

H12025

NOAA FORM 76-35A

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

DESCRIPTIVE REPORT

Type of Survey HYDROGRAPHIC

Field No. RA-05-01-09

Registry No. H12025

LOCALITY

State Washington

General Locality Central Puget Sound

Sublocality Approaches to Elliot Bay - Skiff Point to Alki Point

2009

CHIEF OF PARTY

..... Captain Donald W. Haines, NOAA

LIBRARY & ARCHIVES

DATE

<p style="text-align: center;">U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION</p> <p style="text-align: center;">HYDROGRAPHIC TITLE SHEET</p>	<p>REGISTRY No</p> <p style="text-align: center;">H12025</p>
<p>INSTRUCTIONS – The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.</p>	<p>FIELD No:</p> <p style="text-align: center;">RA-05-01-09</p>
<p>State <u>Washington</u></p> <hr/> <p>General Locality <u>Central Puget Sound</u></p> <hr/> <p>Sub-Locality <u>Approaches to Elliot Bay - Skiff Point to Alki Point</u></p> <hr/> <p>Scale <u>1:5,000</u> Date of Survey <u>April 8, 2009 - April 22, 2009</u></p> <hr/> <p>Instructions dated <u>3/10/2009</u> Project No. <u>OPR-N395-RA-09</u></p> <hr/> <p>Vessel(s) <u>RA1 (1101), RA2 (1103), RA4 (2801), RA5 (2802), RA3 (2803), RA6 (1015)</u></p> <hr/> <p>Chief of party <u>Captain Donald W. Haines, NOAA</u></p> <hr/> <p>Surveyed by <u>RAINIER Personnel</u></p> <hr/> <p>Soundings by <u>Reson SeaBat 7125, Tilted Reson SeaBat 8125, Knudsen 320M</u></p> <hr/> <p>SAR by <u>Annemieke Raymond</u> Compilation by <u>Katie Reser</u></p> <hr/> <p>Soundings compiled in <u>Feet</u></p>	
<p>REMARKS: <u>All times are UTC. UTM Zone 10N.</u></p> <hr/> <p><u>The purpose of this survey is to provide contemporary surveys to update</u></p> <hr/> <p><u>National Ocean Service (NOS) nautical charts.</u></p> <hr/> <p><u>All separates are filed with the hydrographic data.</u></p> <hr/> <p><u>Revisions and end notes in red were generated during office processing.</u></p> <hr/> <p><u>Page numbering may be interrupted or non sequential.</u></p>	

Descriptive Report to Accompany Hydrographic Survey H12025

Project OPR-N395-RA-09
Central Puget Sound, Washington
Approaches to Elliot Bay – Skiff Point to Alki Point
Scale 1:5,000
April, 2009
NOAA Ship *Rainier* (s221)
Chief of Party: Captain Donald W. Haines, NOAA

A. AREA SURVEYED

This hydrographic survey was completed as specified by Hydrographic Survey Project Instructions OPR-N395-RA-09 dated March 10, 2009 and all other applicable direction¹, with the exception of deviations noted in this report. The survey area is the Approaches to Elliot Bay – Skiff Point to Alki Point, Washington, and corresponds to sheet “B” in the sheet layout provided with the Project Instructions. OPR-N395-RA-09 responds to a request from the Puget Sound Pilots Association.

Complete multibeam echosounder (MBES) coverage was achieved in the survey area in waters 8 meters and deeper. In depths less than 8 meters additional MBES coverage was acquired to identify least depths over significant features or shoals, as appropriate for this survey. Additional multibeam coverage was achieved in water depths between 8 m and 4 m that meet or exceed the project instruction requirements. Total mileage acquired by each vessel and system is reference in Table 1.

Data Acquisition Type	Hull Number with Mileage (nm)						Total
	1101	1103	2801	2802	2803	2804	
VBES (mainscheme)	-	1.12	-	-	-	-	1.12
MBES (mainscheme)	27.97	-	92.94	25.91	108.05	117.68	372.55
SSS (mainscheme)	-	-	-	1.07	-	-	1.07
MBES + SSS (mainscheme)	-	-	-	1.93	-	-	1.93
PDBS (Testing)	-	-	-	-	-	-	-
Crosslines	-	-	11.09	9.91	0.33	0.82	22.15
Developments	-	-	-	-	-	-	-
Shoreline	-	-	-	-	-	-	-
Bottom Samples	-	-	-	-	-	-	-
Total Number of Items Investigated	-	-	-	-	-	-	-
Total Area Surveyed (sq. nm)	-	-	-	-	-	-	21.34

Table 1: Statistics for survey H12025

Limited Shoreline Verification was performed for the survey area seaward of the Navigable Area Limit Line (NALL) for H12025, as per section 3.5.5 of the Field Procedures Manual

1. NOS Hydrographic Surveys Specifications and Deliverables (April 2009), OCS Field Procedures Manual for Hydrographic Surveying (April 2009), and all Hydrographic Surveys Technical Directives issued through the dates of data acquisition.

April 2009 (FPM). Shoreline features were given S-57 attribution and included for submission in Notebook .hob files

Due to boat slips, piers, and other structures in Elliot Bay Marina and the far western corner of Eagle Harbor, complete survey coverage was not acquired to the NALL. Limited multibeam coverage was acquired to determine navigationally significant depths, but complete multibeam coverage was not obtained due to time and maneuverability constraints within the marina.

Although not called for in the Project Instructions, 200% side scan sonar (SSS) coverage was acquired in the areas of Eagle Bay and Elliot Bay Marina to improve probability of detection of submerged hazards in navigationally critical areas.

Data acquisition was conducted from April 8 to April 22, 2009 (DN098 to DN112).

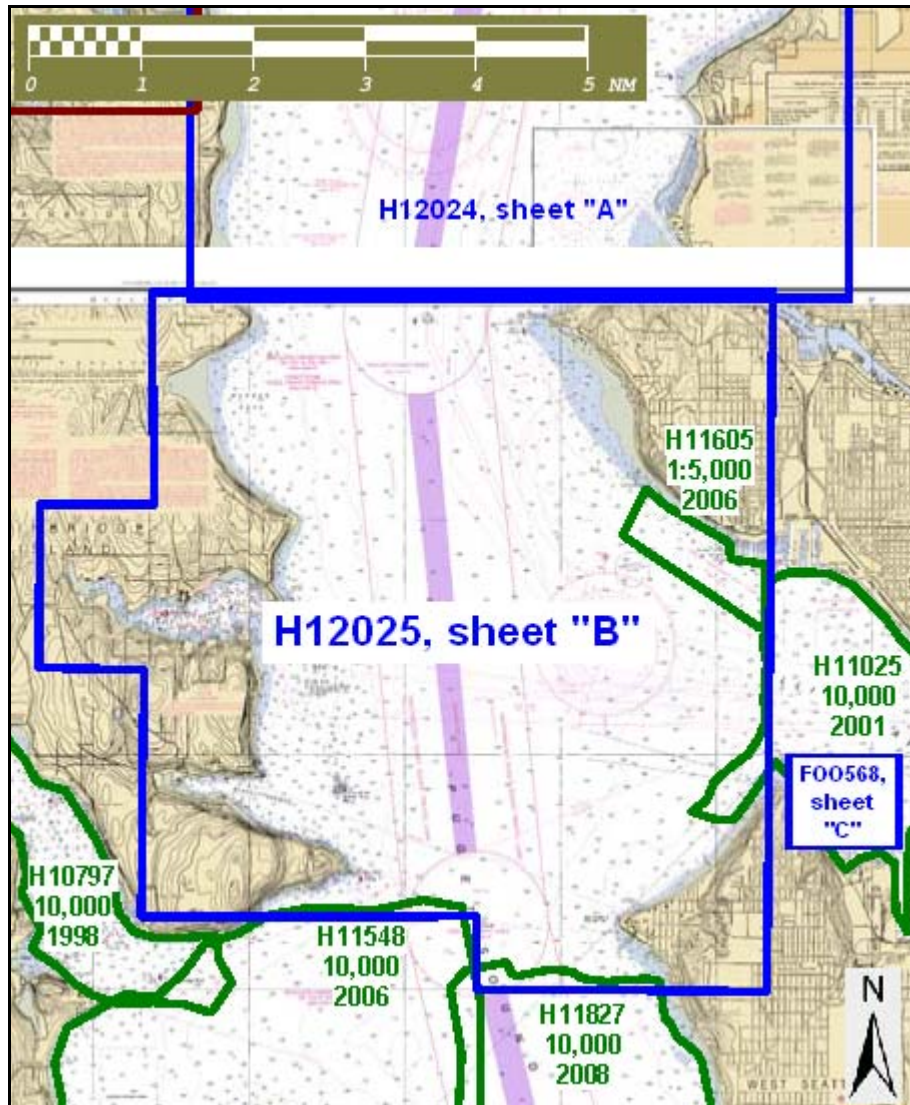


Figure 1: H12025 Survey Outline and Junctions

B. DATA ACQUISITION AND PROCESSING

A complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods can be found in the *OPR-N395-RA-09 Data Acquisition and Processing Report (DAPR)*¹, submitted under separate cover. Items specific to this survey, and any deviations from the DAPR are discussed in the following sections.

Final Approved Water Levels have been applied to this survey. See Section C. for additional information.

B.1. Equipment and Vessels

Data for this survey were acquired by the following vessels:

Hull Number	Name	Length (ft)	Draft (ft)	Acquisition Type
1101	RA-1	29	2	Reson 8125 Multibeam Echosounder Detached Positions
1103	RA-2	29	2	Knudsen 320M Vertical Beam Echosounder Detached Positions
2801	RA-4	29	3.5	Reson 7125 Multibeam Echosounder
2802	RA-5	29	3.5	Reson 7125 Multibeam Echosounder Klein 5000 Side Scan Sonar
2803	RA-3	29	3.5	Reson 7125 Multibeam Echosounder
2804	RA-6	29	3.5	Reson 7125 Multibeam Echosounder

Table 2: Data acquisition vessels and systems for H12025

Sound speed profiles were measured in accordance with the Specifications and Deliverables using SEACAT 19+ profilers.

Multibeam vessel navigation and attitude data were measured and recorded using Applanix POS/MV 320 systems, version 4. Vertical beam echosounder navigation and attitude data were measured using a TSS MAHRS system.

A complete description of survey vessels, hardware, and software systems is included in the *OPR-N395-RA-09 DAPR*.

No unusual vessel configurations were used for data acquisition.

B.2. Quality Control

B.2.a. Crosslines

Multibeam Echosounder (MBES) crosslines totaled 22.15 nautical miles, comprising 5.94% of main scheme MBES hydrography. The main scheme bathymetry was manually compared to the XL nadir beams in CARIS subset mode and agreed within 0.25 meters.²

A statistical Quality Control Report has been conducted on representative data acquired with each system used on this survey. Results of these tests are included in the updated 2009 *Rainier* Hydrographic System Readiness Review package submitted with this survey.

B.2.b Final Uncertainty

Uncertainty values of submitted, finalized grids are calculated in Caris using the “Greater of the Two” of total propagated uncertainty and standard deviation (scaled to 95%). The Uncertainty of all finalized grids fall below the IHO levels as described in the NOS Specifications and Deliverables. This was checked by creating an “IHO-ness” attribute layer under each of the finalized base surfaces in Caris HIPS.

B.2.c. Junctions

Survey H12025 junctions with survey H12024, which is Sheet A of the same project, and surveys H11605, H11827, and H11548.³ The sheet limits and area of overlap can be seen in Figure 1.

Junction Survey	Survey Scale	Date of Survey	Survey Location
H12024	1:5000	2009	North
H11605	1:5000	2001	East
H11827	1:10,000	2008	Southeast
H11548	1:10,000	2006	Southwest

Table 3: Junction Surveys

No data for H11605, H11827, and H11548 were provided for junction comparison and therefore no junction comparisons were completed for these surveys.

Survey H12024 was completed concurrently with survey H12025 during project OPR-N395-RA-09. H12025 finalized combined 8 meter BASE surfaces were compared to the finalized combined 8 meter junction surface in Caris HIPS. Agreement was good with slight discernable offsets in the common area.⁴ Differences are less than 1 meter, with most being less than 0.3 meters, in the area of overlap with soundings from H12024 generally shoaler than those from H12025. Only isolated occurrences of offsets up to 1.0-meter were evident and all occurred in water depths greater than 100 meters. Offsets appear to be the result of tidal corrector errors and that are noted throughout the data from H12025 and discussed in greater detail in section B.2.e.

B.2.d. Quality Control Checks

MBES quality control checks were conducted as discussed in the quality control section B of the DAPR.

B.2.e. Data Quality Factors

True Heave Ethernet Card Transfer Rate Setting Error

On April 12, 2009 the data transfer rate on the network card connecting the Acquisition PC and the POS/MV was set to 100 megabits on all launches. This low data transfer rate resulted in seven (7) second gaps in the POSpac recorded files, which did not allow for True Heave to be correctly calculated. When these POSpac files were used to apply True Heave to MBES lines the lines exhibited “ruffles” (Figure 3). The data transfer rate was reset to a correct value of 1 gigabit on April 15, 2009 (DN 105). Consequently multibeam data acquired on days between April 12, 2009 (DN102) and April 15, 2009 (DN105) did not have True Heave applied (Figure 2 and Table 4). Lines were examined and no significant heave artifacts are present in the data.⁵

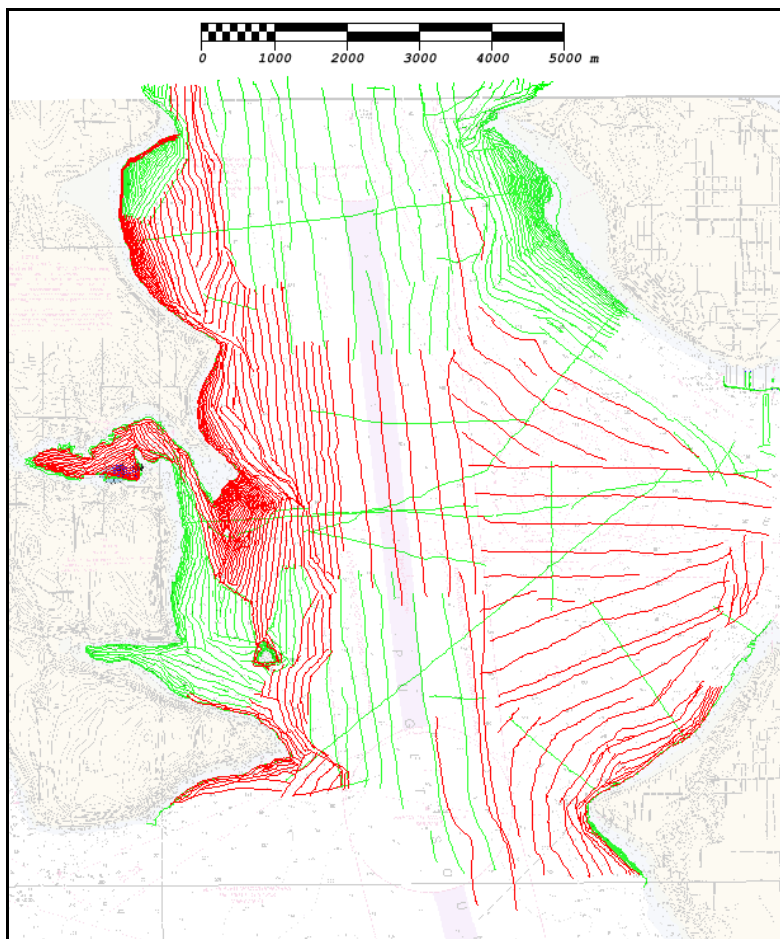


Figure 2: Lines (red) indicate data with no True Heave

2801 HF	2801 LF	2802 HF	2803 HF	2803 LF	2804 HF	2804 LF
DN102	DN102	DN104	DN103	DN104	DN104	DN103
DN103	DN103					DN104
DN105						DN105

Table 4: Days without True Heave by specific launches and sonar frequency

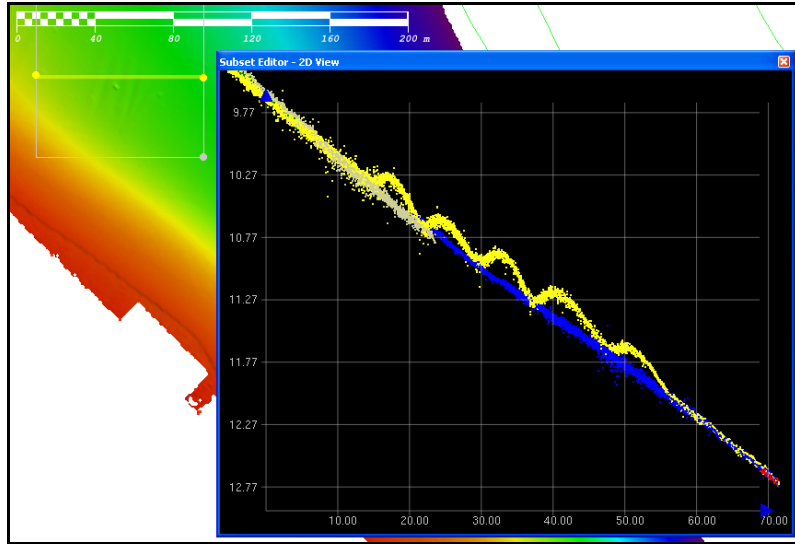


Figure 3: Resulting 'ruffles' in the main scheme bathymetry from erroneous True Heave.

