

H11552

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.

Registry No. H11552

LOCALITY

State Washington

General Locality Approaches to Anacortes and Bellingham

Sublocality Hale Passage

2006

CHIEF OF PARTY
Commander Guy T. Noll, NOAA

LIBRARY & ARCHIVES

DATE

HYDROGRAPHIC TITLE SHEET

H11552

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

FIELD No

State Washington

General Locality Approaches to Anacortes and Bellingham

Sub-Locality Hale Passage

Scale 1:10,000 Date of Survey 10/17/2006 - 11/1/2006

Instructions dated 8/15/2006 Project No. OPR-N161-RA-06

Vessel RA5 (1006), RA6 (1015), RA4 (1016), RA3 (1021), RA2 (1103)

Chief of party Commander Guy T. Noll

Surveyed by RAINIER Personnel

Soundings by echo sounder, hand lead, pole Reson SeaBat 8101, 8125, Seabeam/Elac 1180, Knudsen 320M

Graphic record scaled by N/A

Graphic record checked by N/A Automated Plot N/A

SAR by Martha Herzog Compilation by Fernando Ortiz

Soundings in fathoms and feet at MLLW

REMARKS: All times are UTC, UTM Projection (zone #10)

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. Revisions and end notes in red were generated during office processing. Page numbering may be interrupted or non sequential.

Descriptive Report to Accompany Hydrographic Survey H11552

Project OPR-N161-RA-06
Approaches to Anacortes and Bellingham, Washington
Hale Passage
Scale 1:10,000
October - November 2006
NOAA Ship RAINIER (s221)
Chief of Party: Commander Guy T. Noll, NOAA

A. AREA SURVEYED

This hydrographic survey was completed as specified by Hydrographic Survey Letter Instructions OPR-N161-RA-06 dated August 15, 2006 and all other applicable direction¹, with the exception of deviations noted in this report. The survey area is the Approaches to Anacortes and Bellingham, and the sublocality is Hale Passage. This survey corresponds to sheet "A" in the sheet layout provided with the Letter Instructions. OPR-N161-RA-06 responds to a request from the Puget Sound Pilots Association to address critical areas and inadequate chart data, and to provide contemporary hydrography with full-bottom coverage in the approaches to Bellingham and Anacortes, including channel anchorage areas that support deep-draft vessel traffic to the ports.

The area seaward of the 4m curve and offshore of the Navigable Area Limit Line (NALL) was surveyed with a combination of 100% multi-beam echosounder (MBES) and 200% side scan sonar (SSS) coverage, as described in Section B. In areas covered with 200% SSS, additional MBES coverage was obtained to acquire least depths over significant features or shoals, as appropriate for this survey. Vertical-beam echo sounder (VBES) data were acquired parallel to the shoreline within the limits of the survey area, in approximately 4 meters of water, to aid in the definition of the navigable area limit.¹

Survey statistics were calculated for each vessel (see Table 1).

¹ Standing Instructions for Hydrographic Surveys (May 2006), NOS Hydrographic Surveys Specifications and Deliverables (June 2006), OCS Field Procedures Manual for Hydrographic Surveying (May 2006), and all Hydrographic Surveys Technical Directives issued through November 2006.

Data Acquisition Type	Hull Number with Mileage (nm)					Total
	1021	1103	1015	1016	1006	
VBES (mainscheme)	-	-	-	-	-	-
MBES (mainscheme)	70.2	-	-	30.2	110.4	210.8
MBES + SSS (mainscheme)	-	-	84.0	-	-	84.0
Crosslines	11.0	-	-	-	2.3	13.3
Developments	2.6	-	-	-	0.3	2.9
Shoreline	-	16.1	-	-	-	16.1
Bottom Samples	-	-	-	-	-	16
Total Number of Items Investigated	-	-	-	-	-	14
Total Area Surveyed (sq. nm)	-	-	-	-	-	5.4

Table 1. H11552 Survey Statistics

Data acquisition was conducted from October 17 through November 1, 2006.

Limited Shoreline Verification was performed for the survey area.

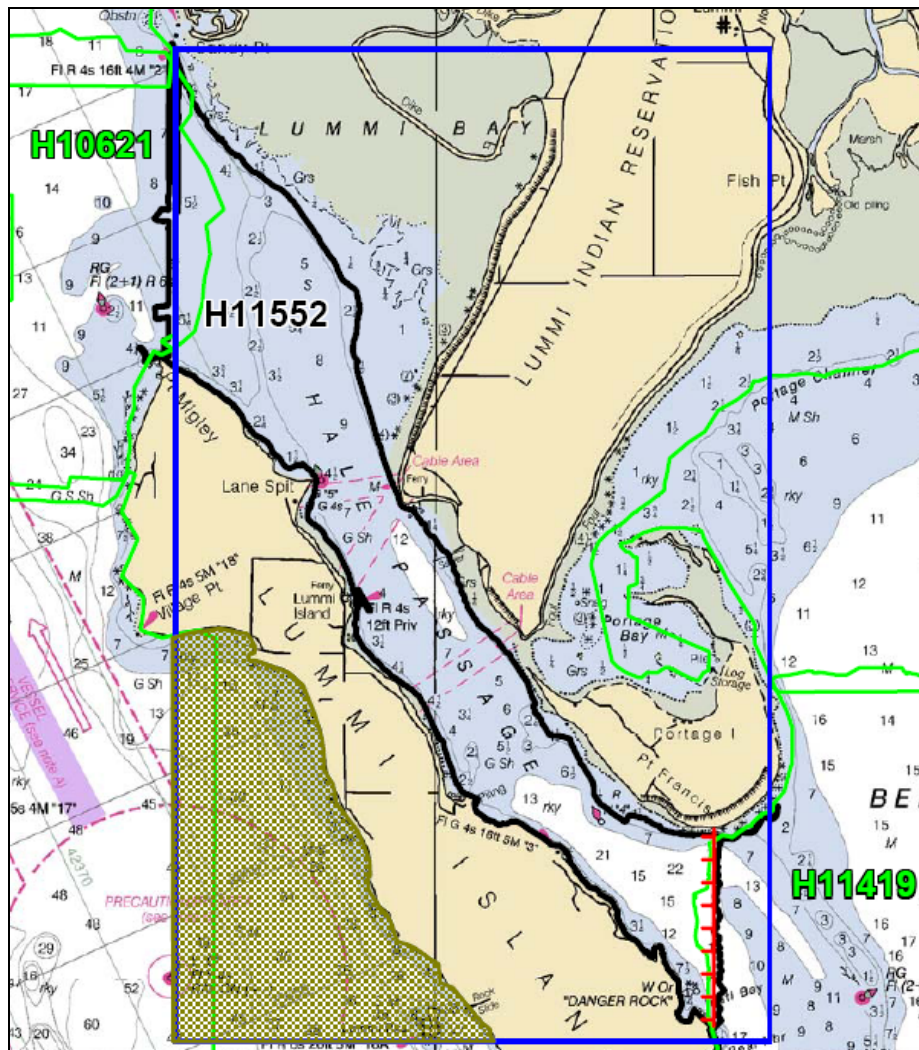


Figure 1. H11552 Survey Limits and corresponding junction surveys (Chart 18421).

B. DATA ACQUISITION AND PROCESSING

Hale Passage was surveyed with 100% MBES in designated areas generally over 6 fathoms in depth while 200% SSS data was acquired in the remaining areas deeper than 4m and seaward of the NALL. An exception was the shoal line crossing the northern entrance to Hale Passage, which was covered with 100% MBES. Objects detected with side scan sonar were also then investigated with MBES development lines to acquire least depths. Coverage is shown in Figure 2 below.

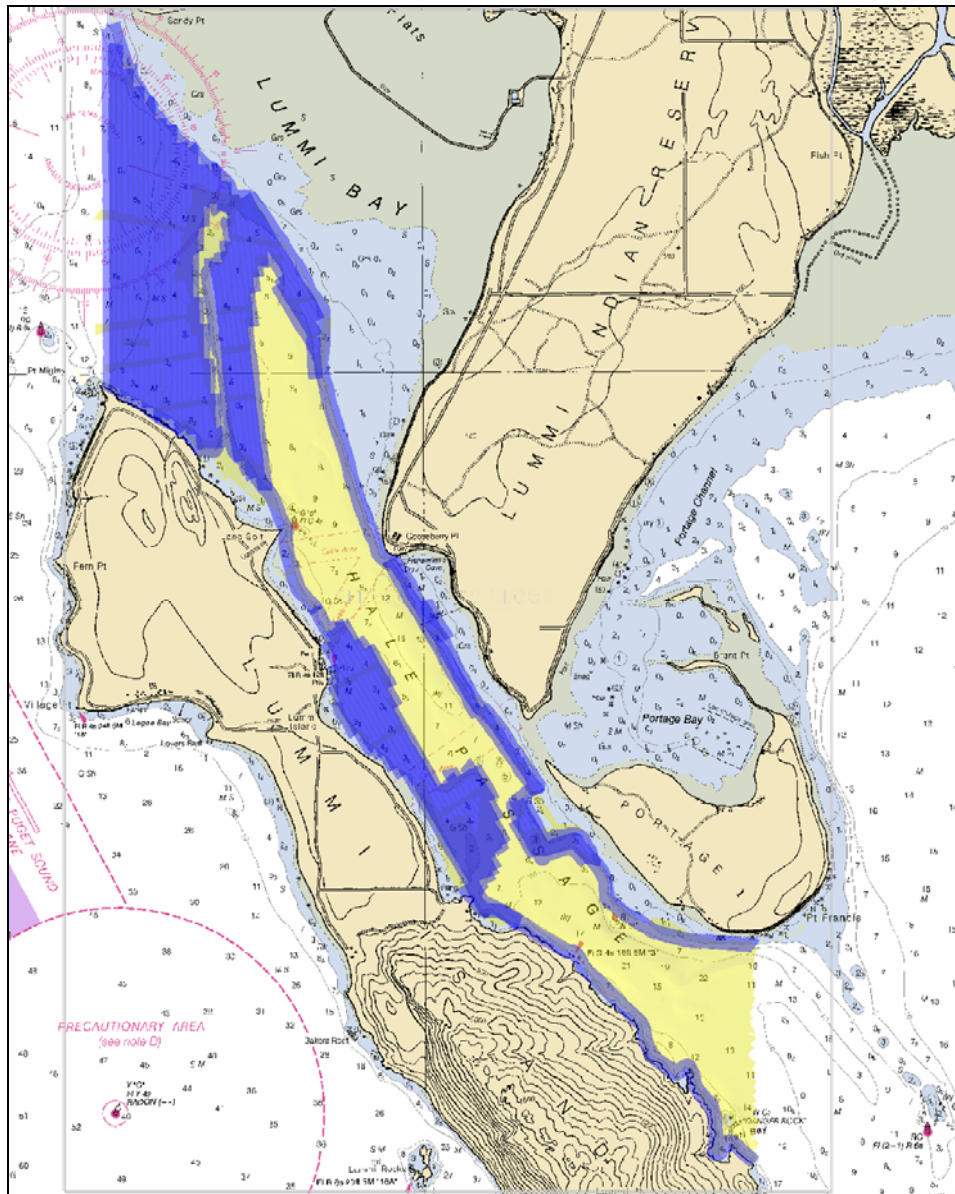


Figure 2. H11552 Coverage overlaid on chart 18424, yellow is 100% MBES and Blue is 200% SSS.

A complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods can be found in the *OPR-N161-RA-06 Data Acquisition and Processing Report (DAPR)*², submitted under separate cover. Items specific to this survey, and any deviations from the aforementioned report are discussed in the following sections.

Final approved water levels have been applied to this survey³. See Section C. for additional information.

B1. Equipment and Vessels

Data for this survey were acquired by the following vessels:

Hull Number	Name	Acquisition Type
1103	RA-2	Vertical-Beam Echosounder Detached Positions Bottom Samples
1021	RA-3	Multi-Beam Echosounder
1016	RA-4	Multi-Beam Echosounder
1006	RA-5	Multi-Beam Echosounder Detached Positions
1015	RA-6	Multi-Beam Echosounder Side Scan Sonar

Table 2. Data Acquisition Vessels for H11552.

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

No unusual vessel configurations were used for data acquisition.

B2. Quality Control

Crosslines

Multi-beam echosounder crosslines totaled 13.3 nautical miles, comprising 6.6% of MBES-only and combined MBES-SSS hydrography. The mainscheme bathymetry was manually compared to the crossline nadir beams in CARIS subset mode and agreed well with differences generally less than 0.2 meters.⁴

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 2006 Hydrographic System Readiness Review package submitted with this survey.

Junctions

The following contemporary surveys junction with H11552 (See Figure 1):

Registry #	Scale	Date	Junction side
H10621	unknown	1996	Northwest
H11419	1:10,000	2005	Southeast

CARIS Field Sheets and BASE surfaces for H11419 were available for junction comparison. H11419 BASE surfaces were compared to H11552 using CARIS HIPS subset mode. Agreement was excellent with no discernable offsets in the common area.⁵ Data for H10621 was not available for comparison.⁶

Data Quality Factors

1015 (RA-6) Dynamic Draft

The majority of the side-scan sonar run by Launch 1015 (RA-6) was acquired at a speed of 12-14 knots. Elac 1180 MBES bathymetry was acquired in addition to side-scan to provide “skunk stripe” bathymetry. This relatively high speed was determined to meet the requirements of this survey, as the Klein 5500 high speed, high resolution side scan sonar provided object detection capability while the Elac 1180 determined bathymetry. As described above, all significant features detected by SSS were further investigated by high resolution shallow water multibeam sonar.

Multibeam sonar data acquisition at these speeds was not anticipated when Launch 1015 dynamic draft properties were measured and correctors generated in Spring 2006. As a result, the maximum speed in the dynamic draft table for Launch 1015's Hydrographic Vessel File (HVF) is approximately 9 knots (4.7 m/s). For the high speed data acquired on survey H11552, CARIS HIPS incorrectly extrapolated dynamic draft correctors from the entered values. The result was a discernable vertical offset (approximately 0.2m) in the data when compared to bathymetry acquired with other vessels (see Figure 3).

The hydrographer addressed this issue by extrapolating an additional corrector data point (-0.38m at 7m/s, or 13.6kts) from the experimental values. This value follows the trend of the measured dynamic draft data, is in line with Jensen survey launch historical measurements, and was empirically shown to reduce the error in H11552 Elac 1180 bathymetric data to less than 0.1m. A new HVF (“1015_Elac1180_HV_ExtendedDraft.hvf”) was created, and all Elac lines were re-imported and processed using the new configuration.

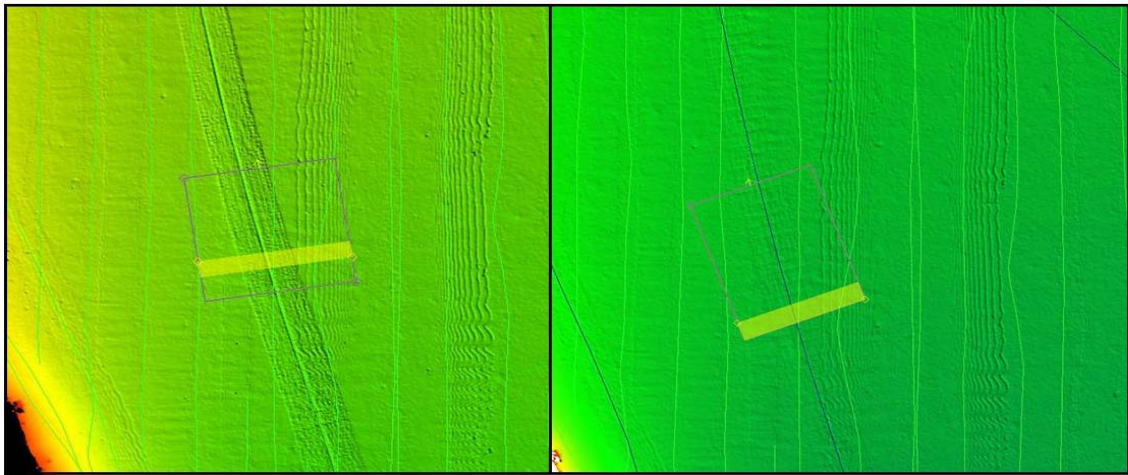


Figure 3. Resulting CUBE surface before (left) and after (right) vessel 1015 (RA-6) configuration file correction for dynamic draft.

Sound Speed Correction Errors

Data from the southern end of Hale Passage exhibits "frown" artifacts indicative of inaccurate sound speed profile correction. Sound speed profiles were not acquired in this immediate area, but were concentrated approximately 500m north of this in deeper water. Southern Hale Passage and the vicinity of Point Francis was found to be an area of strong tidal current and mixing of water masses, possibly causing these artifacts. Artifacts were found through multiple acquisition days and multiple boats. The extent of this error ranges from 0.3m in 25-30m of water, to 0.9m in 20m of water.⁷ Sound velocity cast sites and the artifact region are shown below in Figure 4.

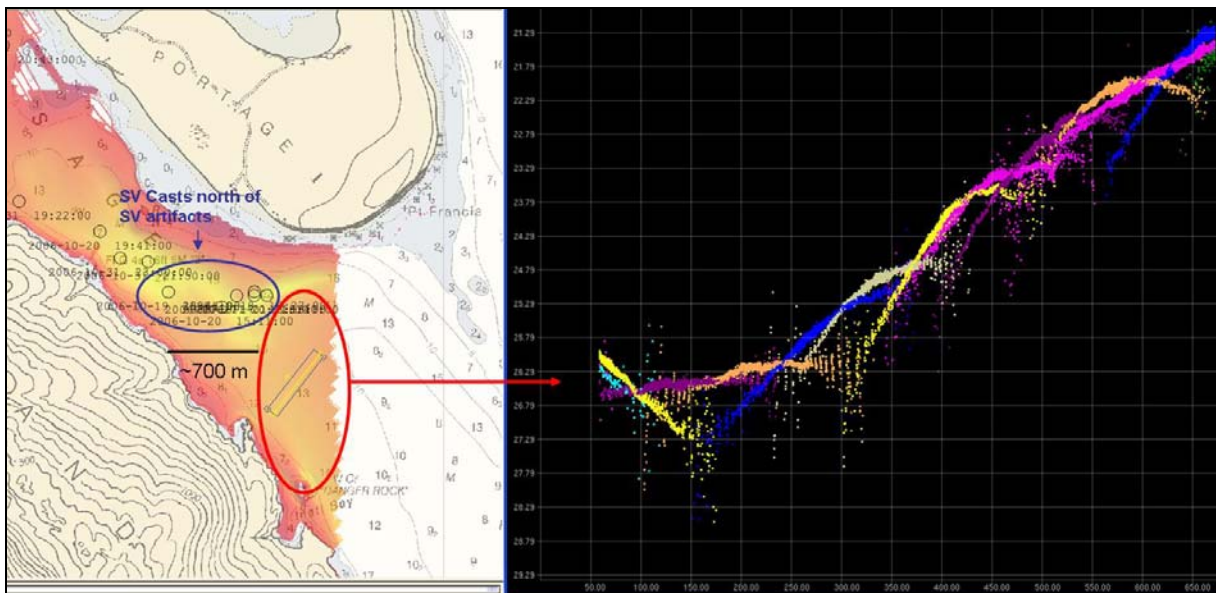


Figure 4. Sound velocity artifacts and cast sites at southern end of Hale Passage.

Coverage Gaps

There are two significant “holidays” in the H11552 survey area. These coverage gaps occurred due to hydrographer survey planning error and compression of the project schedule to avoid impending inclement weather. The hydrographer recommends that prior survey data and charted depths be retained in these areas.⁸

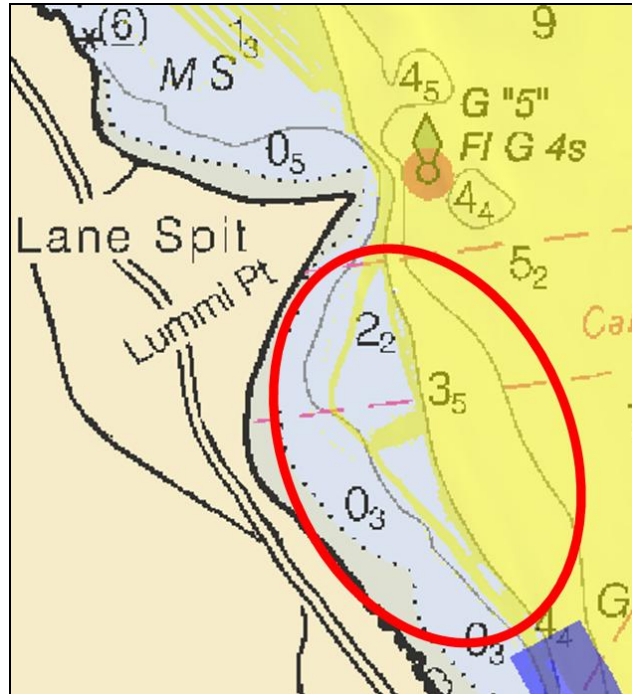


Figure 5. 150m x 550m holiday south of of Lane Spit overlaid on chart 18424.

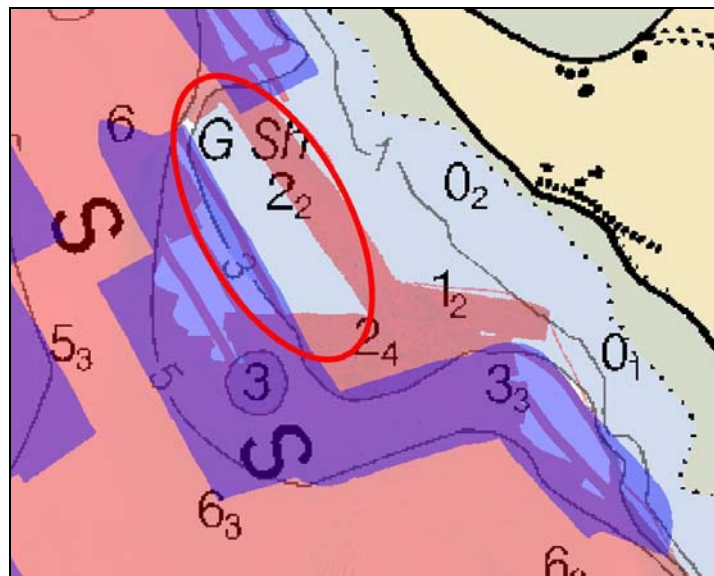


Figure 6. 400m x 150m holiday southwest of Portage Bay overlaid on chart 18424. 100% MBES shown in red and 200% SSS shown in blue.

