H12626

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12626

LOCALITY

State(s):	Washington
General Locality:	Strait of Juan de Fuca, Washington
Sub-locality:	Cattle Point to McArdle Bay

2014

CHIEF OF PARTY
Edward J. Van Den Ameele, CDR/NOAA

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Date:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET	**H12626**

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:	**Strait of Juan de Fuca, Washington**
Sub-Locality:	**Cattle Point to McArdle Bay**
Scale:	**12500**
Dates of Survey:	**11/01/2014 to 11/15/2014**
Instructions Dated:	**11/12/2014**
Project Number:	**OPR-N305-RA-14**
Field Unit:	**NOAA Ship Rainier**
Chief of Party:	**Edward J. Van Den Ameele, CDR/NOAA**
Soundings by:	**Multibeam Echosounder**
Imagery by:	**Multibeam Echosounder 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. Any revisions to the Descriptive Report (DR) generated during office processing are shown in bold, red italic text. The processing branch maintains the DR as a field unit product, therefore, all information and recommendations within the body of the DR are considered preliminary unless otherwise noted. The final disposition of surveyed features is represented in the OCS nautical chart update products. All pertinent records for this survey, including the DR, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via http://www.ngdc.noaa.gov/.

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Descriptive Report to Accompany Survey H12626

Project: OPR-N305-RA-14

Locality: Strait of Juan de Fuca, Washington

Sublocality: Cattle Point to McArdle Bay

Scale: 1:12500

November 2014 - November 2014

NOAA Ship Rainier

Chief of Party: Edward J. Van Den Ameele, CDR/NOAA

A. Area Surveyed

The area surveyed is referred to as Sheet 1: "Cattle Point to McArdle Bay" within the Project Instructions. It encompasses an area of approximately fifteen square nautical miles south of Lopez Island, WA in the Strait of Juan de Fuca (Figure 1).

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
48° 27' 34.38" N 122° 57' 55" W	48° 23' 18.3" N 122° 49' 9.46" W

Table 1: Survey Limits

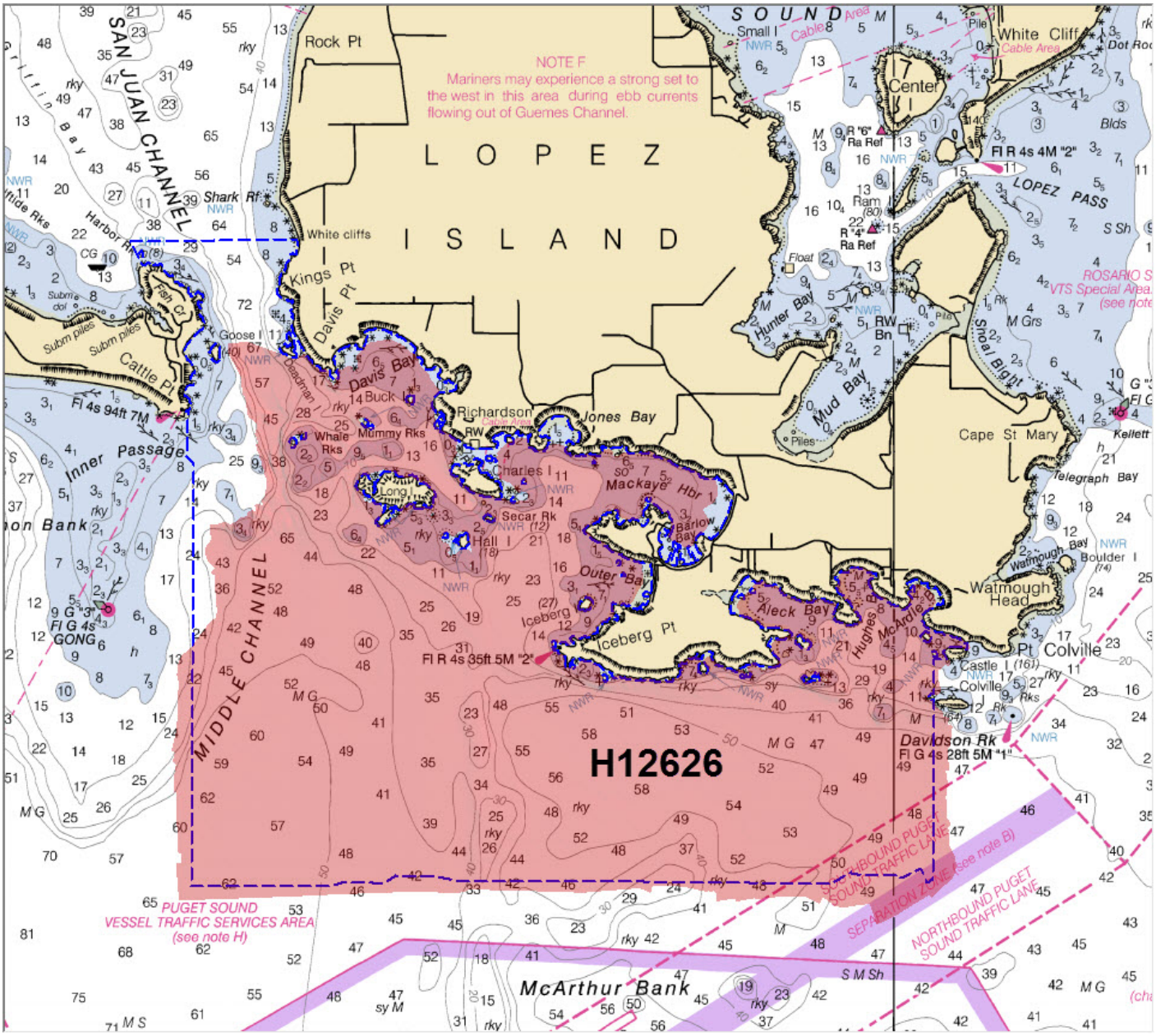

Figure 1: H12626 survey coverage overlaid on Chart 18421 (assigned sheet limits represented by blue dashed line).

Survey data were acquired within limits of the requirements in the Project Instructions and the Hydrographic Surveys Specifications and Deliverables (HSSD), with the exception of the northwest corner near the entrance to the San Juan Channel. Surveying was suspended on 11/17/2014 in order to facilitate the transit to Newport, OR (the ship's homeport) in advance of a storm. No further sea days were allocated. These time constraints prevented surveying to the 4m NALL or sheet limits north of Middle Channel and south of San Juan Channel. Because complete coverage was not obtained, the survey was clipped during processing

between Deadman and Goose Island to facilitate the overlap of future coverage to the north, while retaining data collected in areas depicted on Chart 18434 as wire drag.

Data north of the Middle Channel and south of the San Juan Channel that were 'clipped' by the field hydrographer were re-accepted by the Pacific Hydrographic Branch.

A.2 Survey Purpose

The purpose of this project is to provide contemporary surveys to update National Ocean Service (NOS) nautical charting products. The survey area is in the vicinity of three, high-density traffic lanes separated by shoal areas and is frequently transited by large commercial vessels traveling both north to Cherry Point, Washington and Vancouver, British Columbia and south to Tacoma and Seattle, Washington.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Data acquired on survey H12626 met complete multibeam echosounder (MBES) coverage requirements, including the five soundings per node data density requirement. In order to extract statistics of the data density achieved, the density layer of each finalized surface was queried within Caris then examined in Microsoft Excel. Overall, the required data density was achieved in 99.976% of nodes.

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	7,018,891	1,941	99.972%
2m	18 - 40m	1,850,149	252	99.986%
4m	36 - 80m	887,772	187	99.979%
8m	72 - 160m	473,262	53	99.989%
	TOTAL:	10,230,074	2,433	99.976%

Figure 2: Summary table showing the percentage of nodes satisfying the five sounding density requirements, sub-divided by the appropriate depth ranges.

A.4 Survey Coverage

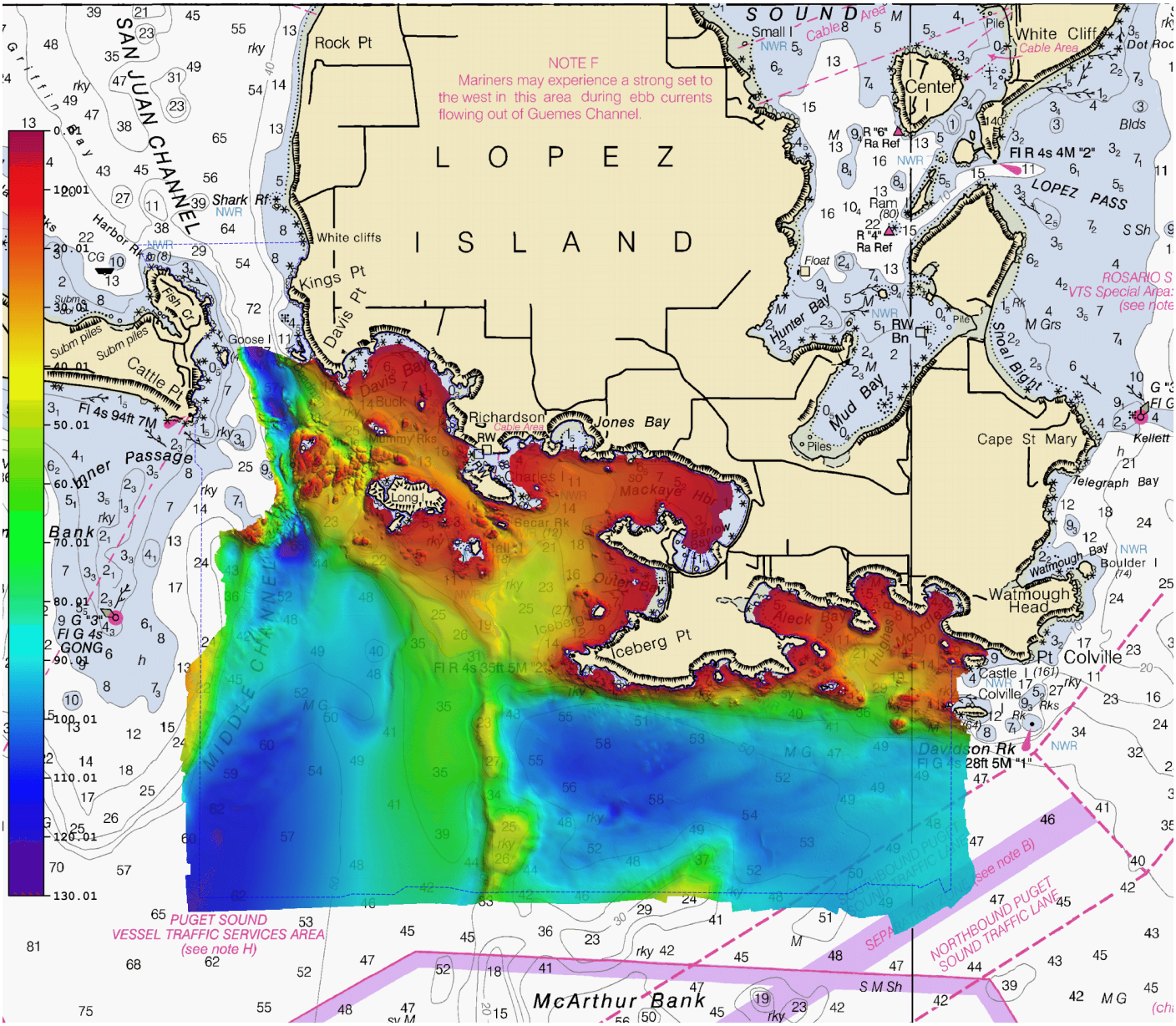

Figure 3: Acquired survey coverage overlaid on Chart 18421. Scale shows depth in meters.

Complete multibeam coverage was achieved within the limits of hydrography with the following exceptions:

Acoustic Shadowing and Downslope Masking: There are numerous gaps in coverage as a result of acoustic shadowing and downslope masking. Acoustic shadowing is an effect seen where data density on the unensonified side of a feature, or between features, was too sparse to produce a surface at the appropriate resolution (see Figure 4). Downslope masking is a lack of coverage due to poor sonar geometry associated with rapid drops in the seafloor. Per section 5.2.2.1 Object Detection Coverage of the HSSD, the shoaler

extent of the coarser resolution grid was modified to prevent this coverage gap. A request for alternative gridding resolutions for survey H12626 submittal was made to NOAA's Hydrographic Survey Division (HSD) on 02/12/2015 and approved on 03/05/2015, which effectively removes these holidays from the finalized surfaces. For more information refer to H12626 Request/Approval Alternative Gridding Resolutions in Appendix 5, Supplemental Correspondence. All cases were examined to assure that least depths were obtained.