Tide Modeling Error

Data from H12025 exhibited vertical offsets throughout the survey area, which were attributed to tide modeling error.⁶ Line 000_1625 from 2803 (RA-3) on April 12, 2009 (DN 102) had varying vertical offset from surrounding data with a maximum offset of 0.4-meters being evident in approximately 12-meters water depth (Figure 4). The location of this offset can be found at 47°35'40.1" N 122°30'17.8" W (537217.39, 5271347.9), near the entrance of Blake Harbor.

Data from 2804 (RA-6) exhibited similar varying offsets on April 20, 2009 (DN 110) with a maximum offset of approximately 0.2-meters evident in roughly 4.5-meters water depth (Figure 5). The location of this offset is located 47°39'29.01" N 122°30'02.22" W (537497.26, 5278416.6), south of Skiff Point.

The varying nature of the offset leads to the conclusion that the vertical offset is largely due to tide error. Data from both 2803 (RA-3) and 2804 (RA-6) on these days show vertical offsets between data acquired at different times of the day. Specifically, the greatest offset of 0.4 meters is evident in 2803 (RA-3) data at 16:27 UTC. Data later in the day, 21:31 UTC, correlated with surrounding data better, with an offset of 0.06 meters.

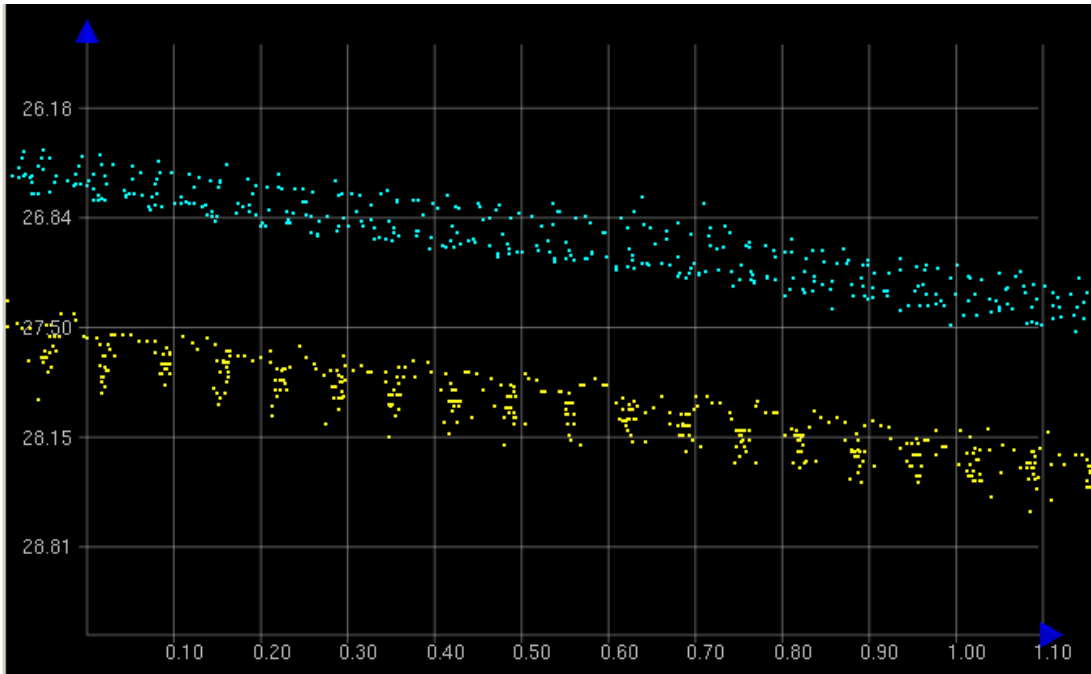


Figure 4: Blue data from 2803 (RA-3) exhibits a 0.4 meter offset from 1101 (RA-1) data, yellow.

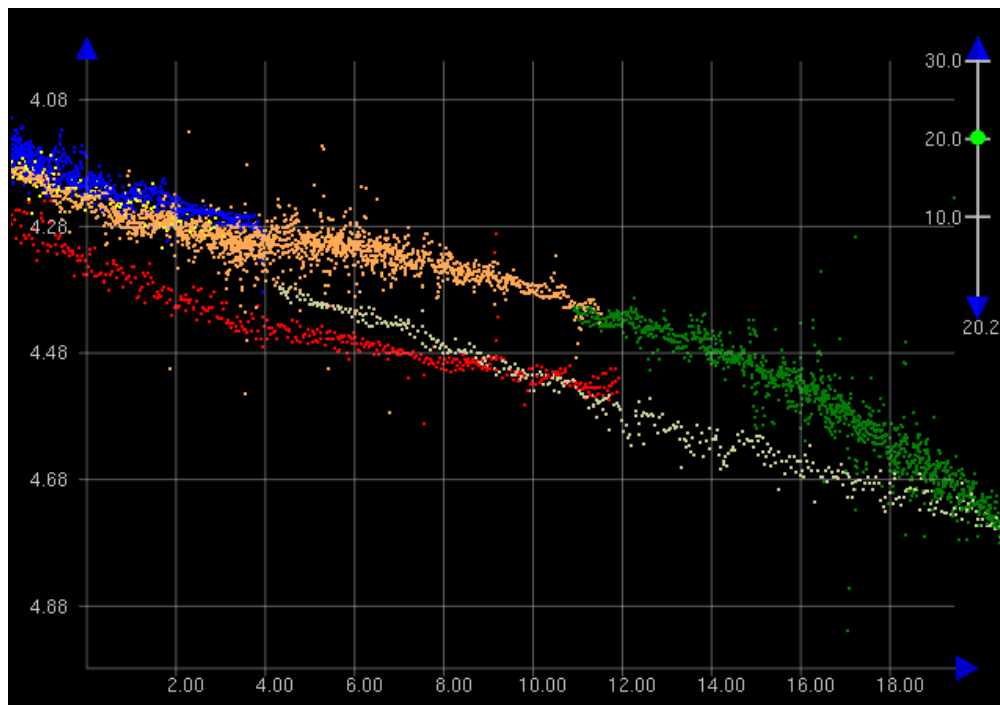


Figure 5: Data from 2804 (RA-6) exhibits a 0.2 meter offset from 2801 (RA-4) data.

B.2.f. Object Detection and Coverage Assessment

Tyee Shoal Holiday

Due to time constraints *Rainier* was unable to acquire 25 meter line spaced multibeam or vertical beam coverage over Tyee Shoal, resulting in two holidays combined to be approximately 65 meters wide and 150 meters long (Figure 6). Complete multibeam coverage was acquired to the 8 meter curve, and Tyee Shoals is marked by a navigation light. The holiday is located at 47°36'36.22" N 122°29'15.05" W (538516.22, 5273088.72), near the entrance to Eagle Harbor. The Hydrographer recommends retaining charted depth.⁷

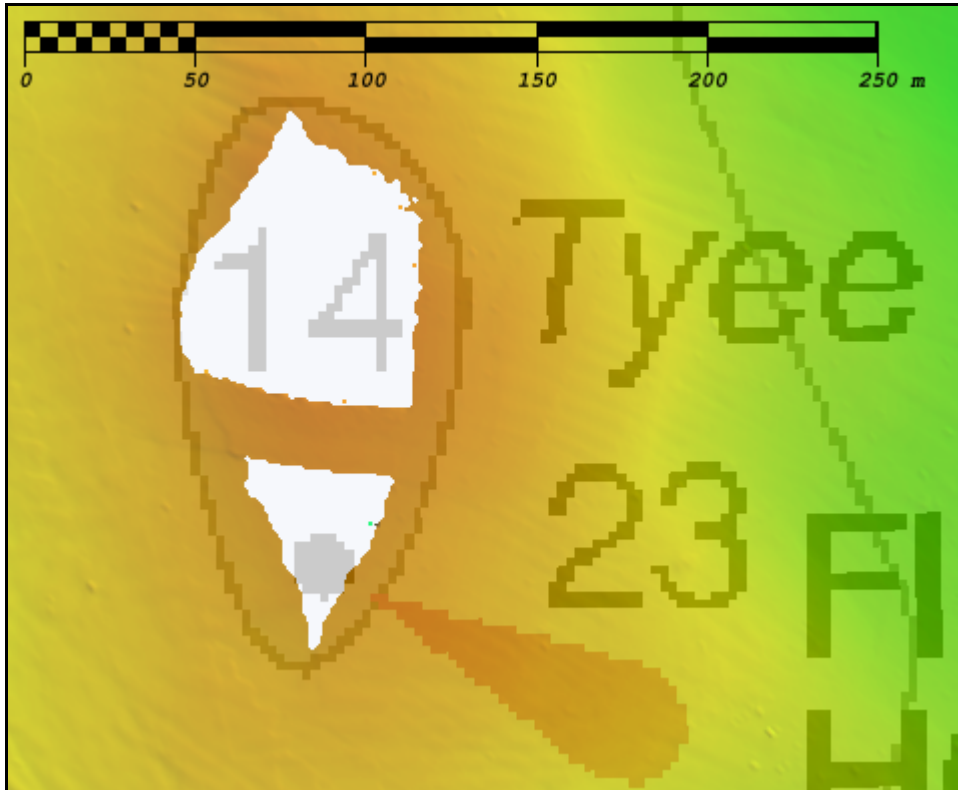


Figure 6: Holiday located at 47°36'36.41" N 122°29'15.38" W (538509.35, 5273094.68).

Sound Velocity Holiday

A holiday was created by a temporary lapse in the surface sound velocimeter of 2803 (RA-3) on April 12, 2009 (DN102), located in position 47°36'29.62" N 122°29'40.03" W (537996.12, 5272881.69) (Figure 7). This holiday was not a result of a systematic error in the system. This holiday was caused by operator error. The corresponding multibeam backscatter side scan was examined and no navigationally significant items were found; additionally, the least depths were represented.⁸

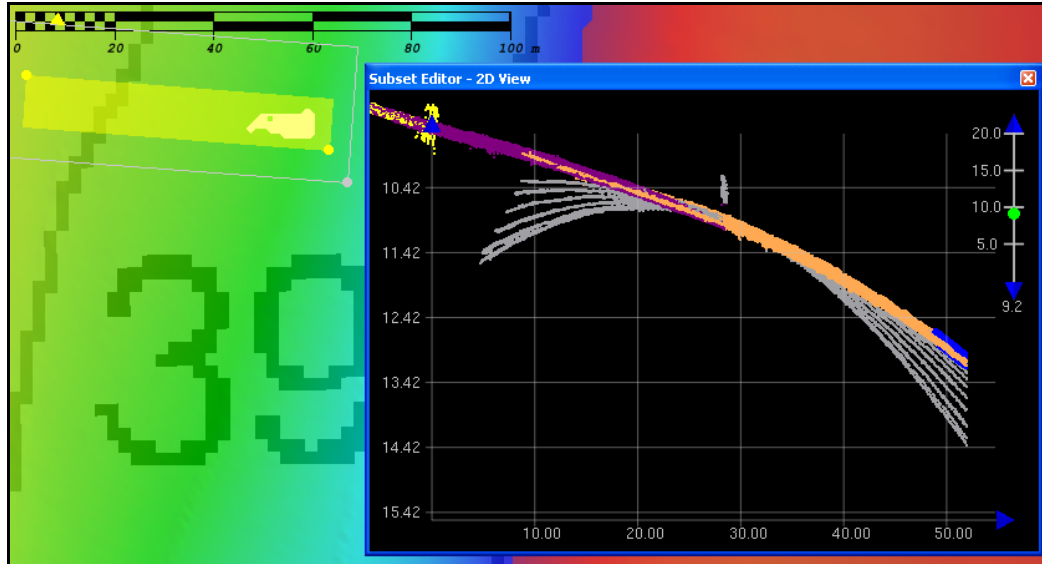


Figure 7: Temporary sound velocity error (gray) caused a holiday.

