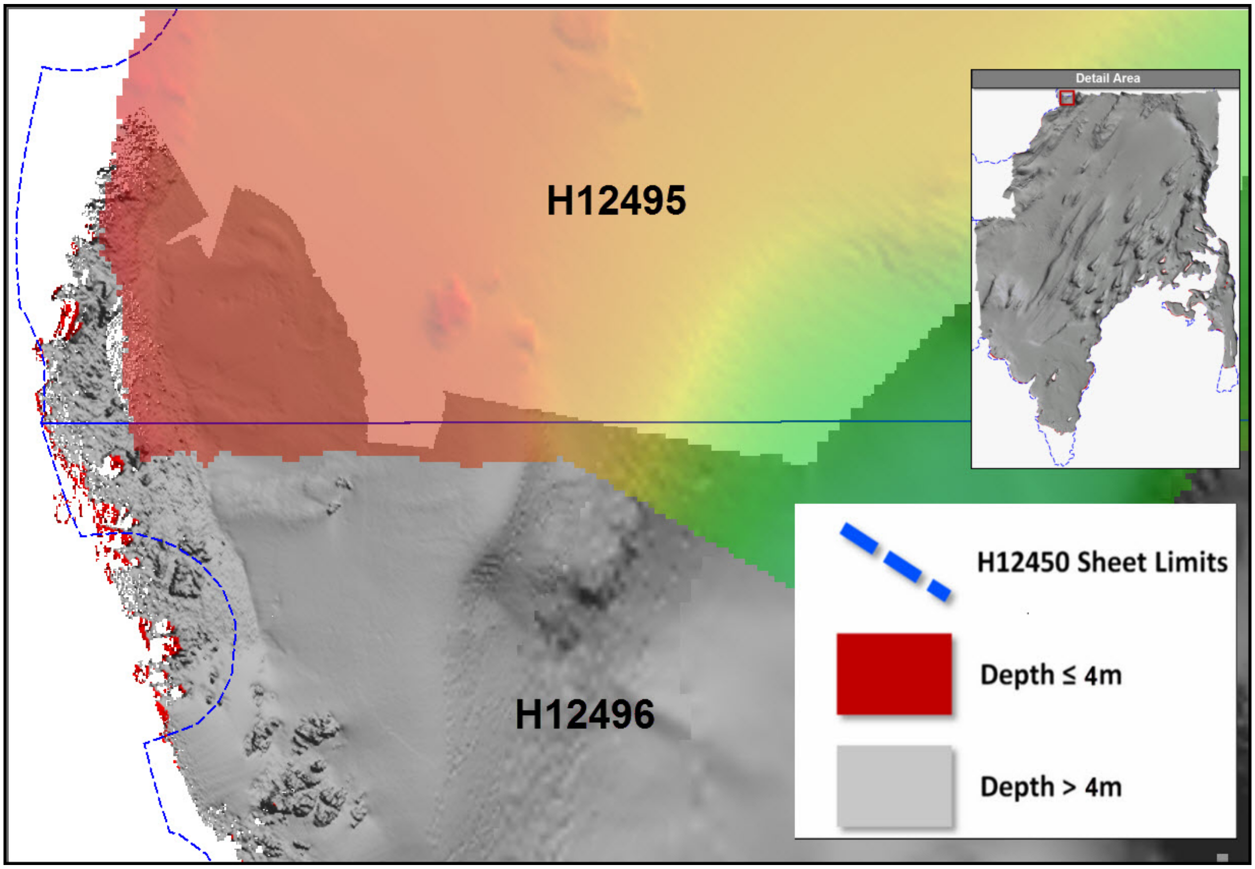


Figure 7: Location where multibeam coverage did not reach survey limits but was covered by junctioning survey H12495.

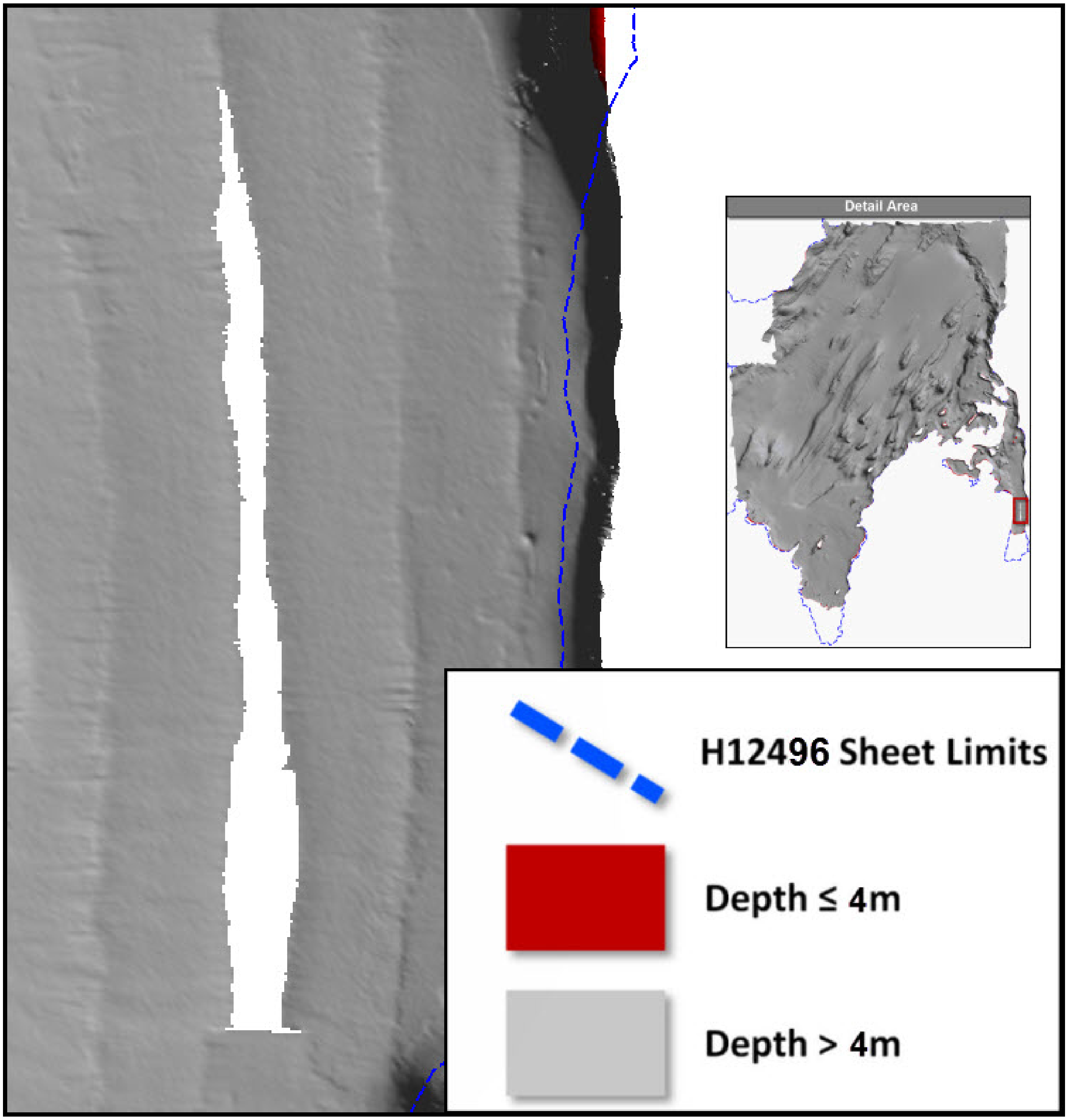


Figure 8: Holiday created due to rejected data that failed accuracy specifications.

Holiday in Larson Bay is at the deepest area of the Bay and is not represented in the chart update product.

A.5 Survey Statistics

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

	Vessel	*S-221*	*2801 (RA-4)*	*2802 (RA-5)*	*2803 (RA-3)*	*2804 (RA-6)*	***Total***
LNM	**SBES Mainscheme**	0	0	0	0	0	0
	MBES Mainscheme	0	78.9	78.0	139.2	174.5	470.6
	Lidar Mainscheme	0	0	0	0	0	0
	SSS Mainscheme	0	0	0	0	0	0
	SBES/MBES Combo Mainscheme	0	0	0	0	0	0
	SBES/SSS Combo Mainscheme	0	0	0	0	0	0
	MBES/SSS Combo Mainscheme	0	0	0	0	0	0
	SBES/MBES Combo Crosslines	22.0	6.7	0	1.5	1.6	31.9
	Lidar Crosslines	0	0	0	0	0	0
Number of Bottom Samples							6
Number AWOIS Items Investigated							0
Number Maritime Boundary Points Investigated							0
Number of DPs							32
Number of Items Items Investigated by Dive Ops							0
Total Number of SNM							24.7

Table 2: Hydrographic Survey Statistics

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

Survey Dates	Julian Day Number
10/09/2012	283
10/11/2012	285
10/16/2012	290
10/17/2012	291
10/18/2012	292
10/20/2012	294
10/21/2012	295
10/22/2012	296
10/23/2012	297
10/24/2012	298
10/25/2012	299

Table 3: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

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

B.1.1 Vessels

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

Hull ID	*S221*	*2801 (RA-4)*	*2802 (RA-5)*	*2803 (RA-3)*	*2804 (RA-6)*	*1906 (RA-7)*	*1905 (RA-8)*
LOA	231 feet	28 feet	28 feet	28 feet	28 feet	19 feet	19 feet
Draft	16.4 feet	3.5 feet	3.5 feet	3.5 feet	3.5 feet	1.7 feet	0.8 feet

Table 4: Vessels Used

Data was acquired by RAINIER and her four survey launches (2801, 2802, 2803, and 2804). The vessels acquired MBES data, sound velocity profiles, and bottom samples. Shoreline was investigated using two RAINIER skiffs (1905 and 1906).

B.1.2 Equipment

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

Manufacturer	Model	Type
Kongsberg	EM710	MBES
Reson	7125	MBES
Applanix	POS-MV V4	Vessel Attitude and Positioning System
Seabird	SBE 19	Conductivity, Temperature, and Depth Sensor
Seabird	SBE 19 Plus	Conductivity, Temperature, and Depth Sensor
ODIM Brooke Ocean (Rolls-Royce group)	MVP 200	Conductivity, Temperature, and Depth Sensor
Reson	SVP 70	Sound Speed System
Reson	SVP 71	Sound Speed System

Table 5: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Crosslines, acquired for this survey, totalled 6.8% of mainscheme acquisition.

Multibeam crosslines were acquired using the EM710 on RAINIER as well as the Reson 7125 on three launches (2801, 2803, 2804). Crosslines totaled 31.9 NM, which comprised 6.8% of mainscheme hydrography. A 4-meter CUBE surface was created using strictly the mainscheme lines, while a second 4-meter CUBE surface was created using only crosslines, from which a surface difference was generated at a 4-meter resolution (Figure 9). Statistics were then derived from the difference surface and are shown in Figure 10. The average difference between the depths derived from mainscheme and crosslines was -0.04 meters (mainscheme being shoaler) with a standard deviation of 0.23 meters. The largest differences (red and black) were seen in areas of high relief.

In addition to performing a crossline comparison using surface differencing, the CARIS QC Report was used to compare the crossline soundings to the depth estimates of the 4-meter resolution surface. The depth differences are calculated for each crossline ping and then compared to the allowable IHO uncertainties. The output QC Report classifies the percentage of pings meeting IHO orders by beam angle. The table was copied and examined in Excel (Figure 11). On average, 99.8% of all soundings for any given depth and beam angle meet IHO Order 1 accuracies.

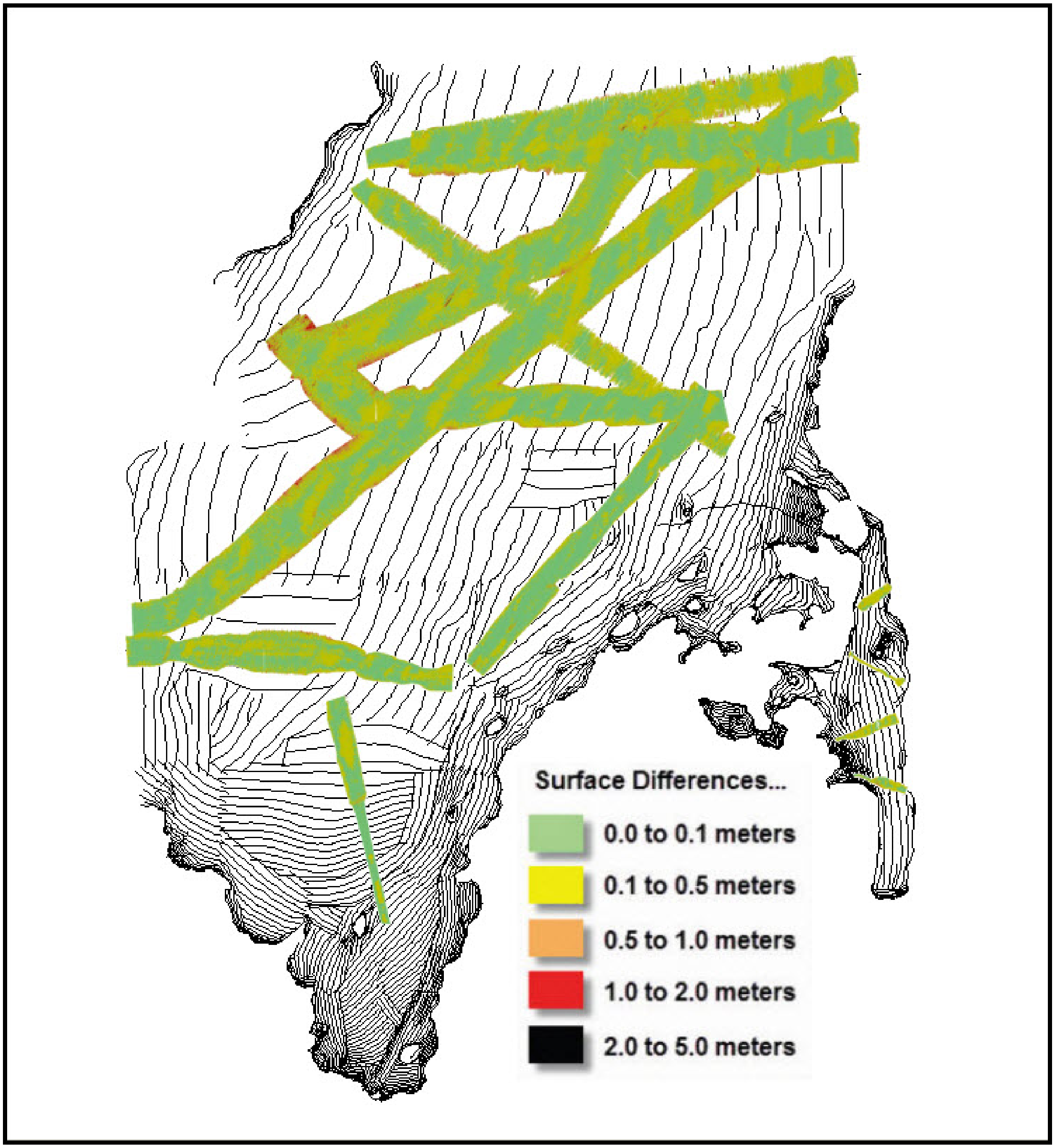


Figure 9: Crossline distribution for H12496. Red and black shows areas of highest variation

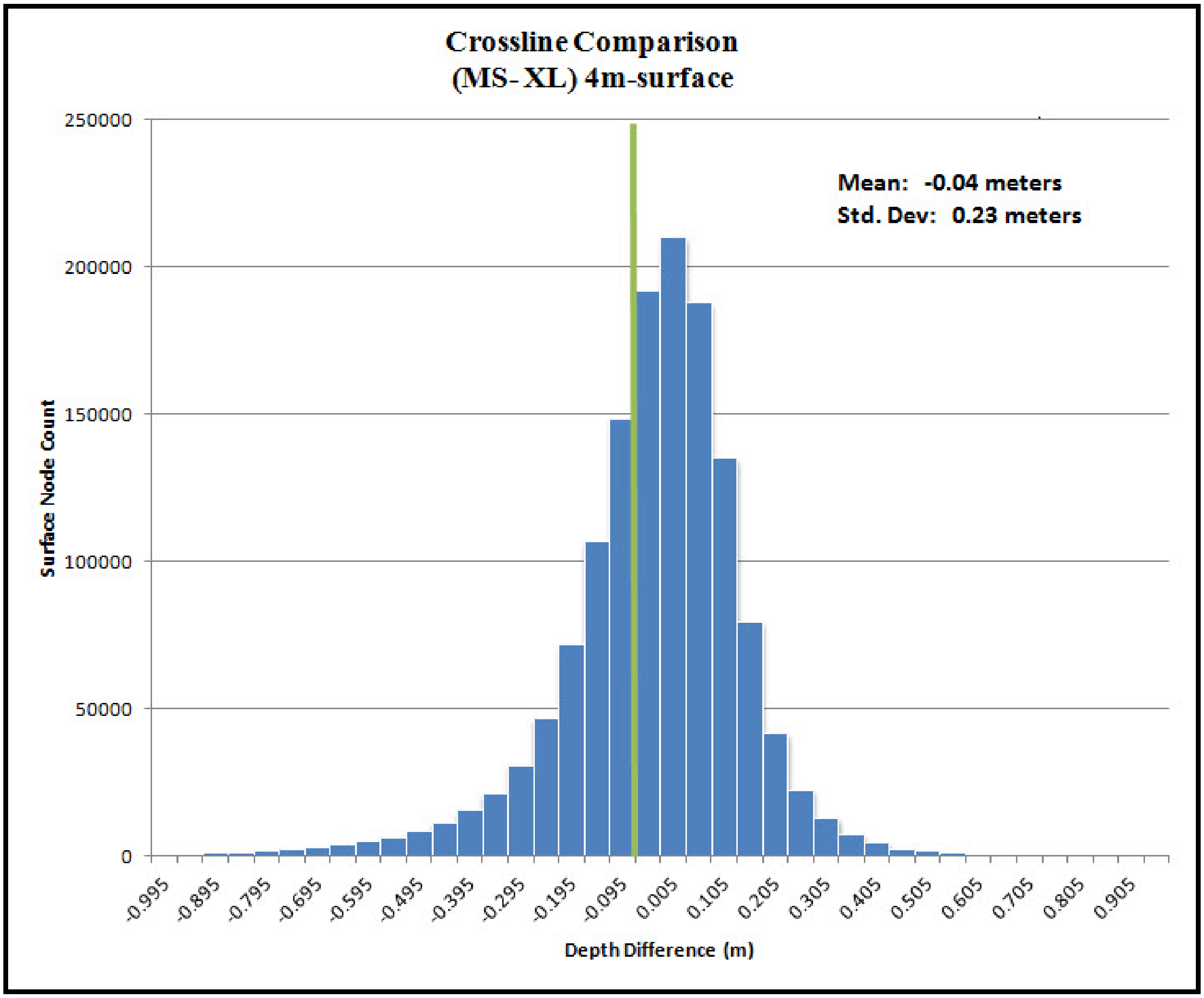


Figure 10: Mainscheme to crossline difference surface statistics.

