

H11631

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey Hydrographic Survey

Field No.

Registry No. H11631

LOCALITY

State Washington

General Locality Approaches to Anacortes and Bellingham

Sublocality Vicinity of Patos and Sucia Islands

2006

CHIEF OF PARTY

Commander Guy T. Noll, NOAA

LIBRARY & ARCHIVES

DATE

HYDROGRAPHIC TITLE SHEET

H11631

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 Vicinity of Patos and Sucia Islands

Scale 1:10,000 Date of Survey 9/12/06 to 10/24/06

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

Vessel RA5 (1006), RA6 (1015), RA4 (1016), RA2 (1103), Rainier (S221)

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 & 1050D MK, Knudsen 320

Graphic record scaled by Rainier Personnel

Graphic record checked by Rainier Personnel Automated Plot HP1050C & HP755CM

SAR by Kurt Brown Compilation by Andrew Clos

Soundings in Fathom and feet at MLLW

REMARKS: All times are UTC. UTM 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 H11631

Project OPR-N161-RA-06
Approaches to Anacortes and Bellingham, WA
Vicinity of Patos and Sucia Islands
Scale 1:10,000
September – October, 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-Change1 dated August 24, 2006 and all other applicable direction¹, with the exception of deviations noted in this report. The survey area is south east of the Strait of Georgia, in the vicinity of Patos and Sucia Islands, and immediately west of Alden Bank. This survey corresponds to sheet “E” in the sheet layout provided with the Letter Instructions. OPR-N161-RA-05 responds to a request from Puget Sound Pilots Association to update current charted bathymetry which is from visually positioned, single beam surveys dating back to the 1950s. Additionally, the Pilots have requested an investigation of the south end of Alden Bank to assess the suspected migration of bank into the adjacent traffic lane. The survey area contains portions of heavily used traffic lanes, and portions of Patos and Sucia Islands both of which have heavy recreational use. Both islands are Washington State Parks. Shallow Bay, a small boat harbor is located on the western shore of Sucia Island has several public use mooring buoys.

One hundred percent multi-beam echosounder (MBES) coverage was obtained in the survey area in waters 8 meters and deeper. In depths less than 8 meters additional MBES coverage was obtained to acquire least depths over significant features or shoals, as appropriate for this survey and near shore where possible. Vertical-beam echo sounder (VBES) data were acquired in depths from approximately 4 to 20 meters to define the navigable area limit, aid in the planning of MBES data acquisition, and provide inshore bathymetry in navigationally significant areas. Steep near shore bathymetry allowed the launches to be safely operated near shore in some areas. These areas include the south side of Patos Island and most of the shoreline of Sucia Island. In these areas MBES data was acquired up to 4 meters where possible. In other areas, coverage could only be obtained to the 8 meters due to kelp patches and other hazards. Shallow Bay and Clements Reef areas were investigated with 25 meter spaced VBES perpendicular the depth contours.

Limited Shoreline Verification was performed for the survey.

Data acquisition was conducted from September 12 to October 24, 2006 (DN 255 to 297).

¹ Standing Instructions for Hydrographic Surveys (July 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 1, 2006.

Data Acquisition Type	Hull Number (nm)						Total
	1103	1021	1016	1006	1015	s221	
VBES (mainscheme)	19.12	--	--	--	--	--	19.12
MBES (mainscheme)	--	0.97	82.05	75.84	52.73	16.12	227.71
Crosslines	8.41	--	--	9.72	13.33	--	31.46
Developments	1.32	--	12.42	21.52	2.16	--	37.42
Shoreline	7.36	--	--	--	--	--	7.36
Bottom Samples	12	--	--	--	--	--	12
Number of items investigated	19	--	--	--	--	--	16
Total area surveyed (sq. nm)	--	--	--	--	--	--	21.38