A third holiday occurred as a result of incomplete 200% SSS coverage along shore (see Figure 7). Although this produced a 700m gap in redundant bottom coverage, the entire area is fully covered with either 100% MBES or 100% SSS. The coverage gap occurred along a steep slope, and there is no evidence of obstructions in either the SSS or MBES coverage which was achieved. The hydrographer considers this holiday to be insignificant, and recommends that H11552 survey soundings and features supersede all charted and prior survey data in the common area despite the gap.⁹

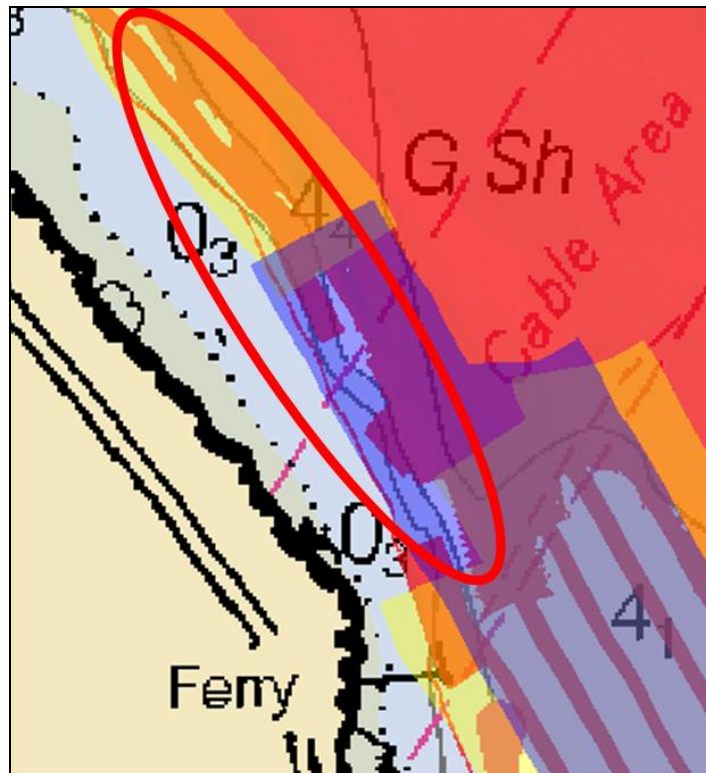


Figure 7. Holidays north of Lummi Island Ferry Terminal. 100% MBES is shown in red, 100% SSS is shown in yellow and blue.

B3. Data Reduction

Data reduction procedures for survey H11552 conform to those detailed in the *OPR-N161-RA-06 DAPR*.

B4. Data Representation

Many CUBE surfaces were used in processing H11552. Final CUBE surface resolutions and depth ranges were set in accordance with the Field Procedures Manual, with field sheets smaller than 25×10^6 nodes. Three regions were not sufficiently represented in the 0.5 meter resolution surfaces and were instead computed at 0.25 meter resolution. The field sheet layout is below in Figures 9, 10, and 11.

Side Scan Sonar data was split into two complete coverage mosaics to demonstrate areas covered by this technique. These mosaics were created at 2 meter resolution and named

“H11552_SSS_100%_2m” and “H11552_SSS_200%_2m.” The Field Sheet structure and CUBE Surfaces are shown in Figure 8 below.

Soundings and contours were generated in CARIS HIPS from the final combined BASE surface for field unit review purposes. They are included for reference only and are not intended as a deliverable.

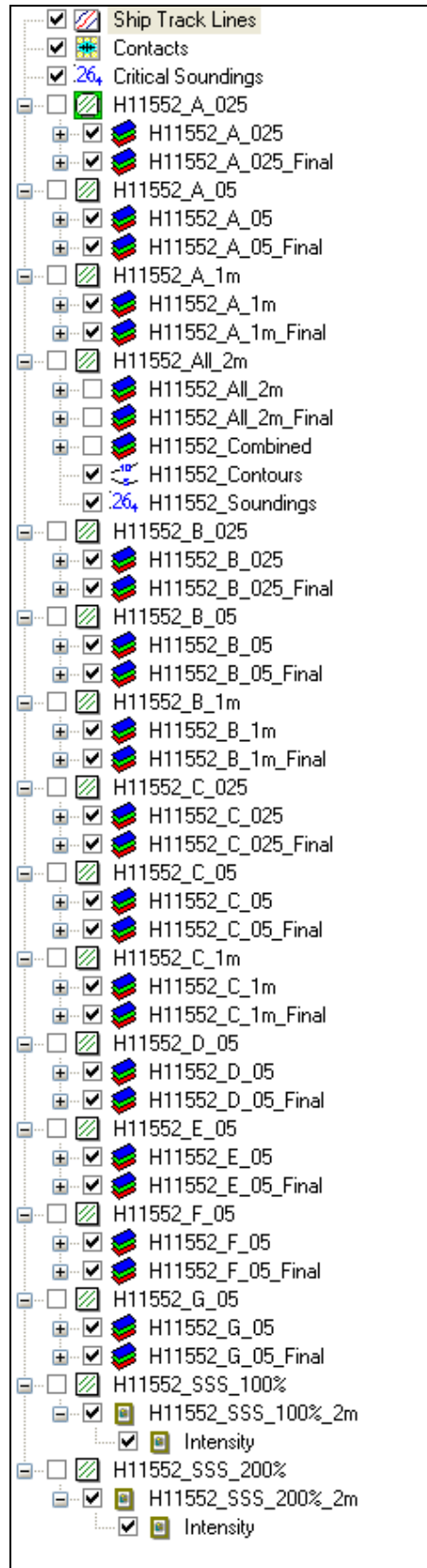


Figure 8. Field sheets and CUBE surfaces submitted with H11552.



Figure 9. H11552 Field sheet layout for 1 meter surfaces.



Figure 10. H11552 Field sheet layout for 0.5 meter surfaces.

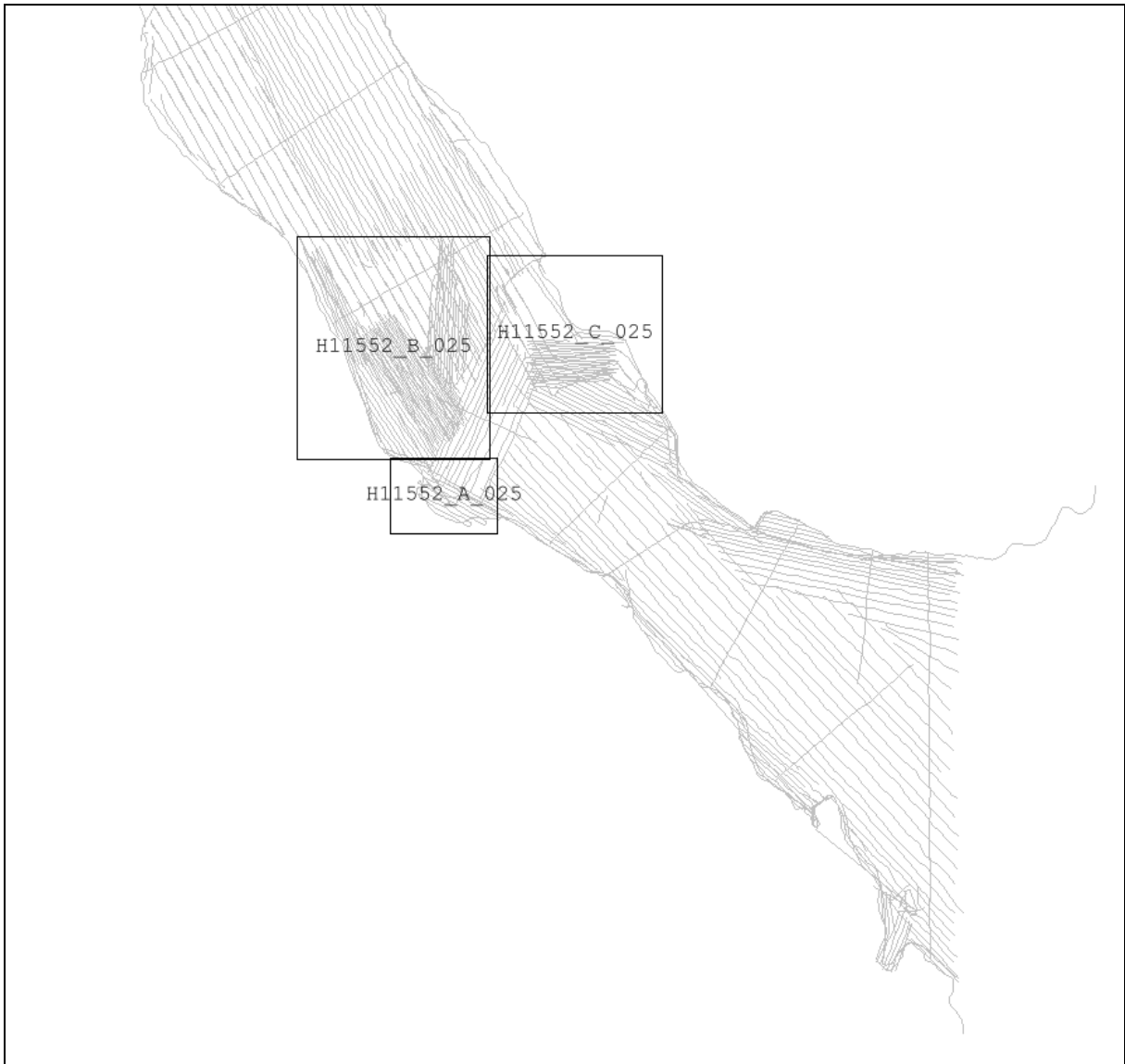


Figure 11. H11552 Field sheet layout for 0.25 meter surfaces.

The 2 meter resolution field sheet and SSS mosaic fieldsheets encompassed the entire survey area.

C. VERTICAL AND HORIZONTAL CONTROL

Project OPR-N161-RA-06 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.¹⁰

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 beacon utilized for this survey is given in Table 3.

Location	Frequency	Operator	Distance	Priority
Whidbey Island	302 kHz	USCG	90nm	Primary

Table 3. Differential Corrector Source for H11552.

Vertical Control

The vertical datum for this project is Mean Lower-Low Water (MLLW). The operating National Water Level Observation Network (NWLON) primary tide station at Friday Harbor, WA (944-9880) served as control for datum determination and as the primary source for water level reducers for survey H11552.