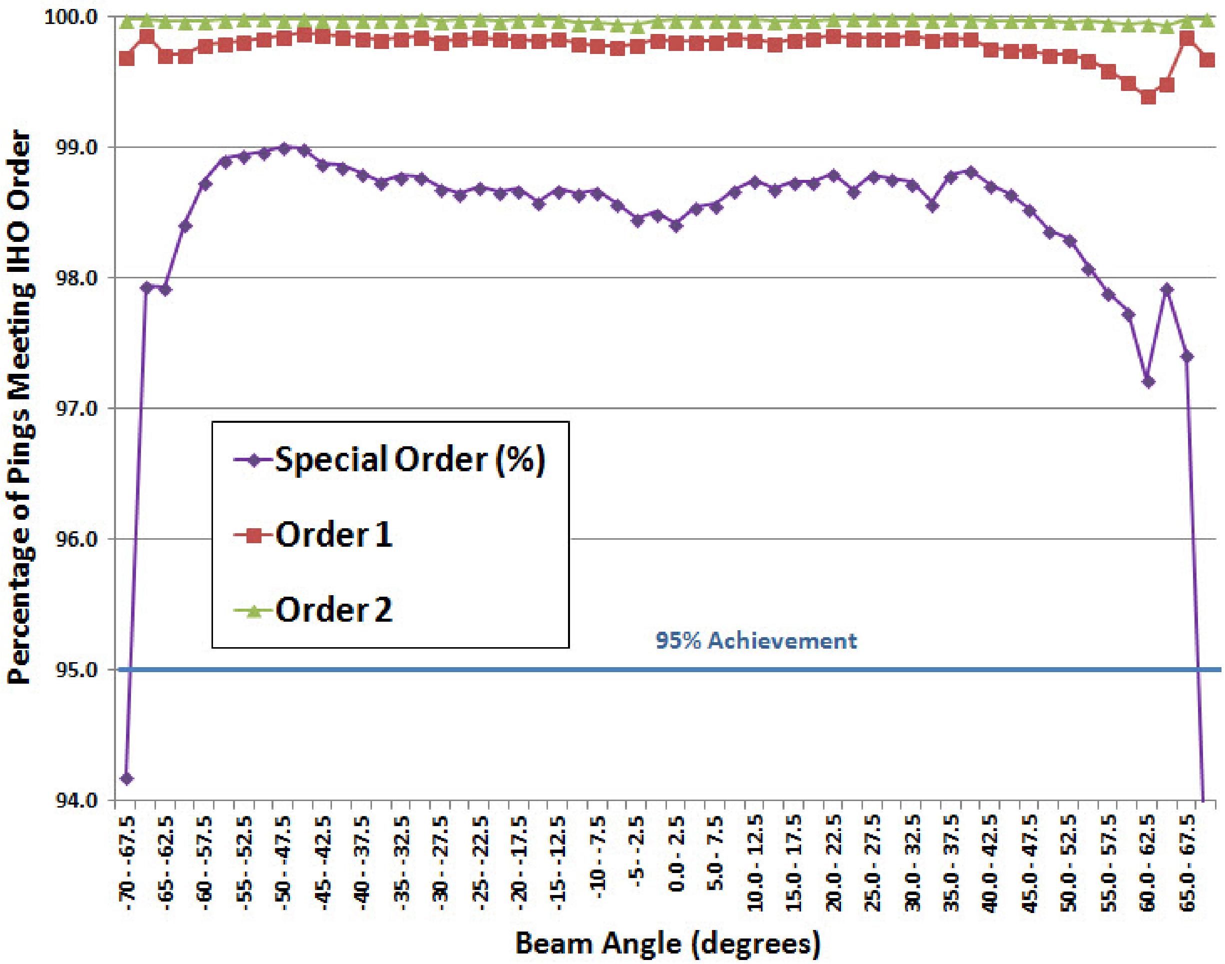


Figure 11: CARIS QC Report comparing crossline soundings to depth estimates.

B.2.2 Uncertainty

Hull ID	Measured - CTD	Measured - MVP	Surface
S221		1 meters/second	0.05 meters/second
2801	3 meters/second		0.15 meters/second
2802	3 meters/second		0.15 meters/second
2803	3 meters/second		0.15 meters/second
2804	3 meters/second		0.15 meters/second

Table 6: Survey Specific Sound Speed TPU Values

Total Propagated Uncertainty values for survey H12496 were derived from a combination of fixed values for equipment and vessel characteristics, as well as field assigned values for sound speed uncertainties. Tidal uncertainties were provided by NOAA's Center for Operational Oceanographic Products and Services (CO-OPS), and were applied to depth soundings using a Tidal Constituent and Residual Interpolation (TCARI) grid. TCARI automatically calculates the uncertainty associated with water level interpolation, which is then written into the CARIS HDCS (Figure 12). For this reason, no tidal uncertainty values were entered into the Tide Value section of the CARIS Compute TPU function.

Uncertainty values of submitted finalized grids were calculated in CARIS using the "Greater of the Two" of uncertainty and standard deviation (scaled to 95%). To visualize the locations in which accuracy requirements were met for each finalized surface, a custom "IHOness" layer was created, based on the difference between calculated uncertainty of the nodes and the allowable IHO uncertainty (Figures 13 and 14). To quantify the extent to which accuracy requirements were met, the preceding "IHOness" layers were queried within CARIS and then examined in Excel (Figures 15). Overall, 100.0% of survey H12496 met the accuracy requirements stated in the HSSDM.

For further uncertainty analysis, refer to Section B.2.1 - Crosslines (Figure 11)

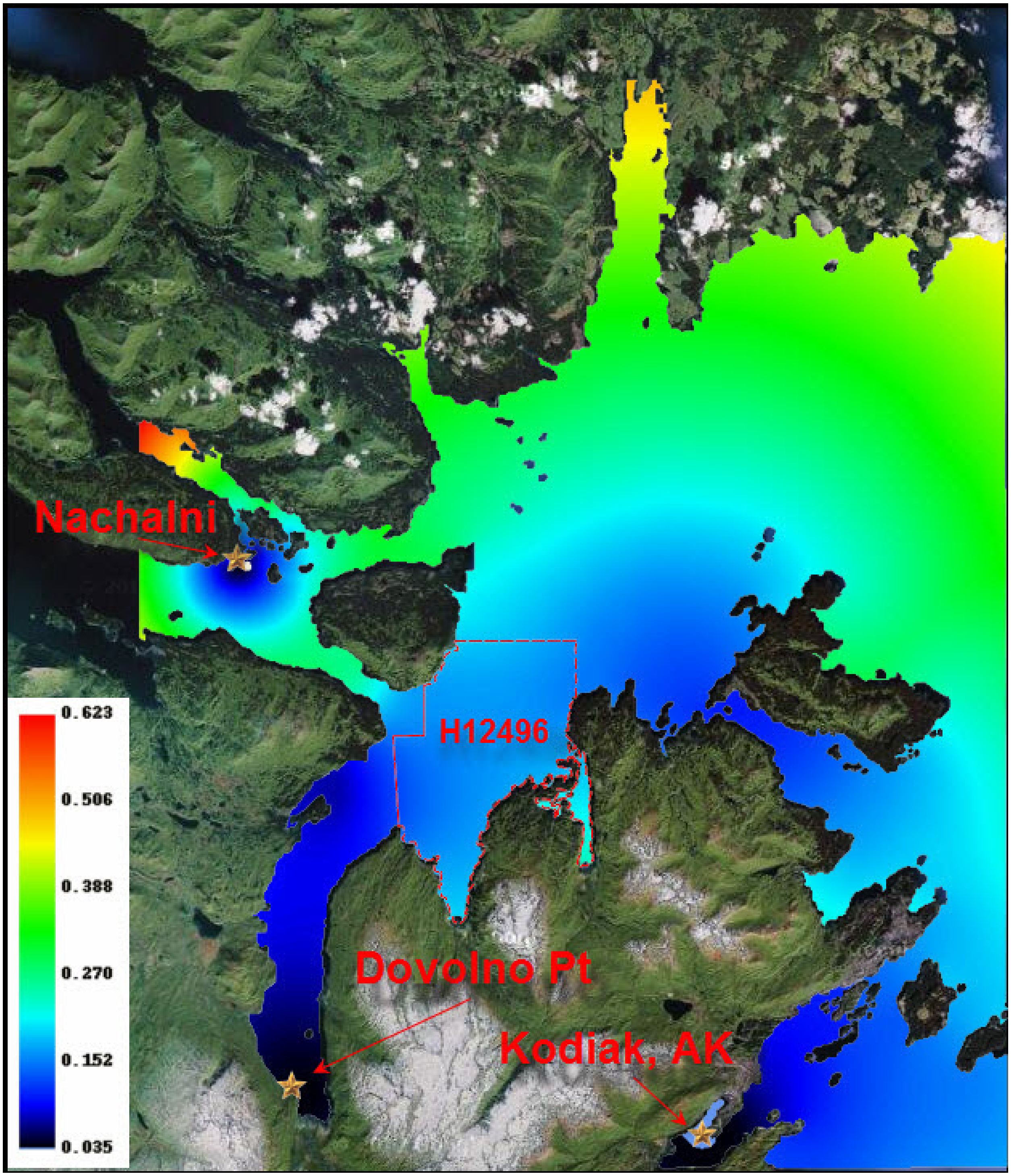


Figure 12: TCARI uncertainty (2-sigma) and locations of the three tide gauges used for the TCARI grid (Kodiak, Nachalni, and Dovolno).

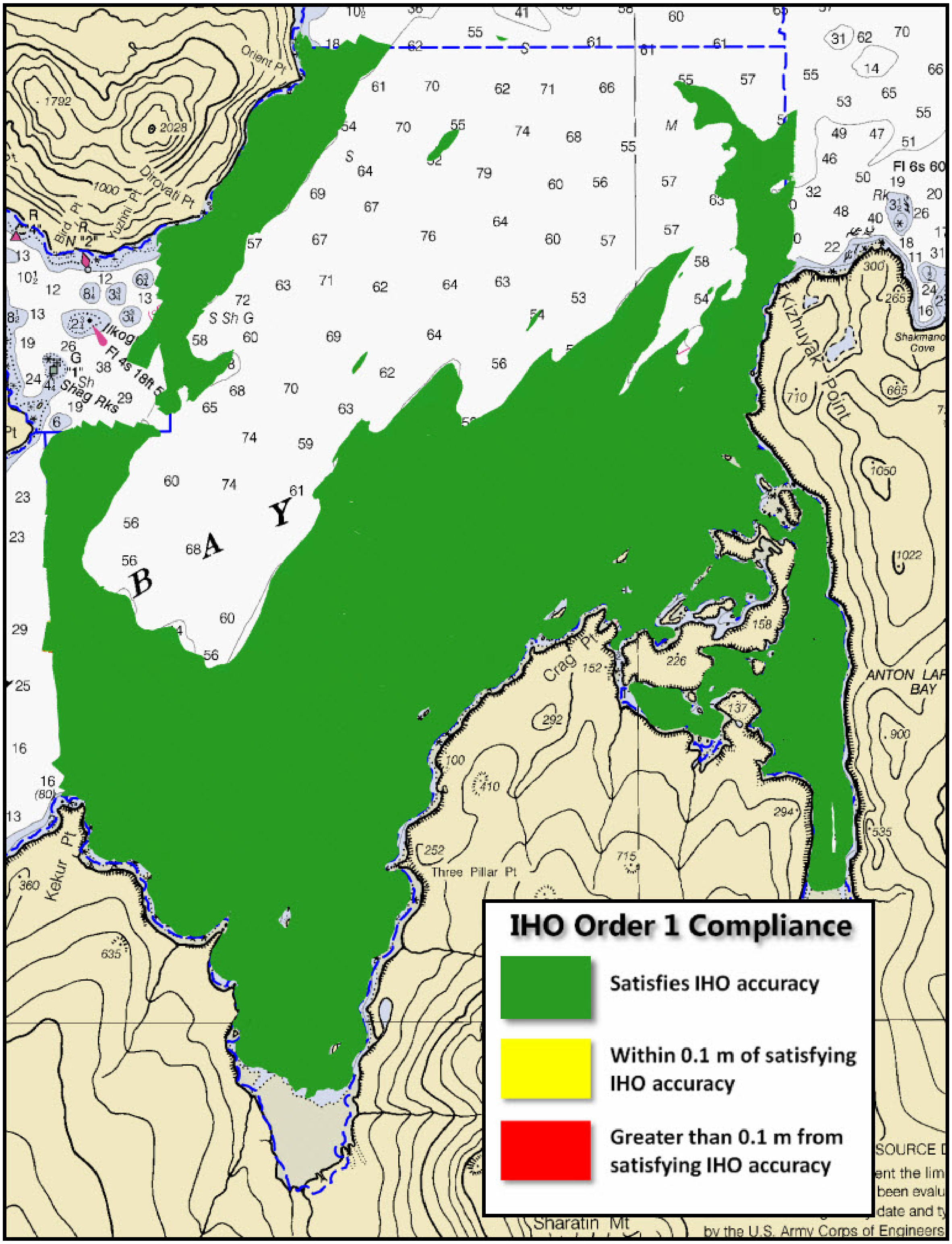


Figure 13: H12496 met the threshold IHO Order 1 standards for accuracy for depths 0 to 100-meters.