Table 1: Statistics for survey H11631

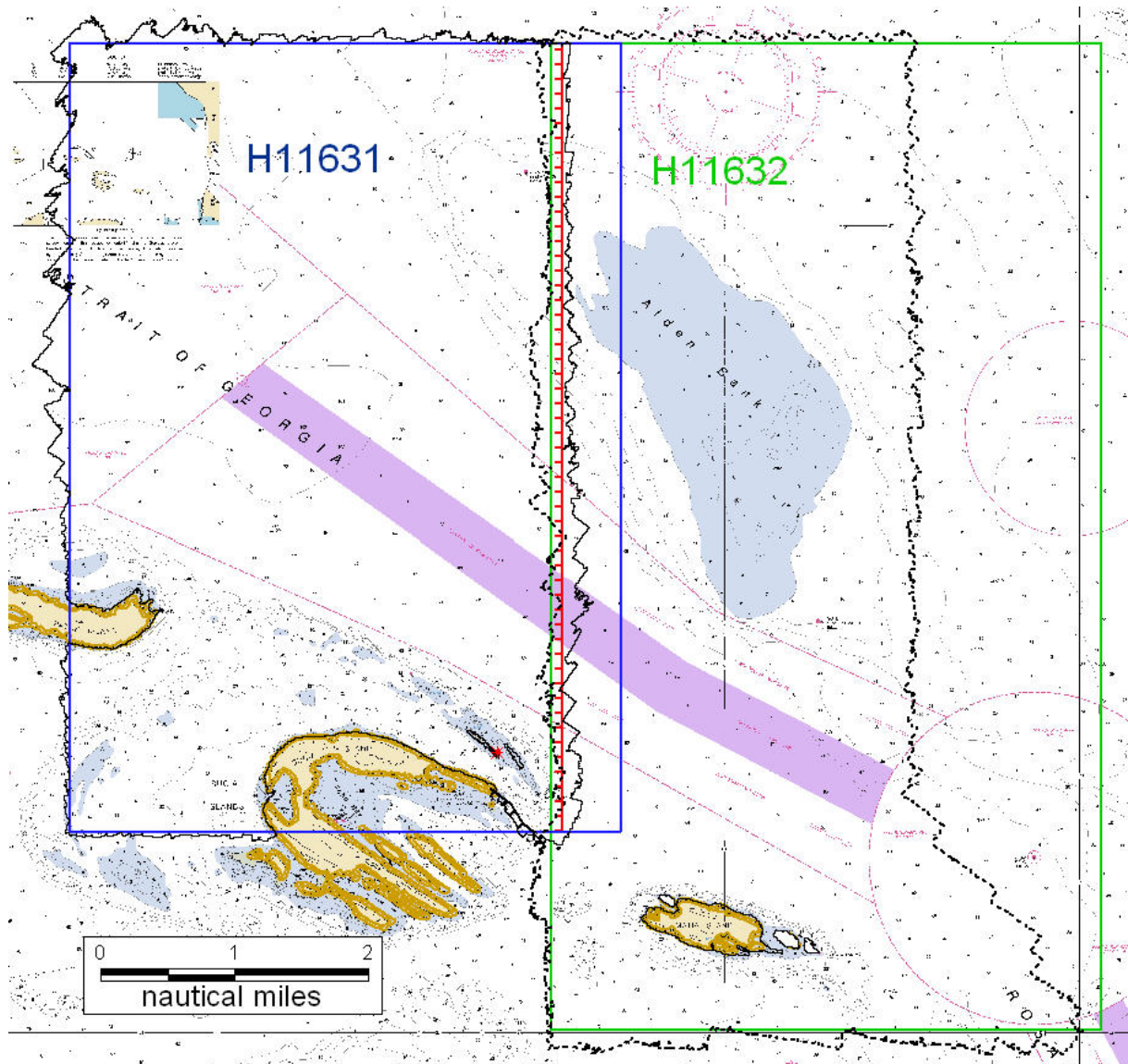


Figure 1. H11631 Survey Limits and adjacent survey H11632 overlaid on Chart 18431. Green and blue lines are sheet limits. Red hashed lines are survey limits. Solid black line is survey outline for H11631. Dotted black line is survey outline for H11632.

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-N161-RA-06 Data Acquisition and Processing Report (DAPR)*¹, 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 survey. 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
s221	RAINIER	Multi-Beam Echosounder
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
1015	RA-6	Multi-Beam Echosounder

Table 2: Data Acquisition Vessels for H11631.