No Top Of A Rock

On April 20, 2009 (DN110), Launch 2804 (RA-6) failed to acquire complete multibeam coverage over a rocky feature located at 47°39'27.4" N 122°29'51.77" W (537715.48, 5278368.33) (Figure 8). The line spacing was too far apart for the outer beams to cover the top of the feature. The feature lies in approximately nine meters of depth, with the shoalest bathymetry recorded at 7.9 meters depth. The Hydrographer recommends charting as per digital data.⁹

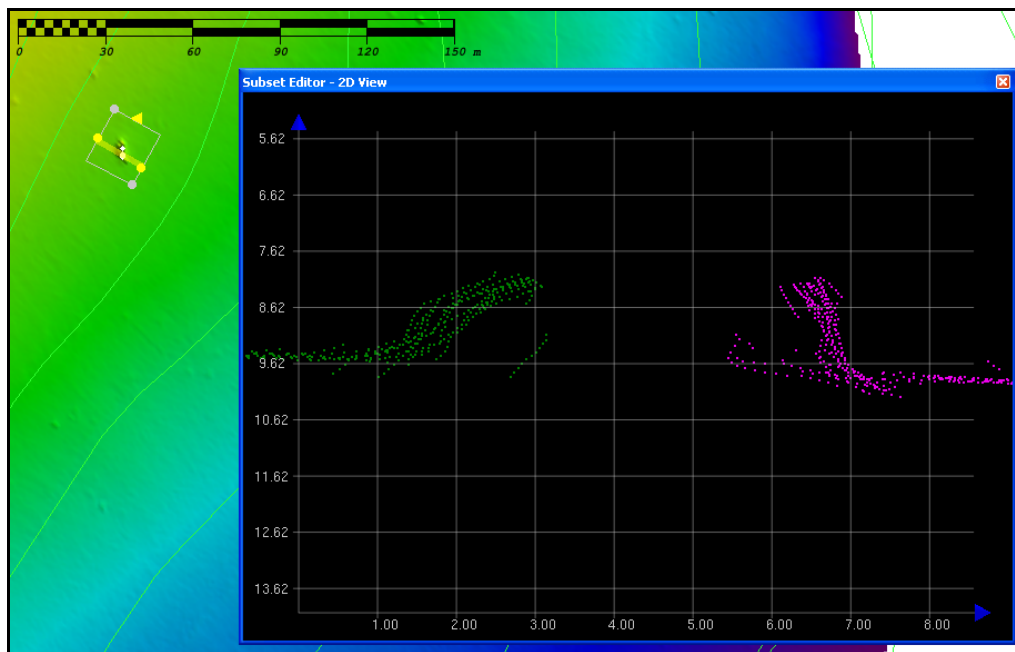


Figure 8: Wide line spacing during acquisition failed to capture the entirety of this feature

Holidays Due To Line Spacing

Four holidays on survey H12025 are a result of poor line spacing. At moments during survey, spacing between lines, as a result of seafloor features causing acoustic shadowing or launch crews briefly surveying too wide, resulted in multibeam coverage not overlapping and the creation of holidays at least 3 nodes across (Figure 9 through 12). The Hydrographer recommends charting as per digital data.¹⁰

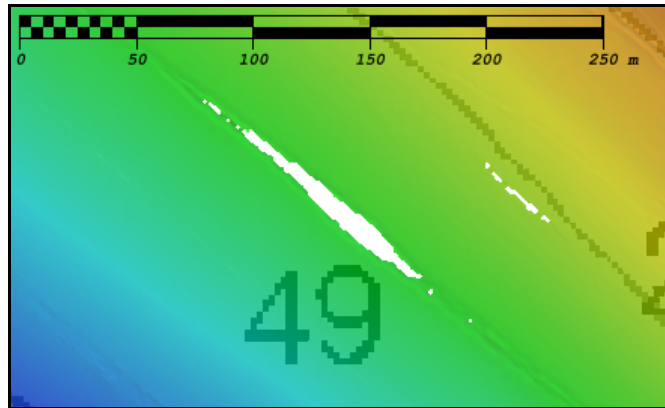


Figure 9: Line spacing holiday located at 47°38'31.8" N 122°25'31.24" W (543162.28, 5276689.66)

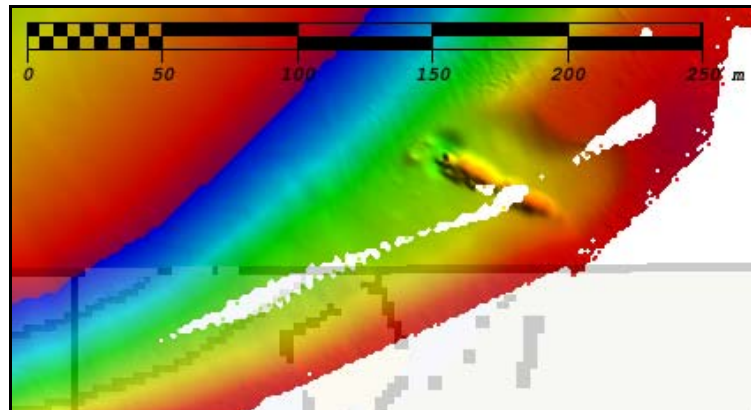


Figure 10: Line spacing holiday located at 47°39'50.01" N 122°25'52.99" W (542690.76, 5279100.79)

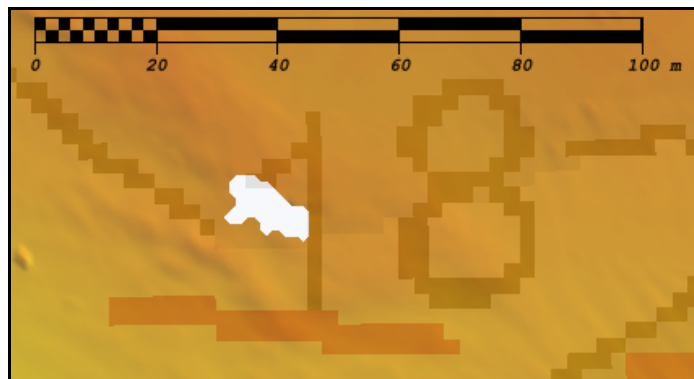


Figure 11: Line spacing holiday located at 47°36'51.96" N 122°29'01.66" W (538792.64, 5273576.58)

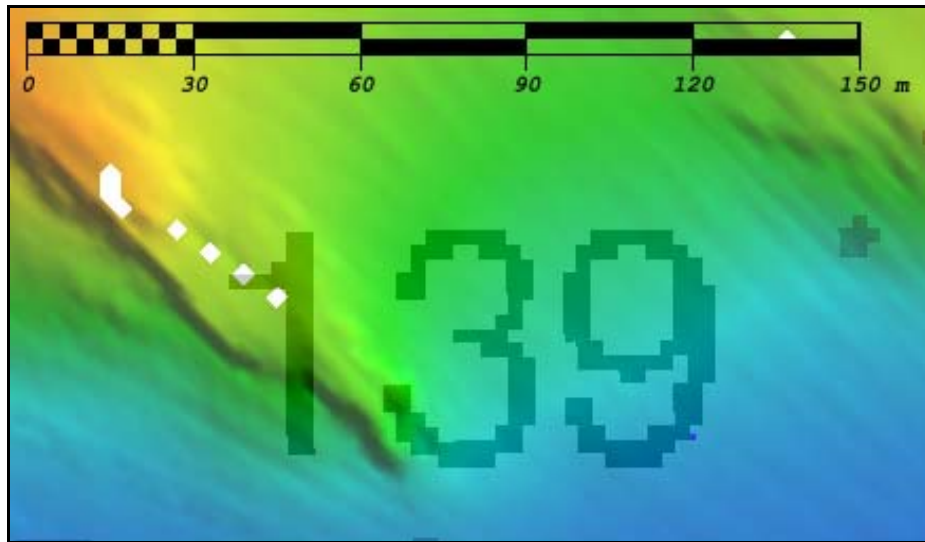


Figure 12: Line spacing holiday located at 47°34'49.89" N 122°28'25.15" W (539580.22, 5269813.35)

Holidays Due To Poor Survey Conditions

Three holidays on survey H12025 are a result of surveying during rough conditions in depths greater than 600 feet. At moments during survey sonar blow-outs resulted in holidays greater than 3 nodes (Figure 13 through 15). The corresponding multibeam backscatter side scan was examined and no navigationally significant items were found; additionally, the least depths were represented. The Hydrographer recommends charting as per digital data.¹¹

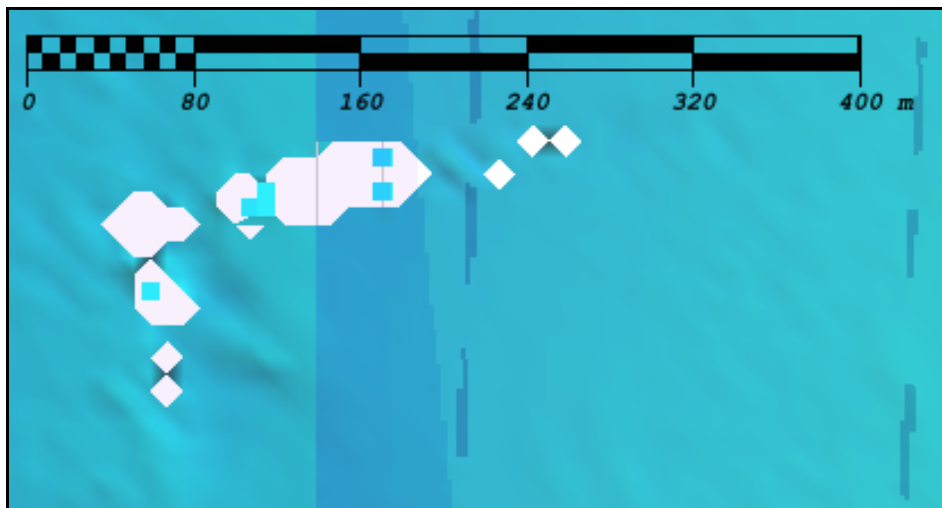


Figure 13: Holiday due to poor survey conditions located at 47°38'46.33" N 122°27'38.1" W (540512.45, 5277119.31)

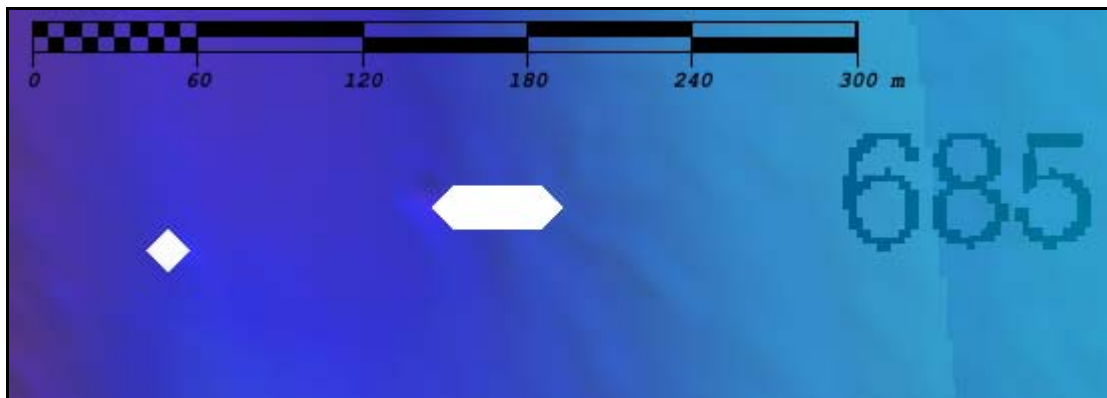


Figure 14: Holiday due to poor survey conditions located at 47°37'17.81" N 122°27'50.79" W (540266.44, 5274384.69)

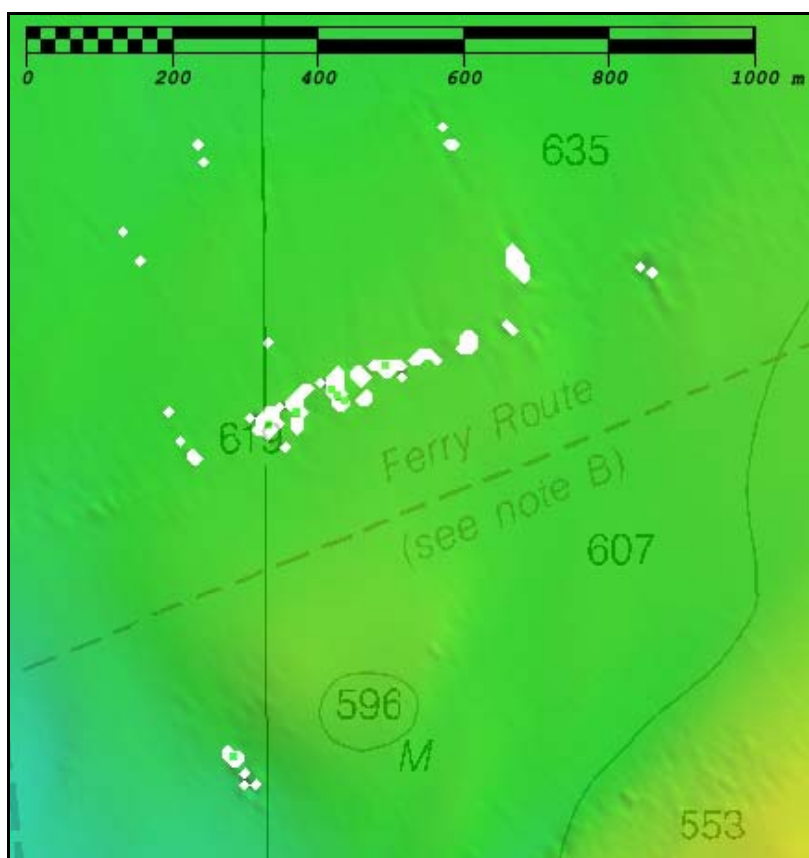


Figure 15: Holiday due to poor survey conditions located at 47°35'36.34" N 122°25'53.83" W (542730.58, 5271269.65)

Holiday Due To Operator Error

One holiday is due to operator error. While surveying with filters, the operator neglected to adjust the range of the filter as the depth of the seafloor rose during survey operations. As a result good data was filtered out. The resulting ‘shotgun’ type holiday ensued, nearly 30 meters long in approximately 38 feet of water (Figure 16). The Hydrographer recommends charting as per digital data.¹²

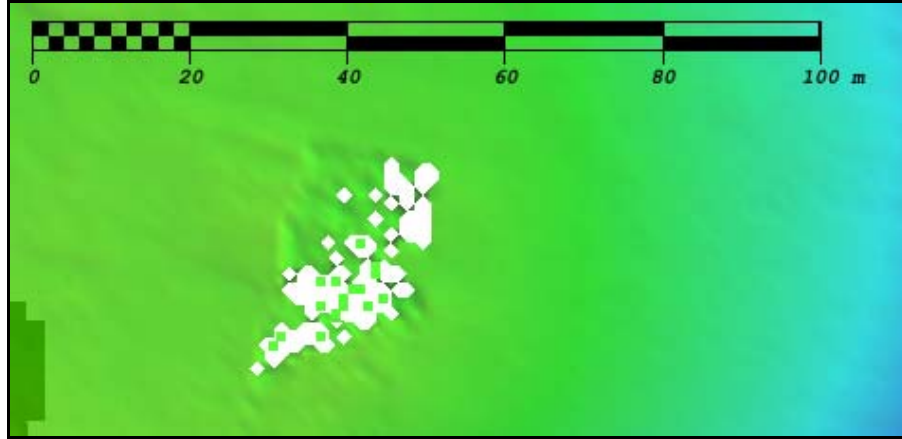


Figure 16: Operator error holiday located at 47°36'48.34" N 122°28'41.88" W (539206.27, 5273467.53)

B.2.g. Unusual Conditions

No unusual conditions were encountered during the survey that affected the expected accuracy and quality of survey data.

B.3. Corrections to Echo soundings

Data reduction procedures for survey H12025 conform to those detailed in the *OPR-N395-RA-09 DAPR*.

B.4. Data Processing

Data processing procedures for survey H12025 conform to those detailed in the DAPR. Data were processed initially using Caris HIPS & SIPS v6.1, Service Pack 2, and Hotfix 7. During the course of survey processing computer systems processing and finalizing data for submission were updated to Caris HIPS & SIPS v6.1, Service Pack 2, and Hotfix 8. Additional processing details regarding Total Propagated Uncertainty (TPU/TPE) and CUBE Surfaces and Parameters utilized, along with any the deviations from the processing procedures outlined in the DAPR are discussed below.

TPU VALUES:

The survey specific parameters used to compute Caris TPU for H12025 are listed in Table 5.

Tide values:	Measured	0.01 m	Zoning	0.0 m
Sound Speed Values:	Measured	0.50 m/s	Surface	As per DAPR

Table 5: Survey Specific Caris TPU Parameters

Many BASE surfaces were used in processing H12025. Final BASE surface resolutions and depth ranges were set according to Table 6 below, with field sheets smaller than 25×10^6 nodes. CUBE surfaces were processed with a parameter set corresponding to each resolution as per HTD 2009-2. The CUBE parameter XML file is included with the data deliverables. The submission Field Sheet and BASE Surface structure are shown in figures 17 and 18.