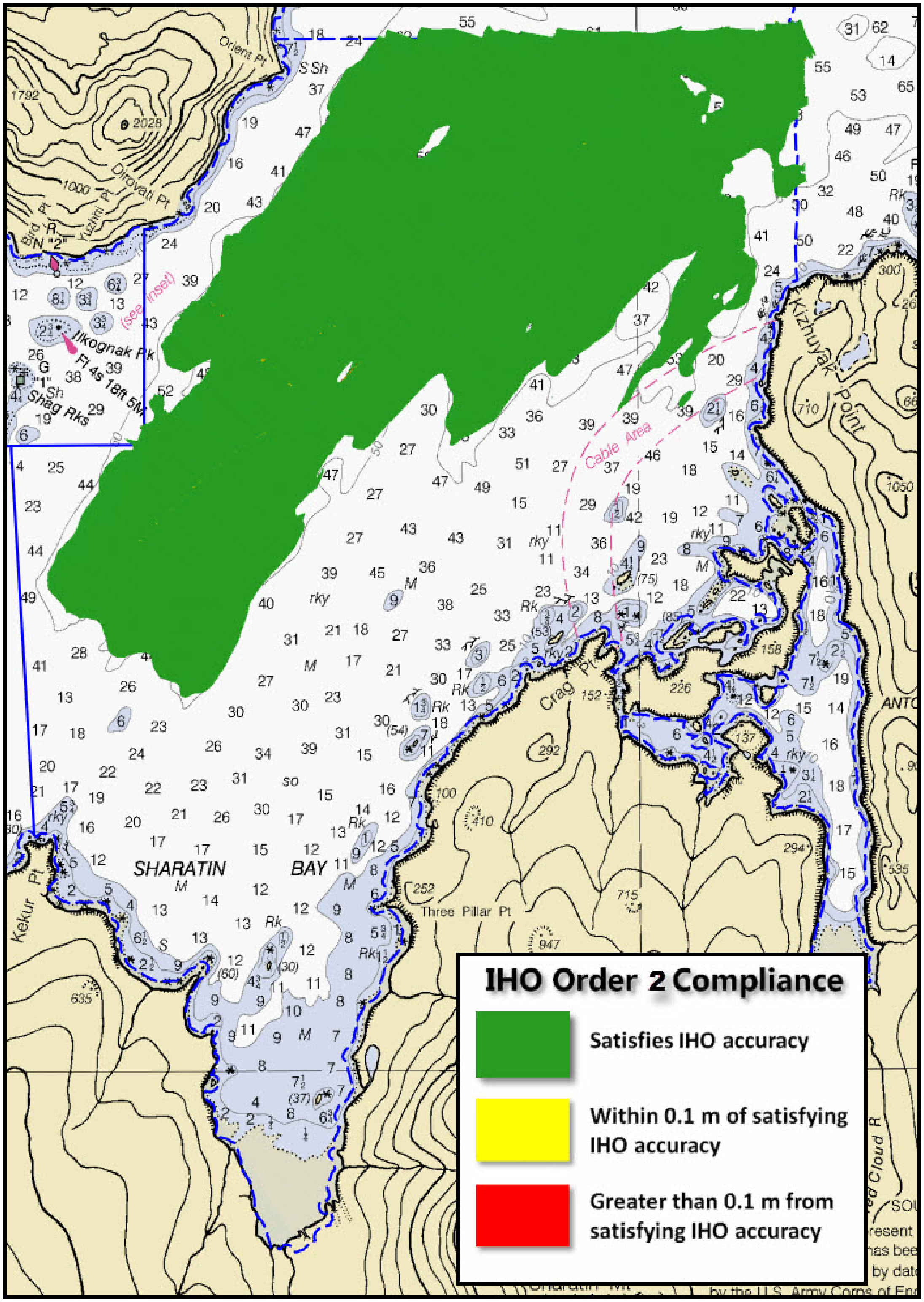


Figure 14: H12496 met the threshold IHO Order 2 standards for accuracy for depths 100-meters and greater.

Resolution (m)	Depth range (m)	IHO Order	Number of nodes	Nodes satisfying IHO accuracy	Percent nodes satisfying IHO accuracy
1m	0 - 20m	Order 1	9,899,856	9,899,452	100.0%
2m	18 - 40m	Order 1	3,706,196	3,706,196	100.0%
4m	36 - 80	Order 1a	1,210,976	1,210,871	100.0%
8m	72 - 160	Order 1a	239,948	239,921	100.0%
8m	100 - 160	Order 2	513,206	513,043	100.0%
		TOTAL:	15,570,182	15,569,483	100.0%
		TOTAL (by area):	59,456,928	59,453,116	100.0%

Figure 15: Summary table showing the percentage of nodes satisfying the indicated IHO accuracy level, sub divided by the appropriate depth ranges.

B.2.3 Junctions

Three junction comparisons were completed for H12496 (Figure 16). One junctioning survey (H12317) was a NOAA Ship FAIRWEATHER survey from 2011 and two surveys (H12495 and H12512) were acquired concurrently with this survey. Depth comparisons were performed using difference surfaces and sounding comparison in CARIS Subset Editor. All surfaces were differenced such that positive differences correspond to deeper depths in H12496. Histograms of the surface differences are included, showing mean and standard deviation.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12317	1:10000	2011	NOAA Ship FAIRWEATHER	NE
H12495	1:40000	2012	NOAA Ship RAINIER	N
H12512	1:40000	2012	NOAA Ship RAINIER	S

Table 7: Junctioning Surveys

H12317

The junction overlap with H12317 was 20 to 200 meters in length along the northeastern border of H12496. A combined 8-meter surface from H12317 was compared to a combined 8-meter surface from H12496 (Figure 17). Larger differences were observed in areas of high relief. A difference surface analysis showed H12496 to be on average 0.13 meters shoaler than H12317 with a standard deviation of 1.15 meters (Figure 19).

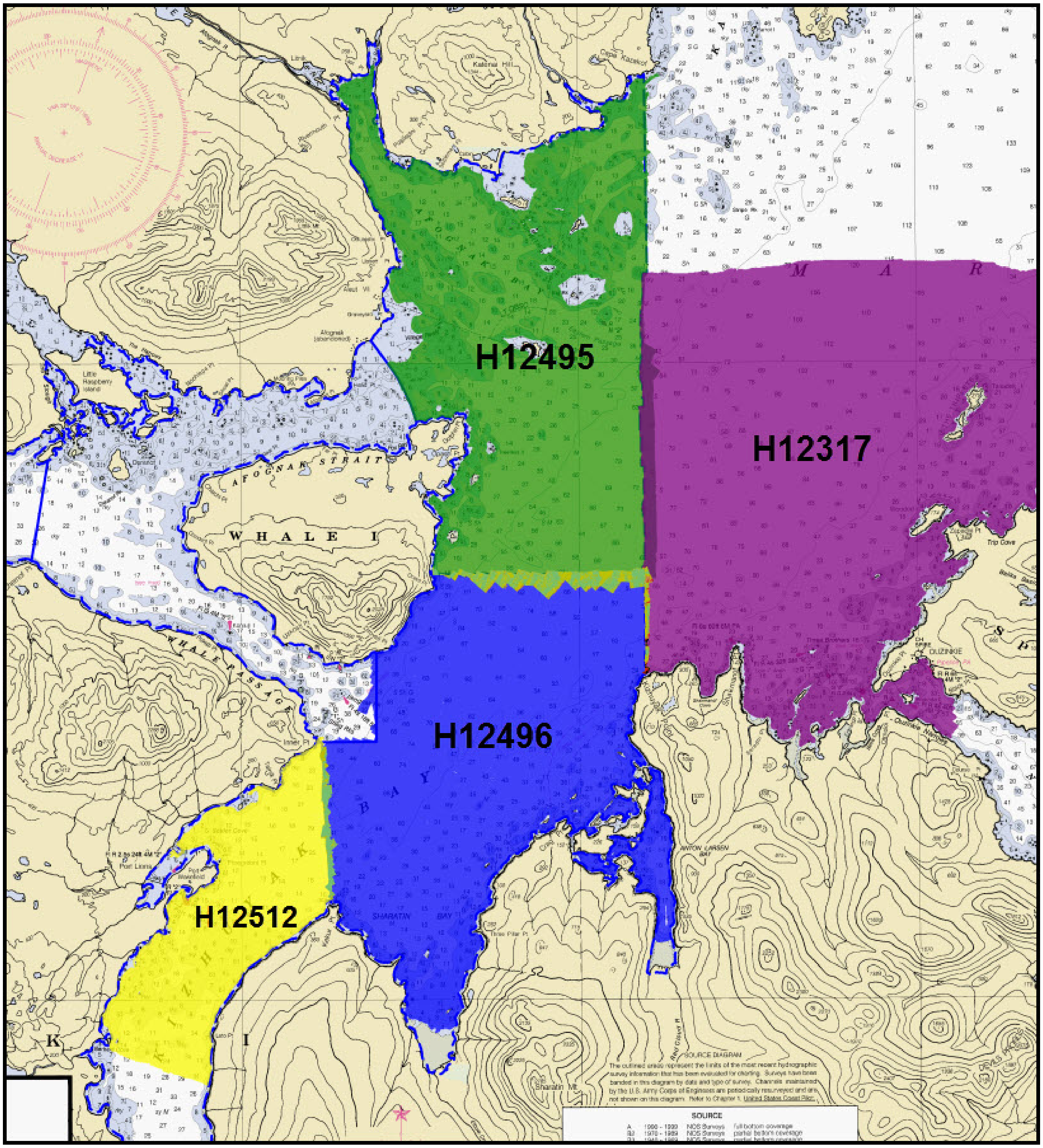


Figure 16: H12496 junctions overview.

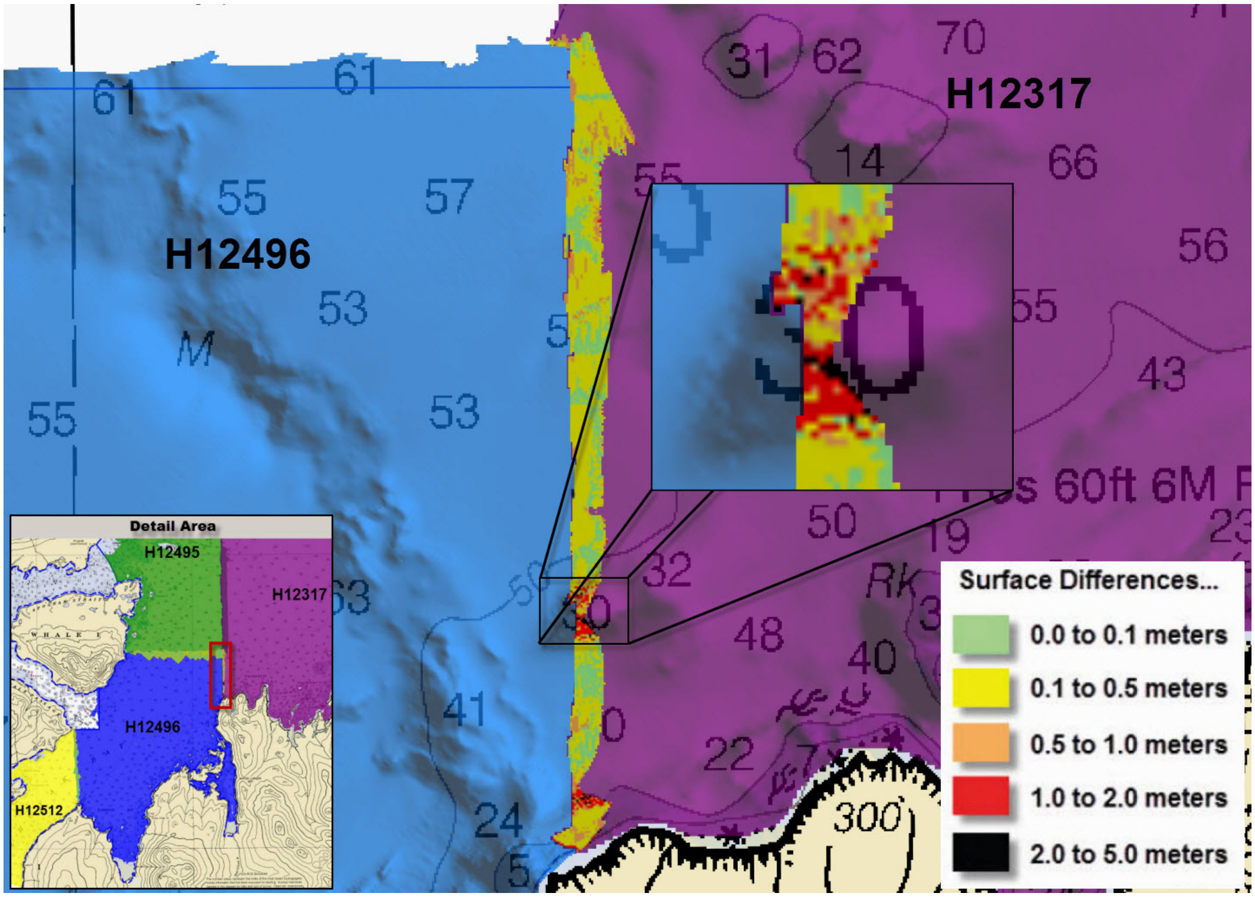


Figure 17: Junction between H12496 (blue) and H12317 (purple) on Chart 16594.

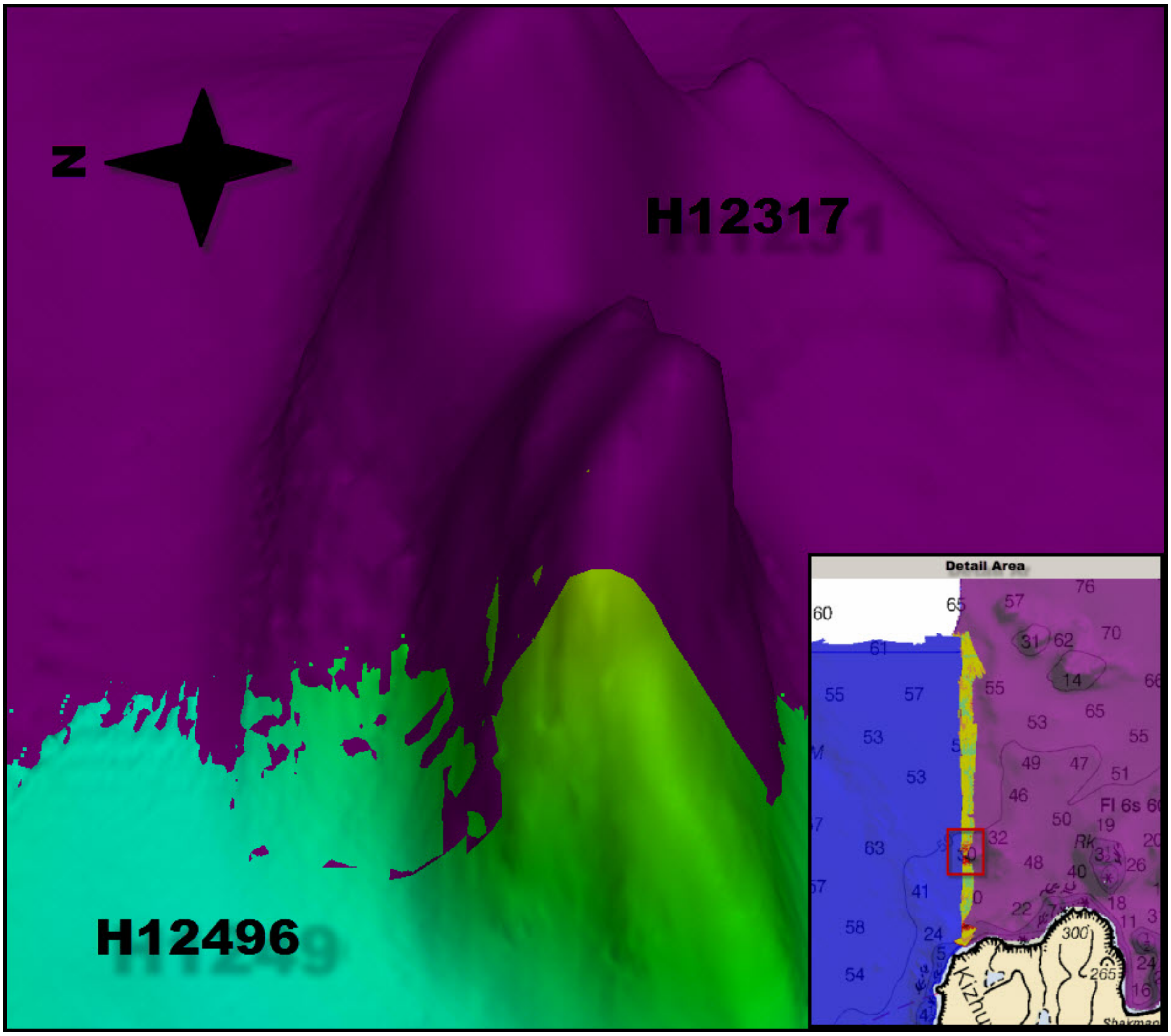


Figure 18: 3 Dimensional view of area with the highest difference, exaggerated by a factor of 10.