Kelp: Numerous shoreline and reef areas within the assigned survey limits were beyond the NALL due to kelp. Kelp areas were inspected in Caris Subset Editor and cleaned. Kelp areas are adequately represented in the H12626 Final Feature File, and the data is adequate to supersede the chart.

Inshore Holidays: There are numerous gaps in coverage where multibeam coverage did not reach the assigned sheet limits nor the 4-meter curve (see Figure 5). These areas were generally located very near shore, subject to dangerous wave action or currents, and judged to be navigationally insignificant.

The northwest corner near the entrance to the San Juan Channel was not surveyed due to time constraints. See discussion in Section A.1. Survey Limits for more information.

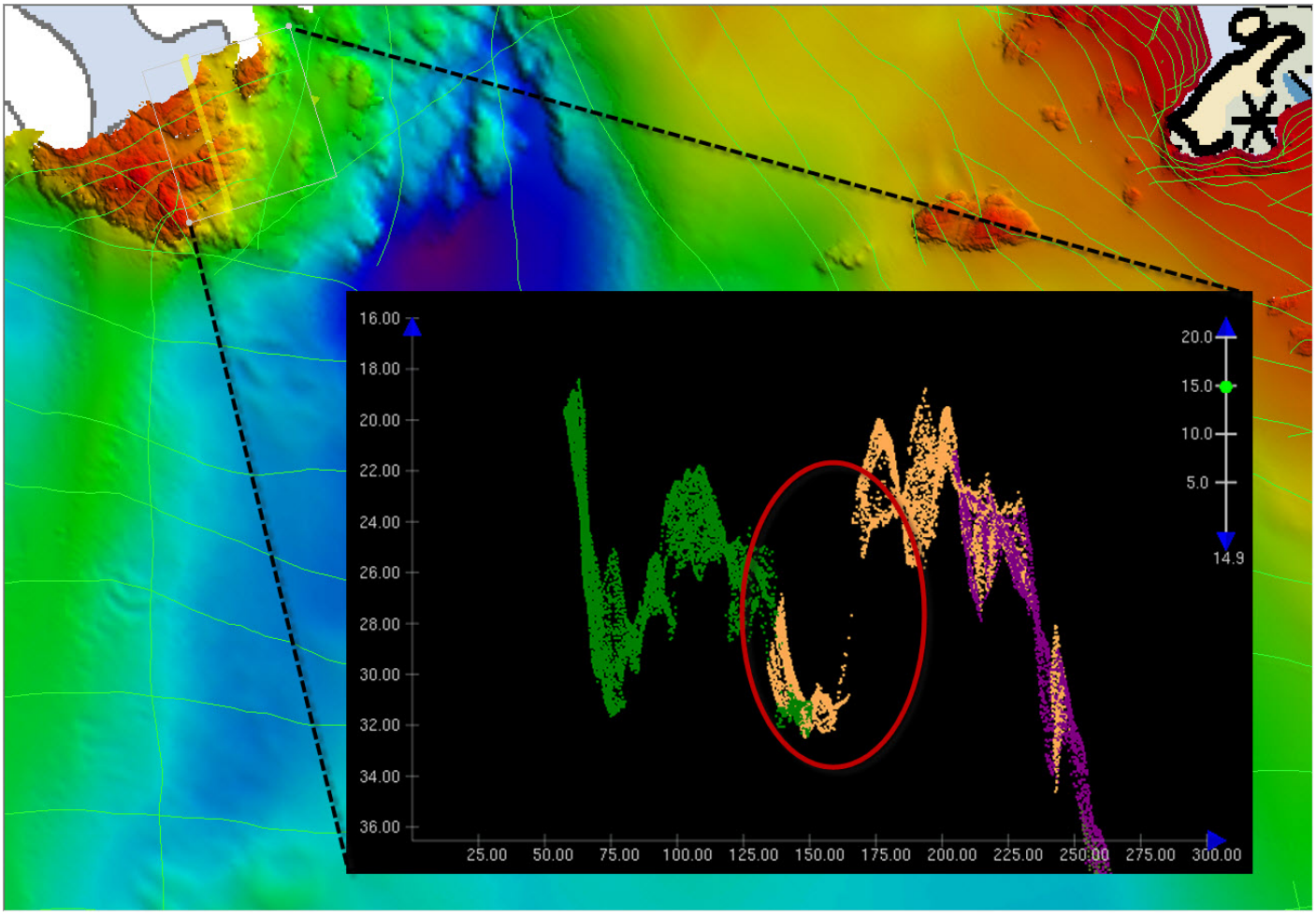

Figure 4: Example of acoustic shadowing on Chart 18434. Tracklines are in green.

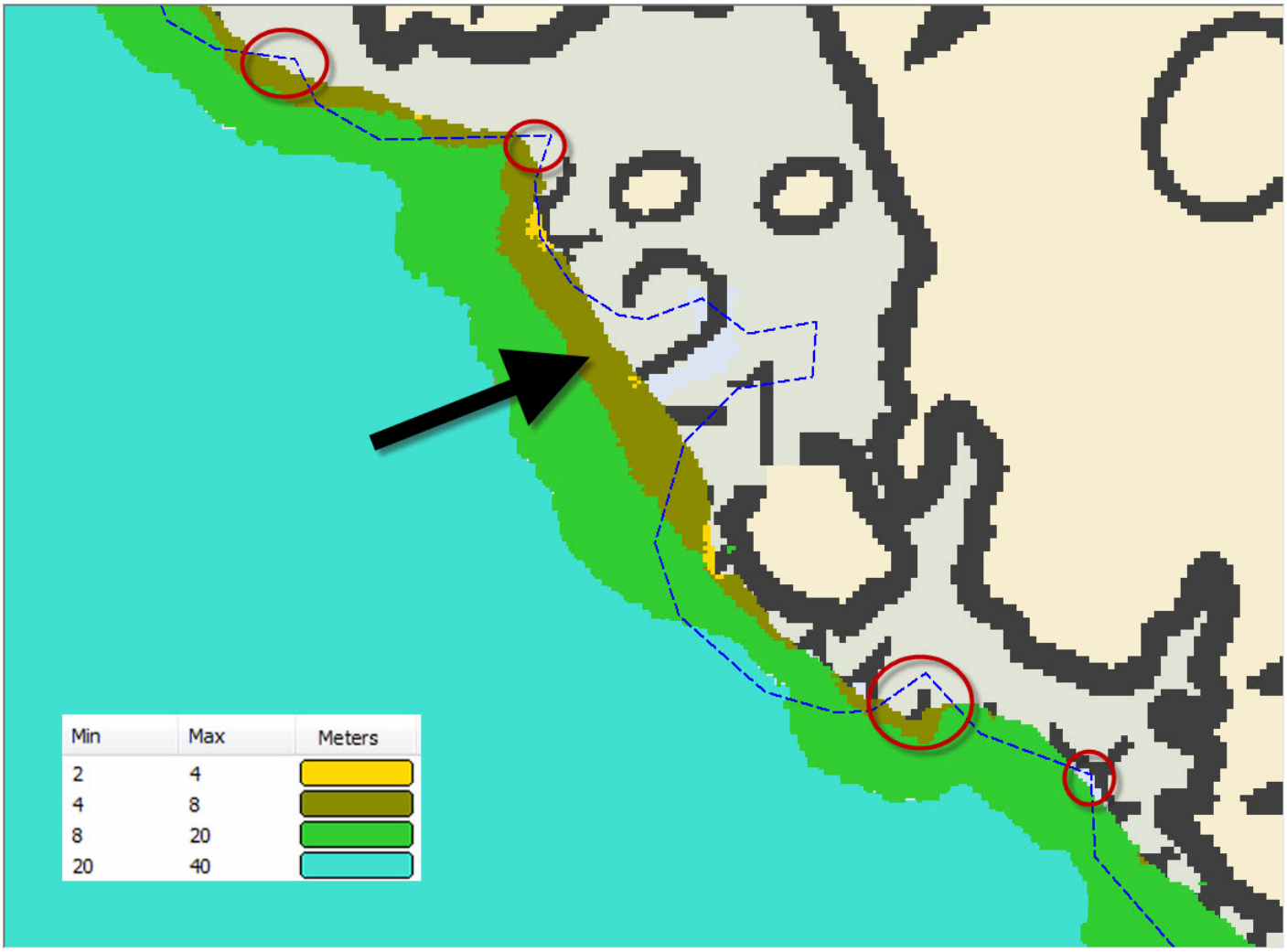

Figure 5: Navigationally insignificant inshore holidays on southwestern Charles Island (Chart 18434). Assigned sheet limits are in blue, 4-meter curve is in yellow.

See attached correspondence regarding the request/approval for alternative gridding resolutions.

A.5 Survey Statistics

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

	HULL ID	*2801*	*2802*	*2803*	*2804*	*S221*	*Total*
LNM	SBES Mainscheme	0	0	0	0	0	0
	MBES Mainscheme	82.7	27.6	52.2	127.8	37.0	327.3
	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	6.8	1.9	0	7.5	0	16.2
	Lidar Crosslines	0	0	0	0	0	0
Number of Bottom Samples							1
Number of AWOIS Items Investigated							0
Number Maritime Boundary Points Investigated							0
Number of DPs							315
Number of Items Investigated by Dive Ops							0
Total SNM							15.44

Table 2: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
11/01/2014	305
11/02/2014	306
11/05/2014	309
11/12/2014	316
11/13/2014	317
11/14/2014	318
11/15/2014	319
11/16/2014	320

Table 3: Dates of Hydrography

Surveying was suspended on 11/17/2014 in order to facilitate the transit to Newport, OR (the ship's homeport) in advance of a storm. No further sea days were allocated.

As part of H12626, MBES mainscheme mileage was 326.15 LNM. Crossline mileage was 17.40 LNM. Data were not acquired on 11/16/2014 (Day Number 320) for survey H12626. The last day of survey was 11/15/2014.

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the 2014 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 2014 DAPR are discussed in the following sections.

B.1.1 Vessels

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

Hull ID	*1905*	*1906*	*2801*	*2802*	*2803*	*2804*	*S221*
LOA	5.7 meters	5.8 meters	8.8 meters	8.8 meters	8.8 meters	8.8 meters	70.4 meters
Draft	0.35 meters	0.33 meters	1.1 meters	1.1 meters	1.1 meters	1.1 meters	4.7 meters

Table 4: Vessels Used

Figure 6: NOAA Ship Rainier with survey launches.

All data for survey H12626 was acquired by NOAA Ship Rainier; launches 2801 (RA-4), 2802 (RA-5), 2803 (RA-3), 2804 (RA-6), skiffs 1905 (RA-8) and 1906 (RA-7). The vessels acquired MBES depth soundings, sound velocity profiles, bottom samples and conducted shoreline verification.

B.1.2 Equipment

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

Manufacturer	Model	Type
Kongsberg	EM 710	MBES
Reson	SeaBat 7125-B	MBES
Reson	SeaBat 7125 SV2	MBES
Applanix	POS-MV V4	Attitude System
Odim Brooke Ocean (Rolls Royce Groups)	MVP200	Conductivity, Temperature, and Depth Sensor
Seabird	SBE 19	Conductivity, Temperature, and Depth Sensor
Seabird	SBE 19Plus	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 totaled 5% of mainscheme acquisition.

Multibeam crosslines were acquired using the Reson 7125 on launches 2801 (RA-4), 2802 (RA-5) and 2804 (RA-6). A 4m CUBE surface was created using only mainscheme lines, a second 4m CUBE surface was created using only crosslines, and a difference surface was generated in Caris at a 4m resolution. This difference surface was compared to the allowable uncertainty values within the HSSD for the observed depths, and statistics were calculated in Excel. In total, 99.166% of the depth differences between H12626 mainscheme and crossline data were within the requirements of the HSSD (Figure 7).

Depth range	IHO Order	Number of nodes	Nodes satisfying HSSD TVU	Percent nodes satisfying HSSD TVU
Less than 100m	Order 1	378,776	374,583	98.9%
Greater than 100m	Order 2	123,809	123,808	100.0%
	TOTAL:	502,585	498,391	99.166%

Figure 7: Summary table indicating percentage of difference surface nodes between H12626 mainscheme and crossline data that meet HSSD requirements.

Based on additional survey data that was re-accepted by the Pacific Hydrographic Branch, crosslines acquired for H12626 totaled 5.3% of mainscheme acquisition.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning
0 meters	0 meters

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
2801	3.0 meters/second		0.15 meters/second
2802	3.0 meters/second		0.15 meters/second
2803	3.0 meters/second		0.15 meters/second
2804	3.0 meters/second		0.15 meters/second
S221		1 meters/second	0.05 meters/second

Table 7: Survey Specific Sound Speed TPU Values

Uncertainty values were measured and applied in accordance with Section B.4 of the 2014 DAPR.