No tertiary gauges were required.

All data were reduced to MLLW using **Final Approved Water Levels** from stations Friday Harbor, WA (944-9880) and Cherry Point, WA (944-9424) using the tide files 9449880.tid and 9449424.tid and approved final time and height correctors using the zone corrector file H11552CORF.zdf.¹¹

D. RESULTS AND RECOMMENDATIONS

D.1. Chart Comparison

D.1.a. Survey Agreement with Chart

RAINIER personnel compared H11552 survey data with the most recent editions of the paper, raster, and electronic nautical charts with coverage of the survey area during data acquisition and processing. The results of these comparisons are described below, as well as in Sections D.2.b. through D.2.f.

H11552 survey soundings were formally compared with depths on the following charts:¹²

Chart	Scale	Edition and Date	Notice to Mariners Applied Through
18424	1:40,000	27/06	2/24/2007
18430	1:25,000	8/03	2/24/2007
18431	1:25,000	7/05	2/24/2007

Table 4. Charts compared with H11552

Since large scale charts 18430 and 18431 encompass only a partial area of the survey, a comparison was also made to chart 18424 which covers the entire survey area. See Figure 12 below.

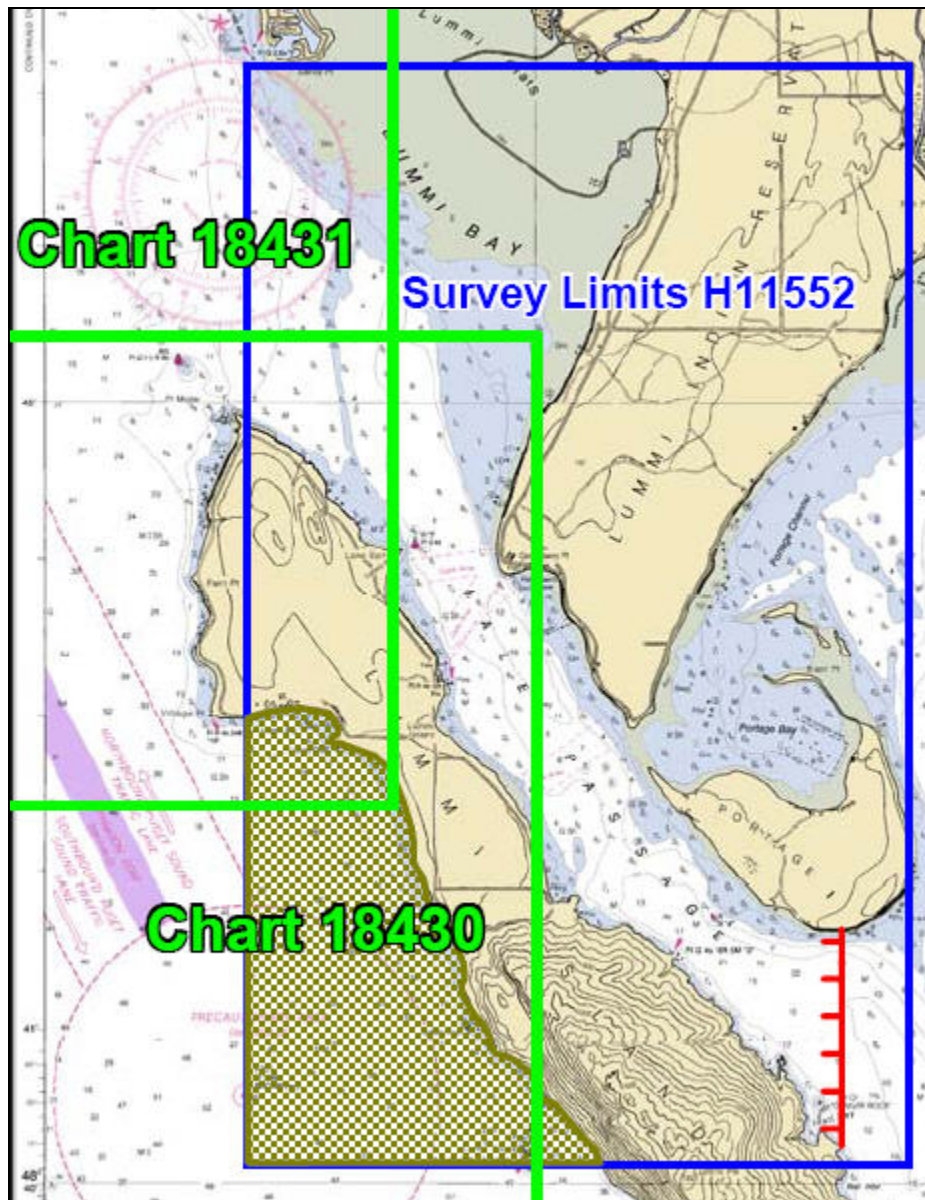


Figure 12. Chart limits with H11552 limits overlaid on Chart 18424.

Data acquired for H11552 generally agreed to within less than 1 fathom on 18430, 18431, and 18424. A 60-80 meter horizontal offset was found at the charted shoal traversing the north end of Hale Passage as seen in Figure 13 below.

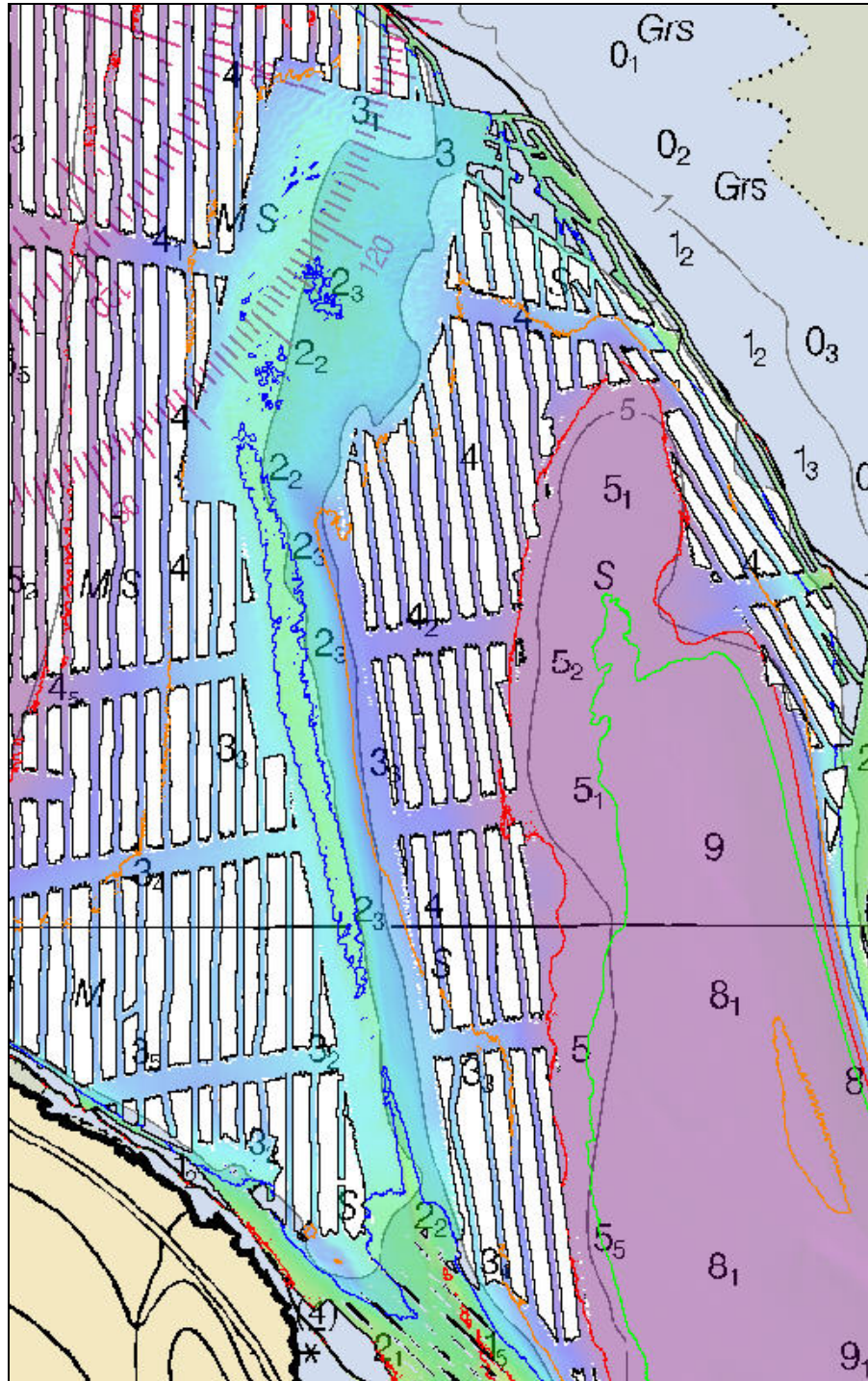


Figure 13. Offset of shoal showing 3 fm contour (blue) at northern entrance to Hale Passage overlaid on chart 18424 (vertical exaggeration 3).

D.1.b. Dangers to Navigation

No dangers to navigation (DTONs) were found in survey H11552.¹³

D.1.c. Other Features

Automated Wreck and Obstruction Information System (AWOIS) Investigations

One (1) AWOIS item (53504) falls within the survey limits of H11552. This item was not approachable or significant and was not investigated. Its location is shown below in Figure 14. A second AWOIS item (53506) falls just outside the southern limit of H11552 and was noted as ‘not seen’ within the 4 meter curve.¹⁴

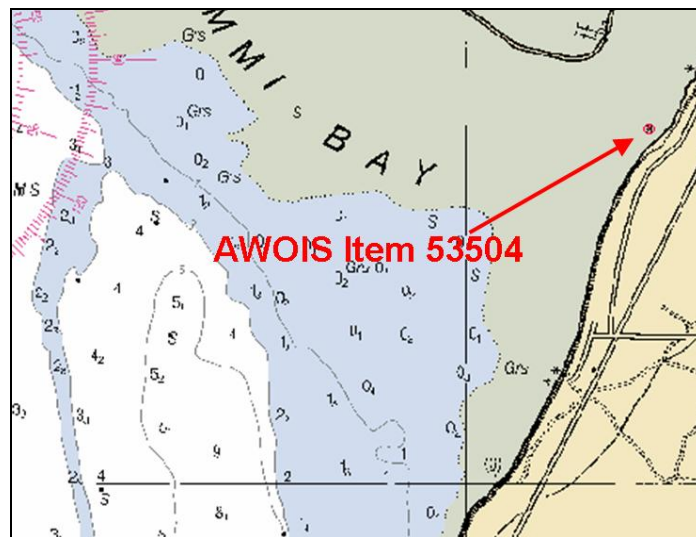


Figure 14. Location of AWOIS item not investigated on Chart 18424.