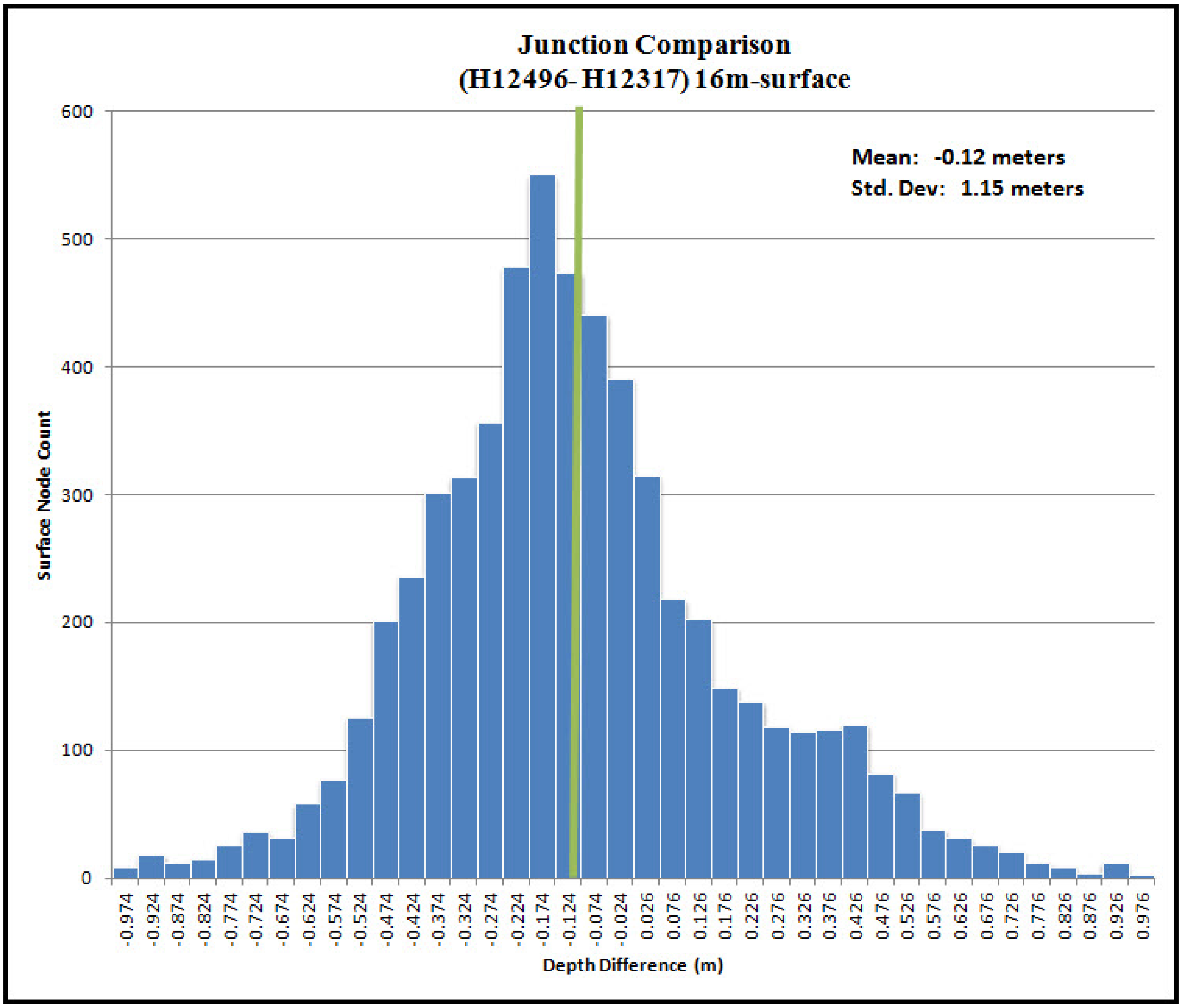


Figure 19: Difference surface statistics between H12496 and H12317 CUBE depth layers (8m combined surfaces). H12496 is on average 0.13 meters shoaler.

<u>H12495</u>

The junction overlap with H12495 was 50 to 750 meters wide along the northern border of H12496 (Figure 20). A difference surface analysis showed H12496 to be on average 0.06 meters shoaler than H12495 with a standard deviation of 0.18 meters (Figure 21).

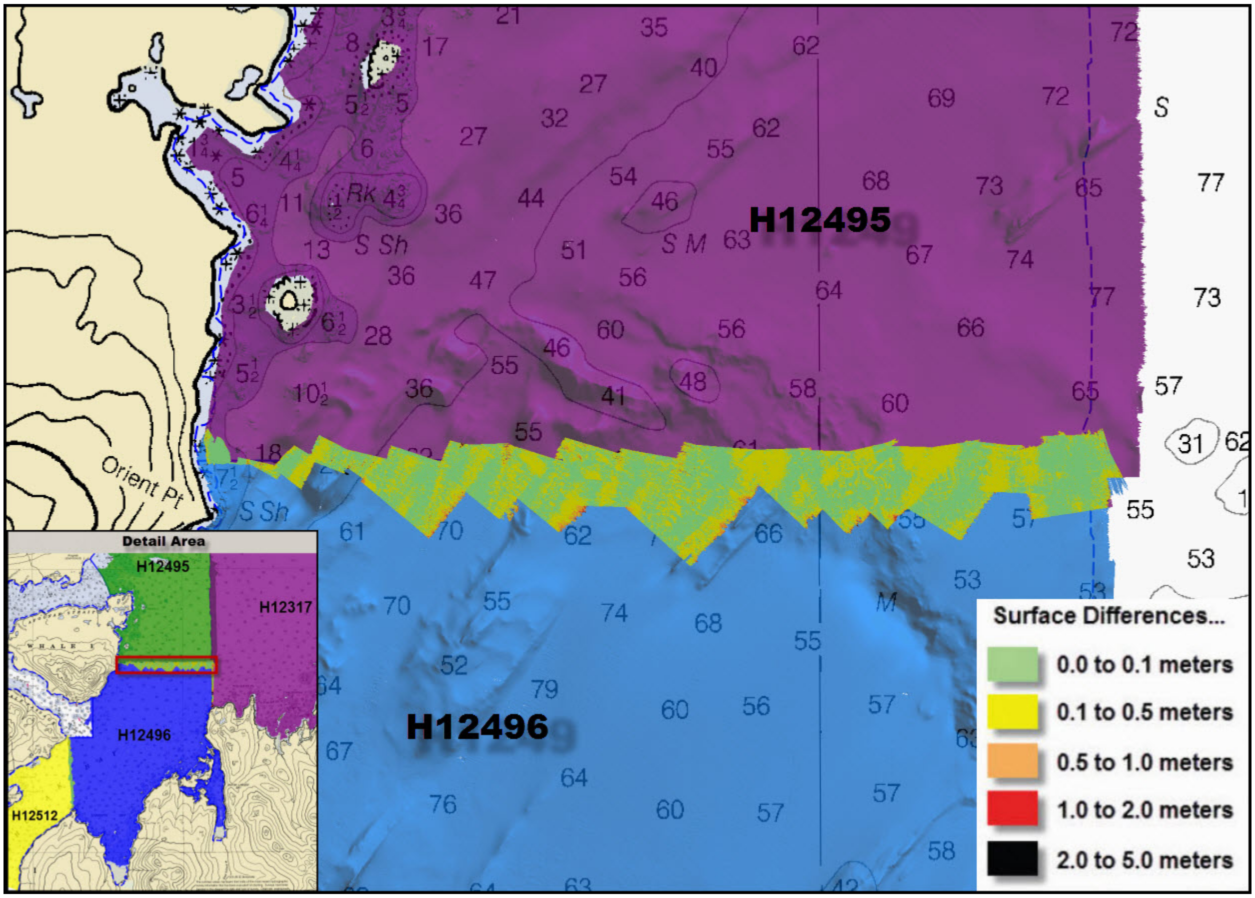


Figure 20: Junction between H12496 (blue) and H12495 (purple) in meters on Chart 16594.

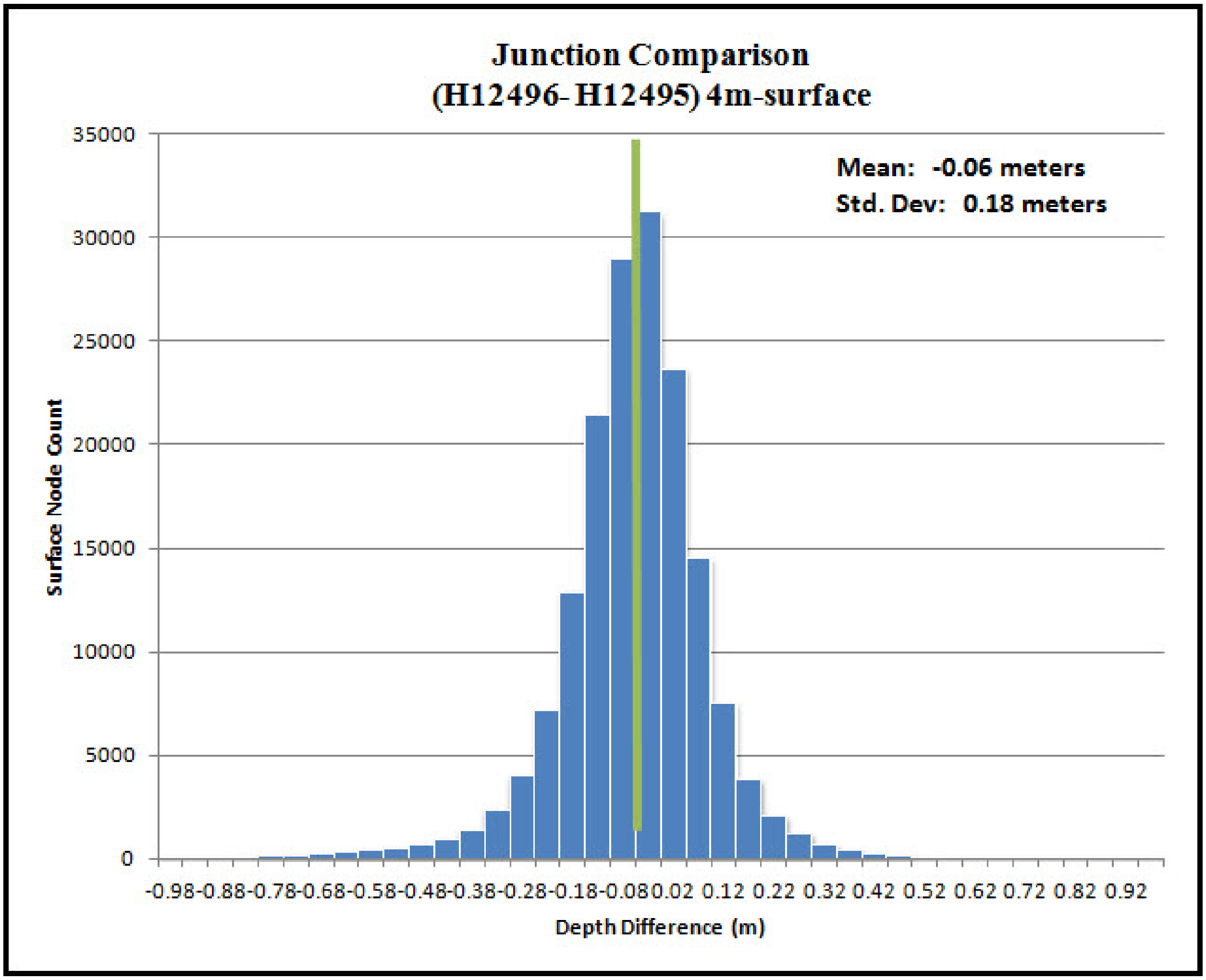


Figure 21: Difference surface statistics between junction of H12496 and H12495 4-meter surfaces. H12496 is on average 0.06 meters shoaler

<u>H12512</u>

The junction overlap with H12512 was 50 to 300 meters wide along the western border of H12496 (Figure 22). A difference surface analysis showed H12496 to be on average 0.01 meters shoaler than H12512 with a standard deviation of 0.15 meters (Figure 23).

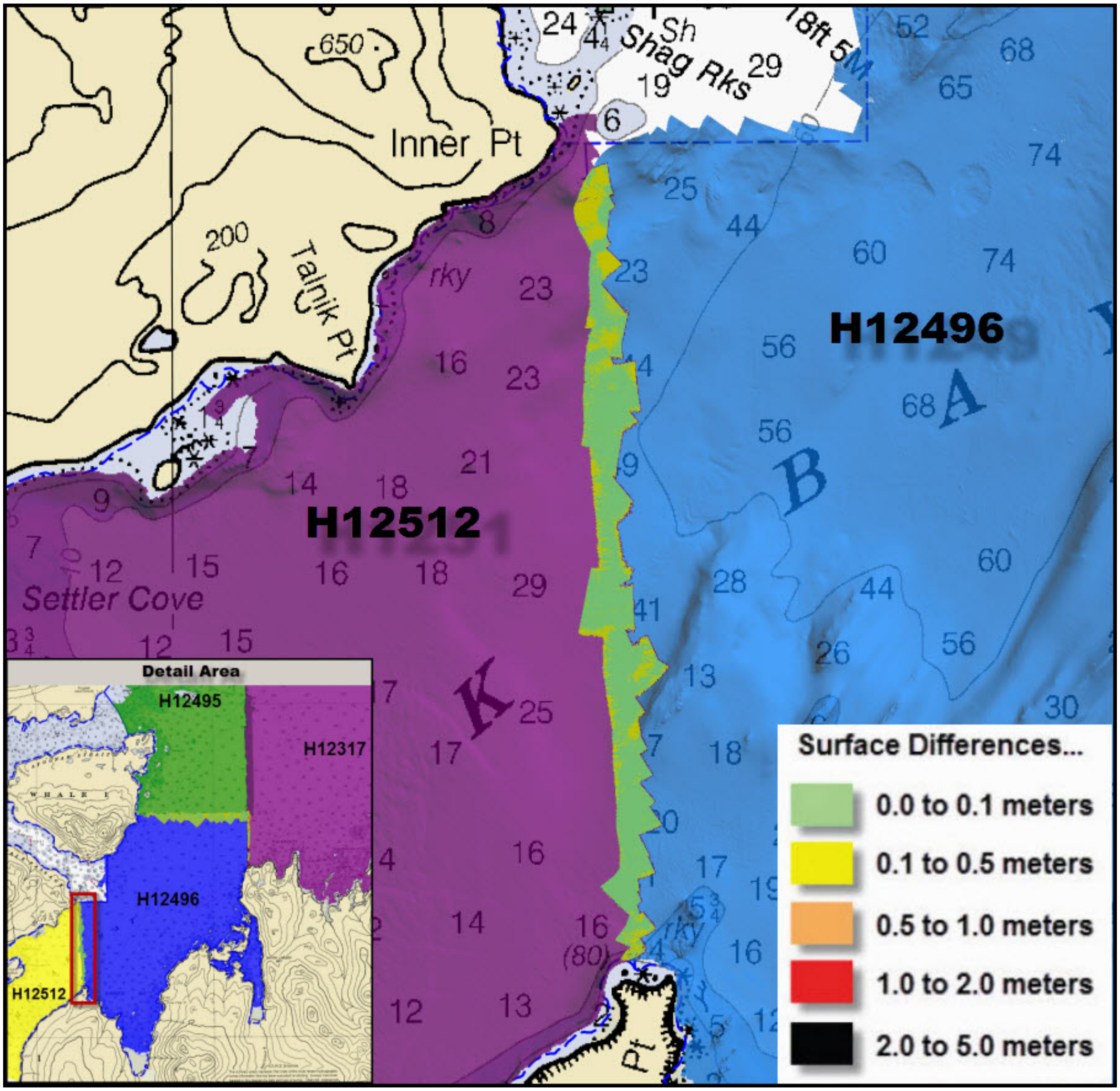


Figure 22: Junction between H12496 (blue) and H12512 (purple) in meters on Chart 16594.