Total Propagated Uncertainty (TPE) values for survey H12626 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 (COOPS), 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 8). For this reason, no tidal uncertainty values were entered into the Tide Value section of the Caris Compute TPE 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 where uncertainty requirements were met, for each surface a custom “HSSD Compliance” layer was created, based on the difference between the calculated uncertainty of the nodes and the allowable uncertainty defined in the HSSD. To quantify the extent to which requirements were met, the HSSD Compliance layers were queried within Caris and examined in Excel. Overall, 99.995% of the nodes of survey H12626 met the uncertainty requirements specified in the HSSD. These HSSD Compliance layers were retained in the submitted surfaces.

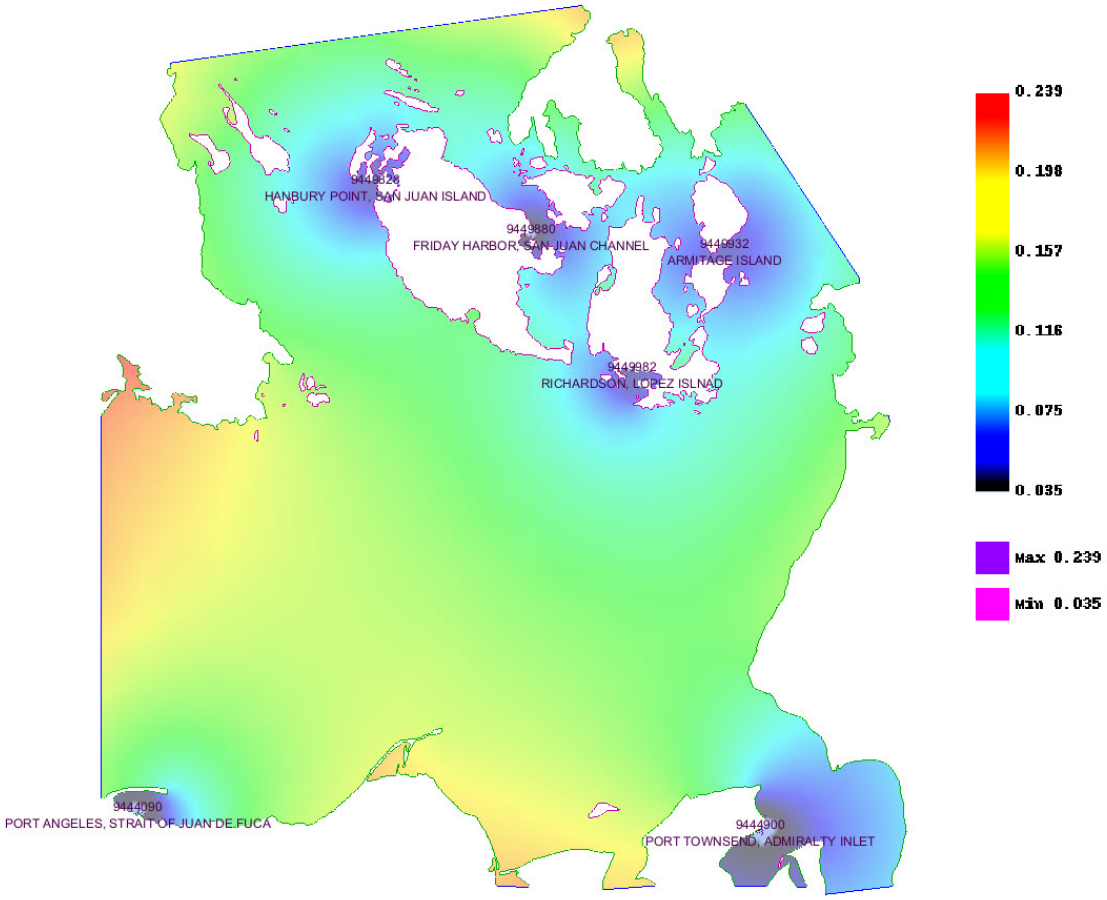

Figure 8: TCARI uncertainty (2-sigma) and locations of the tide gauges used for the Final TCARI grid for OPR-N305-RA-14.

B.2.3 Junctions

Two junction comparisons were completed for H12626. Depth comparisons were performed using 8m Caris Difference Surfaces.

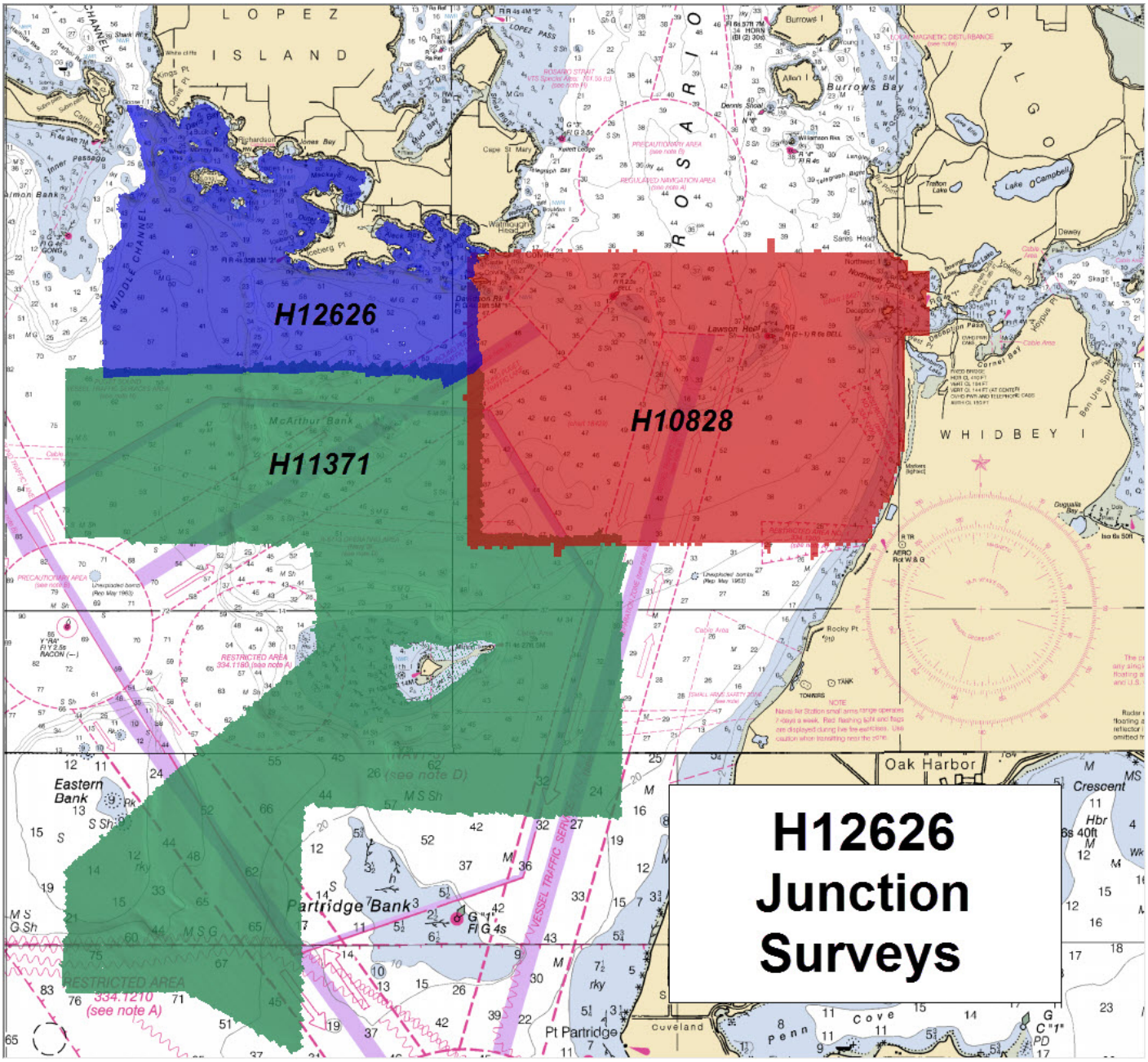

Figure 9: H12626 junction overview.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H11371	1:20000	2005	NOAA Ship Rainier	S
H10828	1:10000	1999	Pacific Hydrographic Party	E

Table 8: Junctioning Surveys

H11371

Overlap with survey H11371 encompassed approximately 0.89 Square Int. Nautical Miles along the southern boundary of H12626 (Figure 9). Depths in the junction area range from 45 to 118 meters. Analysis of the difference surface indicated that H12626 is an average of 0.04 meters shoaler than H11371 with a standard deviation of 0.55 meters. For the respective depths, the difference surface was compared to the allowable TVU standards specified in the HSSD. In total, 96.77% of the depth differences between H12626 and junction survey H11371 are within allowable uncertainties.

H10828

Overlap with survey H10828 encompassed approximately 0.28 Square Int. Nautical Miles along the eastern boundary of H12626 (Figure 9). Depths in the junction area range from approximately four to 92 meters. Analysis of the difference surface indicated that H12626 is an average of 0.11 meters shoaler than H10828 with a standard deviation of 0.7 meters. For the respective depths, the difference surface was compared to the allowable TVU standards specified in the HSSD. In total, 78.58% of the depth differences between H12626 and junction survey H12626 are within allowable uncertainties. This is likely a result of comparing the point cloud .xyz format used by H10828 (gridded at 35m resolution) with complete multibeam coverage.

H12626 also junctions with H12625 of the same project, but was acquired by NOAA Ship Fairweather. The maximum difference between the two surveys is 1.65 meters.

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

Launch 2803 (RA-3) Sonar Quality

The 400kHz Reson 7125 on Launch 2803 (RA-3) had failed prior to this project. The data acquired at 200kHz reveals "horns" of approximately 0.1m that followed the vessel track where bottom detection method bordered magnitude and magnitude plus phase beam process (Figure 10). Experienced users were

unable to tune the poor detections out of the data, and the decision was made after Day Number (DN) 306 to discontinue using this system. Closer inspection of the element level data in the Seabat user interface with the power revealed considerably different patterns in elements between roughly 110 and 120, indicating bad detection near the seafloor around nadir. The survey data meets or exceeds the requirements set forth in the HSSD.

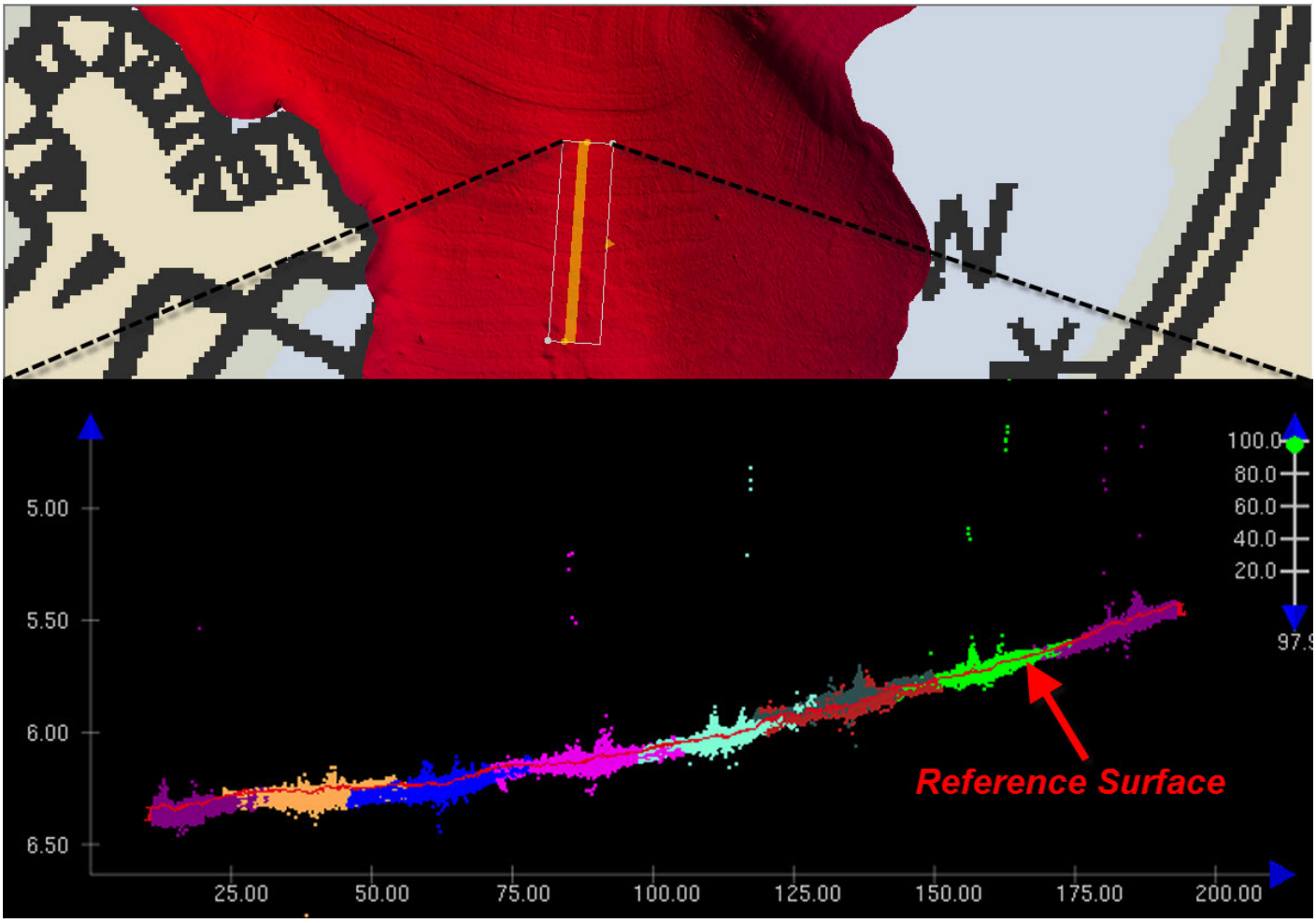

Figure 10: An example of "horns" from Barlow Bay of data acquired from launch 2803 (RA-3) in Caris Subset Editor with an exaggeration of 100x. The reference surface overlaid on Chart 18421 is exaggerated to 30x to show the effect follows the trackline at nadir.