One (1) significant contact selected from SSS imagery was not developed with MBES due to hydrographer error (see Figures 15 and 16). The contact is present in both 100% and 200% SSS coverage, and appears to be a rock. The contact's shadow length indicates a maximum height of 2.17m above the surrounding seabed. Survey soundings immediately adjacent to the contact are 12.26m, and the area is otherwise flat and featureless. The hydrographer recommends charting a 10.09m (5.5 fathom) depth with danger circle and “Rk” annotation. As this feature was imaged with hull mounted SSS and the horizontal positions from the 100% and 200% coverage agree to 2.2m, the hydrographer does not recommend a “PA” qualification.¹⁵ The hydrographer further recommends that this feature be added to the AWOIS database for further investigation.¹⁶ Additional information on this feature can be found in the Pydro PSS and Survey Feature Report under imagery line h11552/1015_k5k_100_hvf/2006-291/sonar_data061018210800, Contact 3 in the “Uncharted Features” category.

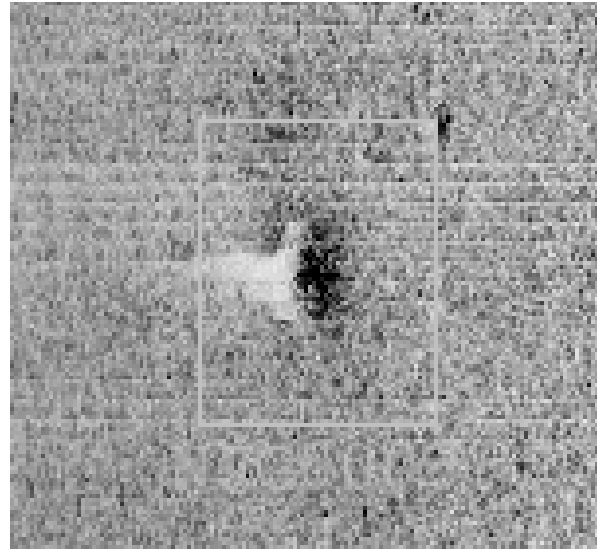
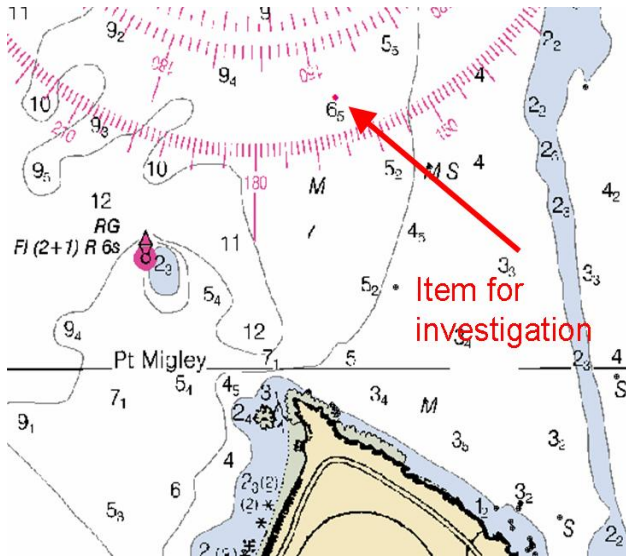


Figure 15. Location of item recommended for addition to AWOIS database for further investigation.

Figure 16. SSS image with shadow height approximately 2.2 meters.

Additional Items¹⁷

Numerous rocks were found in the bathymetry covering the section of the survey area near Portage Bay. The least depths were flagged as designated soundings to be preserved in their respective CUBE surfaces and the two (2) regions were delineated in Notebook (See H11552_Notebook). Both areas use one primary rock each to represent the approximate position of this delineated area while the remaining features are designated as secondary in the PSS. The hydrographer recommends charting a “rocky”¹⁸ notation in this area rather than a charted rock symbol for each designated feature. These features are shown below in Figure 17.¹⁹

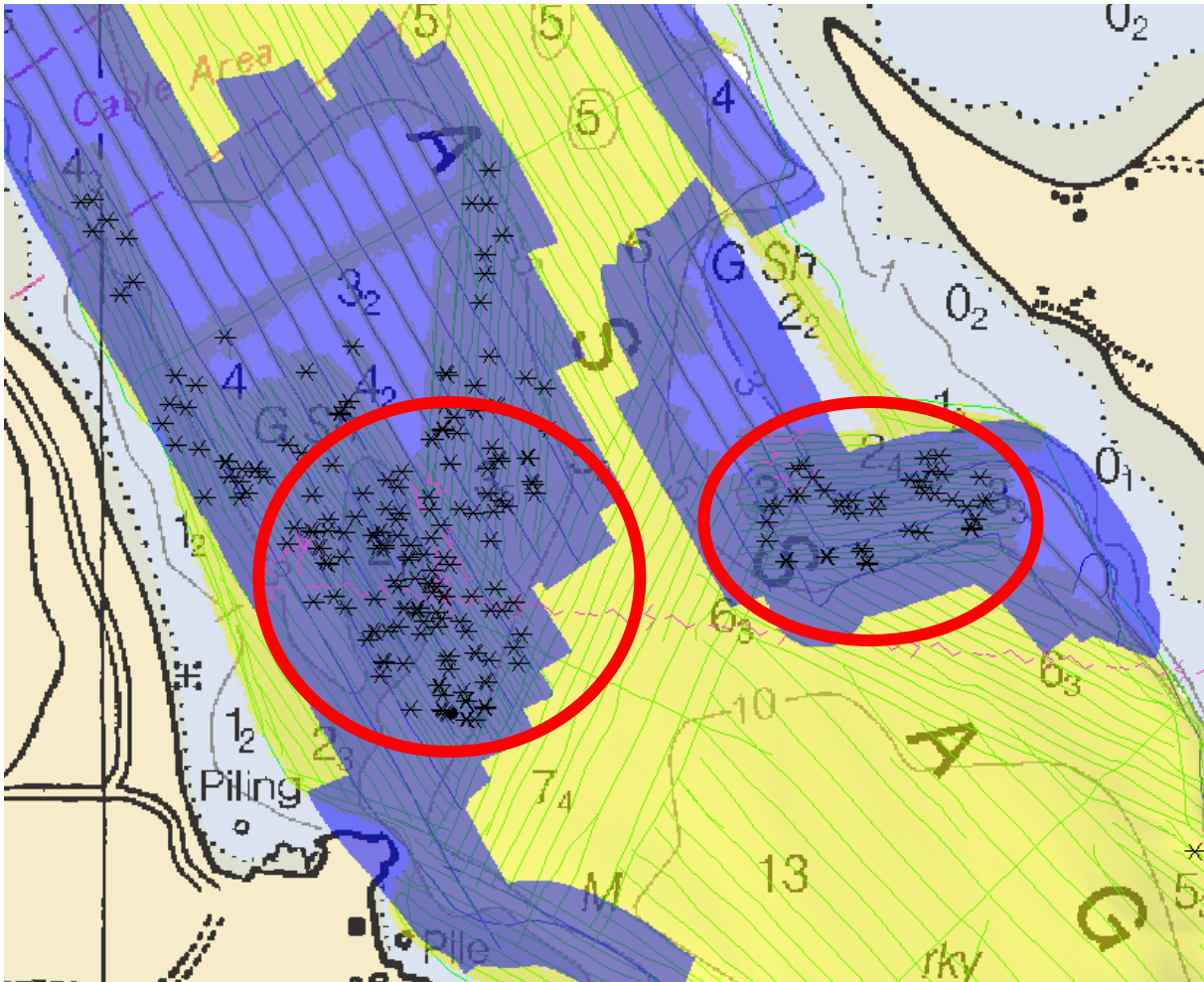


Figure 17. Two areas near Portage Bay recommended to be designated as 'Rky' seabed areas (red circles indicate approximate area) overlaid on chart 18424.

D.2. Additional Results

D.2.a. Prior Survey Comparison

Prior survey comparison was not performed.

D.2.b. Shoreline Verification

Shoreline Source

ENCs USSWA45M was converted into hydrographic object binary (HOB) files for use in CARIS Notebook 2.2. This source data was printed on paper “boat sheets” and displayed in Hypack for field verification.

Shoreline Verification

A zero or negative tide window did not occur during daylight hours while RAINIER was in the OPR-N161-RA-06 project area. Limited shoreline verification was performed during the lowest available daylight tides. See table below for tidal heights of shoreline verification.

Day Number	Date	Times of acquisition (UTC)	Highest Tide (m)	Lowest Tide (m)
290	October 17 th , 2006	1531	1.11	0.45
		1827		
291	October 18 th , 2006	1546	0.73	0.6
		1723		

Table 5: Dates, times, and tidal heights of shoreline verification acquired on H11552.

Detached positions (DPs) acquired during shoreline verification were recorded in HYPACK and on DP forms, and processed in Pydro. These indicate revisions to features and features not found on the verified shoreline. In addition, annotations describing shoreline were recorded on hard copy plots of digital shoreline. DP forms are included in the *Separates to be Included with Survey Data*.

All shoreline data is submitted in Caris Notebook .hob files. The session H11552_NTBK contains the following:

HOB File	Purpose and Contents
H11552_Comp_Source.HOB	Original Source Data as filtered from ENC cells USSWA45M
H11552_pydro_updates.HOB	New or modified items processed through Pydro
H11552_Pydro_Delete.HOB	Items to be removed from chart processed through Pydro
H11552_Field_Verified_Comp_Source.HOB	Field verified source features and shoreline, including edits and updates not requiring DPs.

Table 6. List and Description of Notebook HOB files.

The combination of *pydro_updates.hob* and *Field_Verified_Comp_Source.hob* layers depict the shoreline as surveyed. *Pydro_updates.hob* is the combination of *modify*, *add*, and *none* layers exported from Pydro. The *Field_Verified_Comp_Source.hob* reflects unchanged features that were noted in the field, and also includes a Marker layer with hydrographer notes.

Source Shoreline Changes and New Features

Items for survey H11552 that require further discussion and are associated with a detached position, have been flagged “Report” in Pydro in H11552.pss. Investigation methods and

recommendations are listed in the Remarks and Recommendation tabs. These features are included in the Survey Feature Report in Appendix II.¹⁹

Recommendations

The Hydrographer recommends that the shoreline as depicted in the Notebook .HOB files supersede and complement shoreline information compiled on the CFF and charts as described above.²⁰

D.2.c. Aids to Navigation

Five (5) Aids to Navigation (ATONs) are charted within the limits of H11552. Four (4) aids were found to be correctly charted and serve their intended purpose. Of these four, the positions of three (3) ATONs were verified by DP and are incorporated into the Pydro PSS (H11552_PSS). The fourth, Lummi Island Light “3” (Light List #19295), is a fixed aid ashore and was not directly positioned. Its position was visually verified as correct during shoreline verification operations.²¹

There is a charting discrepancy in the vicinity of Lummi Island Light “3,” causing the light to appear detached from land on chart 18424 (see Figure 18). The ENC (US5WA45M) more accurately depicts this area, showing the light on a ledge as shown in Figure 19 below.²² A photo of this light is shown below in Figure 20.