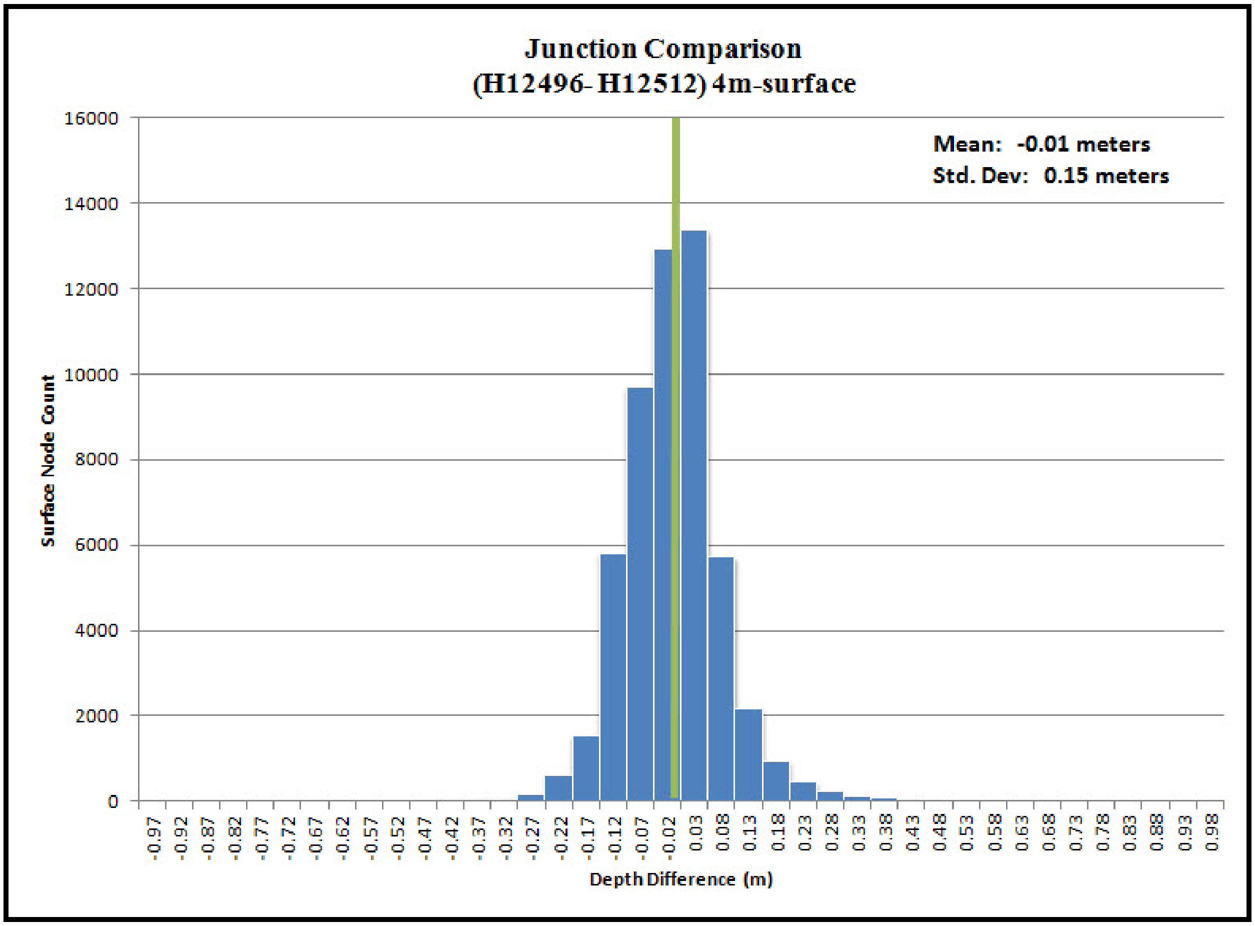


Figure 23: Difference surface statistics between junction of H12496 and H12512 4-meter surfaces. H12496 is on average 0.01 meters shoaler.

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

Surface Sound Velocity

Surface sound velocity values were observed to vary temporally and spatially throughout the survey area, with the most extreme variations being near freshwater sources such as in lower Sharatin Bay and lower Anton Larsen Bay. Despite increasing the frequency at which CTD casts were conducted (in one instance up to twelve casts in a single day), the presence of a highly dynamic environment with respect to surface sound velocity (measuring changes approaching 50 meters/second) made it difficult to properly model the water column. This directly resulted in sound speed artifacts in the form of the outerbeams vacillating up and down (Figure 24 left). Figure 24 (right) shows the surface sound velocity values collected by the SV 71 and how the large range of values affected the gridded data.

Additional data was collected on the last day of acquisition (DN298) in lower Sharatin Bay in an effort to minimize the effect of highly refracted outer beams. Due to time constraints, additional data was not collected in lower Anton Larsen Bay. Heavily refracted data in this area where the outer beams were 0.50 meters below the suspected seafloor was rejected per guidance of the Hydrographic Surveys Division (see Supplemental Correspondence - Rejection of Refracted data.jpg), which resulted in a 600 by 50 meter holiday (Figure 25).

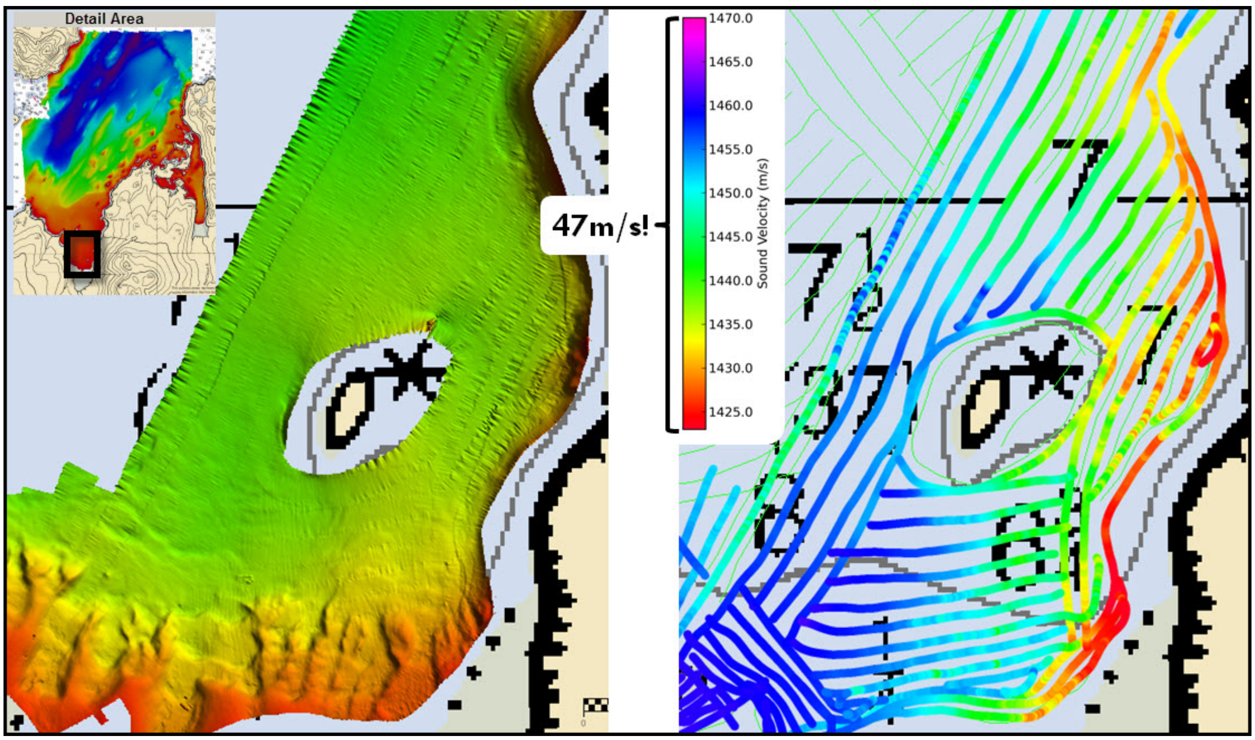


Figure 24: Overview of lower Sharatin Bay. Gridded bathymetry from DN294 (left). Grid of surface sound velocity from SV71 on DN294 (right).

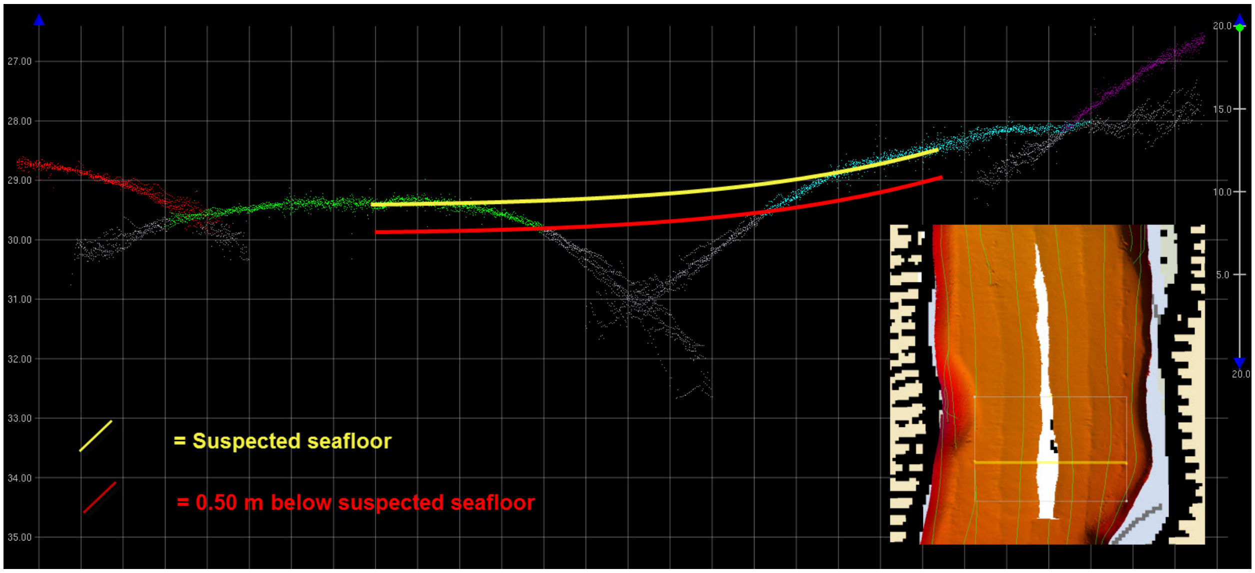


Figure 25: Subset of rejected data in Anton Larsen Bay.

Email correspondence is appended to this report. Despite the fact that the data was rejected in this area. (Figure 25) there are no signs to a hazard to navigation.

Ice Formation

On DN297 and DN298, ice formation caused by the presence of a fresh water lens and freezing temperatures was observed throughout Anton Larsen Bay. Ice was most thick in the morning, along the shore, and in the western arm of the bay but would mostly melt by the end of day. Thicknesses were observed to be roughly 20-40 centimeters. Noise introduced to the water column through the action of an aluminum hull breaking ice caused numerous data blow-outs. Data in these areas was heavily cleaned to eliminate fliers from grids (Figure 26). Efforts were made to break up the ice in areas of significant thickness before acquiring data. Additionally, the quality filter within the Reason SeaBat software was used to reject data that failed collinearity or brightness.

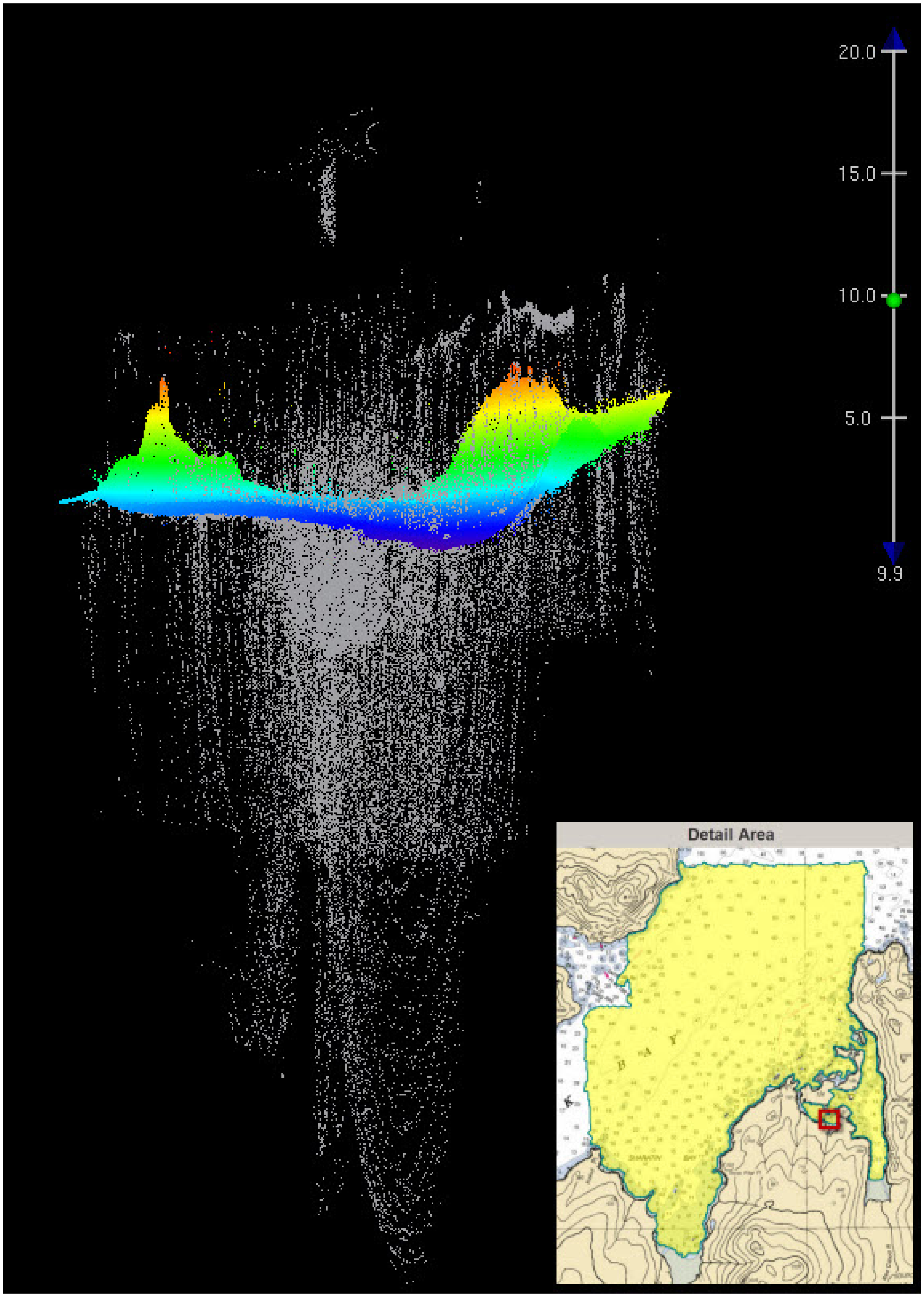


Figure 26: Subset of area in Anton Larsen Bay that was heavily cleaned.

Data is adequate and within specifications to supersede charted data in the common area.

Water Level-Induced Vertical Offsets

The tide stations used as a reference for reduction of soundings to Mean Lower Low Water (MLLW) for H12496 included a primary gauge (Kodiak Island, AK) and two subordinate gauges (Dovolno Point and Nachalni Island). Even with a tide gauge network, storms and localized currents caused variations that were difficult to model due to the complexity of the many bays present in the area. To quantify the water level errors, all lines from H12496 were referenced to ellipsoidal height based on WGS84 (ITRF00). A surface was created from the ellipsoidally-referenced lines, and differenced with the original tidal surface. This difference surface is shown in Figure 27, where differences are colored by their divergence from the mean.

Disregarding the inherent geoidal slope, the localized patterns show the effects of tides and currents. Water level effects can be seen between data collected on different days as well as over the course of a single day of acquisition. This is especially evident for the crosslines in Anton Larsen Bay, where a 20 centimeter vertical offset in data referenced to MLLW is eliminated when referenced to the ellipse (Figure 29).

Note: SBETs could not be applied for four survey lines and therefore could not be referenced to the ellipse. For this reason, the lines were excluded from the comparison resulting in gaps in the difference surface. See Section B.3.1 Corrections to Echo Soundings.

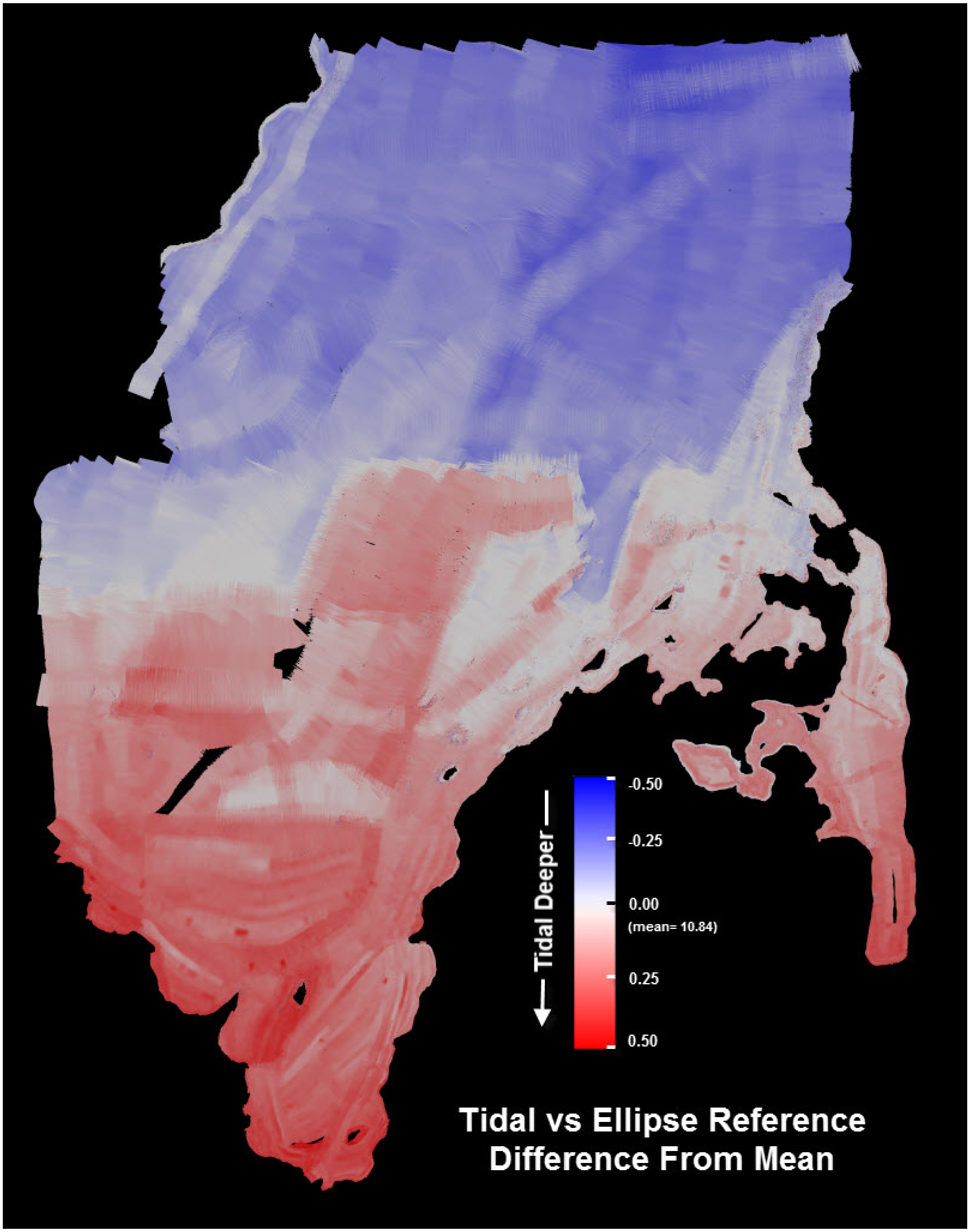


Figure 27: Comparison of tidally-referenced surface to ellipsoidally-referenced surface.