B.2.6 Factors Affecting Soundings

Eelgrass and Seaweed beds

Eelgrass/seaweed beds were found in several nearshore areas throughout the survey. The H12626_MB_1m_MLLW depth surface was used in conjunction with the node standard deviation surface to identify the beds and their effect on the surface. Where possible, soundings on vegetation were then rejected

to more accurately represent the seafloor depth, but in most cases the seafloor was indistinguishable from the kelp (Figure 11). The beds were delineated as WDKLP features with category of weed/kelp seagrass in the H12626 Final Feature File submitted with this report.

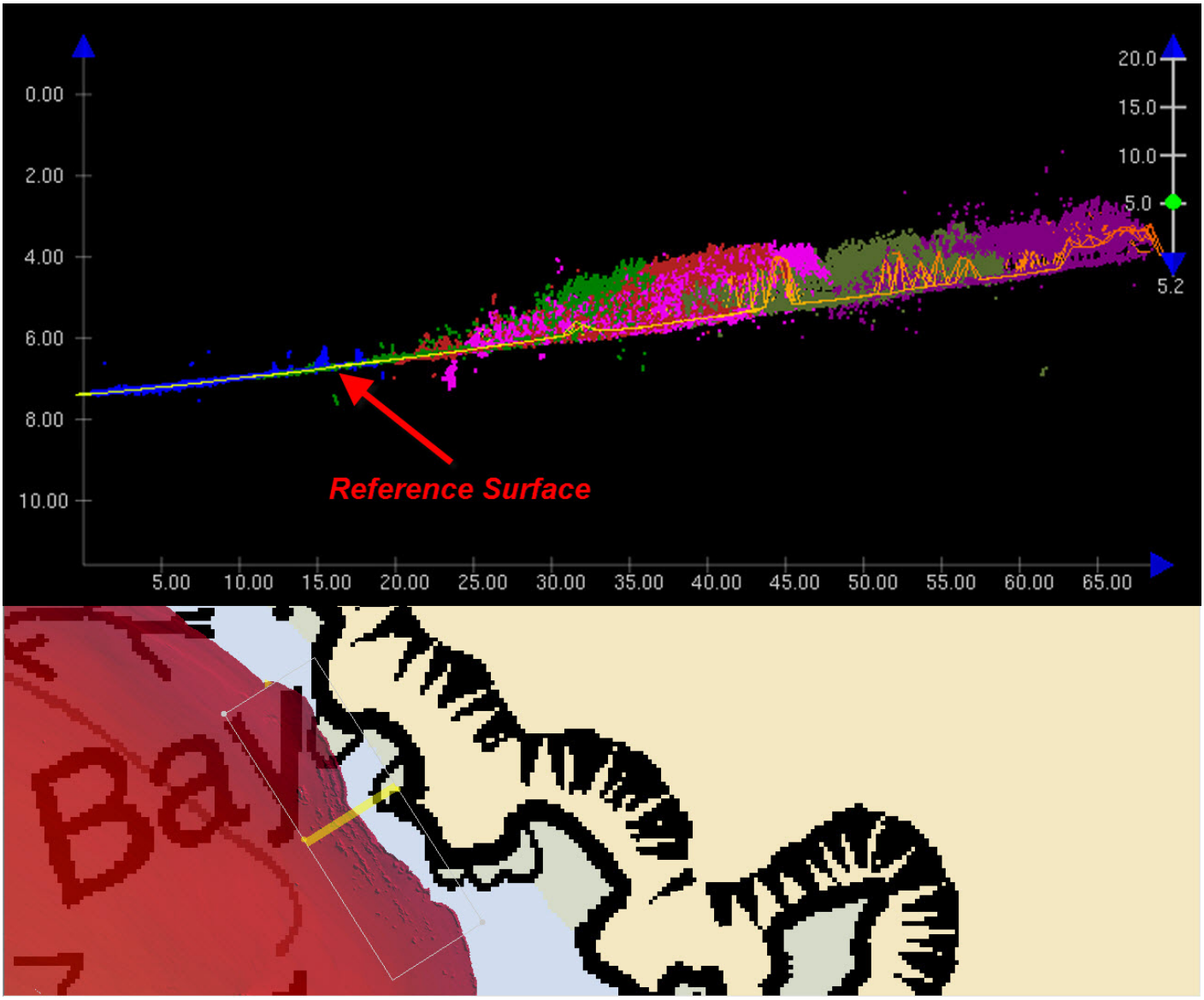

Figure 11: An example from Davis Bay where the seafloor is indistinguishable from eelgrass (the reference surface is in orange, data is colored by line).

The final feature file has been archived and is not appended to this report.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: For data collected by launches, sound speed profiles were acquired using the SBE 19 and SBE 19plus CTDs at discrete locations within the survey area at least once every four hours, when large changes in surface sound speed were apparent, and when moving to a new area. For

data collected on S221 (NOAA Ship Rainier), sound speed profiles were acquired using the Rolls Royce MVP200 approximately every fifteen minutes or when recommended by "CastTime", a cast frequency program developed at the University of New Hampshire. All casts were concatenated into a master file depending on platform type (launch vs. ship) and applied to lines using the "Nearest in distance within time (four hours)" profile selection method.

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

Delayed Heave could not be applied to lines 2357 and 0000 acquired by launch 2804 on DN319 due to non-overlapping time extents. The POSPac file was stopped before UTC midnight on DN319, while line 2804_2014_RA3192357 was still being logged. Line 2804_2014_RA3200000 was acquired on DN320 according to the UTC time stamp. Data was examined in Caris Subset Editor, along with the surrounding area, and no shifts nor artifacts were detected. The survey data meets or exceeds the requirements set forth in the HSSD.

B.3.2 Calibrations

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

Calibration Type	Date	Reason
Patch test	2014-11-12	A 0.25 meter roll artifact was found in low frequency launch 2804 (RA-6) data acquired between DN316 and DN319.

Table 9: Calibrations not discussed in the DAPR.

New patch values were calculated and entered into the HVF. The affected data was examined in Caris Subset Editor, along with adjacent data, and no shifts nor artifacts were detected.

B.4 Backscatter

Backscatter data, logged as .7k or .ALL files, was acquired but not formally processed by NOAA Ship Rainier personnel. Two backscatter lines per boat, per day were reviewed to ensure quality. The data was submitted directly to the National Geophysical Data Center (NGDC).

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 Profile V_5_3_2

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
H12626_MB_1m_MLLW	CUBE	1 meters	0.01 meters - 130 meters	NOAA_1m	Complete MBES
H12626_MB_2m_MLLW	CUBE	2 meters	0.01 meters - 130 meters	NOAA_2m	Complete MBES
H12626_MB_4m_MLLW	CUBE	4 meters	0.01 meters - 130 meters	NOAA_4m	Complete MBES
H12626_MB_8m_MLLW	CUBE	8 meters	0.01 meters - 130 meters	NOAA_8m	Complete MBES
H12626_MB_1m_MLLW_Final_0to20	CUBE	1 meters	0 meters - 20 meters	NOAA_1m	Complete MBES
H12626_MB_2m_MLLW_Final_12to40	CUBE	2 meters	12 meters - 40 meters	NOAA_2m	Complete MBES
H12626_MB_4m_MLLW_Final_26to80	CUBE	4 meters	26 meters - 80 meters	NOAA_4m	Complete MBES
H12626_MB_8m_MLLW_Final_72to160	CUBE	8 meters	40 meters - 160 meters	NOAA_8m	Complete MBES

Table 10: Submitted Surfaces

Using typical depths for gridding resolutions would result in holidays between layers as parts of this survey were very dynamic with steeply sloping bottom. Per section 5.2.2.1 Object Detection Coverage of the HSSD, the shoaler extent of the coarser resolution grid should be modified to prevent this coverage gap. A request for alternative gridding resolutions for survey H12626 submittal was made to NOAA's Hydrographic Survey Division (HSD) on 02/12/2015 and approved on 03/05/2015. For more information refer to H12626 Request/ Approval Alternative Gridding Resolutions in Appendix 5, Supplemental Correspondence.

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying OPR N305-RA-14 Horizontal and Vertical Control Report (HVCR), submitted under separate cover.

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
Friday Harbor, WA	9449880
Port Angeles, WA	9444090
Port Townsend, WA	9444900

Table 11: NWLON Tide Stations

File Name	Status
9444090	Final Approved
9444900	Final Approved
9449880	Final Approved

Table 12: Water Level Files (.tid)

File Name	Status
N305RA2014_final.tc	Final

Table 13: Tide Correctors (.zdf or .tc)

A request for final approved tides was sent to N/OPS1 on 11/16/2014. The final tide note was received on 12/15/2014.

The Project Instructions required a comparison of VDatum based Ellipsoid Referenced Survey (ERS) versus Tidal Constituent and Residual Interpolation (TCARI) vertical transformation techniques using crossline data. Pydro's Post Acquisition Tool utility was used to compare the nadir depths from data corrected with VDatum and TCARI tides. The mean difference was 0.045 meters +/- 0.241 (95% of nodes). These differences may arise from many different sources including: poor vertical GPS solutions, and errors in dynamic draft values and vessel loading errors. Water depths within the boundaries of this comparison range from four to 110 meters. The total allowable vertical uncertainty in this depth range is between 0.5 and 2.7 meters at 95% confidence accounting for all errors. Of this total uncertainty, approximately 0.23 meters is budgeted for water level corrections per the Project Instructions. For survey H12626, differences between the two methods yield mean results and distributions less than the budgeted water level uncertainty. The VDatum method is statistically indistinguishable from the accepted TCARI methodology.

On 03/03/2015, after review of results of the OPR-N305-RA-14 VDatum Test & Evaluation and Recommendations submitted 02/19/2015, the Chief of NOAA's Hydrographic Surveys Division approved NOAA Ship Rainier's request to reduce to Mean Lower Low Water via TCARI due to errors in Smoothed Best Estimate of Trajectory (SBET) application. For more information, refer to the OPR-N305-RA-14 VDatum Approval Memo in Appendix 5, Supplemental Correspondence. H12626 MBES data was corrected using the water level and TCARI zoning files listed above.

See attached VDatum Approval Memo.
See attached Tide Note dated December 15, 2014.

C.2 Horizontal Control

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

The projection used for this project is Universal Transverse Mercator (UTM) Zone 10.

The following PPK methods were used for horizontal control:

Smart Base
Single Base

The following CORS Stations were used for horizontal control:

HVCR Site ID	Base Station ID
ALBH	Albert Head, Victoria, BC - Canada
BLYN	Blyn Mountain, Sequim, WA
CHCM	Chimacum Schools, WA
CHWK	Chilliwack, BC - Canada
P436	Dungeness, WA
P439	Orcas Airport, WA
PGC5	North Saanich, BC - Canada
SC02	Friday Harbor, WA
SC04	Chemainus, BC - Canada
SEAT	Seattle, WA
SEDR	Sedro Woolley, WA
WHD5	Whidbey Island, WA 5
WHD6	Whidbey Island, WA 6

Table 14: CORS Base Stations

The following DGPS Stations were used for horizontal control:

DGPS Stations
Whidbey Island,WA - 302kHz

Table 15: USCG DGPS Stations

C.3 Additional Horizontal or Vertical Control Issues

3.3.1 Lines without Smoothed Best Estimate of Trajectory (SBET)

Delayed Heave could not be applied to line 2804_2014_RA3192357 or 2804_2014_RA3200000 acquired by Launch 2804 on DN319 due to non-overlapping time extents; therefore no SBETs exists for these lines. Data was examined in Caris Subset Editor, along with the surrounding area, and no shifts nor artifacts were detected.