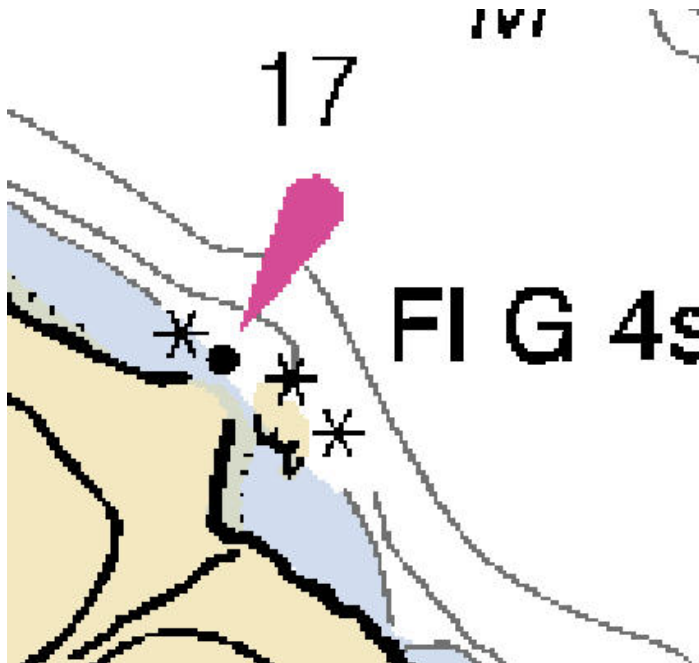


Figure 18. Raster chart 18424 showing light detached from land.



Figure 19. ENC US5WA45M showing correct depiction of light on ledge.



Figure 20. Photo of Lummi Island Light "3" on ledge.

The fifth ATON, Lummi Island Ferry Landing Light (Light List #19300), was found to be atop a dolphin at the end of the ferry pier.²³ This dolphin was DPed and is noted in the PSS as DP 1103_290_3974. See Figure 21 below.

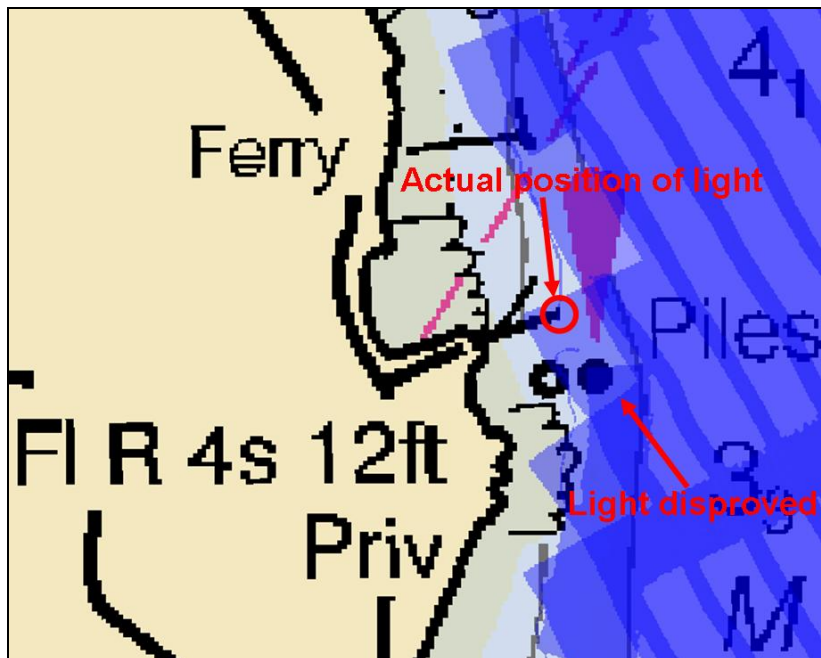


Figure 21. Actual position of Lummi Island Ferry Landing light with MBES and SSS coverage on chart 18424.

D.2.d. Overhead Features

There are no overhead features within the limits of survey H11552.²⁴

D.2.e. Submarine Cables and Pipelines

Survey H11552 includes several charted cable areas and sewer lines as shown in Figures 22 and 23, some of which were marked with signs along the shoreline. Although no evidence of these was seen in the bathymetry, the hydrographer recommends retaining the cable areas as charted.²⁵

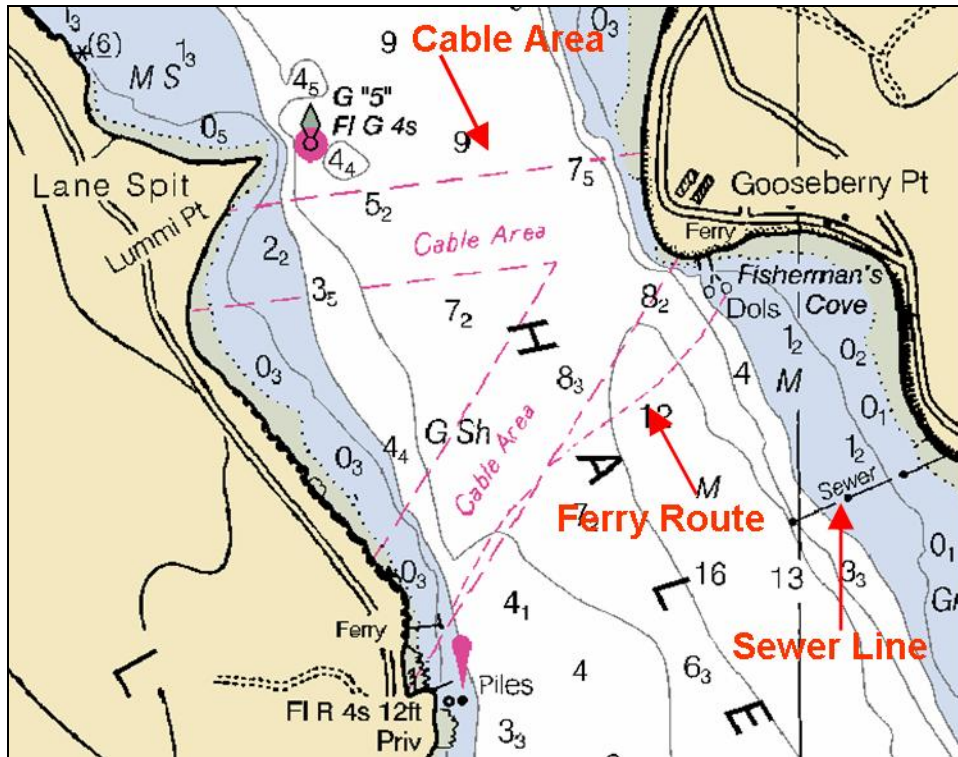


Figure 22. Cable Area, Ferry Route, and Sewer Line in Hale Passage (18424).

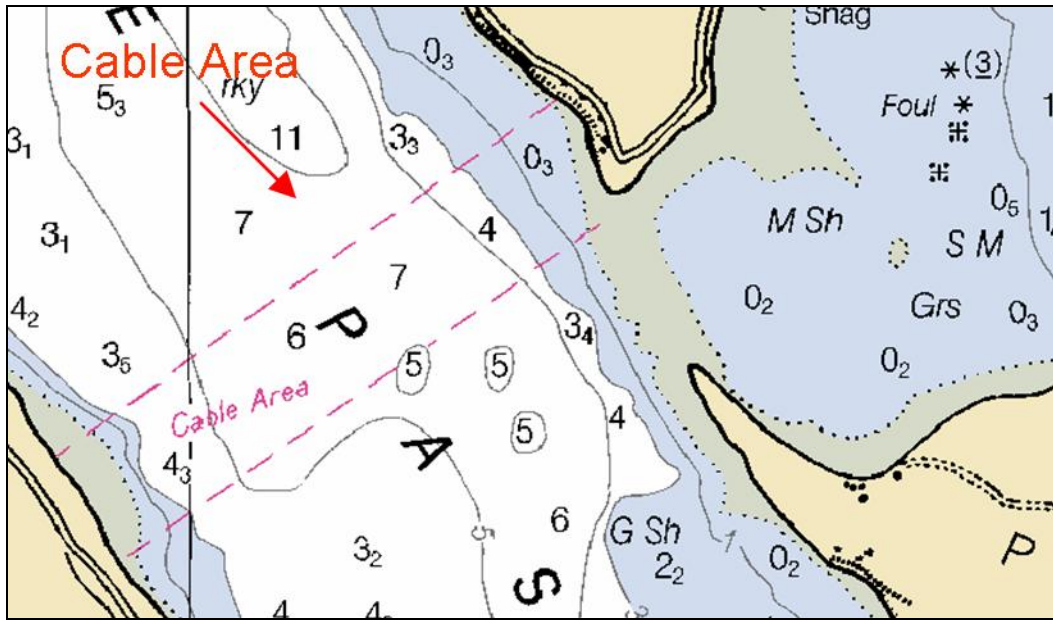


Figure 23. Cable Area near Portage Bay (18424).

D.2.f. Ferry Routes

There is one ferry route within the limits of H11552. The charted ferry route appears to accurately depict ferry traffic observed by RAINIER personnel during the survey. The hydrographer recommends that it be retained as charted.²⁶

The Lummi Island Ferry Terminal Pier is mischarted. Near the current charted position, a DP was taken (1103_290_3973) and a sign on land reads “Lummi Island overlook, site of old Lummi Island ferry terminal dock.” This site was covered with partial SSS and MBES with no evidence seen of a pier or pier ruins.²⁷ A DP (1103_290_3974) of Lummi Island Ferry Landing Light (Light List #19300) marks the end of the existing pier (which is charted as “Priv” and represents the correct position of the new Ferry Terminal. The hydrographer recommends the old pier be removed from the chart (18424 and 18430) and the word “ferry” be moved to the correct position at the new terminal.²⁸



24. Site of old Ferry Terminal partially covered with MBES and SSS in blue overlaid on chart 18430.



25. Photo of sign at old Ferry Terminal stating: Lummi Island overlook, site of old Lummi Island ferry terminal dock."

D.2.g. Bottom Samples

A total of sixteen (16) bottom samples were collected during this survey. The spacing and location of the bottom samples follows the guidelines outlined in OCS Field Procedures Manual for Hydrographic Surveying (May 2006). Fourteen (14) samples were taken over charted bottom types, and two additional samples were taken in areas designated by the Field Operations Officer to sample a potential anchorage and to examine the bottom characteristic at one of the deepest regions of Hale Passage. Most of the samples taken were the same or similar to those already charted. Three (3) of the samples were significantly different than charted. All bottom samples can be found in the Survey Feature Report in Appendix II.²⁹

D.2.h. Other Findings

Bathymetry from the shoal area traversing the northern end of Hale Passage shows significant sand waves ranging in height from 0.1-0.5 meters. Figure 26 shown below depicts the northern part of the shoal.