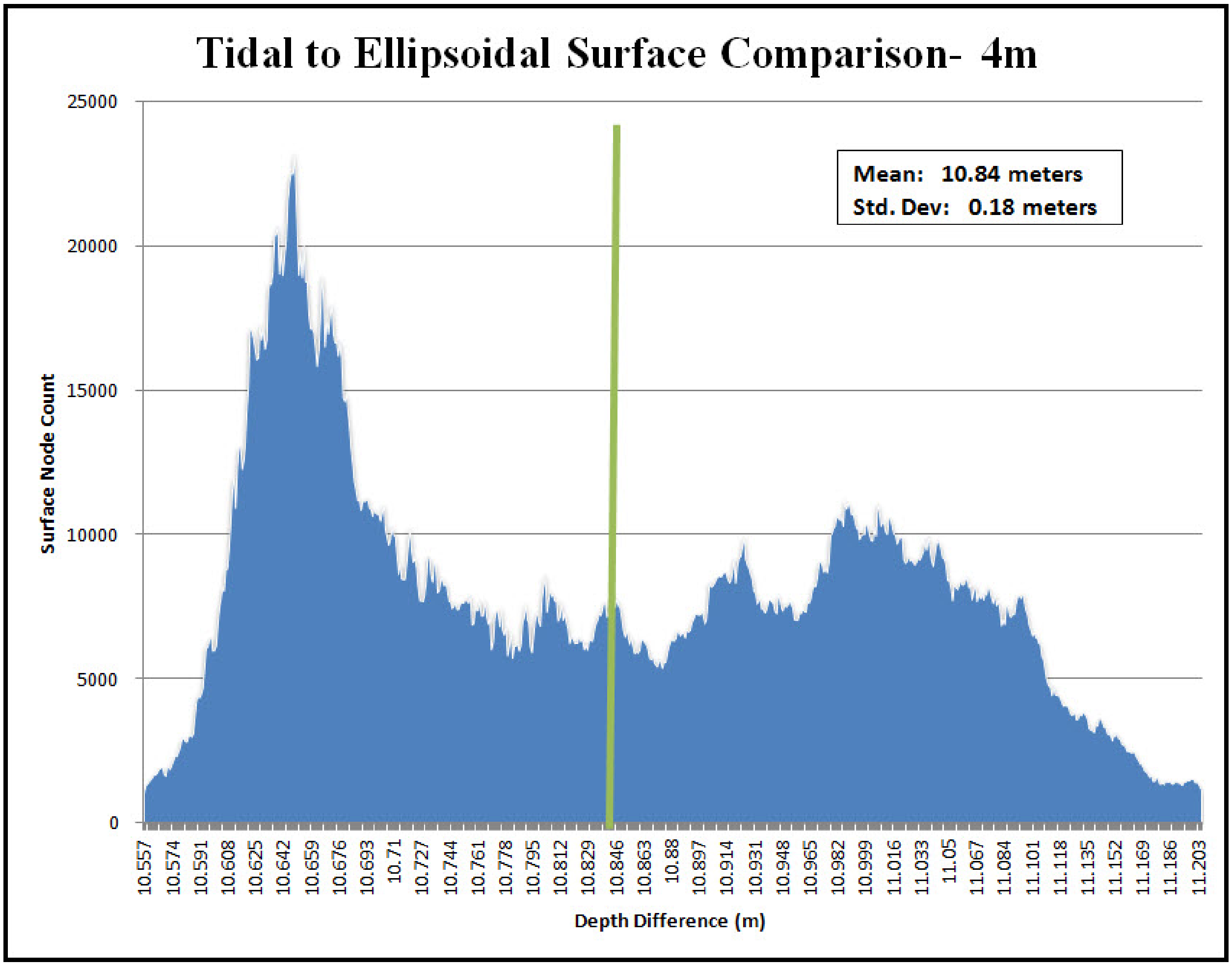


Figure 28: Histogram of comparison between tidal surface and ellipsoidal surface.

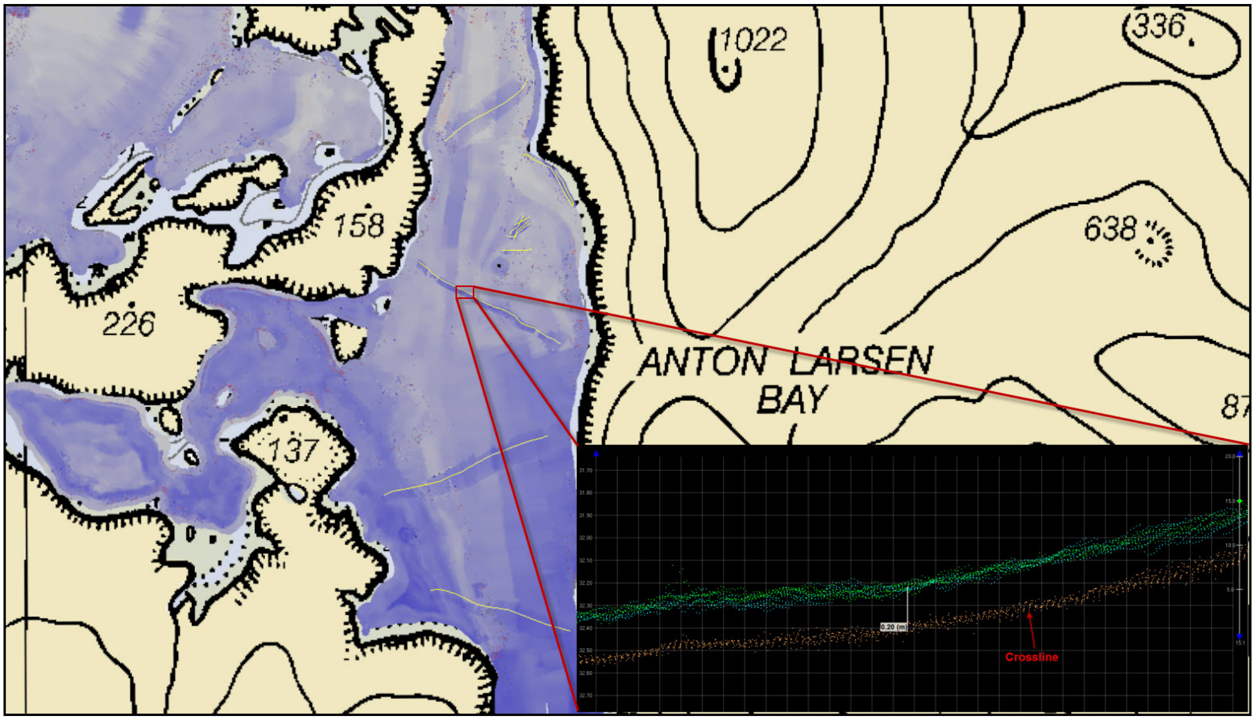


Figure 29: Crossline acquired by 2803 on DN298 that shows a tide artifact that caused a vertical offset in Anton Larsen Bay.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Sound speed profiles were acquired on all survey launches using the SBE-19 and SBE-19 Plus CTDs at discrete locations within the survey area approximately once every four hours, when surveying in a new area, or even more frequently when measured surface sound speed was observed to change due to fresh water inputs. Sound speed profiles were acquired on S221 (RAINIER) using the Rolls Royce MVP200 about every 15 minutes.Casts were concatenated into one file for each vessel and applied to all lines using the "Nearest in distance within time (4 hours)" selection method.

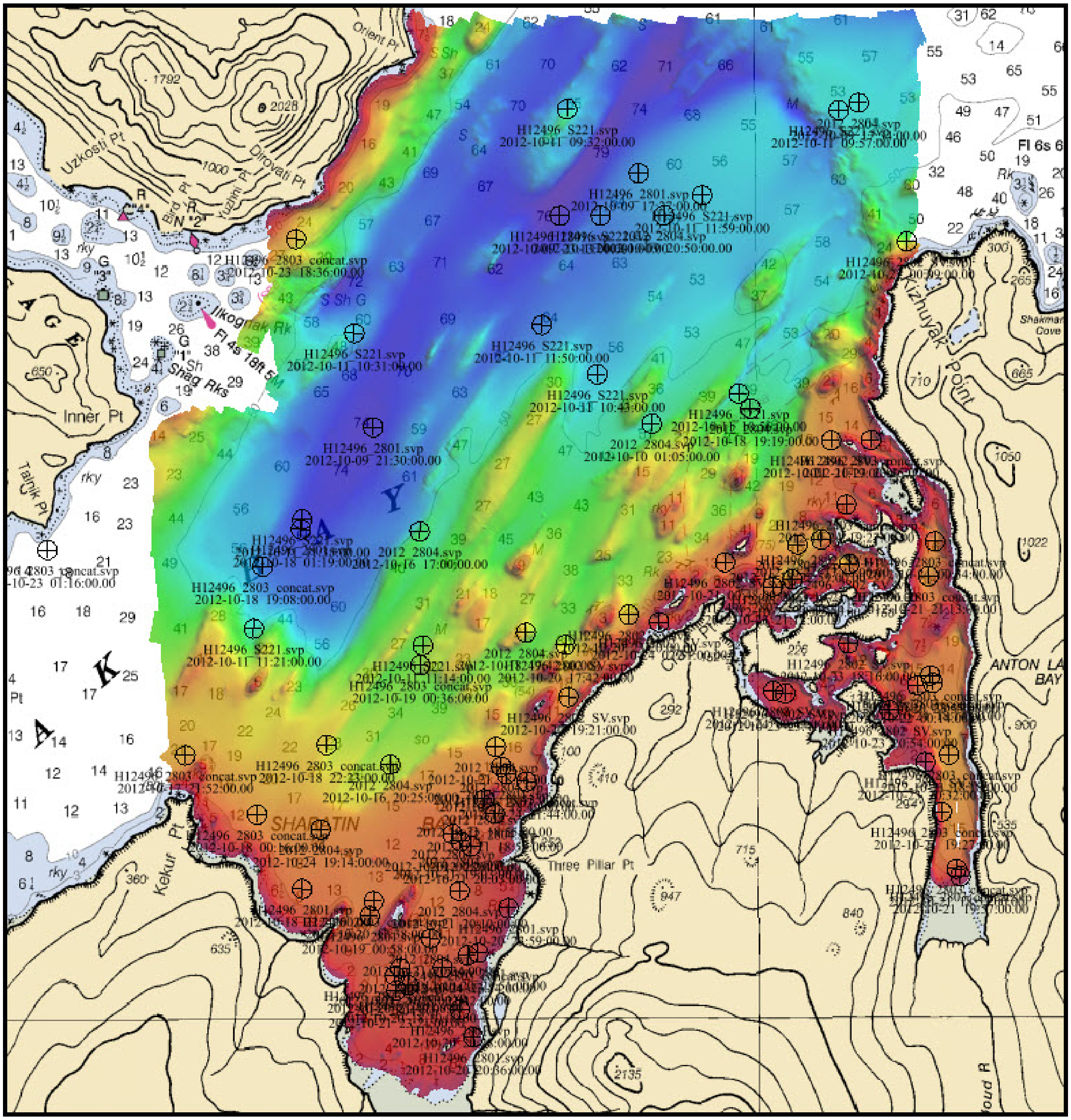


Figure 30: Locations of CTD casts. The western-most cast south of Talnik Pt that falls outside of survey limits was from survey H12512 but was utilized in the processing of H12496 (see Separates I- Logs).

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

Due to a logging failure, the TrueHeave file for line 2803_2012RA2981935 on DN298 was unavailable. Instead, only the heave logged in real-time was applied to the line. The affected data was examined in CARIS Subset Editor and no artifacts are present among overlapping lines.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Backscatter was logged as a 7k or .all file and submitted to NGDC. Backscatter is not included with the data submitted to the Branch.

B.5 Data Processing

B.5.1 Software Updates

There were no software configuration changes after the DAPR was submitted.

The following Feature Object Catalog was used: NOAA Catalogue Control Version 5.2 and NOAA Profile Product Version 2.0.

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
H12496_1m	CUBE	1 meters	-2 meters - 142 meters	NOAA_1m	Complete MBES
H12496_2m	CUBE	2 meters	-2 meters - 142 meters	NOAA_2m	Complete MBES
H12496_4m	CUBE	4 meters	-2 meters - 142 meters	NOAA_4m	Complete MBES
H12496_8m	CUBE	8 meters	-2 meters -	NOAA_8m	Complete MBES

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
			142 meters		
H12496_1m_-2to20_Final	CUBE	1 meters	-2 meters - 20 meters	NOAA_1m	Complete MBES
H12496_2m_18to40_Final	CUBE	2 meters	18 meters - 40 meters	NOAA_2m	Complete MBES
H12496_4m_36to80_Final	CUBE	4 meters	36 meters - 80 meters	NOAA_4m	Complete MBES
H12496_8m_72to160_Final	CUBE	8 meters	72 meters - 160 meters	NOAA_8m	Complete MBES
H12496_8m_Combined	CUBE	8 meters	-2 meters - 142 meters	NOAA_8m	Complete MBES

Table 8: Submitted Surfaces

Multibeam data above 0 meters referenced to MLLW was retained in all surfaces per guidance from Pacific Hydrographic Branch (see Supplemental Correspondence- Negative_Depths.jpeg).

Email correspondence is appended to this report.

C. Vertical and Horizontal Control

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

C.1 Vertical Control

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

Standard Vertical Control Methods Used:

TCARI

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

Station Name	Station ID
Kodiak Island	945-7292

Table 9: NWLON Tide Stations

The following subordinate water level stations were established for this survey:

Station Name	Station ID
Nachalini Island	945-7407
Vicinity of Dovolno Point	945-7393

Table 10: Subordinate Tide Stations

File Name	Status
9457292.tid	Final Approved
9457393.tid	Final Approved
9457407.tid	Final Approved

Table 11: Water Level Files (.tid)

File Name	Status
P136RA2012_Final.tc	Final

Table 12: Tide Correctors (.zdf or .tc)

A request for final approved tides was sent to N/OPS1 on 10/25/2012. The final tide note was received on 01/13/2013.

Tide note is appended to this report.

C.2 Horizontal Control

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

The projection used for this project is UTM 5N.

The following PPK methods were used for horizontal control:

Smart Base

Applanix POSPac software was used to produce a Smoothed Best Estimate of Trajectory (SBET) file. The SBET file consists of GPS position and attitude data corrected and integrated with inertial measurements and reference station correctors, exported into NAD83. The SBET was created using the Applanix proprietary "SmartBase" algorithm, which generates a Virtual Reference Station (VRS) on site from a network of established reference stations surrounding the project area, generally the Continually Operating Reference Station (CORS) network. For further details on the CORS network, refer to the accompanying HVCR. These SBET navigation and attitude files were applied to all lines in CARIS and superseded initial positioning and attitude data; with the exception of S221, in which only the positioning data was post-processed (real-time attitude was retained).

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
AkhiokCorpAK2005	AC02
CAPDOUGLASAK2007	AC08
Ushagat_IsAK2008	AC18
OldHarbor_AK2006	AC34
QUARTZ_CRKAK2005	AC38
SHUYAKISSPAK2006	AC39
PILLARMTN_AK2006	AC67
KODIAK 5	KOD5
KODIAK 6	KOD6

Table 13: CORS Base Stations

The following user installed stations were used for horizontal control:

HVCR Site ID	Base Station ID
Whale Island	NA

Table 14: User Installed Base Stations

The following DGPS Stations were used for horizontal control:

DGPS Stations
Kodiak, AK (313 kHz)

Table 15: USCG DGPS Stations

C.3 Additional Horizontal or Vertical Control Issues

3.3.1 SBET Navigation/Attitude Files

SBETs were not applied to the following lines: 2803 DN292 lines 2803_2012RA2922122 and 2803_2012_RA2922105, 2803 DN298 line 2803_2012RA2981935, and 2804 DN295 line 2804_2012RA2960013. This was due to satellite dropout during corresponding times of acquisition. Navigation files were trimmed in Applanix POSPac software causing data gaps in SBETs corresponding with times of acquisition. The affected data was examined in CARIS Subset Editor and no artifacts are present among overlapping lines.