SBET solutions were not possible on isolated survey lines within survey H12626. As a result, ellispoidally-referenced vertical solutions for those lines may not be accurate enough to reduce to MLLW using VDatum. ERS/VDatum approach is desired when possible because of the ability to eliminate several sources of vertical errors that can be attributed to traditional tide models and ship water line estimators. However, ERS and VDatum require good vertical and horizontal position solutions to be effective. As a result, this survey was reduced with TCARI.

The survey data meets or exceeds the requirements set forth in the HSSD.

D. Results and Recommendations

D.1 Chart Comparison

Chart comparisons were performed using a Caris sounding and contour layer based on the 8m combined CUBE surface. The contours and soundings were overlaid on the charts and visually compared for general agreement and to identify areas of significant change. There is an approximately thirty meter shift between Chart 18434, Chart 18429, and ENC US5WA32M in the area of overlap (see Figure 12). A discrepancy report was filed for Chart 18434 on 10/28/2014 - see Appendix 5, Supplemental Correspondence. Analysis of the area in question finds Chart 18434 to be more representative of the derived sounding and contour layer.

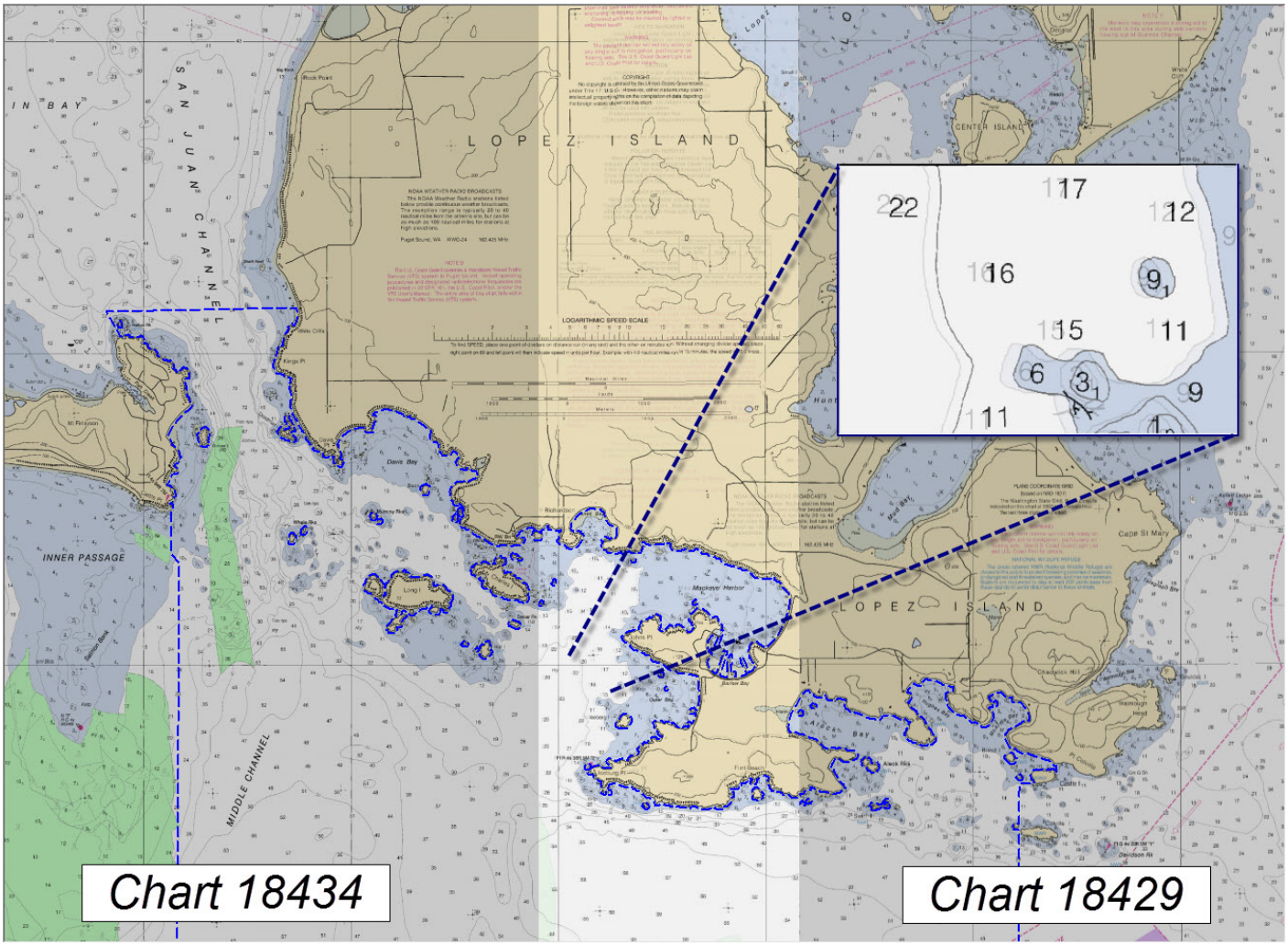

Figure 12: Transparent overlay of Chart 18434 (left) on Chart 18429 showing an approximately thirty meter discrepancy.

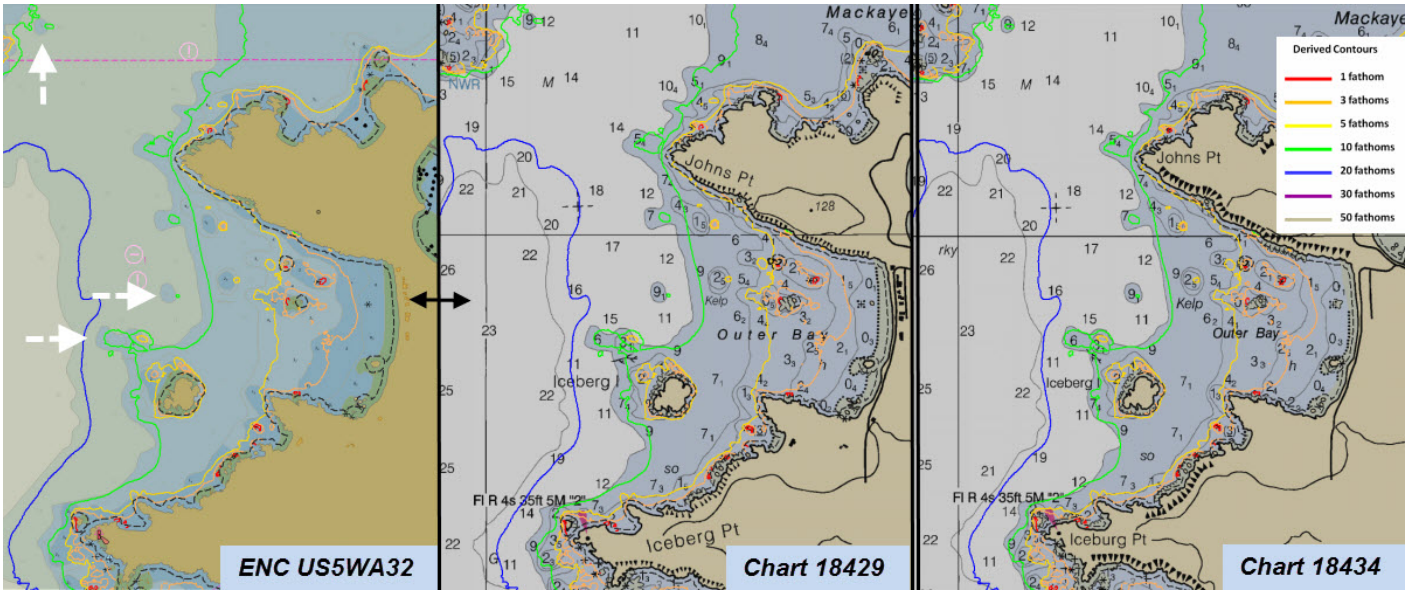

Figure 13: Arrows show areas where Raster Chart 18429 and ENC US5WA32M display contours and shoal areas west of actual. Chart 18434 is more representative of features. Note: The charts have been darkened slightly to enhance derived contour and sounding visuals.

See attached Discrepancy Report for Chart 18434.

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
18434	1:25000	7	09/2013	01/13/2015	12/27/2014
18429	1:25000	11	05/2014	01/13/2015	12/27/2014

Table 16: Largest Scale Raster Charts

18434

H12626 derived soundings agreed with charted depths within two fathoms, with the exception of several deep soundings. The derived 50-fathom contour extends north in the vicinity of Middle Channel, covering the charted 40 fathom sounding. Additionally, southwest of Whale Rocks in the San Juan Channel, there is an uncharted area that shoals to 29 meters. The closest charted sounding reads 38 fathoms. South of Iceberg Point and shoreward of the 10-fathom curve, the charted contours do not match the derived soundings and contours south of Iceberg Point. Note the incorrect spelling of "Iceburg" rather than Iceberg Point in Figure 15. This area should be revised.

It is recommended that H12626 data supersede all charted depths on Chart 18434.

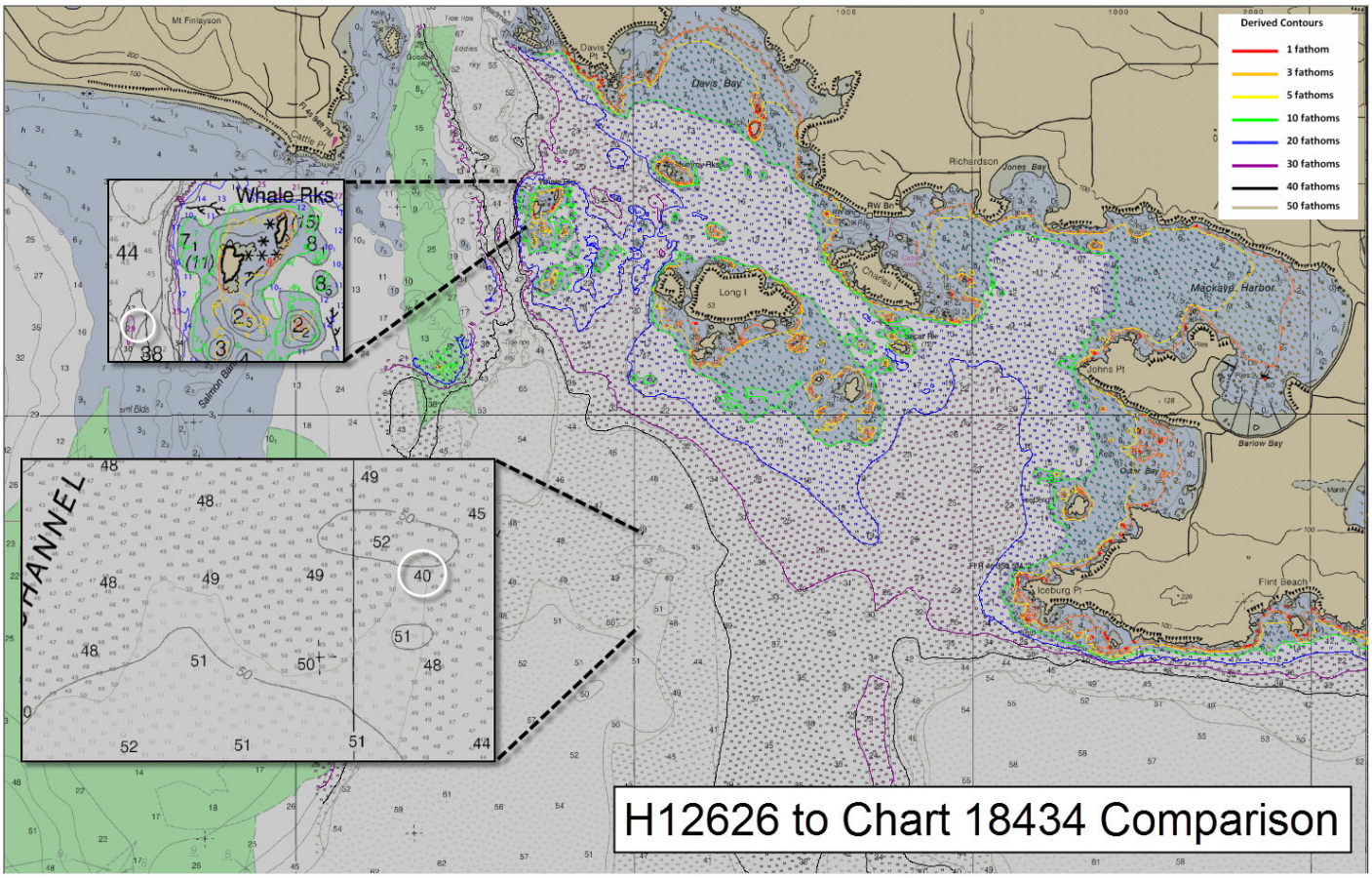

Figure 14: Comparison of Chart 18434 (1:25000) depths to H12626 survey soundings. All units are in fathoms. Chart depths are larger, survey soundings are smaller. Note: the chart has been darkened slightly to enhance derived contour and sounding visuals.