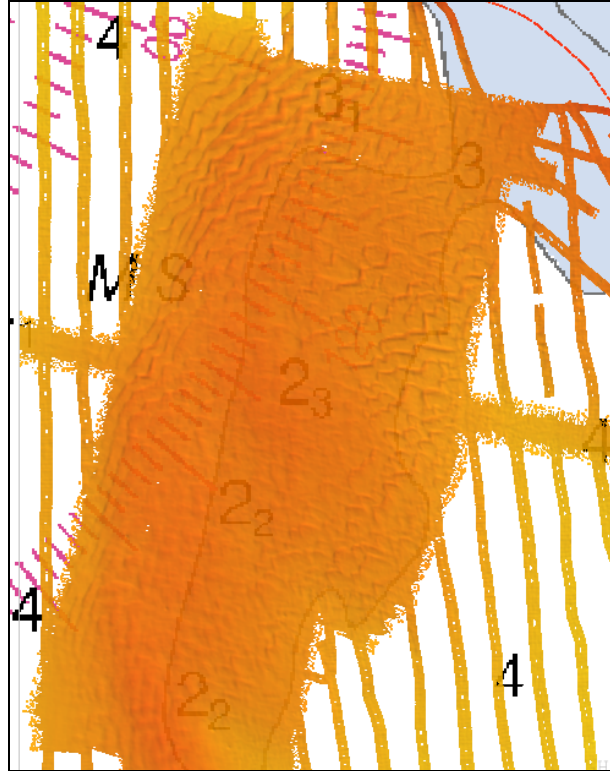


Figure 26. Sand waves seen at shoal northern end of Hale Passage overlaid on chart 18424 with vertical exaggeration of 3.

A stone quarry was seen on land 900 meters northwest of Inati Bay at the unnamed inlet at this location. The approximate location of this stone quarry as well as apparent mooring facilities for rock barges is noted on the boatsheet for H11552 and are also represented by the two (2) new pilings and one (1) new partially submerged piling listed in the PSS in this unnamed bay.³⁰


A log boom and log storage area was seen in Inati Bay and is noted with its approximate location on the boatsheet for H11552. The location is well represented by the current Field Verified Composite Source layer in the H11552 Notebook session and is recommended to be charted at this position.³¹

E. APPROVAL

Field operations for hydrographic survey H11552 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 (June 2006 edition), Field Procedures Manual (May 2006 edition), Standing and Letter Instructions, and all HSD Technical Directives issued through November 2006. 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>
Data Acquisition and Processing Report for OPR-P183-RA-06	2 February 2007	N/CS34
Coast Pilot Report for OPR- P183-RA-06	13 March 2007	N/CS26


Approved and Forwarded:  Guy Noll
I am approving this document
2007.04.06 14:43:21 -07'00'

Guy T. Noll
Commander, NOAA
Commanding Officer


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

Survey Sheet Manager:  Meghan McGovern
cn=Meghan McGovern, c=US, o=NOAA,
ou=NOAA Ship RAINIER, email=meghan.
mcgovern@noaa.gov
I am the author of this document
2007.03.30 15:04:40 Z

Meghan E. McGovern
Ensign, NOAA.

Chief Survey Technician:  James B Jacobson
I have reviewed this
document
2007.04.04 19:21:43 Z

James B. Jacobson
Chief Survey Technician, NOAA Ship RAINIER

Field Operations Officer:  LT Benjamin K. Evans, NOAA
I have reviewed this document
2007.04.05 17:10:57 Z

Benjamin K. Evans
Lieutenant, NOAA

Revisions complied during office processing and certification.

¹ Concur.

² Filed with the project records.

³ Concur.

⁴ Concur.

⁵ Concur.

⁶ Junction with survey H10621 will be discussed in H10621 DR.

⁷ The SVP errors for this area did not meet specs by 0.34 m. However, the data is adequate to superseded charted data despite de fact of the SVP errors.

⁸ Concur.

⁹ Concur.

¹⁰ Concur.

¹¹ See attached Tide note dated Nov 29,2007

¹² Concur with clarification. During office compilation survey H11552 were compared with the latest charts as follow: Chart 18424 (27th Ed., December, 2006). Chart 18430 (8th Ed., October,2003) and Chart 18431 (7th Ed.,April, 2005).

¹³ Concur.

¹⁴ The two AWOIS item should be retained as charted. See attached AWOIS features report.

¹⁵ Concur. The submerged rock is included in the Hcell.

¹⁶ Concur with clarification. The submerged rock was located by Side Scan Sonar at Lat. 48/45.624 N, Log. 122/42.775W; with a depth of 5.5 fathoms. It is recommended that this feature be added to the AWOIS database. Additional information is needed to acquire a least depth by multibeam, diver or leadline.

¹⁷ There is a line on chart 18424 at approximate location 48-41-42.626N, 122-37-47.669W that has no corresponding feature. The line appears to be in error and it is recommended to be removed.

¹⁸ Concur. (see following end note)

¹⁹ Several rocky seabed areas were located within the limits of this survey. See Hcell for the depiction.

²⁰ All features have been reviewed and have been added to this Hcell. The survey features report is filed with the hydrographic records.

²¹ Concur.

²² Concur. Use the latest ATONIS information to chart these AIDS to Navigation.

²³ Concur with clarification. A blue note was added to the Hcell to modify the correct position of the light using the ENC correct position. Verify with the latest ATONIS information.

²⁴ Concur.

²⁵ Concur.

²⁶ Concur.

²⁷ Concur.

²⁸ Concur.

²⁹ Concur. The correct position of the new Ferry Terminal is 48-43-13.9N – 122-40-50.2W

³⁰ Concur. 16 bottom samples were collected during H11552 and 16 are included in the Hcell 11552. No additional bottom samples were imported from the ENC.

³¹ Concur. New piles are included in the Hcell.

³² Concur. New log boom is included in the Hcell.

H11552 AWOIS FEATURES

Registry Number: H11552
State: Washington
Locality: Approaches to Anacortes and Bellingham
Sub-locality: Hale Passage
Project Number: OPR-N161-RA-06
Survey Date:

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
18424	27th	12/01/2006	1:40,000 (18424_1)	[L]NTM: ?
18423	35th	05/01/2005	1:80,000 (18423_1)	[L]NTM: ?
18421	48th	09/01/2006	1:80,000 (18421_1)	[L]NTM: ?
18400	47th	10/01/2006	1:200,000 (18400_1)	[L]NTM: ?
18003	20th	11/01/2006	1:736,560 (18003_1)	[L]NTM: ?
18007	32nd	07/01/2005	1:1,200,000 (18007_1)	[L]NTM: ?
501	12th	11/01/2002	1:3,500,000 (501_1)	[L]NTM: ?
530	31st	06/01/2005	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.	Name	Feature Type	Survey Depth	Survey Latitude	Survey Longitude	AWOIS Item
1.1	OBSTRUCTION	AWOIS	[no data]	[no data]	[no data]	---
1.2	OBSTRUCTION	AWOIS	[no data]	[no data]	[no data]	---

1 - Tree

1.1) AWOIS #53504 - OBSTRUCTION**No Primary Survey Feature for this AWOIS Item**

Search Position: 48° 46' 07.4" N, 122° 39' 06.9" W
Historical Depth: [None]
Search Radius: 30
Search Technique: VS, ES, S2, SWMB
Technique Notes: Conduct search within the limits of the survey.

History Notes:

Charted position LAT. 48/46/07.43 N LONG. 122/39/6.88 W (NAD83) of rock is offset from source position. Conduct search to verify or disprove charted rock. (Entered by KRW, 08/15/2006)

Survey Summary

Charts Affected: 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

Not approachable, not navigationally significant

Feature Correlation

Address	Feature	Range	Azimuth	Status
OPR-N161-RA-06	AWOIS # 53504	0.00	000.0	Primary

Hydrographer Recommendations

Not approachable, not navigationally significant

Office Notes

Retain as Charted

1.2) AWOIS #53506 - OBSTRUCTION

No Primary Survey Feature for this AWOIS Item

Search Position: 48° 41' 37.0" N, 122° 36' 54.5" W
Historical Depth: [None]
Search Radius: 30
Search Technique: VS, ES, S2, SWMB
Technique Notes: Conduct search within the limits of the survey.

History Notes:

Charted position LAT. 48/41/36.99 N LONG. 122/36/54.51 W (NAD83) of rock is offset from source position. Conduct search to verify or disprove charted rock. (Entered by KRW, 08/15/2006)

Survey Summary

Charts Affected: 18424_1, 18421_1, 18423_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

Not seen during shoreline verification.

Not fully investigated- inshore of NALL and outside survey limits.

Feature Correlation

Address	Feature	Range	Azimuth	Status
OPR-N161-RA-06	AWOIS # 53506	0.00	000.0	Primary

Hydrographer Recommendations

Retain as charted.

Office Notes

Concur.



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

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE : November 29, 2007

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-N161-RA-2006
HYDROGRAPHIC SHEET: H11552

LOCALITY: Hale Passage, Bellingham Bay, WA
TIME PERIOD: October 17 - November 1, 2006

TIDE STATION USED: 944-9880 Friday Harbor, WA
Lat. 48° 32.8' N Long. 123° 0.6' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.167 meters

TIDE STATION USED: 944-9424 Cherry Point, WA
Lat. 48° 51.8' N Long. 122° 45.5' W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 2.535 meters

REMARKS: RECOMMENDED ZONING

Use zone(s) identified as: PS245, PS248, PS249, PS250 & PS259

Refer to attachments for zoning information.

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

Note 2: Use tide data from the appropriate station with applicable zoning correctors for each zone according to the order in which they are listed in the Tidezone corrector file (*.ZDF). For example, tide station one (TS1) would be the first choice for an applicable zone followed by TS2, etc. when data are not available.