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

Shallow-Water Multi-beam (SWMB) crosslines totaled 23.1 nautical miles, comprising 10.1% of SWMB mainscheme hydrography. The mainscheme bathymetry was manually compared to the crossline nadir beams in CARIS subset mode and agreed well with differences averaging less than 0.2 meter.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 2006 RAINIER Hydrographic System Readiness Review package³ submitted with this survey.

Junctions

The following contemporary survey junction with H11631 (See Figure 1):

<u>Registry #</u>	<u>Scale</u>	<u>Date</u>	<u>Junction side</u>
H11632	1:10,000	2006	East

Agreement between Survey H11631 and H11632 were compared in CARIS subset mode. The two surveys overlap by 100-500 m.⁴ In all cases the two surveys were found to agree within 0.25 meter.

Data Quality Factors

The data acquired during this survey was generally of good quality and was processed in accordance with the procedures specified in the DAPR. There are limited instances of sound velocity issues, non-standard processing, and noisy data.⁵

Surface Sound Speed Outage

A portion of line number 346_1838 (colored yellow in figure 2 below) from Launch 1016 (RA 4) on day number 281 did not agree with surrounding data. The disagreement is isolated to the outer beams at the beginning of the line. This type of error on this system is indicative of a surface sound speed outage. Such outages can occur when a launch turns around at the end of one line and starts another, going into its own wake. Small bubbles in the wake can cause a surface sound speed outage when the air passes over the sensor. The affected beams in this line did not influence the BASE surface.⁶

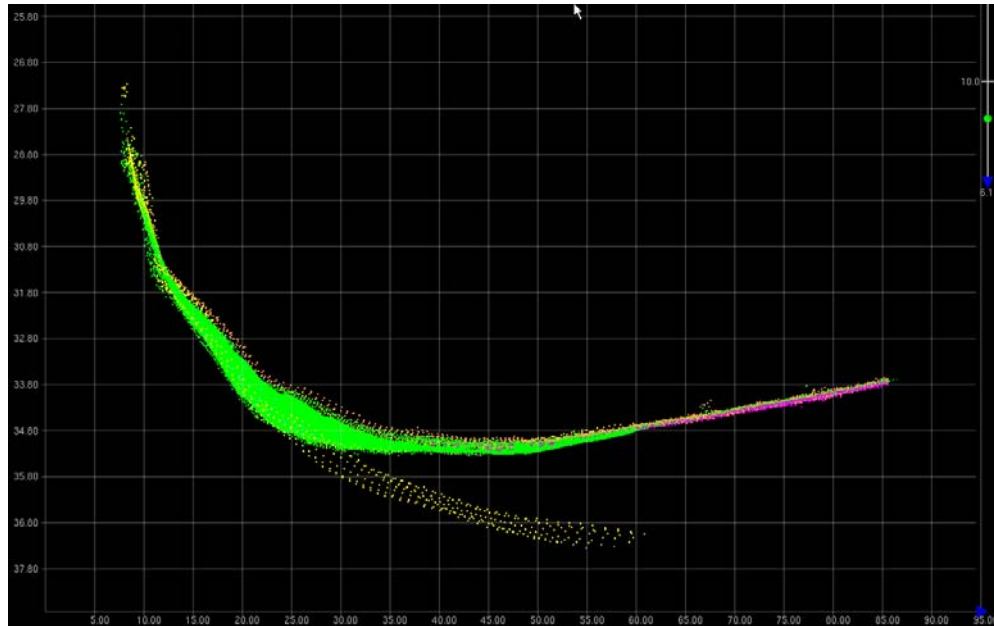


Figure 2: A portion of line number 346_1838 (yellow) from Launch 1016 (RA 4) on day number 281 did not agree with surrounding lines. Base surface appears in solid green.