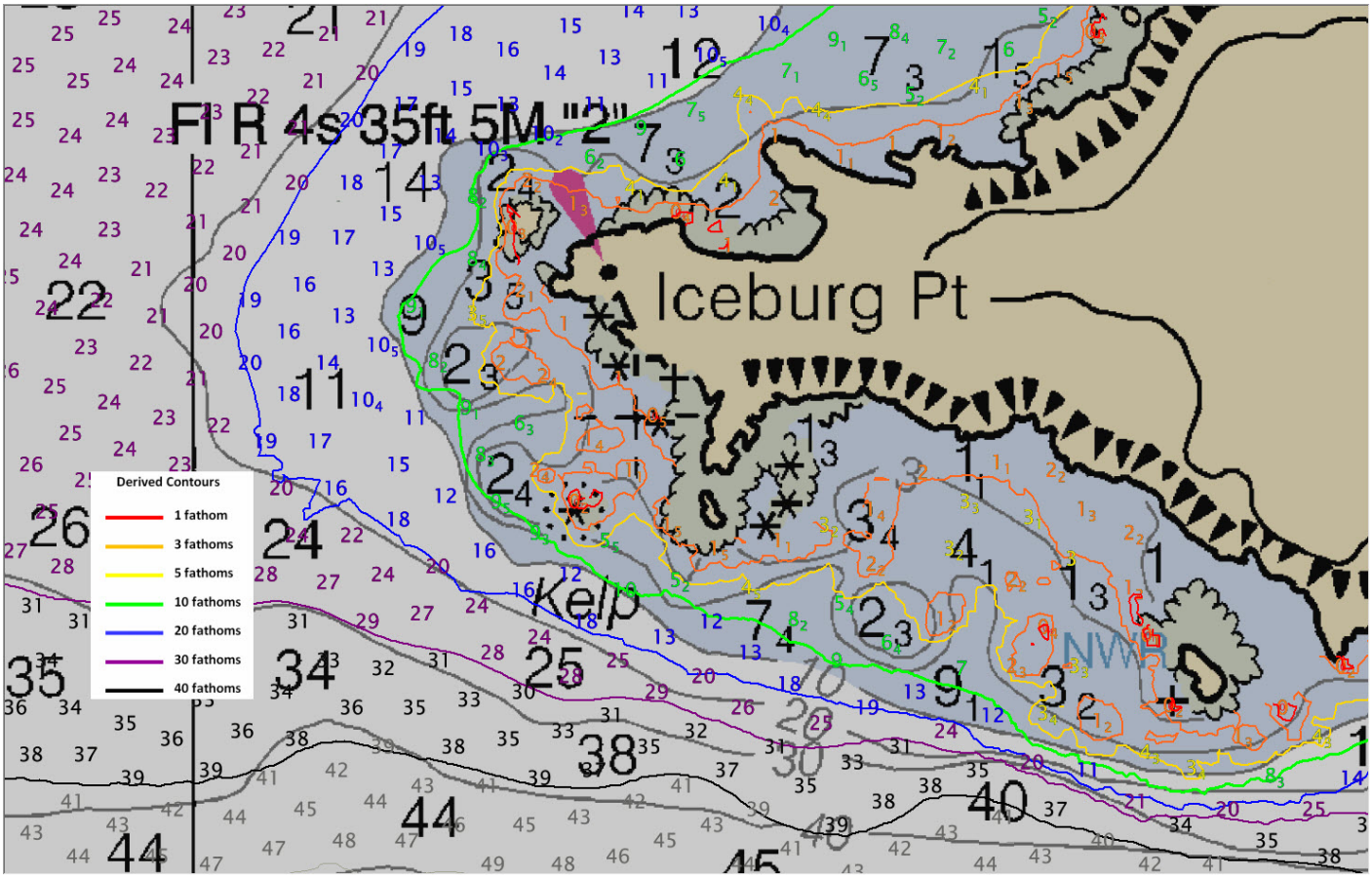

Figure 15: Overview of Iceberg Point with an overlay of H12626 survey soundings and contours. Note: shoreward of the 10-fathom curve, contours do not agree.

18429

Comparison of H12626 and Chart 18429 (1:25000) shows a general trend where contours and soundings have been shifted thirty meters to the west (actual position is east). See discussion and examples above. Additionally, in the vicinity between Swirl Island and Coville Island, there are three areas with depths shoaler than ten fathoms which are offshore of presently charted blue tint regions (see Figure 16). The 5-fathom curve above Swirl Island is northwest of is actual position, potentially creating confusion about the location of safe water between this and Aleck Rocks. When approaching Flint Beach from the east, there is a four fathom shoal that is uncharted (see Figure 17). This may be navigationally significant, as vessels may seek shelter/anchorage from north winds in the area charted as a mud bottom (not verified as part of this survey), while giving the National Wildlife Refuge a wide berth.

It is recommended that H12626 data supersede all charted depths on Chart 18429.

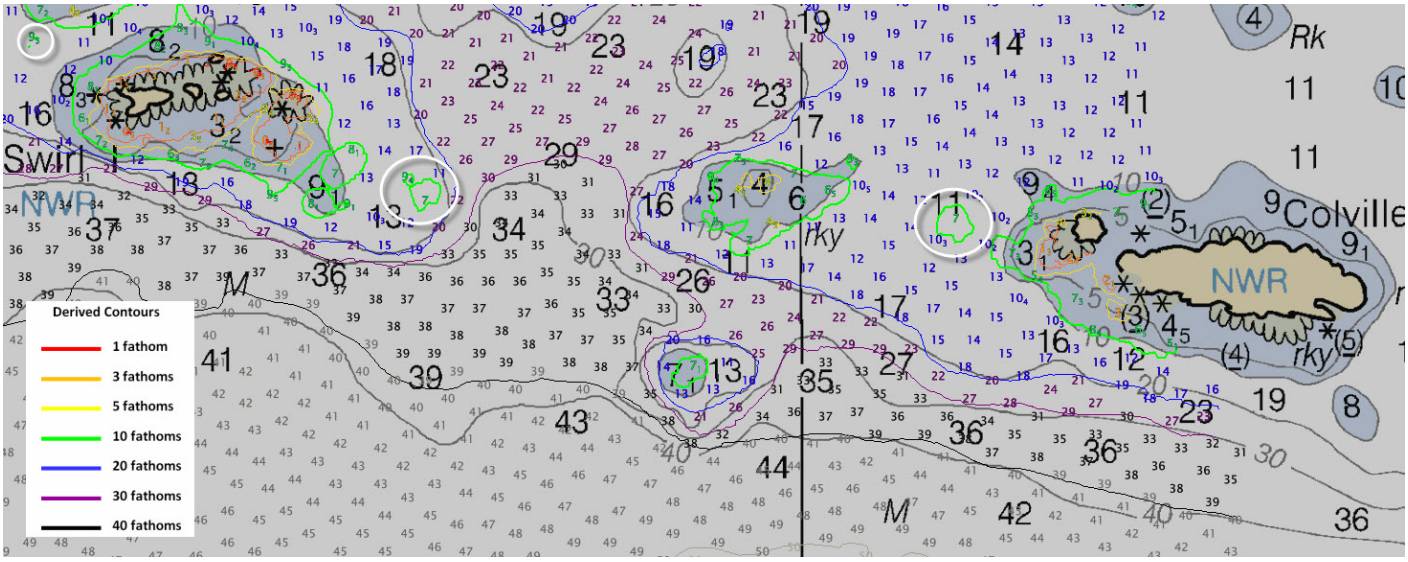

Figure 16: Overview between Coville and Swirl Island with an overlay of H12626 survey soundings and contours.

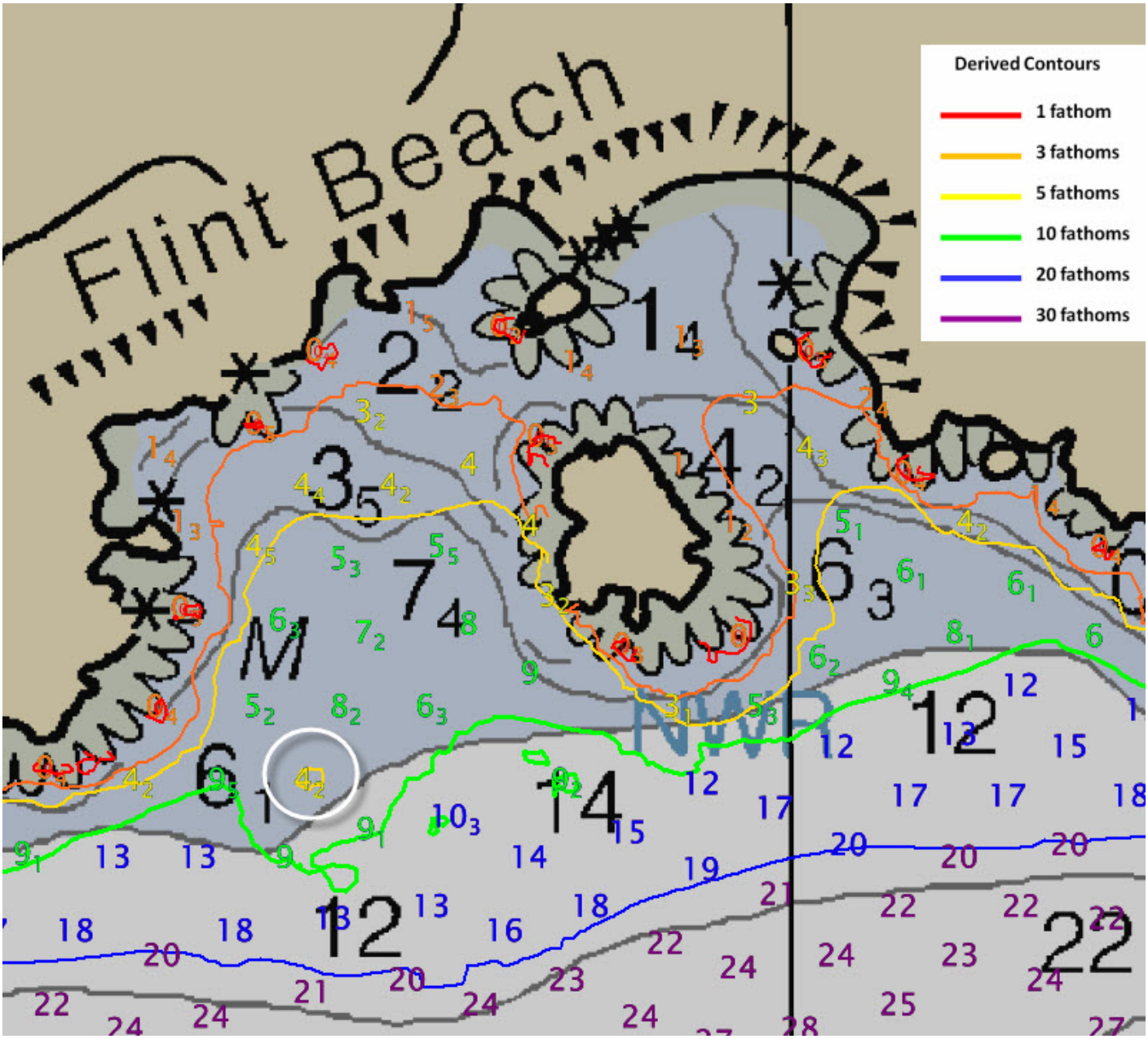

Figure 17: Overview of Flint Beach with an overlay of H12626 survey soundings and contours.

Charts 18423_14 (1:25,000) and 18423_11 (1:80,000) also cover the survey area. Chart 18423_14 is not addressed in the comparison because is covered entirely by Charts 18434 and 18429, both of which are the same scale. Depths from survey H12626 generally agree within 1 fathom of depths on Chart 18423 in the common area that is not addressed by a larger scale chart, and there are no charted contours available for comparison in that area.

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?
US5WA32M	1:25000	13	07/16/2014	08/26/2014	NO
US5WA42M	1:40000	10	01/24/2013	08/27/2014	NO

Table 17: Largest Scale ENCs

US5WA32M

Electronic Navigation Chart (ENC) US5WA32M coincides with raster Chart 18429. Navigation information contained on the ENC matches the raster, therefore a comparison between H12626 and the ENC is equivalent to the preceding comparison with Chart 18429.