3.3.2 SBET RMS Files

A 'script execution failed' error was received when SBET RMS files were loaded and therefore were not applied to the following lines: 2803 DN291 line 2803_2012RA2912359, 2803 DN292 line 2803_2012RA2922122, 2803 DN295 line 2803_2012RA2960000, 2803 DN 296 lines 2803_2012RA2970205 and 2803_2012RA2970219, and 2804 DN295 line 2804_2012RA2960013.

D. Results and Recommendations

D.1 Chart Comparison

D.1.1 Raster Charts

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

Chart	Scale	Edition	Edition Date	LNM Date	NM Date
16594	1:78900	13	04/1998	11/27/2012	12/01/2012

Table 16: Largest Scale Raster Charts

<u>16594</u>

A comparison was performed between survey H12496 and Chart 16594 (1:78,900) using a CARIS sounding and contour layer, CARIS Tool Tip, and CARIS Subset Editor. Figure 31 shows generally where areas have shoaled or deepened by at least 2 fathoms. Soundings were created from MBES data in locations of charted soundings. Comparisons that were two fathoms shoaler or deeper were noted. Soundings that had shoaled or deepened were generalized into areas.

The charted (16594) 10-fathom contour was compared to a green H12496 contour where soundings were shown to be in close agreement with the chart (Figures 32 and 33). A charted 3-fathom contour was compared with data from H12496; the actual 3-fathom contour is located at the junction between the gray and red depth ranges shown in Figures 32 and 33.

Two locations where found to have shoaled to less than ten fathoms in areas outside of the charted 10-fathom contour (Figure 34). Both areas will require a new charted 10-fathom contour. Two sounding point features (SOUNDG) were created in the Final Feature File for reference.

It is recommended that H12496 data supersede all charted depths.

Description of specific feature investigations and shoreline data are included in the Final Feature File.

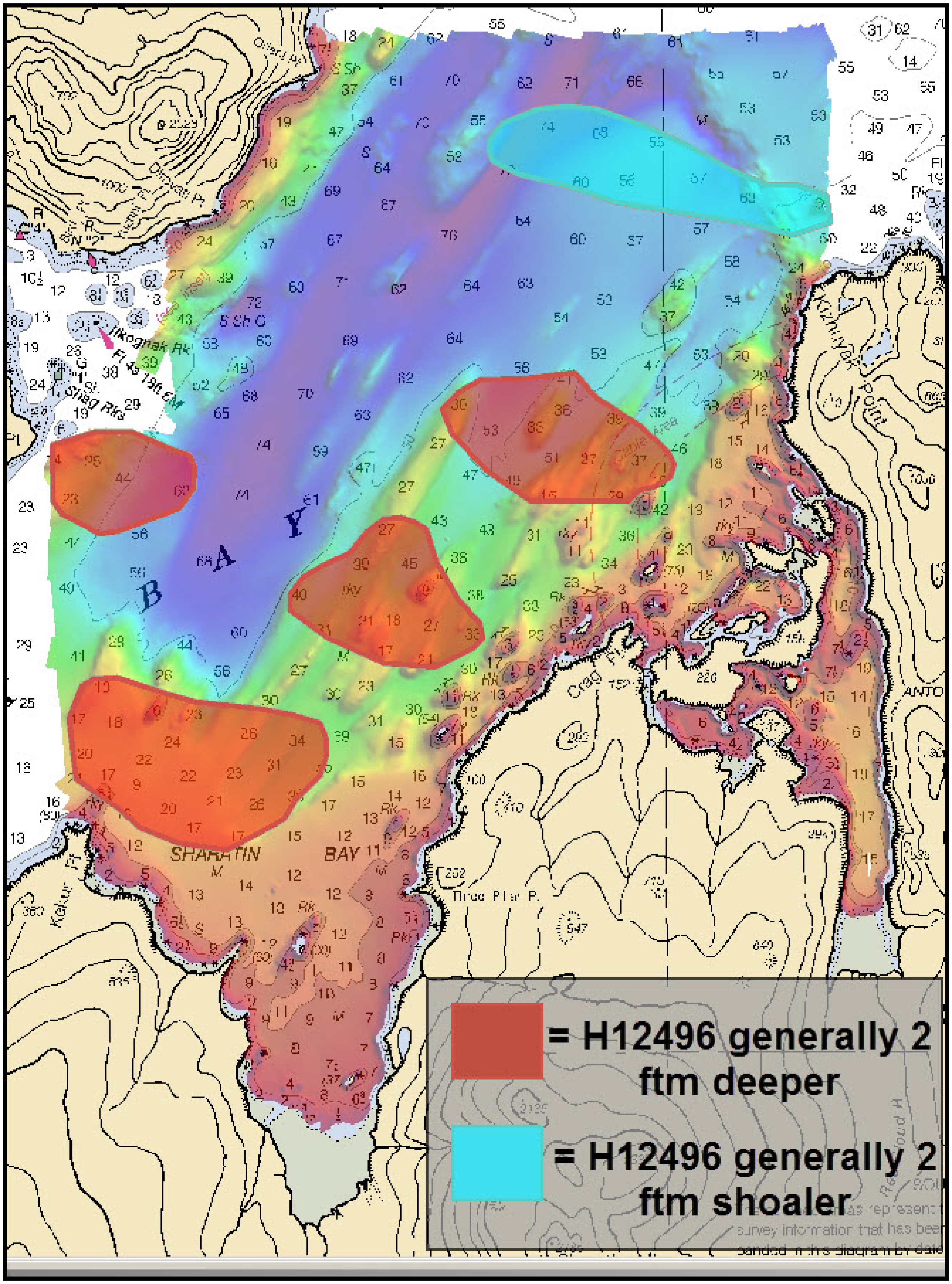


Figure 31: Chart comparison between survey H12496 and Chart 16594.

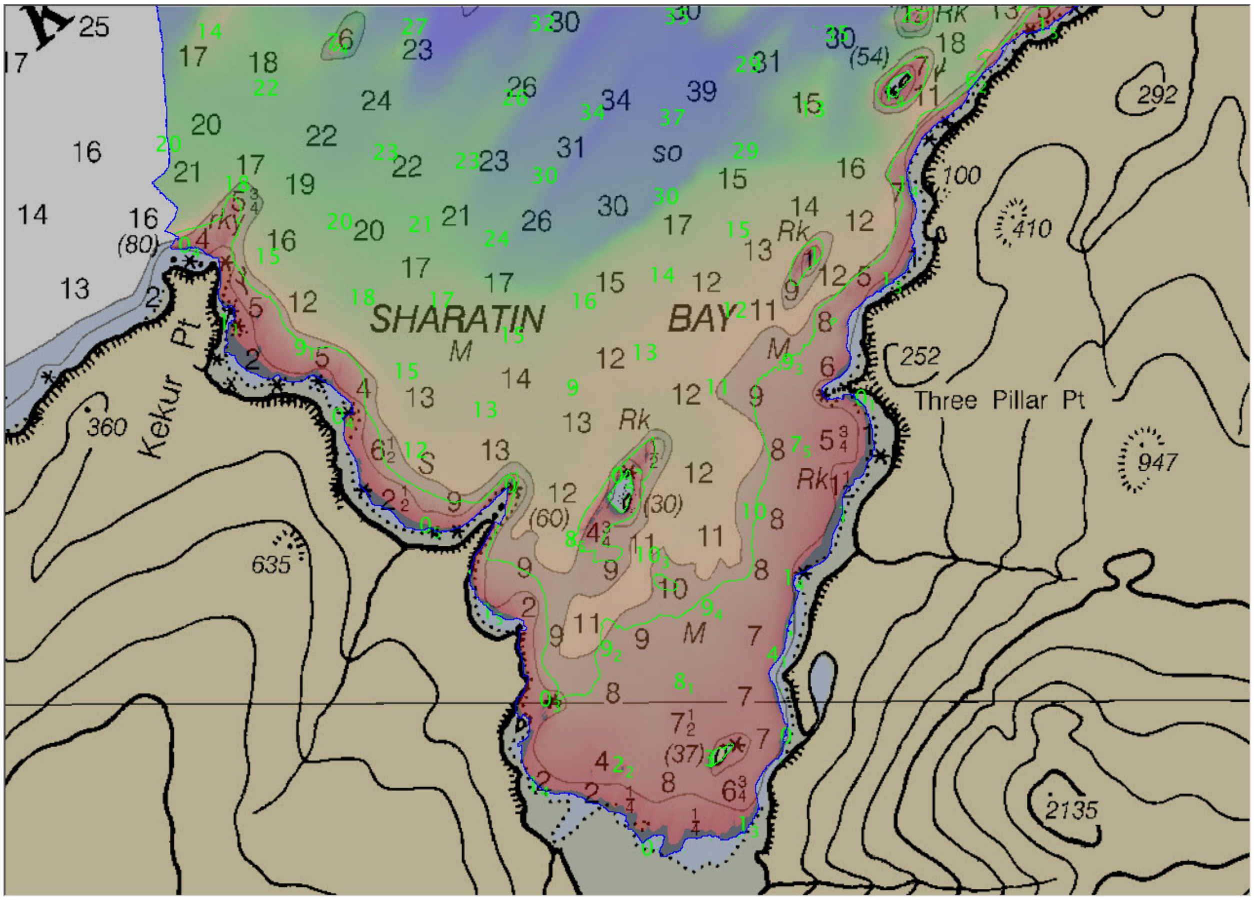


Figure 32: H12496 green sounding and contour layers over Chart 16594.

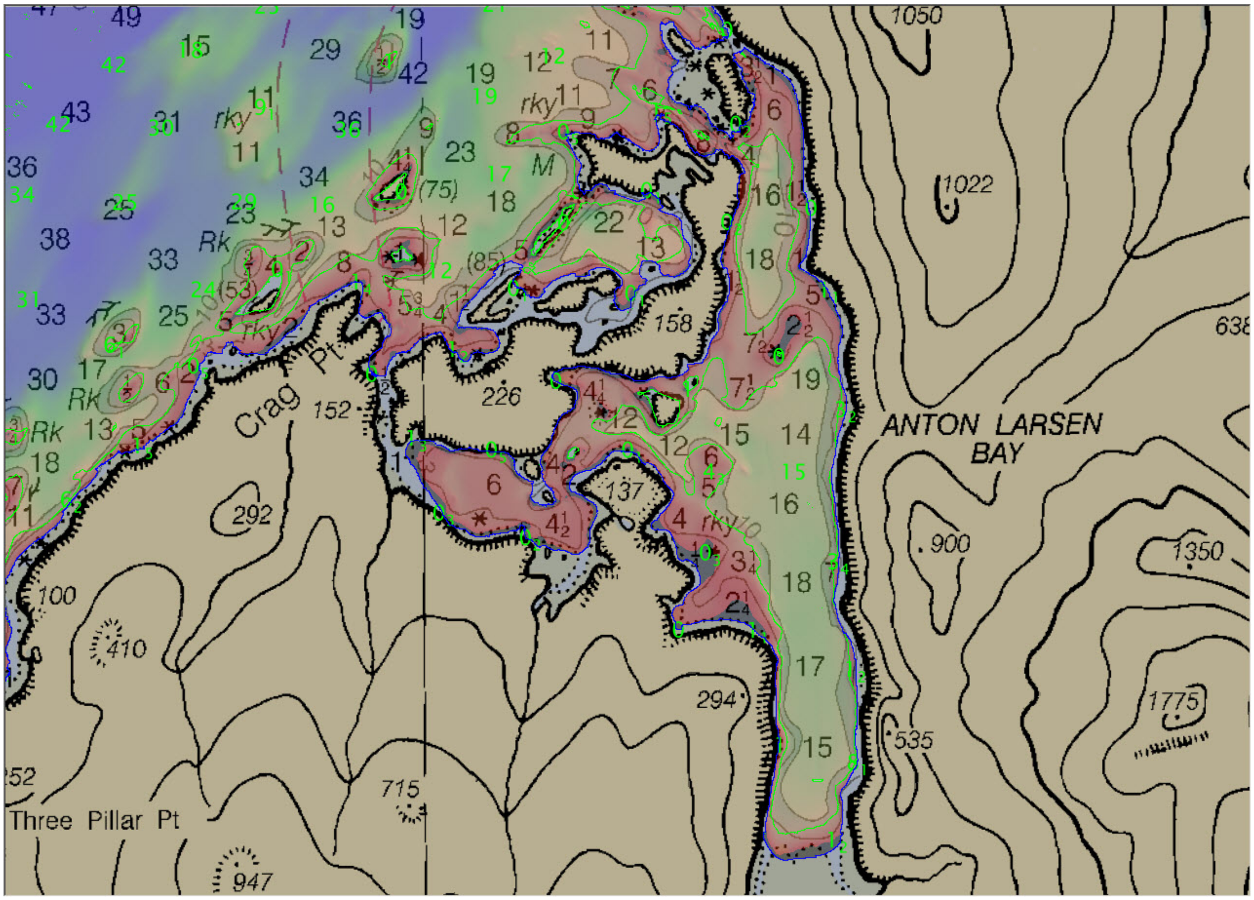


Figure 33: H12496 green sounding and contour layers over Chart 16594.

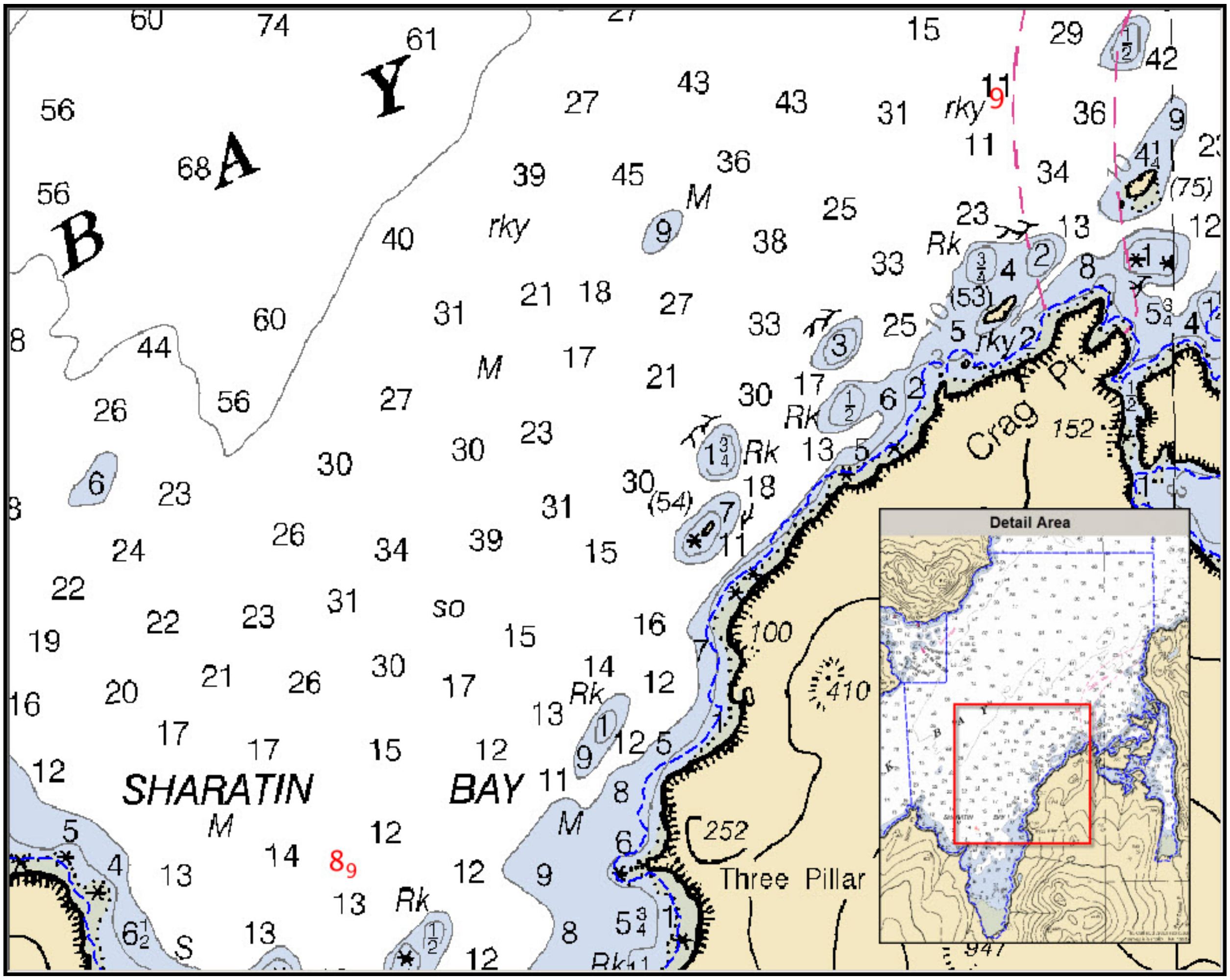


Figure 34: H12496 shoal soundings.