Back-Timed Sound Velocity Cast

Launch 1006 (RA 5) acquired one line (404_1528) on DN 297. Launch 1006 (RA 5) did not take a SV cast on this sheet on this day. Launch 1006 (RA 5) did take an SV cast on this day for adjacent sheet H11632 which was back timed from 1717 to 1500 and used for the processing of the one line (404_1528) for sheet H11631. The position of the SV cast applied to line 404_1528 is approximately 5.5 nm from the line. Launch 1003 (RA 5) did take a SV cast on sheet H11632 at 1547 on DN 297, but that cast did not have sufficient depth for the processing of line 404_1528. The processed line agrees with other lines acquired in the area.⁷

Elac True Heave

True heave was not applied to Elac acquisitions due to an offset between the time stamps of the True Heave data and the Elac data as converted in Caris. This issue is discussed in detail in the *OPR-N161-RA-06 Data Acquisition and Processing Report*. There are no apparent heave artifacts in this survey, except as noted below.⁸

There are no apparent heave artifacts in this survey, except as noted below.

A noticeable heave artifact is present in Elac line 20061007163741_004 from Launch 1015 (RA 6) on day number 280. This artifact is isolated to depths shoaler than 8 meters and the first few seconds of the line. The base surface was not affected by this line.⁹ See figure 3 below.

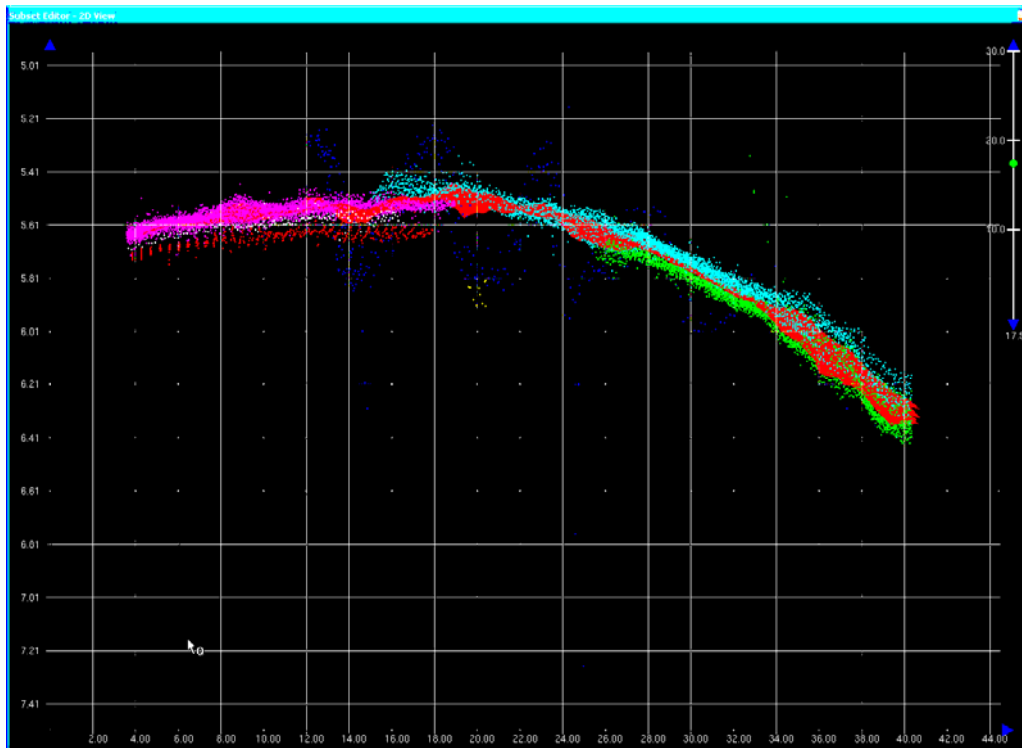


Figure 3: Elac line 20061007163741_004 (blue) from vessel 1015 (RA 6) on day number 280.

Down Slope Noise

Large amounts of down slope noise on steep slopes near shore and around Clements Reef were experienced. This noise was able to be either filtered or manually rejected, and does not affect the final base surfaces.¹⁰

B3. Data Reduction

Data reduction procedures for survey H11631 conform to those detailed in the *OPR-N161-RA-06 DAPR*.

B4. Data Representation

Many BASE surfaces were used in processing H11631. Final BASE surface resolutions and depth ranges were set in accordance with the Field Procedures Manual, with field sheets smaller than 25×10^6 nodes. The submission Field Sheet and BASE Surface structure are shown in Figures 4-6.