Depth Range (m)	Resolution (m)
0-23	1
20-52	2
46-115	4
103-350	8

Table 6: Depth range and surface resolutions for H12025

In areas where multibeam data was acquired on charted cultural features (pilings, piers, etc) that were above MLLW, all data were rejected on the feature itself to more accurately represent the seafloor below these features.

Side Scan Sonar mosaics were created to demonstrate coverage of this technique (in addition to the required 100% SWMB). These mosaics were created at 2m resolution and are included in the “H12025_A_FINAL” and “H12025_E_FINAL” field sheets.

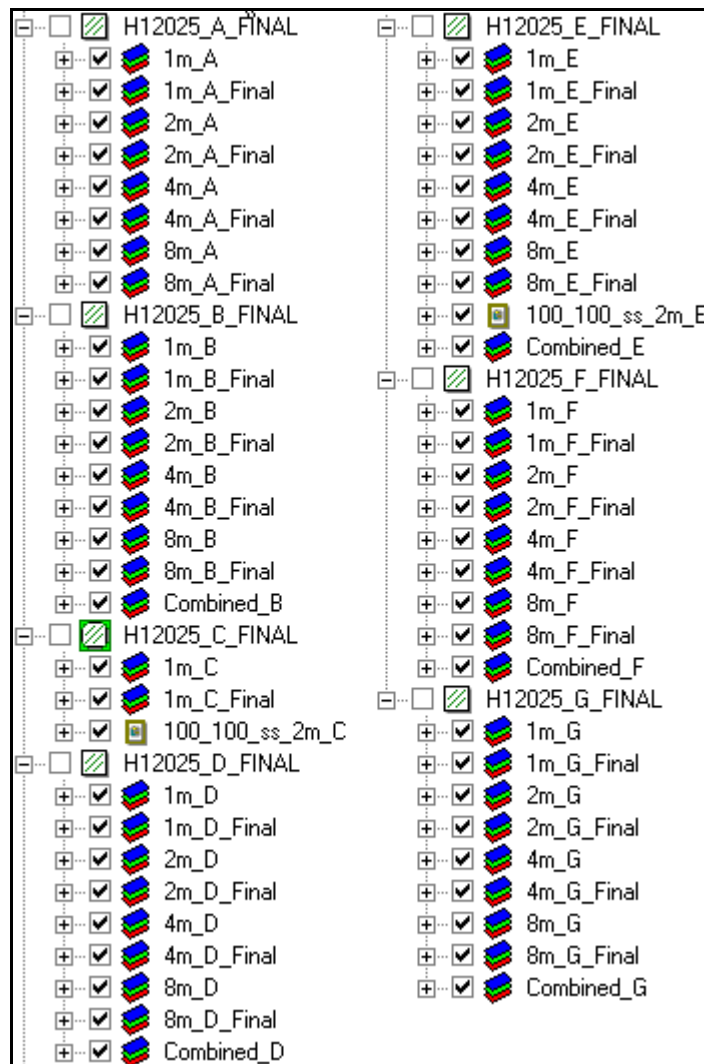


Figure 17: Field sheets and BASE surfaces submitted with H12025

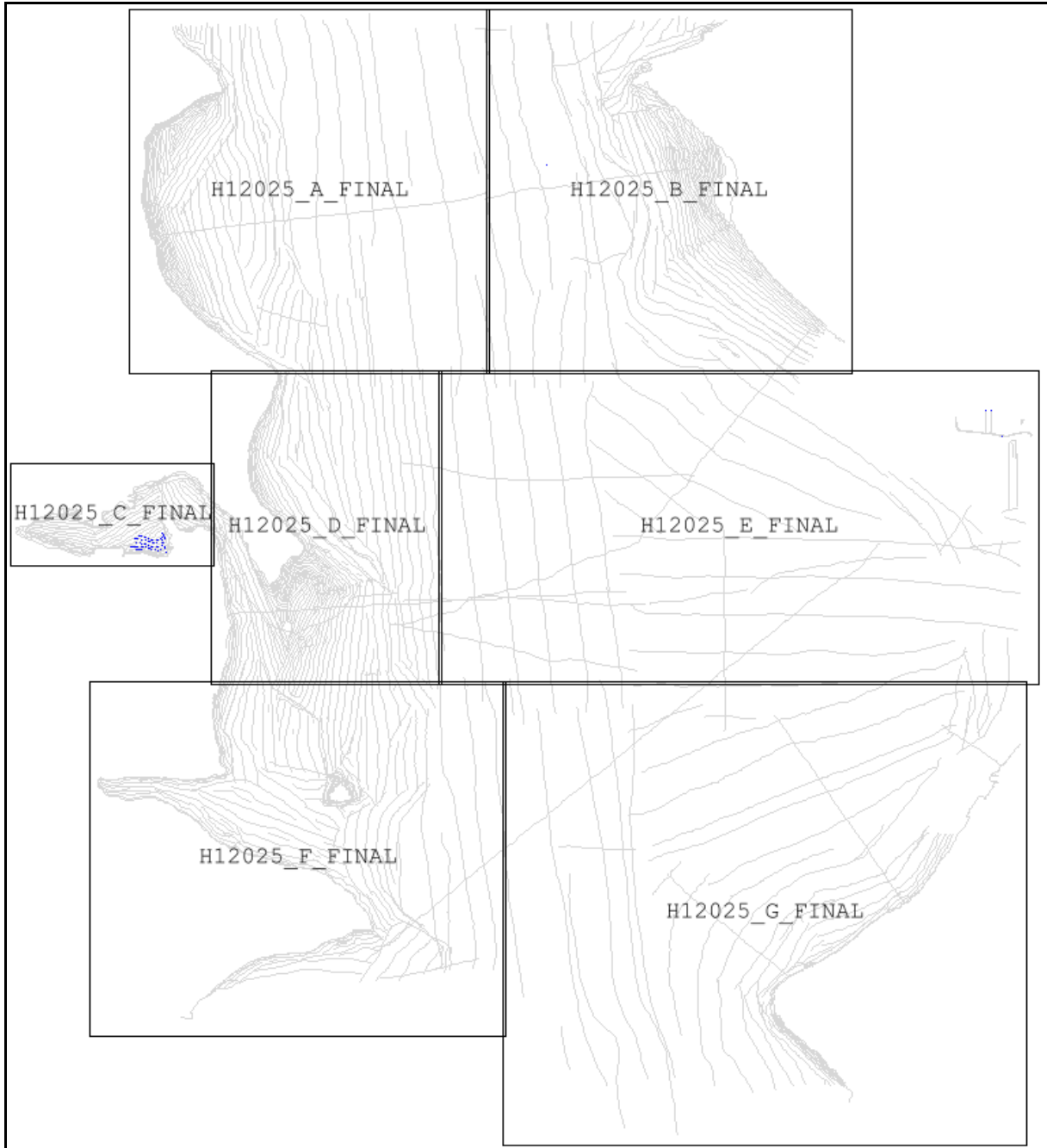


Figure 18: H12025 Field Sheet Layout

C. VERTICAL AND HORIZONTAL CONTROL

Project OPR-N395-RA-09 did not require static GPS observations or other horizontal control work, and all tide corrections were generated from CO-OPS maintained tide stations. Thus, no Horizontal and Vertical Control Report will be submitted.

C.1. Horizontal Control

The horizontal datum for this project is the North American Datum of 1983 (NAD83). Differential GPS (DGPS) was the sole method of positioning. The differential corrector beacons utilized for this survey are given in Table 7.

Location	Frequency	Operator	Priority
Robinson Pt.	323 kHz	USCG	Primary
Whidbey Island	302 kHz	USCG	Secondary

Table 7: Differential Corrector Sources for H12025

C.2. Vertical Control

The vertical datum for this project is Mean Lower-Low Water (MLLW). The operating National Water Level Observation Network (NWLON) primary tide stations at Seattle, WA (944-7130), Tacoma, WA (944-6484), and Port Townsend, WA (944-4900) served as control for datum determination and as the primary source for water level reducers for survey H12025.

No tertiary gauges were required.

As per the Project Instructions, all data were reduced to MLLW using the final approved water levels from the stations at Seattle, WA (944-7130), Port Townsend, WA (944-4900), and Tacoma, WA (944-6484) by applying tide file 9447130.txt, 9444900.txt, and 9446484.txt and final time and height correctors using the Tidal Constituent And Residual Interpolator (TCARI) corrector file N395RA2009.tc. **It will not be necessary for the Pacific Hydrographic Branch to reapply the final approved water levels to the survey data during final processing.**

The request for Final Approved Water Levels for H12025 was submitted to CO-OPS on April 27, 2009 in accordance with the Field Procedures Manual (FPM), dated April 2009. The Final Tide Note was received on May 15, 2009. This documentation is included in Appendix IV. ¹³

D. RESULTS AND RECOMMENDATIONS

D.1. Chart Comparison

D.1.a. Survey Agreement with Chart

Chart comparison procedures were followed as outlined in section 4.5 of the FPM and section 8.1.3-D.1 of the HSSDM, utilizing Caris HIPS.

Survey H12025 was compared with the following charts:

Chart	Scale	Edition and Date	Local Notice to Mariners Applied Through
18446	1:25,000	17th Ed; Sept 2005	09/20/2008
18449	1:25,000	18 th Ed, Feb 2004	09/20/2008
18447	1:10,000	29 th Ed; May 2008	09/20/2008
18450	1:10,000	18 th Ed; Feb 2004	09/20/2008

Table 8: Charts compared with H12025

Chart 18446

Depths from survey H12025 generally agreed with charted depths to within 10 feet with one significant discrepancy. All differences of greater than 5 feet were found in waters deeper than 300 feet and are thus not navigationally significant.¹⁴

The 19 foot charted depth south of West Point is nearly 20 feet shoaler than bathymetry due to dredging of the area (Figure 19).¹⁵

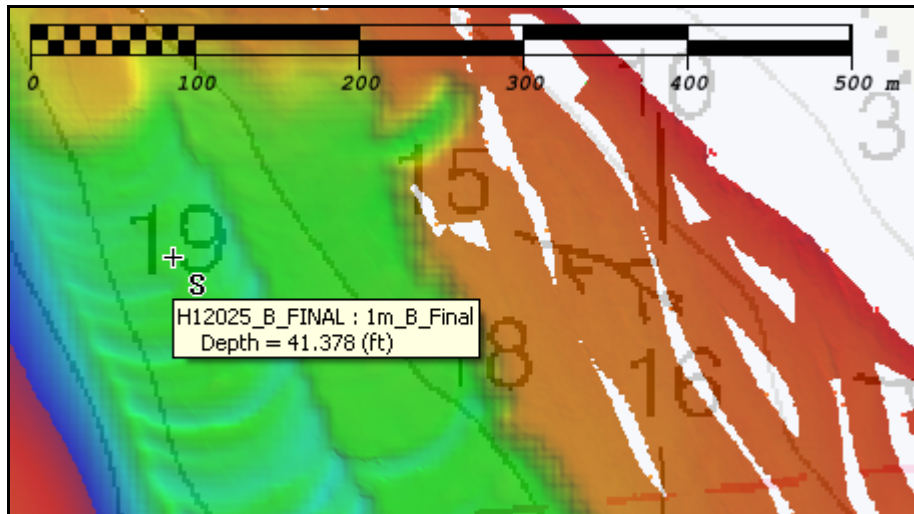


Figure 19: Bathymetry is nearly 20 feet deeper than charted 19 foot depth

The Hydrographer recommends that survey soundings supersede all prior survey and charted depths in the common area.¹⁶

Chart 18447

Depths from survey H12025 generally agreed with charted depths to within 8 feet. The following significant discrepancies were noted:

Charted depths near the northern extent of shoreline of West Point are as much as 50 feet deeper than bathymetry. The Hydrographer recommends adjusting the 12 and 30 foot contour to reflect main scheme bathymetry.¹⁷ Further investigation in survey H12024 reveals that these discrepancies are mostly exclusive in survey H12025, near the northern tip of West Point.

South of West Point charted depths are nearly 30 feet shoaler than bathymetry due to dredging of the area (Figure 20).¹⁸

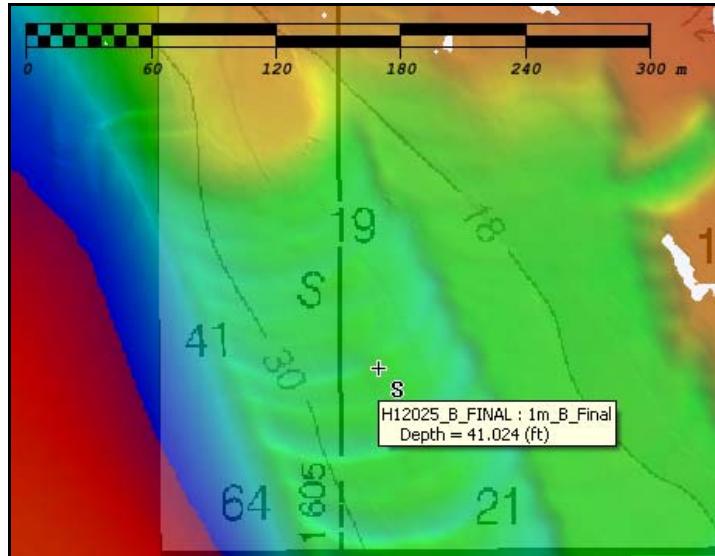


Figure 20: Charted depths are nearly 30 feet shoaler than the dredged area south of West Point

The Hydrographer recommends that survey soundings supersede all prior survey and charted depths in the common area.¹⁹

Chart 18450

Soundings from survey H12025 generally agreed with charted depths to within 12 feet and no significant discrepancies were noted with charted depths. All differences greater than 5 feet were found in waters deeper than 200 feet and are thus not navigationally significant.²⁰

The Hydrographer recommends that survey soundings supersede all prior survey and charted depths in the common area.²¹

Chart 18449

The former Wyckoff wood-treating facility, located at the mouth of Eagle Harbor on Bainbridge Island, forms part of the Wyckoff / Eagle Harbor Superfund site, located in approximate position 47°37'01.69"N 122°30'13.9"W (537282.62, 5273867.03). The facility operated as a wood-treating operation from 1903 until 1988. As a result of these wood-treatment operations, surface and subsurface soils at the facility and groundwater beneath the facility have been severely contaminated with creosote and pentachlorophenol. The wood treating facility, harbor, and other upland sources were included as one site on the National Priorities List (Superfund) on July 22, 1987.

The West Harbor cleanup project was completed October, 1997, and included the excavation and stabilization of upland soils contaminated with heavy metals, and the construction of a tidal barrier around an old landfill. Contaminated sediments dredged from the harbor were disposed in a one-acre, confined disposal facility (CDF) that was constructed in a near-shore area of the site. As a result there are changes to the shoreline and features for chart 18449

(Figure 21).²² The City of Bainbridge provided updated geospatial shoreline files that were authenticated during shoreline verification and then used to digitize the field verified shoreline for the area in the H12025_Final_Features_File.hob. Much of the contaminated area was covered with a clean sediment cap to prevent further contamination. Ellen Hale, the Environmental Protection Agency (EPA) Project Manager, was contacted with regard to potential anchorage restriction in this capped area. No answer on the matter was available at the time and a response had not been received at the completion of this descriptive report.