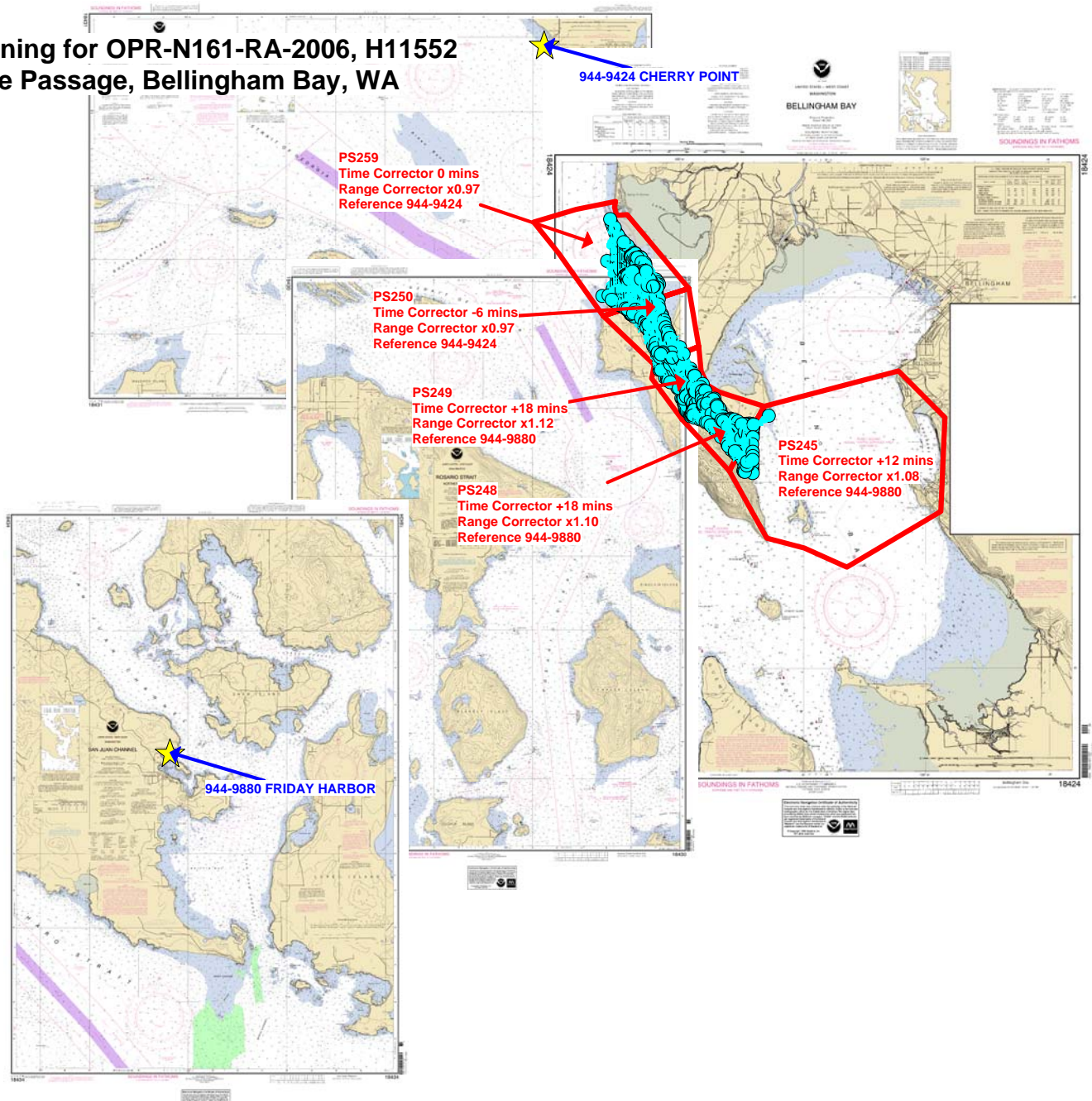
Peter J. Stone

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: 2010.03.22 16:48:48 -04'00'

CHIEF, PRODUCTS AND SERVICES DIVISION



Final Zoning for OPR-N161-RA-2006, H11552 Hale Passage, Bellingham Bay, WA



Final tide zone node point locations for OPR-N161-RA-2006, H11552

Format: Tide Station (in recommended order of use)
 Average Time Correction (in minutes)
 Range Correction
 Longitude in decimal degrees (negative value denotes Longitude West),
 Latitude in decimal degrees

	Tide Station Order	AVG Time Correction	Range Correction
Zone PS245	944-9880	+12	1.08
-122.489376 48.653514			
-122.486617 48.695651			
-122.518053 48.716593			
-122.609231 48.700738			
-122.632858 48.671748			
-122.607529 48.641504			
-122.58199 48.637064			
-122.553165 48.628482			
-122.489376 48.653514			
Zone PS248	944-9880	+18	1.10
-122.609231 48.700738			
-122.63994 48.7072			
-122.665008 48.694922			
-122.632858 48.671748			
-122.609231 48.700738			
Zone PS249	944-9880	+18	1.12
-122.647411 48.710129			
-122.651934 48.716457			
-122.653521 48.727603			
-122.683712 48.719401			
-122.685485 48.713218			
-122.665008 48.694922			
-122.63994 48.7072			
-122.647411 48.710129			
Zone PS250	944-9424	-6	0.97
-122.653521 48.727603			
-122.660278 48.753753			
-122.718404 48.741353			
-122.683712 48.719401			
-122.653521 48.727603			
Zone PS259	944-9424	0	0.97
-122.660278 48.753753			
-122.702117 48.786853			
-122.70916 48.786558			

-122.710626 48.790122
-122.709904 48.792798
-122.736643 48.789258
-122.765442 48.783545
-122.748502 48.769539
-122.734954 48.756852
-122.718404 48.741353
-122.660278 48.753753

H11552 HCell Report
Fernando Ortiz, Hydrographic Contractor
Pacific Hydrographic Branch

Introduction

The primary purpose of the HCell is to provide new survey information in International Hydrographic Organization (IHO) format S-57 to update the largest scale ENC's and RNC's in the region: NOAA ENC's US5WA45M.000, and NOAA RNC's 18430_1, 18431_1 and 18424_1.

HCell compilation of survey H11552 used Office of Coast Survey DRAFT HCell Specifications Version 4.0. For additional information on the standards and protocols used for HCell Compilation, see the DRAFT A/PHB HCell Reference Guide, version 2.0, March 17th, 2010.

1. Compilation Scale

Depths for HCell H11552 were compiled to the largest scale charts in the region, 18430_1 (1:25,000) and 18431_1 (1:25,000). The density and distribution of soundings from H11552 were selected to emulate the distribution on these charts. Non-bathymetric features have been generalized to chart scale.

2. Soundings

A survey-scale sounding (SOUNDG) feature object layer was built from the 2-meter finalized surface, **H11552_final_combined_2m.hns**, in CARIS BASE Editor. A shoal-biased selection was made at 1:10,000 scale for both charts the 18430_1 and 18431_1. These shoal-based selections were made using a Radius Table file with values shown in the table, below . The resultant sounding layer contains 32,627 depths ranging from 0 to 41.5 meters.

Upper limit (m)	Lower limit (m)	Radius (mm)
0	20	2.0
20	50	2.5

In CARIS BASE Editor soundings were manually selected from the high density sounding layers and imported into a new layer created to accommodate chart density depths. Manual selection was used to accomplish a density and distribution that closely represents the seafloor morphology.

3. Depth Contours

Depth contours at the intervals on the largest scale chart are included in the H11552_SS HCell for MCD raster charting division to use for guidance in creating chart contours. The generalized metric and fathom equivalent contour values are shown in the table below.

Chart Contours in Fathoms	Metric Equivalent of Chart Contours	Metric Equivalent of Chart Contours NOAA Rounded	Actual Value of Chart Contours
1	1.8288	2.0574	1
2	3.6576	3.8862	2
3	5.4864	5.715	3
5	9.144	9.3726	5
10	18.288	18.5166	10

Contours delivered in the H11552_SS file have not been deconflicted against soundings and hydrography as all other features in the H11552_CS file and soundings in the H11552_SS have been. This results in conflicts between the H11552_SS file contours and HCell features at or near the survey limits.

4. Meta Areas

The following Meta object areas are included in HCell 11552:

M_QUAL
M_CSCL

Meta area objects were constructed on the basis of the limits of the hydrography. The extents of the highest resolution BASE Surface together with the extents of the soundings layer were used to digitize the hydrographic extents, which were then used to create the single, all encompassing M_QUAL.

5. Features

Shoreline features for H11552 were delivered from the field in one S-57 file defining new features and modification to GC or charted features. The features included in the HCell were de-conflicted against GC shoreline, the chart and hydrography during office processing.

Features delivered in survey H11552 were reduced to chart scale and they were included in H11552_CS.000.

16 bottom samples were collected during H11552 and 16 are included in the Hcell 11552. No additional bottom samples were imported from the ENC.

There were 2 AWOIS items assigned to the survey.

There were no DTONs found during survey H11552.

The source of all features included in the H11552 HCell can be determined by the SORIND field.

5.3 Mean High Water Used for HCells

For the purposes of determining the height at which a rock becomes an islet, the CO-OPS *“Tide Note for Hydrographic Survey”*, *“Height of High Water Above the Plane of Reference”* is used.

6. S-57 Objects and Attributes

The *_CS HCell contains the following Objects:

\$CSYMB	Blue notes
COALNE	Coastline imported from ENC
DEPCNT	Zero depth curves.
LIGHTS	Lights
LOGPON	Log pond
MORFAC	A structure used for mooring
M_CSCL	Compilation scale meta area
M_QUAL	Data quality Meta object
PILPNT	Piles
SBDARE	Bottom samples and rocky seabed areas
SOUNDG	Chart scale soundings
SLCONS	Shoreline Construction
UWTROC	Rocks

The *_SS HCell contains the following Objects:

SOUNDG	Soundings at the survey scale density
DEPCNT	NOAA rounded contours at chart scale intervals

All S-57 Feature Objects in the *_CS HCell have been attributed as fully as possible based on information provided by the Hydrographer and in accordance with current guidance and the OCS HCell Specifications.

7. Blue Notes

Notes to the RNC and ENC chart compilers are included in the HCell as \$CSYMB features. By agreement with MCD, the NINFOM field is populated with an abbreviated version of the Blue Note (30 characters or less), describing the chart disposition, to be used by MCD in generating their Chart History spreadsheet.

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):	Fathoms and 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, and therefore have lower precision. 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

- All depths deeper or equal to 11 fathoms display as whole fathoms.
- All depth units between 0 fathoms (MLLW) and 11 fathoms display as fathoms and whole feet.
- All depth units above MLLW (0 fathoms) to 2.0 feet above MHW display in feet for values that round to 5 feet or less, and in fathoms and feet above that.
- All height units (HUNI) which have been converted to charting units, and that are 2.0 feet above MHW and greater, are shown in feet.

In an ENC viewer fathoms and feet depth units (DUNI) display in the format X.YZZZ, where X is fathoms, Y is feet, and ZZZ is decimals of the foot. In an ENC viewer, heights (HUNI) display as whole feet.

9. Data Processing Notes

9.1 Junctions

Refer to section B.2 of the Descriptive Report for information on junction surveys.

10. QA/QC and ENC Validation Checks

H11552 was subjected to QA checks in S-57 Composer prior to exporting to the HCell base cell (000) file. The millimeter precision metric S-57 HCell was converted to a 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 have been approved by MCD as inherent to and acceptable for HCells.

11. Products

11.1 HSD, MCD and CGTP Deliverables

- H11552_CS, Chart Units, Soundings compiled to 1:10,000
- H11552_SS, Chart Units, Soundings compiled to ;1:10,000
- H11552 Descriptive Report including end notes compiled during office processing and certification, the HCell Report, and supplemental items
- H11552 Survey Outline to populate SURDEX

11.2 File Naming Conventions

- Chart units base cell file, chart scale soundings H11552_CS.000
- Chart units base cell file, survey scale soundings H11552_SS.000
- Descriptive Report package H11552_DR.pdf
- Survey outline H11552_Outline.gml & *.xsd

11.3 Software

CARIS HIPS Ver. 6.1	Inspection of Combined BASE Surfaces
CARIS BASE Editor Ver. 2.2	Creation of soundings and bathy-derived features, creation of the depth area, 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.
Jeppesen Marine, dKart Inspector Ver. 5.1	Validation of the base cell file.
Newport Systems, Inc., Fugawi View ENC Ver.1.0.0.3	Independent inspection of final HCells using a COTS viewer.

12. Contacts

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

Fernando Ortiz, Hydrographic Contractor, PHB, Seattle, WA; 206-526-6883;
Fernando.ortiz@noaa.gov.

**APPROVAL SHEET
H11552**

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 disproof 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.