In addition, the half meter resolution BASE surface for field sheet H11631_05_F was finalized to the depth range of 0-25 m to ensure that all features were accurately portrayed in the bathymetric model of this particularly rocky area. This practice reduced the number of designated soundings required. The BASE surface of 1 meter for this field sheet was finalized to the depth range of 14-30 m in accordance with the Field Procedures Manual.

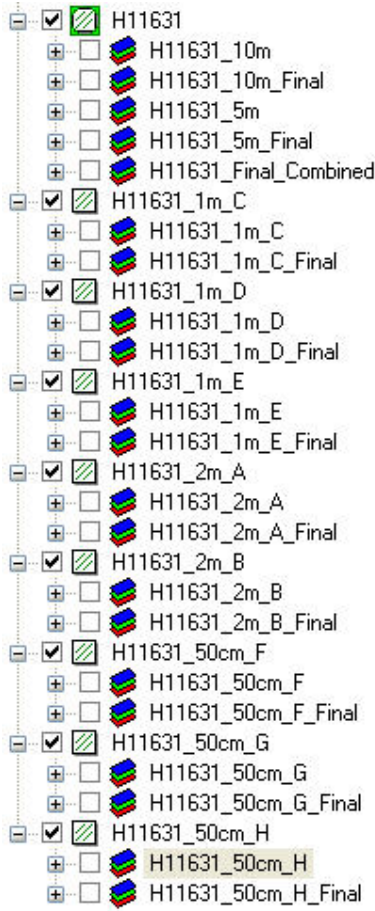


Figure 4: Field sheets and BASE surfaces submitted with H11631.

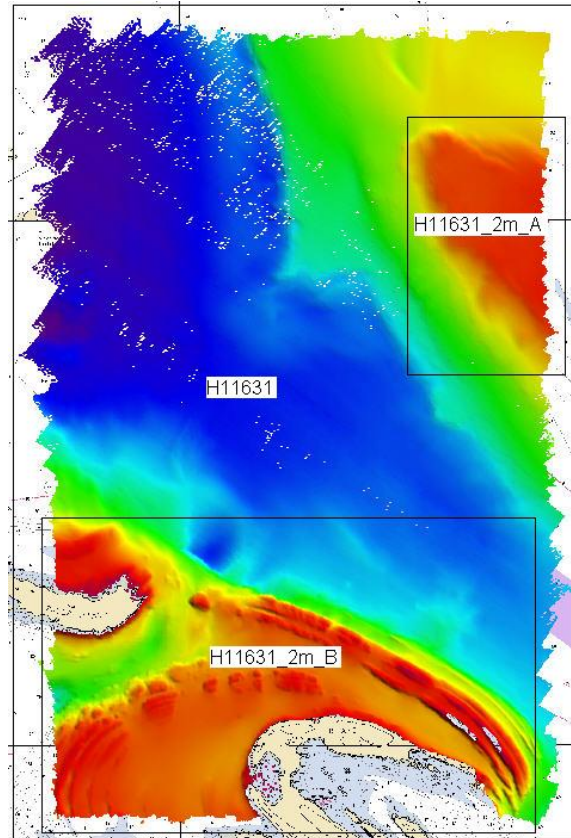


Figure 5: Layout of field sheets and BASE surfaces for H11631, overlaid on NOAA Chart 18431. Field Sheet H11631 has both 10 meter and 5 meter surfaces, while Field Sheets H11631_2m_A and H11631_2m_B have one 2 meter resolution surface each.