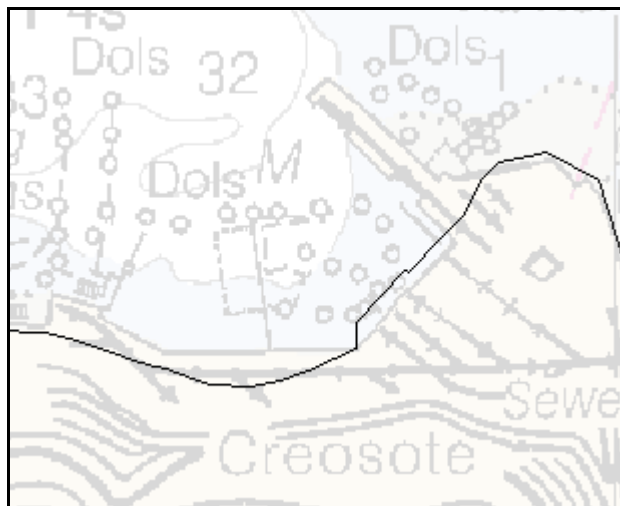


Figure 21: The updated shoreline for Creosote (black) as compared to the charted shoreline / features

Soundings from survey H12025 generally agreed with charted depths to within 10 feet. All differences of greater than 5 feet were found in waters deeper than 250 feet and are thus not navigationally significant.²³

Discovered features near the northern entrance to Blakely Harbor are as great as 30 feet shoaler than nearby charted soundings (Figure 22).²⁴

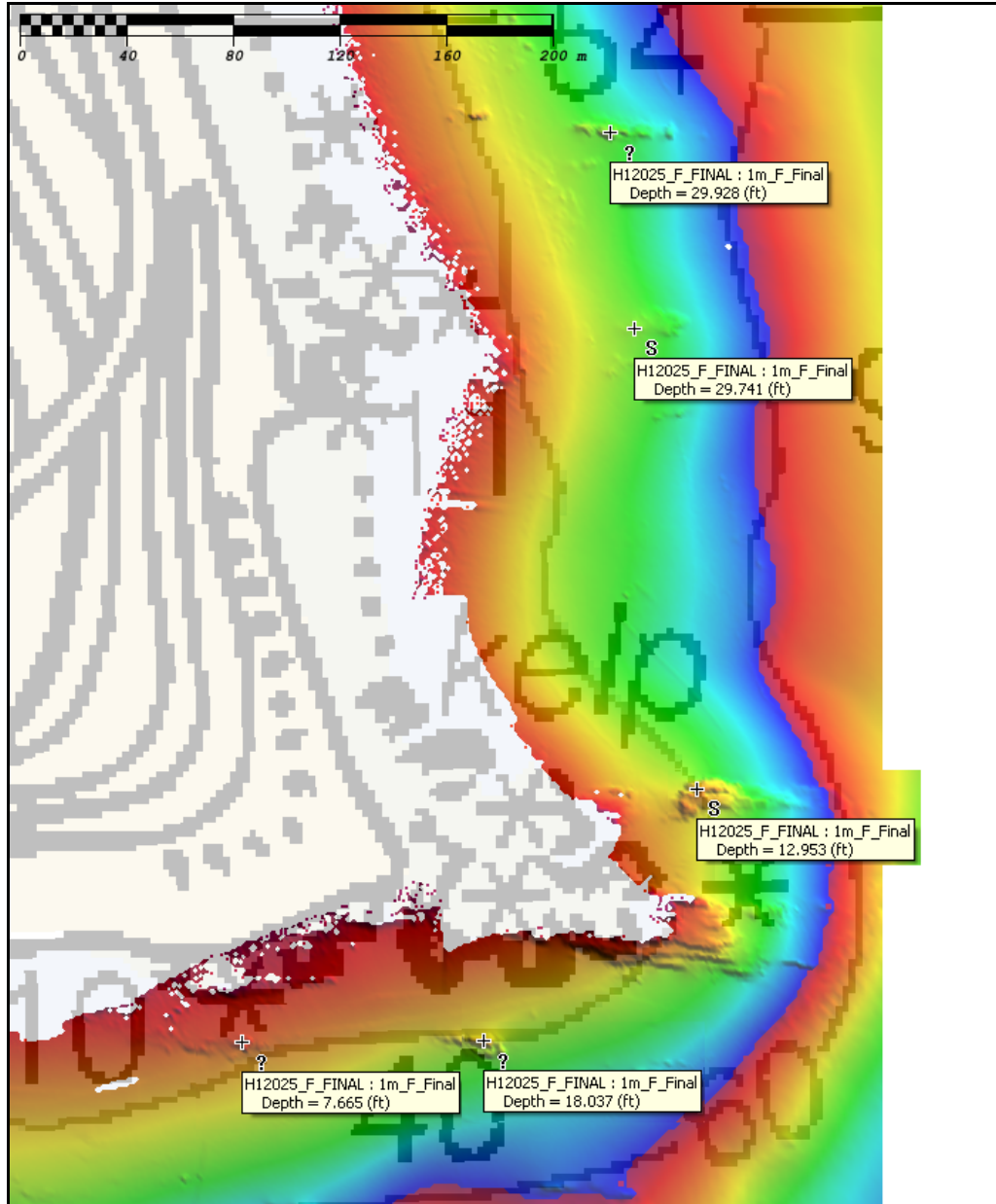


Figure 22: Discovered features are as much as 30 feet shoaler than nearby charted soundings

The 19 foot charted depth south of West Point on chart 18449 is nearly 20 feet shoaler than bathymetry due to dredging of the area (Figure 23).²⁵

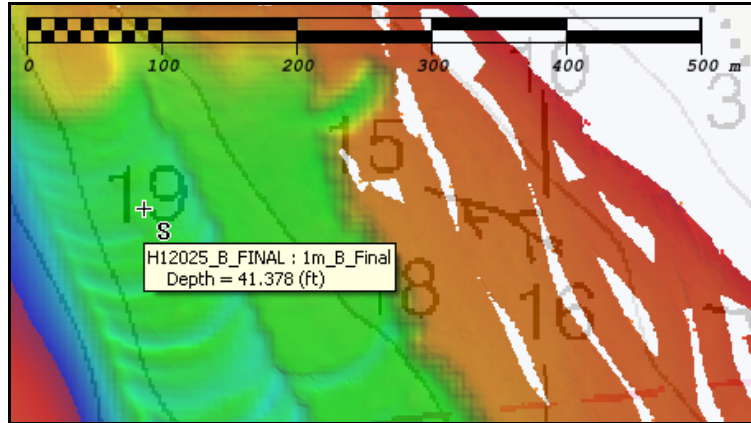


Figure 23: Bathymetry is nearly 20 feet deeper than charted 19 foot depth on chart 18449

The Hydrographer recommends that survey soundings and features supersede all prior survey and charted depths in the common area.²⁶

D.1.b. Automated Wreck and Obstruction Information System (AWOIS) Items

One AWOIS item was located within the survey limits of H12025, and was assigned for full investigation (Figure 24 and Table 9).²⁷

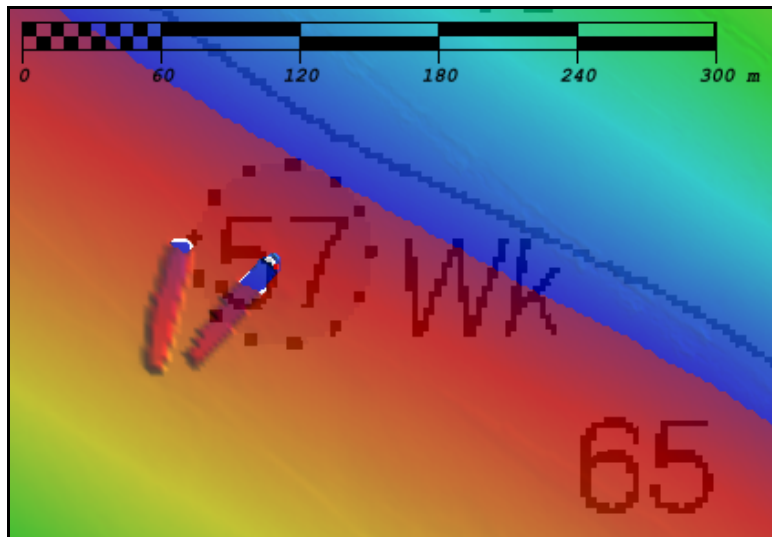


Figure 24: Wrecks fall outside of charted area with a least depth of 56.21 feet

AWOIS#	Latitude	Longitude	Remark	Recommendation
53451	47° 38' 24.49"	122° 25' 38.59"	New position	Chart Wks as per digital data with least depth.

Table 9: Assigned AWOIS Items and the Hydrographer’s remarks and recommendations.

D.1.c. Other Investigated Features

Additional Items

Included in the H12025 Caris Notebook session in the H12025_Final_Feature_File.hob file are three uncharted wrecks. These features are discussed in greater detail below.²⁸

An uncharted shipwreck was found in main scheme bathymetry west of Duwamish Head in approximately 132 meters of depth, located at 47°35'39.83" N 122°24'16.52" W (544761.93, 5271392.47). She is roughly 52 meters in length with a beam approximately 8 meters, with least depth of 124.9 meters (Figure 25). The Hydrographer recommends charting as a non-dangerous wreck.²⁹

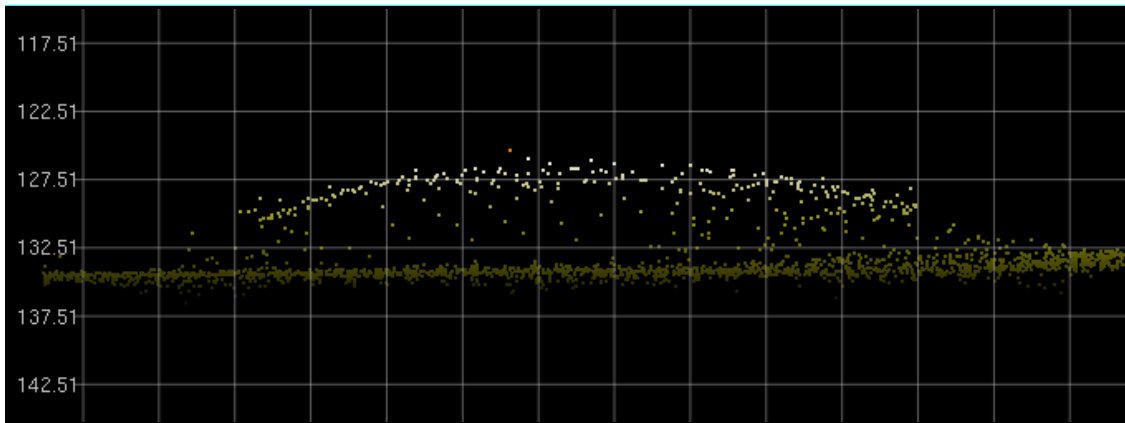


Figure 25: Shipwreck found west of Duwamish Head

A second uncharted shipwreck was found in main scheme bathymetry near the entrance to Blakely Harbor, located at 47°35'27.76" N 122°29'46.19" W (537880, 5270971.18). She is approximately 26 meters in length with a beam of approximately 8 meters, with a least depth of 9.22 meters (Figure 26). This shipwreck was not considered a DTON because she rests on a slope between two charted soundings, the shoalest of which is 26 feet (7.9 meters). The Hydrographer recommends charting wreck as per digital data with least depth.³⁰

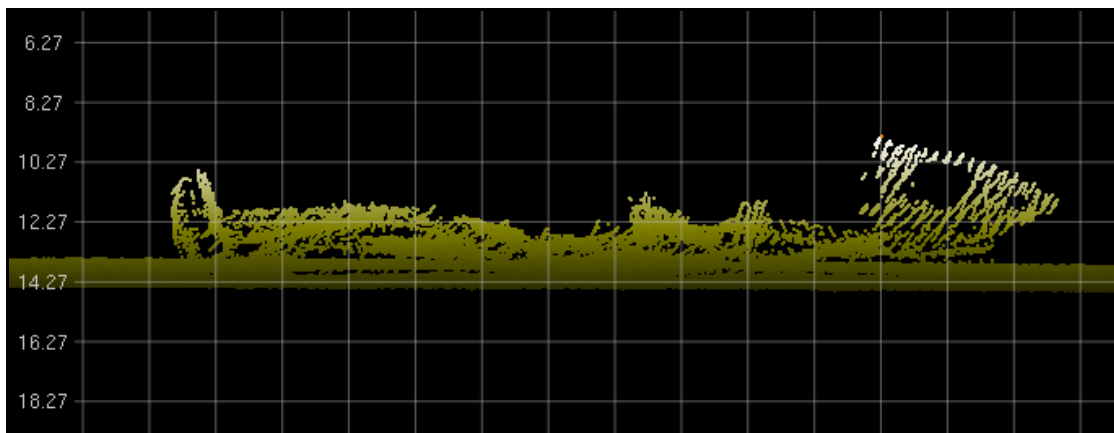


Figure 26: Shipwreck found near the entrance of Blakely Harbor

A third uncharted wreck was found in main scheme bathymetry in Blakely Harbor, located at 47°35'40.73" N 122°30'20.25" W (537166.15, 5271366.81). She is approximately 3.2 meters in length with a beam of approximately 1.6 meters. Her least depth is 9.2 meters (Figure 27). The Hydrographer recommends charting wreck as per digital data with least depth.³¹

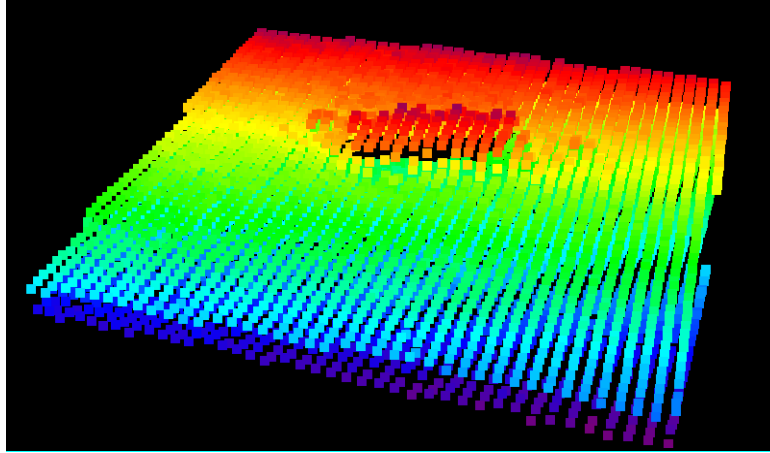


Figure 27: A small craft found in main scheme bathymetry in Blakely Harbor

D.1.d. Dangers to Navigation

One Danger to Navigation (DTONs), a submerged wreck, was found within the survey limits of H12025 (Figure 28), and reported to the Marine Chart Division via email on October 28, 2009.³² The original DTON submission package is included in Appendix I.³³ This DTON is located at 47°37'08.45" N 122°31'11.04" W (536088.7, 5274068.35). Her least depth is 5.43 meters, length is 9.27 meters, and her beam is 3.34 meters.