US5WA42M

Electronic Navigation Chart (ENC) US5WA32M coincides with raster Chart 18434. Navigation information contained on the ENC matches the raster albeit at a smaller scale. A comparison between H12626 and the ENC is equivalent to the preceding comparison with Chart 18434.

ENC US5WA42M coincides with raster Chart 18434 and has a scale of 1:25,000
ENC US4WA34M also covers the survey area and has a scale of 1:80,000. The ENC corresponds to chart 18423_11, therefore, the comparison for that chart is also applicable to this ENC.

D.1.3 AWOIS Items

No AWOIS items were assigned 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 that were not addressed elsewhere in this report.

D.1.6 Uncharted Features

One hundred twenty-nine (129) new features were found during shoreline verification. All new features were addressed as required with S-57 attribution and recorded in the H12626 Final Feature File.

The final feature file has been archived and is not appended to this report.

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 HSSD, and are addressed in the H12626 Final Feature File.

The final feature file has been archived and is not appended to this report.

D.1.9 Channels

The southwest corner of survey H12626 overlapped a Southbound Puget Sound Traffic Lane and the separation zone between the corresponding Northbound Puget Sound Traffic Lane used by vessels transiting between the Strait of Juan de Fuca and Rosario Strait. Depths in the Traffic Separation Scheme area ranged from 85.71 to 94.52 meters (46.9 to 51.7 fathoms), which agreed with charted depths to within approximately one fathom.

D.1.10 Bottom Samples

Due to time constraints, only one bottom sample was acquired for this survey. It is detailed in the H12626 Final Feature File accompanying this report.

The final feature file has been archived and is not appended to this report.

D.2 Additional Results

D.2.1 Shoreline

Shoreline investigation results are contained within the H12626 Final Feature File submitted with this report. NOAA's Hydrographic Survey Division (HSD) was made aware that no dedicated shoreline window existed near predicted low water in accordance with the applicable sections of the NOAA HSSD and FPM during the time of data acquisition. HSD instructed NOAA Ship Rainier to acquire as much shoreline data as possible with the understanding that tides were unfavorable (see Appendix 5, Supplemental Correspondence submitted with this report). Shoreline verification was postponed until HSD instructions were received,

which provided a major time constraint. As a result, shoreline verification for the eastern section of H12626 (Charles Island to Cattle Point) was not completed.

D.2.2 Prior Surveys

No prior survey comparisons exist for this survey.

D.2.3 Aids to Navigation

Five aids to navigation (ATON) were present in the survey area, but were not assigned for investigation. The location of the daymark in the waterway between Richardson and Charles Island was observed in the field to be incorrectly charted, and was repositioned in the H12626 Final Feature File submitted with this report.

Figure 18: Incorrectly charted aid to navigation.

The final feature file has been archived and is not appended to this report.

D.2.4 Overhead Features

No overhead features exist for this survey.

D.2.5 Submarine Features

Cable crossing signs were seen in the charted cable areas west of Richardson,WA during shoreline investigation, inshore of the NALL. Where multibeam echosounder coverage exists, no obvious features were seen in the data.

Figure 19: Cable crossing sign observed west of Richardson,WA.

D.2.6 Ferry Routes and Terminals

No ferry routes or terminals exist for this survey.

D.2.7 Platforms

No permanent platforms exist for this survey.

D.2.8 Significant Features

No significant features 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 Recommendation

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

D.2.11 Inset Recommendation

No new insets are recommended for this area.

E. Approval Sheet

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

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

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys and Specifications Deliverables Manual, 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	2015-02-19

Approver Name	Approver Title	Approval Date	Signature
Edward J. Van Den Ameele, CDR/NOAA	Commanding Officer, NOAA Ship Rainier	03/13/2015	
Adam C. Pfundt, LTJG/NOAA	Field Operations Officer, NOAA Ship Rainier	03/13/2015	 Adam Pfundt I have reviewed this document 2015.03.13 10:31:29 -07'00'
James B. Jacobson	Chief Survey Technician, NOAA Ship Rainier	03/13/2015	 James Jacobson I have reviewed this document 2015.03.13 09:55:41 -07'00'
Micki Ream, ENS/NOAA	Junior Officer, NOAA Ship Rainier	03/13/2015	

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
TPE	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

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

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : December 15, 2014

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-N305-RA-2014
HYDROGRAPHIC SHEET: H12626

LOCALITY: Cattle Point to McArdie Bay, WA
TIME PERIOD: November 01 - November 16, 2014

TIDE STATION USED: Port Angeles, WA 944-4090
Lat. 48° 7.5′ N Long. 123° 26.5' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 1.987 meters

TIDE STATION USED: Port Townsend, WA 944-4900
Lat. 48° 6.7' N Long. 122° 45.5' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.389 meters

Tide STATION USED: Friday Harbor, WA 9449880
Lat. 48° 32.7′ Long. 123° 0.8' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.167 meters

REMARKS: RECOMMENDED GRID

Please use the TCARI grid "N305RA2014_final.tc" as the final grid for project OPR-N305-RA-2014, H12626 during the time period between November 01 and November 16, 2014.

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).

HOVIS.GERALD.THOMAS.JR.1365860250

Digitally signed by HOVIS.GERALD.THOMAS.JR.1365860250
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=HOVIS.GERALD.THOMAS.JR.1365860250
Date: 2014.12.17 14:33:28 -05'00'

CHIEF, PRODUCTS AND SERVICES BRANCH


Final TCARI grid for N305-RA-2014, H12626
Cattle Point to McArdie Bay, Strait of Juan de Fuca, WA
9449880 FRIDAY HARBOR, SAN JUAN CHANNEL
9444090 PORT ANGELES, STRAIT OF JUAN DE FUCA
9444900 PORT TOWNSEND, ADMIRALTY INLET
bing
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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Office of Coast Survey
Silver Spring, Maryland 20910-3282

March 3, 2015

MEMORANDUM FOR: CDR Edward Van Den Ameele, NOAA
Commanding Officer, NOAA Ship *Rainier*

FROM: CAPT Eric Berkowitz, NOAA
Chief, Hydrographic Surveys Division

SUBJECT: Vertical Datum Transformation Technique,
OPR-N305-RA-14, Strait of Juan de Fuca, WA

Hydrographic survey H12623 is approved for vertical reduction to chart datum, Mean Lower Low Water (MLLW), using the NOAA Vertical Datum Transformation (VDatum) (http://vdatum.noaa.gov) derived separation (SEP) model..

Approval of VDatum, in lieu of the NOAA Center for Operational Oceanographic Products and Services (CO-OPS) discrete zoning package as per the Project Instructions, is based on your recommendation and the review of comparison results you included in your attached email from February 19, 2015.

The results of the data analysis show that ellipsoidally referenced survey (ERS) techniques with VDatum used as the vertical datum reducer yield a superior solution and meet or exceed the horizontal and vertical specifications for hydrographic survey H12623. It is acknowledged that survey H12626 will be reduced to datum via TCARI due to errors in SBET application.

The comparison techniques are in line with the procedures outlined in the NOS Hydrographic Surveys Specifications and Deliverables document.

You shall include a description of your ERS processing procedures and the comparisons you conducted between ERS and traditional tides or prior survey data in the appropriate Descriptive Report (DR), Horizontal and Vertical Control Report and/or Data Acquisition and Processing Report. As appropriate in the DR, document specific vessel day(s) or line(s) that have not been processed using VDatum as the vertical reducer to MLLW where discrete zoning provides better results and/or where vertical uncertainties of your post processed vertical positional data are inaccurate.

Include this memo in the supplemental correspondence Appendix of the DR.

Micki Ream - NOAA Federal <micki.ream@noaa.gov>

Request for Alternative Gridding Resolutions for H12626

Adam Pfundt <ops.rainier@noaa.gov> Thu, Feb 12, 2015 at 11:21 AM
To: Michael Gonsalves - NOAA Federal <Michael.Gonsalves@noaa.gov>
Cc: co.rainier@noaa.gov, PHB Chief - NOAA Service Account <PHB.Chief@noaa.gov>, micki ream <Micki.Ream@noaa.gov>, _OMAO MOP ChiefST RAINIER <ChiefST.Rainier@noaa.gov>

LCDR Gonsalves,

I am writing to request alternative depth ranges of gridding resolutions for submittal of survey H12626 as part of project OPR-N305-RA-14. Parts of this survey were very dynamic with steeply sloping bottom. Using typical depths for gridding resolutions would result in holidays between layers. Per section 5.2.2.1 Object Detection Coverage of the HSSD, the shoaler extent of the coarser resolution grid should be modified to prevent this coverage gap. I would like to propose the following alternative depth ranges for the various resolutions:

H12626_MB_1m_MLLW_Final ... 0 meters - 20 meters
H12626_MB_2m_MLLW_Final ... 12 meters - 40 meters
H12626_MB_4m_MLLW_Final ... 26 meters - 80 meters
H12626_MB_8m_MLLW_Final ... 40 meters - 130 meters

Please let me know whether or not these proposed resolutions are acceptable for submittal. Thanks in advance.

V/r,

LTJG Pfundt

--
LTJG Adam Pfundt, NOAA
Operations Officer
NOAA Ship Rainier
2002 SE Marine Science Drive
Newport, OR 97365-5229
Ship's Cell (206) 660-8747

Micki Ream - NOAA Federal <micki.ream@noaa.gov>

Request for Alternative Gridding Resolutions for H12626

Michael Gonsalves - NOAA Federal <michael.gonsalves@noaa.gov> Wed, Mar 4, 2015 at 11:45 PM
To: Adam Pfundt <ops.rainier@noaa.gov>
Cc: _OMAO MOP CO Rainier <co.rainier@noaa.gov>, PHB Chief - NOAA Service Account <PHB.Chief@noaa.gov>, micki ream <Micki.Ream@noaa.gov>, _OMAO MOP ChiefST RAINIER <ChiefST.Rainier@noaa.gov>, Christina Fandel - NOAA Federal <christina.fandel@noaa.gov>, Corey Allen - NOAA Federal <corey.allen@noaa.gov>

Hey Adam,

My apologies for the delay in replying, your message was lost in my inbox. In the future please direct your correspondences to your project manager, Christy - you will get a much more timely reply.

With regard to your question, yes, you may proceed with the proposed modified gridding resolutions.

Cheers!
~~ mike.g.

On Thu, Feb 12, 2015 at 2:21 PM, Adam Pfundt <ops.rainier@noaa.gov> wrote:

> LCDR Gonsalves,
>
> I am writing to request alternative depth ranges of gridding resolutions for submittal of survey H12626 as part of project OPR-N305-RA-14. Parts of this survey were very dynamic with steeply sloping bottom. Using typical depths for gridding resolutions would result in holidays between layers. Per section 5.2.2.1 Object Detection Coverage of the HSSD, the shoaler extent of the coarser resolution grid should be modified to prevent this coverage gap. I would like to propose the following alternative depth ranges for the various resolutions:
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> H12626_MB_1m_MLLW_Final ... 0 meters - 20 meters
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> H12626_MB_4m_MLLW_Final ... 26 meters - 80 meters
> H12626_MB_8m_MLLW_Final ... 40 meters - 130 meters
>
> Please let me know whether or not these proposed resolutions are acceptable for submittal. Thanks in advance.
>
> V/r,
>
> LTJG Pfundt
>
> --
> LTJG Adam Pfundt, NOAA
> Operations Officer
> NOAA Ship Rainier
> 2002 SE Marine Science Drive
> Newport, OR 97365-5229
> Ship's Cell (206) 660-8747

http://ocs-mcd-webapps1.ncd-tcn.noaa.gov/IDMS/discrepancy.aspx?S Internal DR 24860

File Edit View Favorites Tools Help

Subject: Coast Survey Discrepancy
Date: 10/28/2014
From: Peter.Holmberg

Printed below is a tabulated listing of the information you provided. Any further correspondence concerning this specific report should reference the sequentially assigned report number listed in the first row of the table.

Email responses sent to you may come from nautical.charting@noaa.gov. Please make sure your spam filtering allows you to receive email from this address.