D.1.2 Electronic Navigational Charts

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

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US4AK5PE	1:78900	4	07/13/2011	07/13/2011	YES

Table 17: Largest Scale ENCs

<u>US4AK5PE</u>

ENC US4AK5PE coincides with raster 16594. The depths and contours on the ENC match the raster and the comparison between survey H12496 and the ENC is equivalent to the preceding comparison with Chart 16594.

D.1.3 AWOIS Items

No AWOIS items exist for this survey.

D.1.4 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.5 Charted Features

No charted features exist for this survey.

D.1.6 Uncharted Features

No uncharted features exist for this survey.

D.1.7 Dangers to Navigation

No Danger to Navigation Reports were submitted for this survey.

D.1.8 Shoal and Hazardous Features

All shoal and hazardous features were investigated in accordance with the Project Instructions and the HSSDM and are addressed in the Final Feature File.

D.1.9 Channels

No channels exist for this survey. There are no designated anchorages, precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas, or channel and range lines within the survey limits.

D.1.10 Bottom Samples

Five bottom characteristics were collected during this survey and They are included in the chart update product.

D.2 Additional Results

D.2.1 Shoreline

Shoreline was investigated in accordance with the Project Instructions and the HSSDM.

D.2.2 Prior Surveys

Prior survey comparisons exist for this survey, but were not investigated.

D.2.3 Aids to Navigation

Aids to navigation (ATONs) do not exist for this survey.

D.2.4 Overhead Features

Overhead features do not exist for this survey.

D.2.5 Submarine Features

Submarine features do not exist for this survey.

There is charted cable area from Crag Pt. to Kizhuyak Point. It has been recommended to be retained.

D.2.6 Ferry Routes and Terminals

The Homer-to-Port Lions Ferry crosses through the Southwestern corner of survey H12495 twice a week (Figure 55).

Figure 35: H12496 ferry routes.

D.2.7 Platforms

No platforms exist for this survey.

D.2.8 Significant Features

No significant features exist for this survey.

D.2.9 Construction and Dredging

There is no present or planned construction or dredging within the survey limits.

D.2.10 New Survey Recommendations

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

D.2.11 New Inset Recommendations

No new insets are recommended for this area.

E. Approval Sheet

As Chief of Party, Field operations for this hydrographic survey were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports.

All field sheets, this Descriptive Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys and Specifications Deliverables Manual, Field Procedures Manual, 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 Descriptive Report.

Approver Name	Approver Title	Approval Date	Signature
Richard T. Brennan, CDR/NOAA	Commanding Officer	12/04/2012	Richard T. Brennan 2013.05.13 12:26:02 -07'00'
Michael O. Gonsalves, LT/NOAA	Field Operations Officer	12/04/2012	Michael O. Gonsalves 2013.05.13 10:17:49 -08'00'
James B. Jacobson	Chief Survey Technician	12/04/2012	James Jacobson I have reviewed this document 2013.05.13 11:20:20 -08'00'
John R. Kidd, ENS/NOAA	Sheet Manager	12/04/2012	2013.05.13 11:36:55 -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	Continually Operating Reference Staiton
CTD	Conductivity Temperature Depth
CEF	Chart Evaluation File
CSF	Composite Source File
CST	Chief Survey Technician
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DGPS	Differential Global Positioning System
DP	Detached Position
DR	Descriptive Report
DTON	Danger to Navigation
ENC	Electronic Navigational Chart
ERS	Ellipsoidal Referenced Survey
ERZT	Ellipsoidally Referenced Zoned Tides
FFF	Final Feature File
FOO	Field Operations Officer
FPM	Field Procedures Manual
GAMS	GPS Azimuth Measurement Subsystem
GC	Geographic Cell
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSD	Hydrographic Surveys Division
HSSD	Hydrographic Survey Specifications and Deliverables

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

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

Fwd: Data Density -- Supplemental Correspondence

Inbox x

ops

to Starla, me, John, CDR, meghan.mcgovern, _OMAO

2:31 AM (4 hours ago)

Starla, Rita and John,

Please add the following email below to your supplemental correspondence folder with the name "8125 density". I would then ask that each of you add the following paragraph within Section A.3 - Survey Quality of your DRs:

"While the tilted 8125 did not always meet data density requirements, the Hydrographic Surveys Division acknowledges this data serves the purpose of providing general bathymetry (see Supplemental Correspondence - 8125 density). It is to be acknowledged that some small features may have been missed within these bands of sparse coverage, however the data was retained and is adequate to supersede the chart."

Please let me know if there are any questions.

~~ mog

> -------- Original Message --------
> **Subject:** Re: When to reject data?
> **Date:** Thu, 28 Feb 2013 10:16:28 -0500
> **From:** Jeffrey Ferguson - NOAA Federal <Jeffrey.Ferguson@noaa.gov>
> **To:** CDR Rick Brennan <CO.Rainier@noaa.gov>
> **CC:** Marc Moser <Marc.S.Moser@noaa.gov>, David Zezula <David.J.Zezula@noaa.gov>, Abigail Higgins <Abigail.Higgins@noaa.gov>, Olivia Hauser <Olivia.Hauser@noaa.gov>, Mike Brown - NOAA Federal <Mike.Brown@noaa.gov>
>
> The density issue, especially around the edges is easy. It should be retained, with the understanding that it is probably more then good enough for general bathymetry and contour generation, but some small rocks/features may have been missed. The DR should state this, the Branch should accept it and handle it appropriately. Even density issues in the middle, should be retained and discussed, but I don't see a big reason to put holes in the grid. The low density areas can still be used to generate contours, etc., as long as we are honest about the object detection, etc., for those areas.
>
> ...
>
> So, to summarize my thoughts, if that is possible at this point. No, we don't want to reject data just because it failed the density or uncertainty thresholds, although all such areas should be discussed in the DR and if the data is kept it should be explained why.
>
> ...
> My thoughts...
> Jeff
>
> *******************
>
> Jeffrey Ferguson
> NOAA, Office of Coast Survey
> Chief, Hydrographic Surveys Division
> office: 301-713-2700 x124
> cell: 240-753-4729

Re: Negative depths... Inbox x

ops
to Peter, Crescent, me, John, Starla, Rita, CO

7:51 AM (22 minutes ago)

Thanks for the advice Pete!
Sheet managers, please add the email below to your supplemental correspondence.

~~ mog

On 3/25/2013 7:51 AM, Peter Holmberg - NOAA Federal wrote:

> Mike,
>
> Please leave the negative depths in. Even though we don't chart negative soundings, its helpful to see the entire picture, or at least all data that was collected.
>
> Pete
>
> On Mon, Mar 25, 2013 at 7:42 AM, Crescent Moegling <crescent.moegling@noaa.gov> wrote:
>
> > I think I know the answer (leave them in) but I'll defer to you. Thanks!
> >
> > Crescent Moegling
> > Pacific Hydrographic Branch
> > O 206.526.6840
> > C 206.707.5409
> >
> > Begin forwarded message:
> >
> > **From:** ops <ops.rainier@noaa.gov>
> > **Date:** March 25, 2013, 7:29:12 AM PDT
> > **To:** crescent moegling <crescent.moegling@noaa.gov>
> > **Cc:** meghan.mcgovern@noaa.gov, David Zezula - NOAA Federal <David.J.Zezula@noaa.gov>, CO Rainier <CO.Rainier@noaa.gov>
> > **Subject: Negative depths...**
> >
> > Hey Crescent!
> >
> > What are your thoughts on negative depths? We have a couple surveys (one with Maritime Boundary Investigations and one without) in which we surveyed up to, and a little bit past, the zero-meter contour. How would you suggest should we handle these points in our processing pipeline?
> >
> > For our finalized surfaces, if we use the traditional depth thresholding (1m-resolution between 0m & 20m), then we'll chop out all these depths and exclude them from the final combined surface. Is this what we want?
> >
> > Presently I have our people shifting the finalization boundaries slightly (say, -2m to 20m), just to make sure the depths are pushed forward. From there PHB or MCD can elect to chop them at their will.
> >
> > What would you suggest?
> >
> > Cheers!
> >
> > ~~ mike.g.
> >
> > ...

-------- Original Message --------
Subject: Re: When to reject data?
Date: Thu, 28 Feb 2013 10:16:28 -0500
From: Jeffrey Ferguson - NOAA Federal <Jeffrey.Ferguson@noaa.gov>
To: CDR Rick Brennan <CO.Rainier@noaa.gov>
CC: Marc Moser <Marc.S.Moser@noaa.gov>, David Zezula <David.J.Zezula@noaa.gov>, Abigail Higgins <Abigail.Higgins@noaa.gov>, Olivia Hauser <Olivia.Hauser@noaa.gov>, Mike Brown - NOAA Federal <Mike.Brown@noaa.gov>

...

The bigger issue, I believe is the refraction or other areas that don't "meet" uncertainty specs. In a perfect world the uncertainty would be bigger in these areas and all our end users would be smart enough to understand and view the uncertainty layer and use the data appropriately. However, we live in a world far from perfect.

One issue I have is that the grids/BAGs will show amazing "sand waves" or other bottom "features" if we keep all the refraction in. Would it be "better" (sorry for all the "air" quotes) if we clipped out this data and showed gaps in the coverage instead of showing full bottom coverage with weird bottom features? Be honest where we got good data vs not so good?

We definitely need better tools to handle the uncertainty. Being able to semi-automatically increase the uncertainty across the swath as refraction increases seems like the best method. Then we can decide whether the field or the office should be the place to cut the grids based on uncertainty when/if we decide to do that. I don't know if that sort of tool is hard or easy. I assume the overlap between the outer swaths is not increasing the uncertainty, number of hypothesis or other metric enough to reflect what is happening?

...

...

Data that fails the tests and looks bad (refraction, etc.), I'm leaning towards rejecting, if the data could be misconstrued by another party as real features. But, I'll need to see some specific examples to see how far I'm leaning in that direction.

My thoughts...
Jeff

****

Jeffrey Ferguson
NOAA, Office of Coast Survey
Chief, Hydrographic Surveys Division
office: 301-713-2700 x124
cell: 240-753-4729

UNITED STATES DEPARMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
Silver Spring, Maryland 20910

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : January 13, 2013

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-P136-RA-2012
HYDROGRAPHIC SHEET: H12496

LOCALITY: Entrance to Kizhuyak Bay, North Coast of Kodiak Island, AK
TIME PERIOD: October 9 - 25, 2012

TIDE STATION USED: Kodiak Island, AK 945-7292
Lat.57° 43.9' N Long. 152° 30.7' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.398 meters

TIDE STATION USED: Dovolno Point, AK 945-7393
Lat. 57° 44.3' N Long. 152° 52.5 W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.636 meters

Tide STATION USED: Nachalni Island, AK 945-7407
Lat. 57° 58.7' Long. 152° 55.5' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 3.809 meters

REMARKS: RECOMMENDED GRID

Please use the TCARI grid "P136RA2012-Final.tc" as the final grid for project OPR-P136-RA-2012, H12496, during the time period between October 9 - 25, 2012.

Refer to attachments for grid information.

Note 1: Provided time series data are tabulated in metric units (meters), relative to MLLW and on Greenwich Mean Time on the 1983-2001 National Tidal Datum Epoch (NTDE).

Note 2: Tidal datums at Dovolno Point, AK 945-7393 and Nachalni Island, AK 9457407 are provisional datums because leveling dates bracket less than 30 days of water level data usable for datum computation.

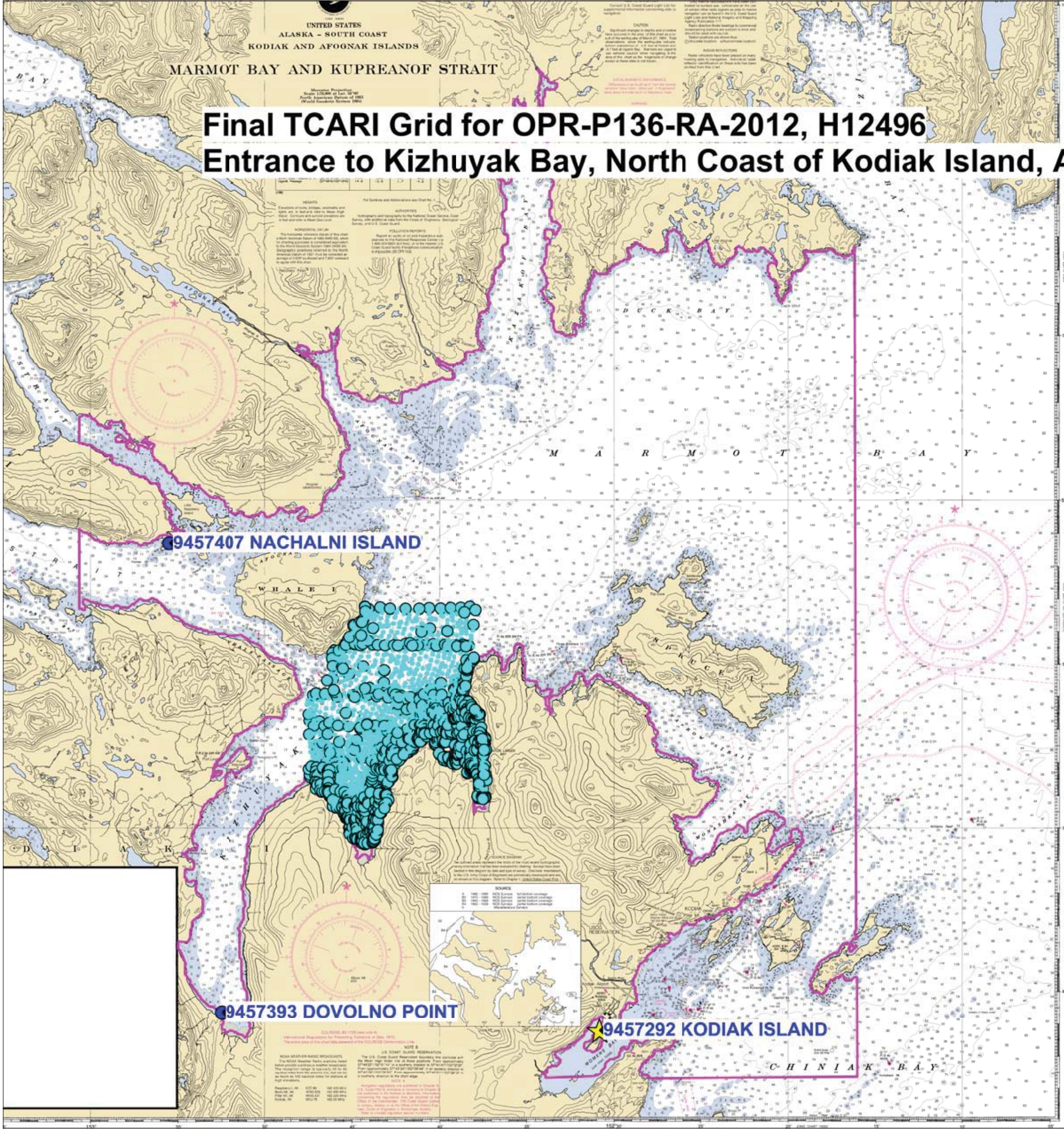
Note 3: Due to inaccurate shoreline at the entrance of Kizhuyak Bay, survey tracklines fall outside of the TCARI grid boundaries in some areas. TCARI will extrapolate the tide corrector to cover these soundings.

HOVIS.GERALD.THOMAS.1365860250

Digitally signed by HOVIS.GERALD.THOMAS.1365860250
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=HOVIS.GERALD.THOMAS.1365860250
Date: 2013.01.18 10:24:28 -05'00'

CHIEF, PRODUCTS AND SERVICES BRANCH

Final TCARI Grid for OPR-P136-RA-2012, H12496
Entrance to Kizhuyak Bay, North Coast of Kodiak Island, AK



APPROVAL PAGE

H12496

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 NGDC for archive

- H12496_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12496_GeoImage.pdf

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

Digitally signed by HOLMBERG.PETER.SCOTT.1365886101
Date: 2014.03.25 13:25:14 -07'00'

Approved:____

Peter Holmberg
Cartographic Team Lead, Pacific Hydrographic Branch

The survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.

Benjamin K. Evans
2014.03.25 15:30:04 -07'00'

Approved:____

LCDR Benjamin K. Evans, NOAA
Chief, Pacific Hydrographic Branch