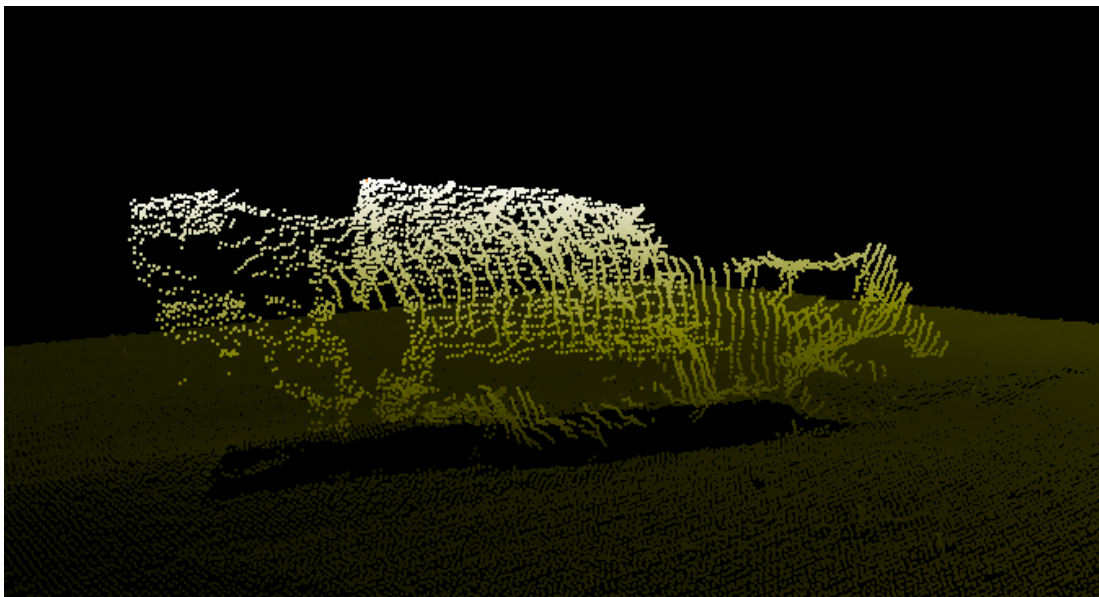


Figure 28: DTON found in Eagle Harbor with least depth of 18 feet

D.2. Additional Results

D.2.a. Shoreline Verification

Shoreline Source

Limited shoreline verification was accomplished using the composite source file (CSF) provided with the project instructions. The CSF has been created using the latest ENC's, most recent aerial photogrammetry, and prior hydrographic surveys. Prior survey features within the CSF are for reference. This composite source was printed on paper "boat sheets" and displayed in Caris Notebook and/or Hypack for field verification.

Shoreline Verification

Limited shoreline verification was conducted near predicted low water in accordance with the Specifications and Deliverables and FPM sections 6.1 and 6.2. Detached positions (DPs) acquired during shoreline verification were recorded and s-57 attributed in Caris Notebook. These indicate revisions to features and features not found in the provided CSF. In addition, annotations describing shoreline were recorded on the hard copy plots of the CSF as described above.

All shoreline data is submitted in Caris Notebook .hob files. The session H12025_NTBK contains the following:

HOB File	Purpose and Contents
H12025_Comp_Source.hob	Original Source Data as provided for project OPR-N395-RA-09 and filtered to the limits of survey H12025
H12025_Reference.hob	Survey outline and limit lines, and AWOIS item positions and radii.
H12025_Final_Feature_File.hob	Composite source data modified by the field to best represent the shoreline at survey scale. This includes the addition of new features and modification of source features. This file retains all features neither verified nor disproved by this survey
H12025_Disprovals.hob	Composite source items that were deleted or modified in position or geographic type.

Table 10: List and Description of Notebook HOB files

Recommendations

The Hydrographer recommends that the shoreline as depicted in the Notebook .hob files supersede and complement shoreline information compiled on the composite source file and charts as described above.³⁴

D.2.b. Prior Survey Comparison

Prior survey comparison was not performed.

D.2.c. Aids to Navigation

There are 19 aids to navigation (ATONs) located within the sheet limits of H12025, eleven of which are private aids (Table 11). Positions were verified during shoreline verification. All aids to navigation (ATONs) were found to be correctly charted and serve their intended purpose.³⁵

Light Name	Ownership	Latitude	Longitude
Fourmile Rock Light 1	public	47 38 20.439N	122 24 48.561W
Tyee Shoal Light	public	47 36 34.548N	122 29 15.424W
Blakely Rock Light	public	47 35 39.967N	122 28 49.555W
Elliott Bay Marina West Entrance Light 1	private	47 37 42.000N	122 23 48.000W
Elliott Bay Marina West Entrance Light 2	private	47 37 42.000N	122 23 48.000W
Elliott Bay Marina Breakwater Light A	private	47 37 48.000N	122 23 48.000W
Elliott Bay Marina Breakwater Light B	private	47 37 42.000N	122 23 48.000W
Elliott Bay Marina Breakwater Light C	private	47 37 36.000N	122 23 18.000W
Elliott Bay Marina Breakwater Light D	private	47 37 42.000N	122 23 18.000W
Elliott Bay Marina East Entrance Light 1	private	47 37 36.000N	122 23 12.000W
Elliott Bay Marina East Entrance Light 2	private	47 37 42.000N	122 23 18.000W
Duwamish Head Light	public	47 35 55.854N	122 23 16.464W
Alki Point Light	public	47 34 34.582N	122 25 13.982W
Eagle Harbor Light 1	public	47 36 58.800N	122 29 47.500W
Eagle Harbor Light 3	public	47 37 08.849N	122 29 51.761W
Eagle Harbor Light 4	public	47 37 19.133N	122 29 50.640W
Bainbridge Island Boat Yard Lights (2)	private	47 37 04.000N	122 30 33.000W
Eagle Harbor Marina Lights (2)	private	47 37 02.000N	122 30 45.000W
Eagledale Mooring Lights (2)	private	47 37 00.000N	122 30 42.000W

Table 11: List of lights located within survey H12025

D.2.d. Overhead Features

There are no overhead features within the limits of survey H12025.³⁶

D.2.e. Submarine Cables and Pipelines

No visible indications of cables were evident in the MBES data in the cable areas on charts 18446, 18447, 18449 and 18450, which includes cable areas charted West Point to Elliot Bay, Elliot Bay to Eagle Harbor, Blakely Harbor to Alki Point, and all cable areas within the Puget Sound traffic lanes. The Hydrographer recommends retaining the cable areas as charted.³⁷

Survey H12025 includes several charted pipelines. All charted pipelines on charts 18446, 18447, 18449, and 18450 were noted in the MBES data and agree well with charted positions, with the following exceptions:

Pipeline north of West Point, in position $47^{\circ}39'50.78''$ N $122^{\circ}25'52.41''$ W (542702.75, 5279124.78), is not charted (Figure 29). Recommend charting new pipeline in location depicted in the H12025_Final_Feature_File in the Caris Notebook session.³⁸

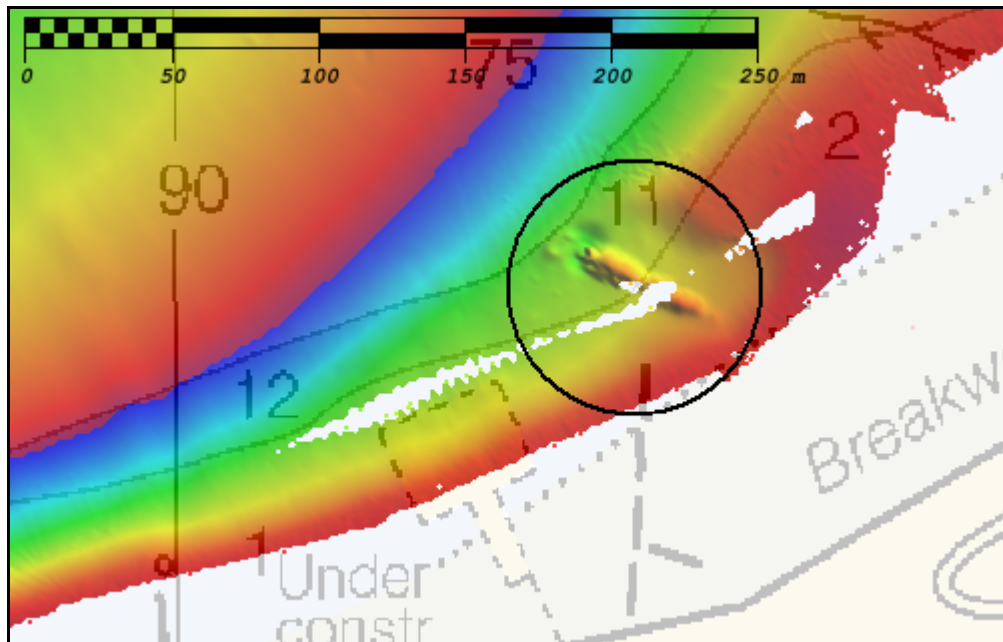


Figure 29: An uncharted sewer as seen in main scheme bathymetry (circled) located north of West Point

Sewer pipeline west of West Point, in position $47^{\circ}39'38.98''$ N $122^{\circ}26'55.62''$ W (541387.11, 5278750.95), is 60 meters south of charted pipeline (Figure 30). This new location for the charted sewer pipeline has been included in the H12025_Final_Feature_File in the Caris Notebook session.³⁹

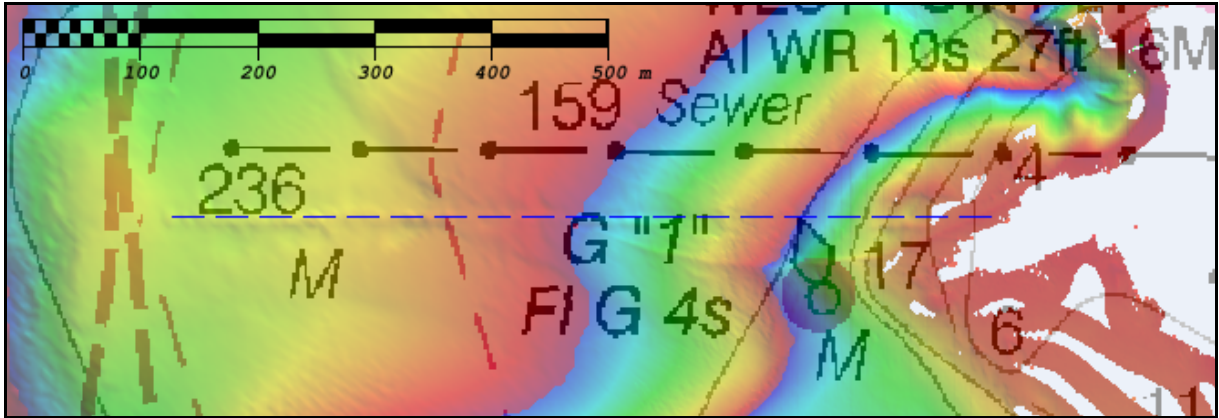


Figure 30: (dashed blue line) west of West

Sewer pipeline near Magnolia Bluffs, in position 47°38'23.5" N 122°25'14.55" W (543512.41, 5276436.08), is 120 meters northwest of charted pipeline (Figure 31). This new location for the charted sewer pipeline has been included in the H12025_Final_Feature_File in the Caris Notebook session.⁴⁰

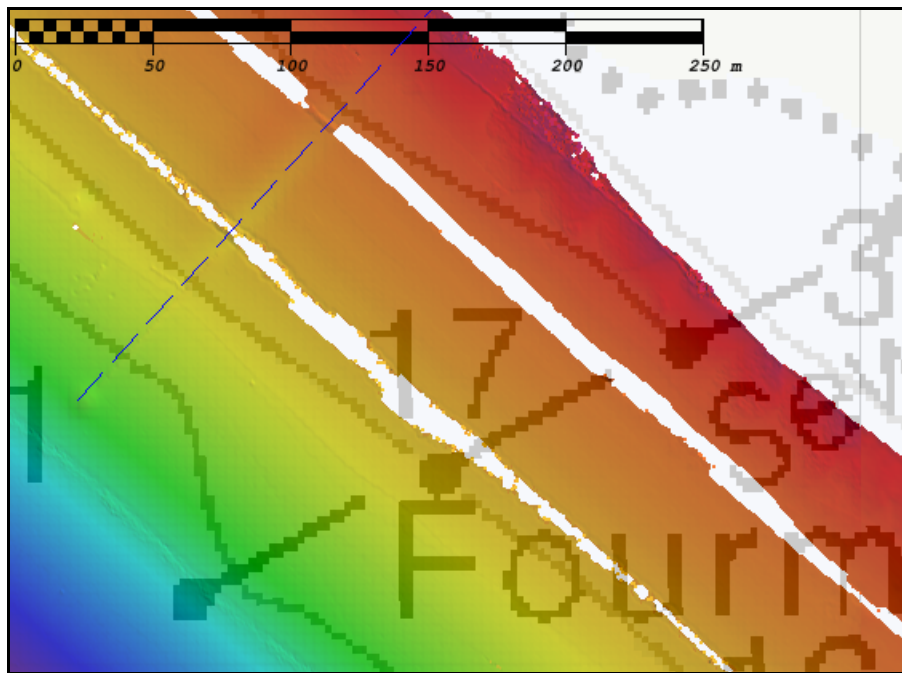


Figure 31: Sewer (dashed blue line) near Magnolia Bluffs

Sewer pipeline near Alki Point, in position 47°34'12.94" N 122°25'20.02" W (543455.76, 5268700.15), extends 200 meters further than charted (Figure 32). A second sewer pipeline, in position 47°34'20.68" N 122°25'15.29" W (543552.96, 5268939.61), is not charted. These new locations for the charted sewer pipelines have been included in the H12025_Final_Feature_File in the Caris Notebook session.⁴¹

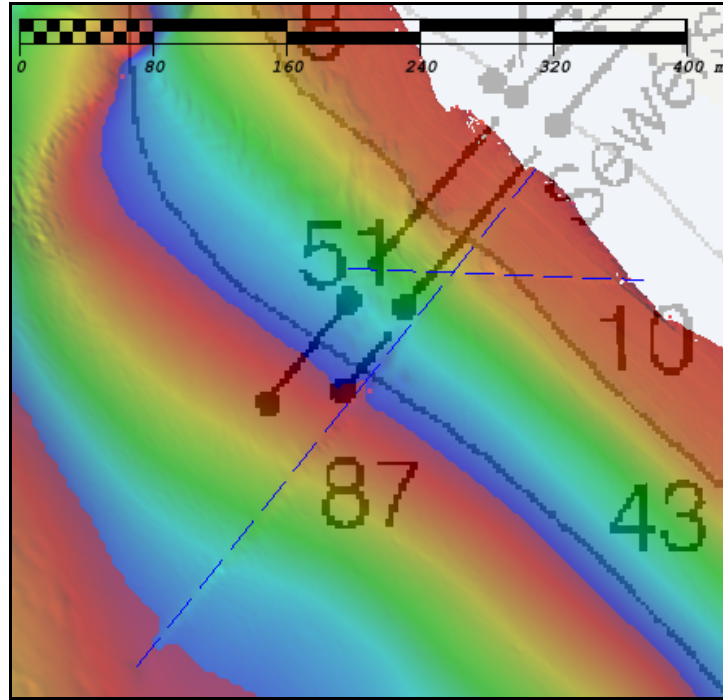


Figure 32: Sewers (dashed blue lines) near Alki Point

Sewer pipelines near Wing Point, in position 47°37'23.06" N 122°29'21.69" W (538368.27, 5274533.93), is 50 meters south of charted pipeline (Figure 33). This new location for the charted sewer pipeline has been included in the H12025_Final_Feature_File in the Caris Notebook session.⁴²