Report number	24860
Date submitted	10/28/2014
Email	Peter.Holmberg@noaa.gov
Discrepancy	Offset between RNC 18434 and ENC USWA32M in the vicinity of In the vicinity of 48-26-47N, 122-53-45.
Product	Chart: 18434, 4th Ed. ENC: USWA32M, 13th Ed. Update number 1
Date Observed:	10/28/2014
Position:	In the vicinity of 48-26-47N, 122-53-45

Email sent to: ocs.pbd@noaa.gov

Close

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H12626 Feature Report

Registry Number: H12626
State: Washington
Locality: Strait of Juan de Fuca
Sub-locality: Cattle Point to McArdle Bay
Project Number: OPR-N305-RA-14
Survey Dates: 11/01/2014 - 11/15/2014

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
18429	10th	01/01/2007	1:25,000 (18429_1)	[L]NTM: ?
18423	36th	07/01/2007	1:80,000 (18423_11) 1:25,000 (18423_14)	[L]NTM: ?
18434	7th	04/01/2008	1:25,000 (18434_1)	[L]NTM: ?
18465	38th	05/01/2008	1:80,000 (18465_1)	[L]NTM: ?
18421	49th	02/01/2008	1:80,000 (18421_1)	[L]NTM: ?
18400	48th	12/01/2008	1:200,000 (18400_1)	[L]NTM: ?
18003	20th	11/01/2006	1:736,560 (18003_1)	[L]NTM: ?
18007	33rd	02/01/2009	1:1,200,000 (18007_1)	[L]NTM: ?
501	12th	11/01/2002	1:3,500,000 (501_1)	[L]NTM: ?
530	32nd	06/01/2007	1:4,860,700 (530_1)	[L]NTM: ?
50	6th	06/01/2003	1:10,000,000 (50_1)	[L]NTM: ?

* Correction(s) - *source: last correction applied (last correction reviewed--"cleared date")*

Features

No.	Feature Type	Survey Depth	Survey Latitude	Survey Longitude
1.1	Wreck	[None]	48° 26' 08.4" N	122° 52' 16.1" W
2.1	Wreck	13.60 m	48° 26' 32.7" N	122° 52' 51.1" W
2.2	Wreck	0.60 m	48° 26' 08.3" N	122° 52' 16.1" W

1 - Charted Features

1.1) US 0000006125 00001

Survey Summary

Survey Position:	48° 26' 08.4" N, 122° 52' 16.1" W
Least Depth:	[None]
TPU (±1.96σ):	**THU (TPEh)** [None] ; **TVU (TPEv)** [None]
Timestamp:	2010-124.00:00:00.000 (05/04/2010)
Dataset:	H12626_Wrecks.000
FOID:	US 0000006125 00001(0226000017ED0001)
Charts Affected:	18423_14, 18429_1, 18434_1, 18421_1, 18423_11, 18465_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

Wreck disproved with complete MBES.

Hydrographer Recommendations

Delete wreck - see feature US 0000006123.

S-57 Data

Geo object 1:	Wreck (WRECKS)
Attributes:	CATWRK - 5:wreck showing any portion of hull or superstructure
	SORDAT - 20100504
	SORIND - US,US,reprt,13thCGD,LNM 18/10
	WATLEV - 2:always dry

Office Notes

Concur.

2 - New Features

2.1) US 0000006124 00001

Survey Summary

Survey Position:	48° 26' 32.7" N, 122° 52' 51.1" W
Least Depth:	13.60 m (= 44.62 ft = 7.437 fm = 7 fm 2.62 ft)
TPU (±1.96σ):	**THU (TPEh)** [None] ; **TVU (TPEv)** [None]
Timestamp:	2014-319.00:00:00.000 (11/15/2014)
Dataset:	H12626_Wrecks.000
FOID:	US 0000006124 00001(0226000017EC0001)
Charts Affected:	18423_14, 18429_1, 18434_1, 18421_1, 18423_11, 18465_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

New wreck found with multibeam

Hydrographer Recommendations

Chart per H12626 MBES

Cartographically-Rounded Depth (Affected Charts):

7 ¼fm (18421_1, 18465_1, 18400_1, 18003_1, 18007_1, 530_1)

7fm 2ft (18423_14, 18429_1, 18434_1, 18423_11)

13.6m (501_1, 50_1)

S-57 Data

Geo object 1:	Wreck (WRECKS)
Attributes:	CATWRK - 1:non-dangerous wreck
	QUASOU - 6:least depth known
	SORDAT - 20141115
	SORIND - US,US,graph,H12626
	TECSOU - 3:found by multi-beam
	VALSOU - 13.600 m
	WATLEV - 3:always under water/submerged

Office Notes

Concur.

Feature Images

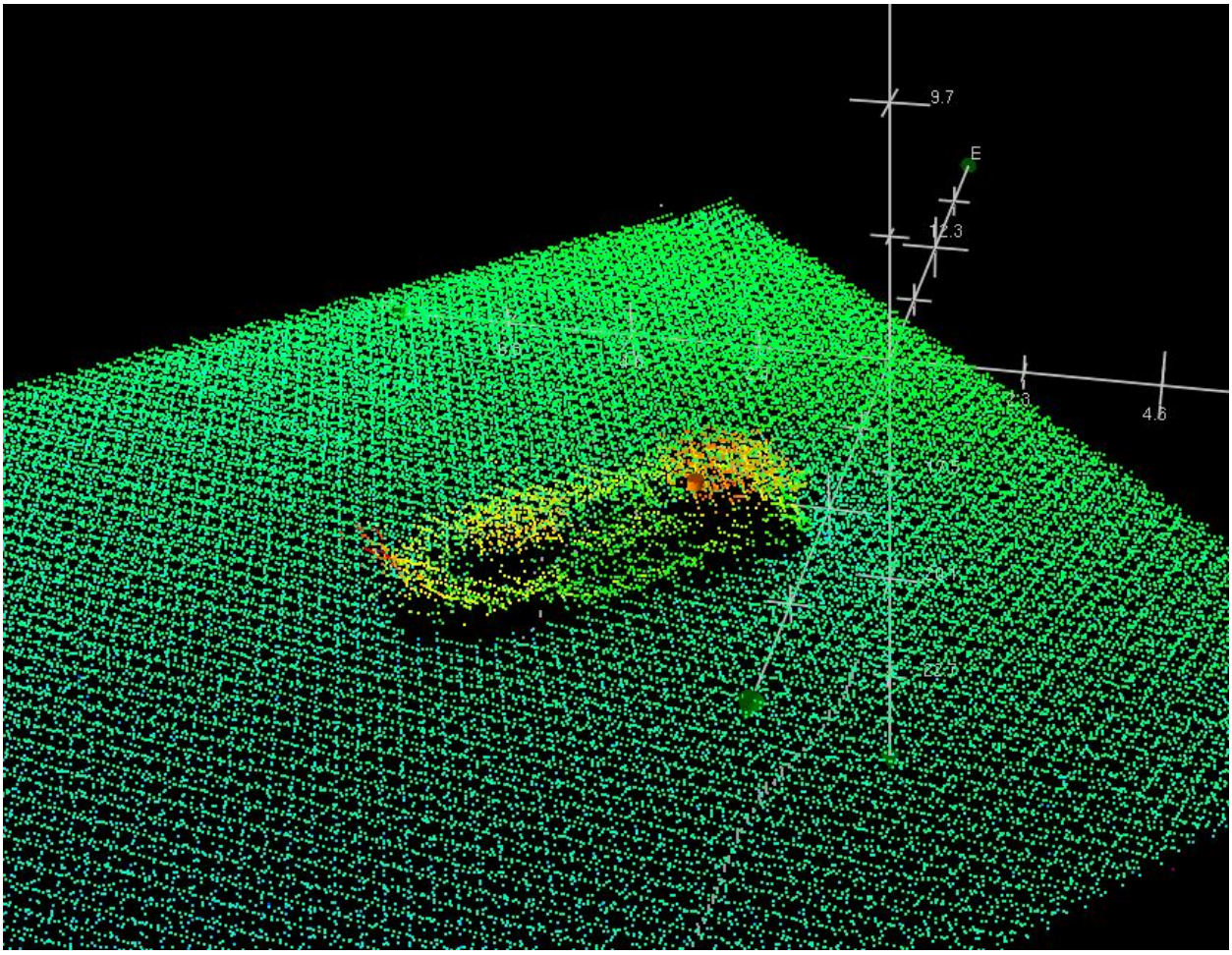

Figure 2.1.1

2.2) US 0000006123 00001

Survey Summary

Survey Position:	48° 26' 08.3" N, 122° 52' 16.1" W
Least Depth:	0.60 m (= 1.97 ft = 0.328 fm = 0 fm 1.97 ft)
TPU (±1.96σ):	**THU (TPEh)** [None] ; **TVU (TPEv)** [None]
Timestamp:	2014-319.00:00:00.000 (11/15/2014)
Dataset:	H12626_Wrecks.000
FOID:	US 0000006123 00001(0226000017EB0001)
Charts Affected:	18423_14, 18429_1, 18434_1, 18421_1, 18423_11, 18465_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

Wreck positioned with multibeam

Hydrographer Recommendations

Chart as depicted

Cartographically-Rounded Depth (Affected Charts):

0 ¼fm (18421_1, 18465_1, 18400_1, 18003_1, 18007_1, 530_1)

0fm 2ft (18423_14, 18429_1, 18434_1, 18423_11)

0.6m (501_1, 50_1)

S-57 Data

Geo object 1:	Wreck (WRECKS)
Attributes:	CATWRK - 1:non-dangerous wreck
	QUASOU - 6:least depth known
	SORDAT - 20141115
	SORIND - US,US,graph,H12626
	TECSOU - 3:found by multi-beam
	VALSOU - 0.600 m
	WATLEV - 3:always under water/submerged

Office Notes

Concur.

Feature Images

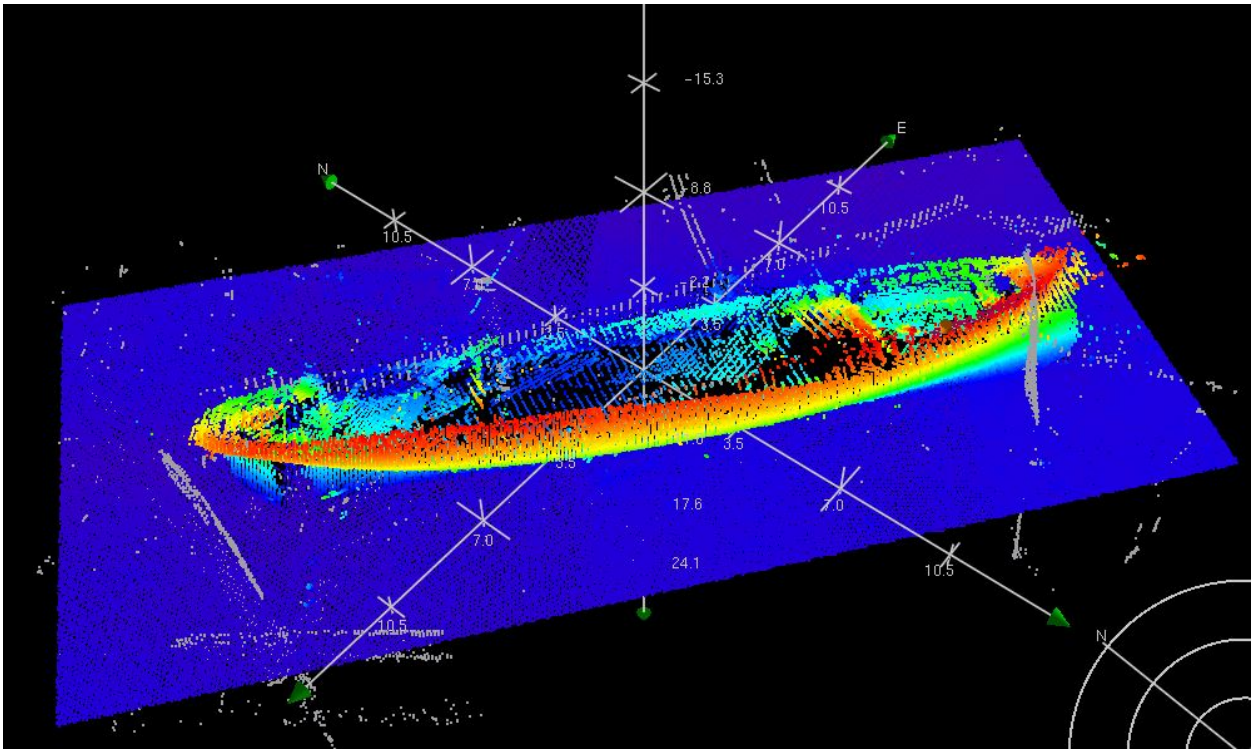

Figure 2.2.1

APPROVAL PAGE

H12626

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

- H12626_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12626_GeoImage.pdf

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

Digitally signed by HOLMBERG.PETER.SCOTT.1365886101
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=HOLMBERG.PETER.SCOTT.1365886101
Date: 2016.01.06 14:55:01 -08'00'

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.

Digitally signed by BROWN.KURT.E.1156712600
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=BROWN.KURT.E.1156712600
Date: 2016.01.06 14:29:19 -08'00'

Approved:_____

Kurt Brown
Physical Scientist, Pacific Hydrographic Branch