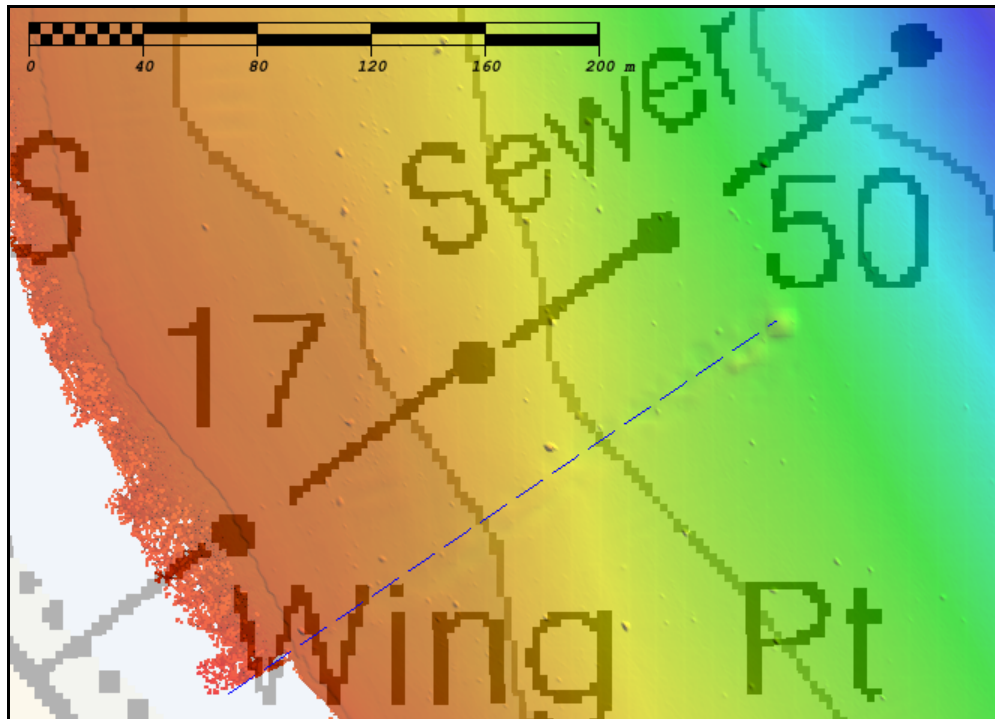


Figure 33: Sewer (dashed blue line) near Wing Point

D.2.f. Ferry Routes

Survey H12025 contains three ferry routes servicing Seattle to Bremerton, Bainbridge, and Vashon Island. Ferry routes are well established. The Hydrographer noted that ferry traffic did not deviate from charted routes and occurred at scheduled times. The traffic lanes for the Seattle Vessel Traffic System (VTS) do run north and south through roughly the middle of the sheet. These lanes are accurately charted and heavily utilized.⁴³

D.2.g. Bottom Samples

Bottom samples were not performed in survey H12025.⁴⁴

D.2.h. Other Findings


There are no other findings on survey H12025.

E. APPROVAL

As Chief of Party, Field operations for hydrographic survey H12025 were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports. The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys and Specifications Deliverables Manual (April 2009 edition), Field Procedures Manual (April 2009 edition), Standing and Project Instructions, and all HSD Technical Directives issued through April 2009. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required. All data and reports are respectfully submitted to N/CS34, Pacific Hydrographic Branch.


Listed below are supplemental reports submitted separately that contain additional information relevant to this survey:

<u>Title</u>	<u>Date Sent</u>	<u>Office</u>
Hydrographic Systems Readiness Review Package	<i>Under separate cover</i>	N/CS34
Data Acquisition and Processing Report for OPR-N395-RA-09	24-Jul-2009	N/CS34
Coast Pilot Report for OPR-N395-RA-09	<i>To be submitted</i>	N/CS26


Approved and Forwarded:  Donald W. Haines, CAPT/NOAA
I am approving this document
2009.12.02 11:09:57 -08'00'

Captain Donald W. Haines, NOAA
Commanding Officer, NOAA Ship *Rainier*


In addition, the following individuals were also responsible for overseeing data acquisition and processing of this survey:

Survey Sheet Manager:  Ian Colvert
I am the author of this document
2009.12.02 19:06:05 Z

Ian Colvert
Senior Survey Technician, NOAA Ship *Rainier*

Chief Survey Technician:  James B Jacobson
I have reviewed this document
2009.12.02 19:02:47 Z

James B. Jacobson
Chief Survey Technician, NOAA Ship *Rainier*

Field Operations Officer:  Brent Pounds
I have reviewed this document
2009.12.02 10:07:44 -09'00'

Lieutenant Brent J. Pounds, NOAA
Field Operations Officer, NOAA Ship *Rainier*

Revisions and Corrections Compiled During Office Processing and Certification

¹ Filed with project records.

² Concur.

³ A common junction has been made with H12024, H11827 and H11548, all of which have been compiled. No data was available to make a common junction with H11605, which was processed at Atlantic Hydrographic Branch.

⁴ Concur.

⁵ Concur. The data meets specification and is adequate to supersede charted data in the common area.

⁶ The shoalest data is represented in the combined surface that was used as the basis for compilation. The data is adequate to supersede charted data in the common area despite the tide modeling errors.

⁷ Concur. Tye Shoal and depth have been blue noted to be retained.

⁸ Concur. Chart depths as depicted in the HCell.

⁹ Concur. Chart depths as depicted in the HCell.

¹⁰ Concur. Chart depths as depicted in the HCell.

¹¹ Concur. Chart depths as depicted in the HCell.

¹² Concur. Chart depths as depicted in the HCell.

¹³ See attached Tide Note dated May 15, 2009.

¹⁴ Concur.

¹⁵ Concur. Chart depths as depicted in the HCell.

¹⁶ Concur.

¹⁷ Concur. Chart depths as depicted in the HCell and update contours based on new survey data.

¹⁸ Concur. Chart depths as depicted in the HCell.

¹⁹ Concur.

²⁰ Concur.

²¹ Concur.

²² Chart remaining features as depicted in the HCell. All other features in the area have been blue noted to be removed.

²³ Concur. Chart depths as depicted in the HCell.

²⁴ Concur. Chart depths as depicted in the HCell.

²⁵ Concur. Chart depths as depicted in the HCell.

²⁶ Concur.

²⁷ Do not concur. There are two AWOIS items within the H12025 survey area, however, only one was assigned for investigation. It is recommended that the item investigated (AWOIS 53451) during the survey be charted as depicted in the HCell. The item not assigned for investigation (AWOIS 52351) is included in the HCell to be retained. It is recommended that AWOIS 52351 be retained as described in the AWOIS database.

²⁸ See attached document for information and photos of two additional wrecks found during the Survey Acceptance Review that are not discussed in the Additional Items section. Both wrecks are included in the HCell.

²⁹ Concur. The wreck is included in the HCell and it is recommended that it be added to the AWOIS database.

³⁰ Concur. The wreck is included in the HCell and it is recommended that it be added to the AWOIS database.

³¹ Concur. The wreck is included in the HCell and it is recommended that it be added to the AWOIS database.

³² The DTON has been applied to the charts and is included in the HCell.

³³ See attached DTON report.

³⁴ Concur with clarification. The submitted hob files were used in the compilation of HCell H12025. During compilation, some modifications were made to accommodate chart scale. Chart features as depicted in the HCell.

³⁵ Chart all federally maintained ATONs per latest ATONIS information. Additional private ATONs were located during compilation and all are included in the HCell.

³⁶ Concur.

³⁷ Concur. There is an all-encompassing blue note to retain all cable areas.

³⁸ Concur. The position of the new pipeline is included in the HCell as a \$LINES linear blue note.

³⁹ Concur. The position of the new pipeline is included in the HCell as a \$LINES linear blue note.

⁴⁰ Concur. The position of the new pipeline is included in the HCell as a \$LINES linear blue note.

⁴¹ Concur. The position of the new pipeline is included in the HCell as a \$LINES linear blue note.

⁴² Concur. The position of the new pipeline is included in the HCell as a \$LINES linear blue note.

⁴³ Concur. Retain as charted.

⁴⁴ All charted bottom samples have been imported from the ENC's to be retained.

H12025 DTON Report

Registry Number: H12025
State: Washington
Locality: Central Puget Sound
Sub-locality: Approaches to Elliot Bay - Skiff Point to Alki Point
Project Number: OPR-N395-RA-09
Survey Date: 04/13/2009

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
18445	32nd	08/01/2007	1:80,000 (18445_1) 1:25,000 (18445_4)	[L]NTM: ?
18449	18th	10/01/2003	1:25,000 (18449_1)	USCG LNM: 09/09/2008 (09/16/2008) NGA NTM: 11/13/1999 (09/20/2008)
18474	8th	10/01/2003	1:40,000 (18474_1)	[L]NTM: ?
18441	46th	12/01/2007	1:80,000 (18441_1)	[L]NTM: ?
18440	29th	09/01/2007	1:150,000 (18440_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	AWOIS Item
1.1	Wreck	5.42 m	47° 37' 08.5" N	122° 31' 10.8" W	---

1 - Danger To Navigation

1.1) Profile/Beam - 4373/147 from h12025 / 2803_reson7125_hf_512 / 2009-103 / 000_2144

DANGER TO NAVIGATION

Survey Summary

Survey Position: 47° 37' 08.5" N, 122° 31' 10.8" W
Least Depth: 5.42 m (= 17.79 ft = 2.965 fm = 2 fm 5.79 ft)
TPU ($\pm 1.96\sigma$): **THU (TPEh)** ± 1.961 m ; **TVU (TPEv)** ± 0.122 m
Timestamp: 2009-103.21:48:02.026 (04/13/2009)
Survey Line: h12025 / 2803_reson7125_hf_512 / 2009-103 / 000_2144
Profile/Beam: 4373/147
Charts Affected: 18445_4, 18449_1, 18474_1, 18441_1, 18445_1, 18440_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

Wreck in Eagle Harbor.

Feature Correlation

Address	Feature	Range	Azimuth	Status
h12025/2803_reson7125_hf_512/2009-103/000_2144	4373/147	0.00	000.0	Primary

Hydrographer Recommendations

Wreck is a DTON, add to chart.

Cartographically-Rounded Depth (Affected Charts):

18ft (18449_1)
 3fm (18441_1, 18440_1, 18003_1, 18007_1, 530_1)
 1fm 0ft (18445_4, 18474_1, 18445_1)
 5.4m (501_1, 50_1)

S-57 Data

Geo object 1: Wreck (WRECKS)
Attributes: CATWRK - 2:dangerous wreck

QUASOU - 1:depth known

SORDAT - 20090412

SORIND - US,US, nsurf, H12025

TECSOU - 3:found by multi-beam

VALSOU - 5.423 m

WATLEV - 3:always under water/submerged

Feature Images

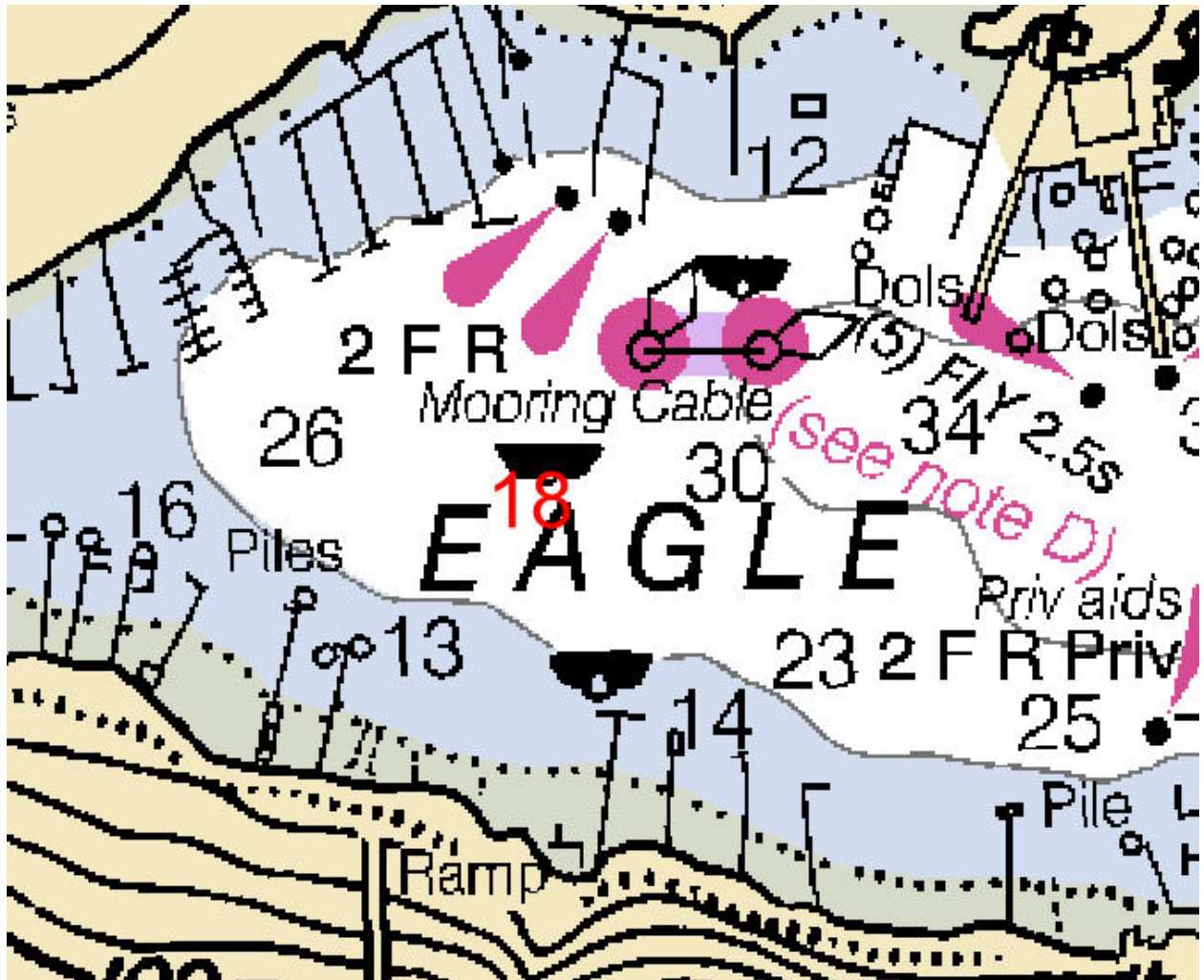


Figure 1.1.1

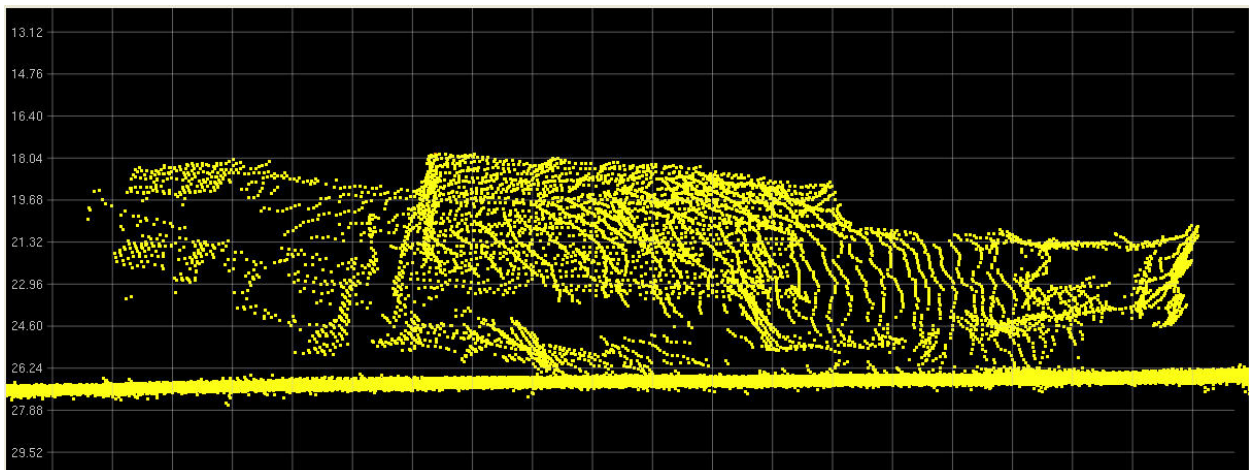


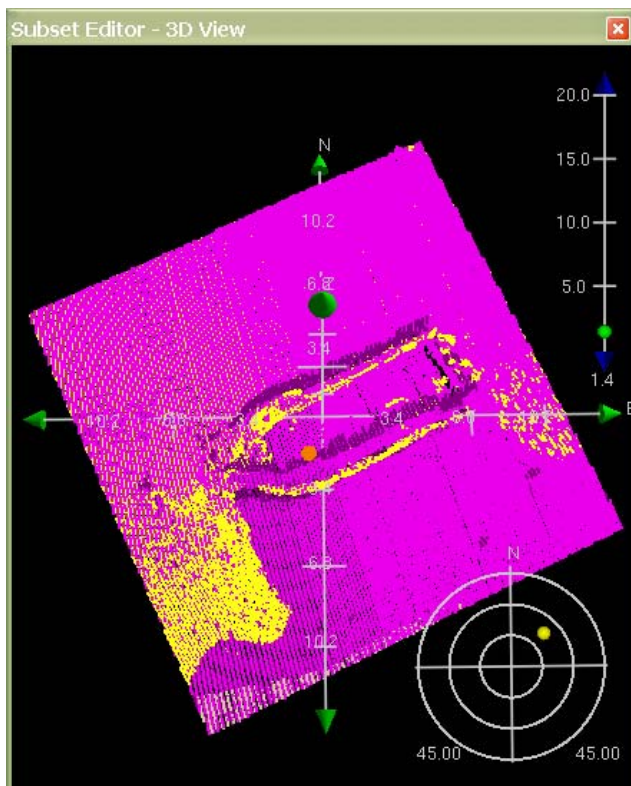
Figure 1.1.2

Two additional uncharted wrecks not listed in the DR for H12025 (OPR-N395-RA-09):

47-35-44.258N, 122-30-47.834W, partially submerged wreck at high water.



47-34-53.08N, 122-28-47.823W, least depth 6.44m in aprox. 8.4m of water, aprox.13m length.





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

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : May 15, 2009

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-N395-RA-2009
HYDROGRAPHIC SHEET: H12025

LOCALITY: Approaches to Elliott Bay - Skiff Point to Alki Point, WA
TIME PERIOD: April 8 - 22, 2009

TIDE STATION USED: Seattle, WA 944-7130
Lat. 47° 36.2' N Long. 122° 20.4' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 3.199 meters

TIDE STATION USED: Port Townsend, WA 944-4900
Lat. 48° 06.8' N Long. 122° 45.6' 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: Tacoma, WA 944-6484
Lat. 47°16.0' Long. 122°24.7'
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 3.336 meters

REMARKS: RECOMMENDED GRID

Please use the TCARI grid "N395RA2009.tc" as the final grid for project OPR-N395-RA-2009, H12025, during the time period between April 8 and 22, 2009.

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).

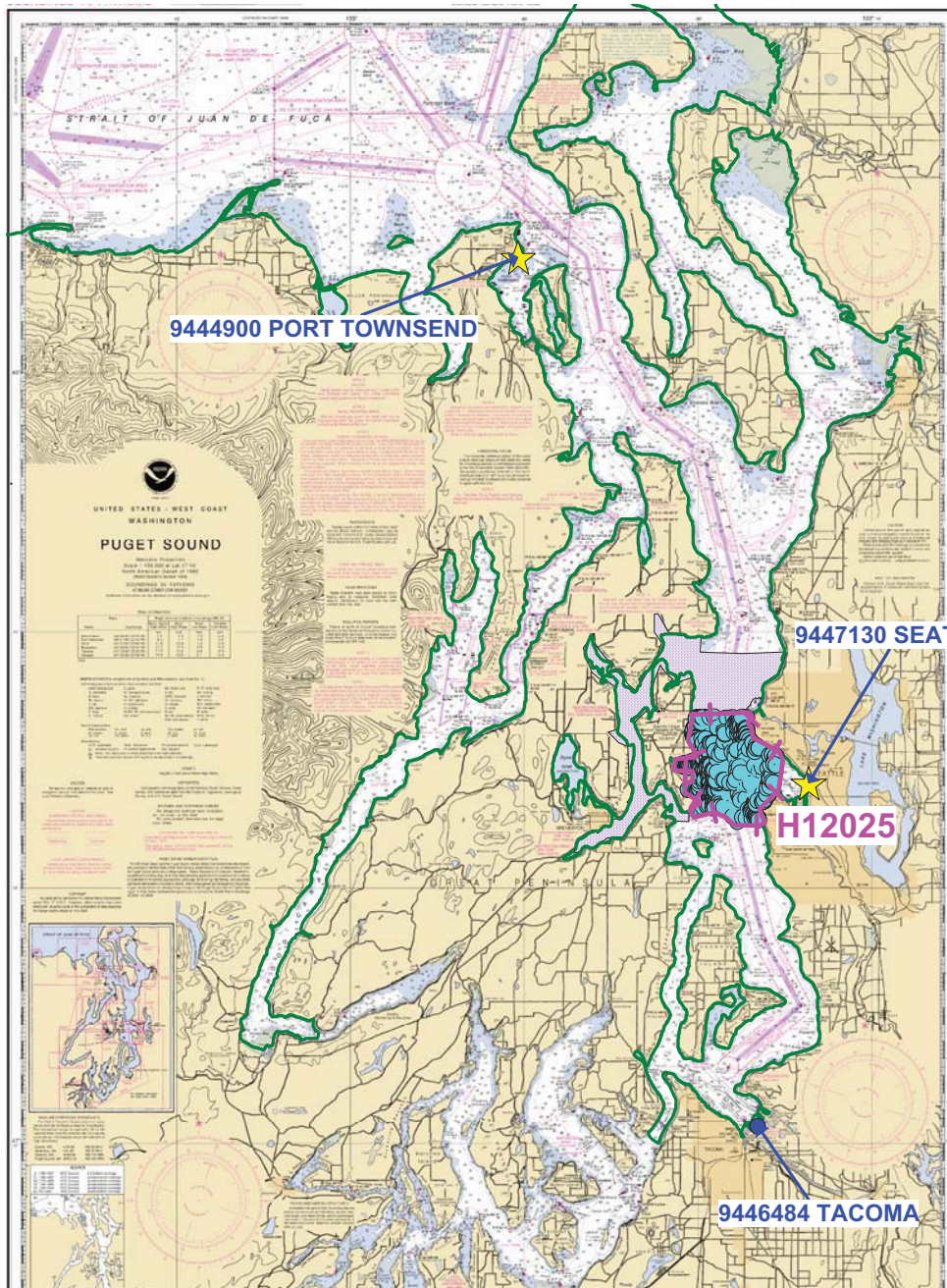
Peter J. Stone

Digitally signed by Peter J. Stone
DN: cn=Peter J. Stone, o=CO-OPS, ou=NOAA/
NOS, email=peter.stone@noaa.gov, c=US
Date: 2009.05.18 14:13:12 -04'00'

CHIEF, OCEANOGRAPHIC DIVISION



**Stations used for TCARI grid N395-RA-2009
Central Puget Sound, WA**



Labeled Stations (blue) used for harmonics and residuals

Shoreline for TCARI grid boundary shown in green

H12025 HCell Report
Katie Reser, Physical Scientist
Pacific Hydrographic Branch

1. Specifications, Standards and Guidance Used in HCell Compilation

HCell compilation of survey H12025 used:

Office of Coast Survey HCell Specifications: Draft, Version: 4.0, 17 March, 2010.
HCell Reference Guide: Version 2.0, 22 February, 2010.

2. Compilation Scale

Depths and features for HCell H12025 were compiled to the largest scale raster charts shown below:

Chart	Scale	Edition	Edition Date	NTM Date
18447	1:10,000	29 th	05/01/2008	08/07/2010
18450	1:10,000	18 th	02/01/2004	08/07/2010
18446	1:25,000	17 th	09/01/2005	08/07/2010
18449	1:25,000	18 th	10/01/2003	08/07/2010

The following ENCs were also used during compilation:

Chart	Scale
US5WA12M	1:25,000
US5WA13M	1:10,000
US5WA14M	1:25,000
US5WA15M	1:10,000

3. Soundings

A survey-scale sounding (SOUNDG) feature object layer was built from a 8-meter multibeam combined surface from H12025 in CARIS BASE Editor. A shoal-biased selection was made at 1:4,000 and 1:10,000 survey scale using a Radius Table file with values shown in the table, below.

Shoal Limit (m)	Deep Limit (m)	Radius (mm)
-5	10	3
10	20	4
20	50	4.5
50	500	5

In CARIS BASE Editor soundings were manually selected from the high density sounding layers (SS) and imported into a new layer (CS) created to accommodate chart

density depths. Manual selection was used to accomplish a density and distribution that closely represents the seafloor morphology.

4. Depth Contours

Depth contours at the intervals on the largest scale chart are included in the *_SS HCell for MCD raster charting division to use for guidance in creating chart contours. The metric and fathom equivalent contour values are shown in the table below.

Chart Contour Intervals in Feet	Metric Equivalent to Chart Feet, Arithmetically Rounded	Metric Equivalent of Chart Feet, with NOAA Rounding Applied	Feet with NOAA Rounding Applied	Feet with NOAA Rounding Removed for Display on H12025_SS.000
0	0.0000	0.2286	0.750	0
6	1.8288	2.0574	6.750	6
12	3.6576	3.8862	12.750	12
18	5.4864	5.715	18.750	18
30	9.144	9.3726	30.750	30
60	18.288	18.5166	60.750	60
300	91.44	91.6686	300.750	300
600	182.88	183.1086	600.750	600

With the exception of zero contours included in the *_CS file, contours have not been de-conflicted against shoreline features, soundings and hydrography, as all other features in the *_CS file and soundings in the *_SS have been. This may result in conflicts between the *_SS file contours and HCell features at or near the survey limits. Conflicts with M_QUAL, COALNE, DEPCNT and SBDARE objects should be expected. HCell features should be honored over *_SS.000 file contours in all cases where conflicts are found.

5. Meta Areas

The following Meta object areas are included in HCell H12025:

M_QUAL
M_CSCL

The Meta area objects were constructed on the basis of the limits of the hydrography.

6. Features

Features addressed by the field units are delivered to PHB where they are de-conflicted against the hydrography and the largest scale chart. These features, as well as features to be retained from the chart and features digitized from the Base Surface, are included in the HCell. The geometry of these features may be modified to emulate chart scale per the HCell Reference Guide on compiling features to the chart scale HCell.

7. S-57 Objects and Attributes

The *_CS HCell contains the following Objects:

\$CSYMB	Blue notes
\$LINES	Linear blue notes for placement of new sewer pipelines
BCNLAT	Private lateral marks
BCNSPP	Private beacons
BOYSPP	Private warning marks
COALNE	Coastline
DEPCNT	Zero contours
LIGHTS	Private Lights
MORFAC	Dolphins, private mooring buoys and cable
M_CSCL	Compilation scale meta object
M_QUAL	Data quality meta object
OBSTRN	Obstruction
OFSPLF	Floating platform
PILPNT	Pilings
SBDARE	Retained bottom samples, modified ledges and reef
SLCONS	Piers, seawall and ruined slipway
SOUNDG	Soundings at the chart scale density
WRECKS	Wrecks

The *_SS HCell contains the following Objects:

DEPCNT	Generalized contours at chart scale intervals
SOUNDG	Soundings at the survey scale density

8. Spatial Framework

8.1 Coordinate System

All spatial map and base cell file deliverables are in an LLDG geographic coordinate system, with WGS84 horizontal, MHW vertical, and MLLW (1983-2001 NTDE) sounding datums.

8.2 Horizontal and Vertical Units

DUNI, HUNI and PUNI are used to define units for depth, height and horizontal position in the chart units HCell, as shown below.

Chart Unit Base Cell Units:

Depth Units (DUNI):	Feet
Height Units (HUNI):	Feet
Positional Units (PUNI):	Meters

During creation of the HCell in CARIS BASE Editor and CARIS S-57 Composer, all soundings and features are maintained in metric units with as high precision as possible. Depth units for soundings measured with sonar maintain millimeter precision. Depths on rocks above MLLW and heights on islets above MHW are typically measured with range finder, so precision is less. Units and precision are shown below.

BASE Editor and S-57 Composer Units:

Sounding Units:	Meters rounded to the nearest millimeter
Spot Height Units:	Meters rounded to the nearest decimeter

See the HCell Reference Guide for details of conversion from metric to charting units, and application of NOAA rounding.

9. Data Processing Notes

There were no significant deviations from the standards and protocols given in the HCell Specification and HCell Reference Guide.

10. QA/QC and ENC Validation Checks

H12025 was subjected to QA checks in S-57 Composer prior to exporting to the metric HCell base cell (000) file. The millimeter precision metric S-57 HCell was converted to chart units and NOAA rounding applied. dKart Inspector was then used to further check the data set for conformity with the S-58 ver. 2 standard (formerly Appendix B.1 Annex C of the S-57 standard). All tests were run and warnings and errors investigated and corrected unless they are MCD approved as inherent to and acceptable for HCells.

11. Products

11.1 HSD, MCD and CGTP Deliverables

H12025_CS.000	Base Cell File, Chart Units, Soundings and features compiled to 1:10,000 and 1:25,000
H12025_SS.000	Base Cell File, Chart Units, Soundings and Contours compiled to 1:4,000 and 1:10,000
H12025_DR.pdf	Descriptive Report including end notes compiled during office processing and certification, the HCell Report, and supplemental items
H12025_Outline.gml	Survey outline
H12025_Outline.xsd	Survey outline

11.2 Software

CARIS HIPS Ver. 6.1	Inspection of Combined BASE Surfaces
CARIS BASE Editor Ver. 2.2	Creation of soundings and bathy-derived features, meta area objects, and blue notes; Survey evaluation and verification; Initial HCell assembly.
CARIS S-57 Composer Ver. 2.0	Final compilation of the HCell, correct geometry and build topology, apply final attributes, export the HCell, and QA.
CARIS GIS 4.4a	Setting the sounding rounding variable for conversion of the metric HCell to NOAA charting units with NOAA rounding.
CARIS HOM Ver. 3.3	Perform conversion of the metric HCell to NOAA charting units with NOAA rounding.
HydroService AS, dKart Inspector Ver. 5.1	Validation of the base cell file.
Northport Systems, Inc., Fugawi Marine ENC Ver.3.1.0.435	Independent inspection of final HCells using a COTS viewer.

12. Contacts

Inquiries regarding this HCell content or construction should be directed to:

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APPROVAL SHEET
H12025

The survey evaluation and verification has been conducted according to branch processing procedures and the HCell compiled per the latest OCS HCell Specifications.

The survey and associated records have been inspected with regard to survey coverage, delineation of the depth curves, development of critical depths, S-57 classification and attribution of soundings and features, cartographic characterization, and verification or disapproval of charted data within the survey limits. The survey records and digital data comply with OCS requirements except where noted in the Descriptive Report and are adequate to supersede prior surveys and nautical charts in the common area.

I have reviewed the HCell, accompanying data, and reports. This survey and accompanying digital data meet or exceed OCS requirements and standards for products in support of nautical charting except where noted in the Descriptive Report.