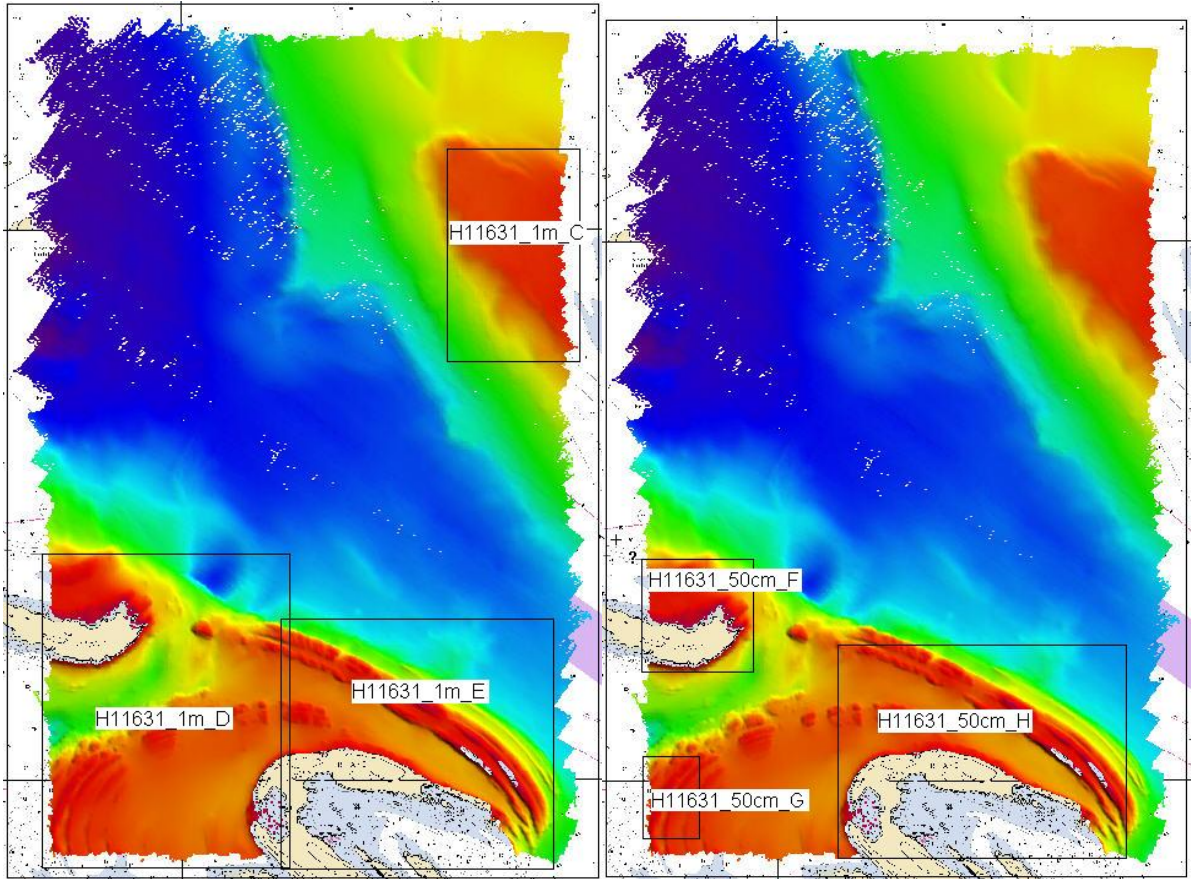


Figure 6: Layout of field sheets and BASE surfaces for H11631, overlaid on NOAA Chart 18431. On the left is the layout of field sheets with 1 meter resolution surfaces. On the right is the layout of field sheets with half meter resolution surfaces.

C. VERTICAL AND HORIZONTAL CONTROL

Project OPR-P161-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. No Horizontal and Vertical Control Report will be submitted.

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 3.

Location	Frequency	Operator	Distance	Priority
Whidbey Island	302 kHz	USCG	30 nm	Primary
Amphitrite	315 kHz	USCG	85 nm	Backup

Table 3: Differential Corrector Sources for H11631.

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 Friday Harbor, WA (944-9880) served as control for datum determination and as the primary source for water level reducers for survey H11631.

No tertiary gauges were required.

All data were reduced to MLLW using **final approved water levels** from stations Friday Harbor, WA (944-9880) using the tide file 9449880.tid and **final** time and height correctors using the zone corrector file N161RA2006CORP_Rev.zdf.

D. RESULTS AND RECOMMENDATIONS

D.1. Chart Comparison

D.1.a. Survey Agreement with Chart

RAINIER personnel compared H11631 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.

H11631 survey soundings were formally compared with depths on the following chart:

Chart	Scale	Edition and Date	Notice to Mariners Cleared Through
18421	1:80,000	47 st Ed; May 2005	10/28/06
18431	1:25,000	7 st Ed; April 2005	10/28/06
18432	1:25,000	6 st Ed; April 2005	10/28/06

Table 4: Charts compared with H11631.

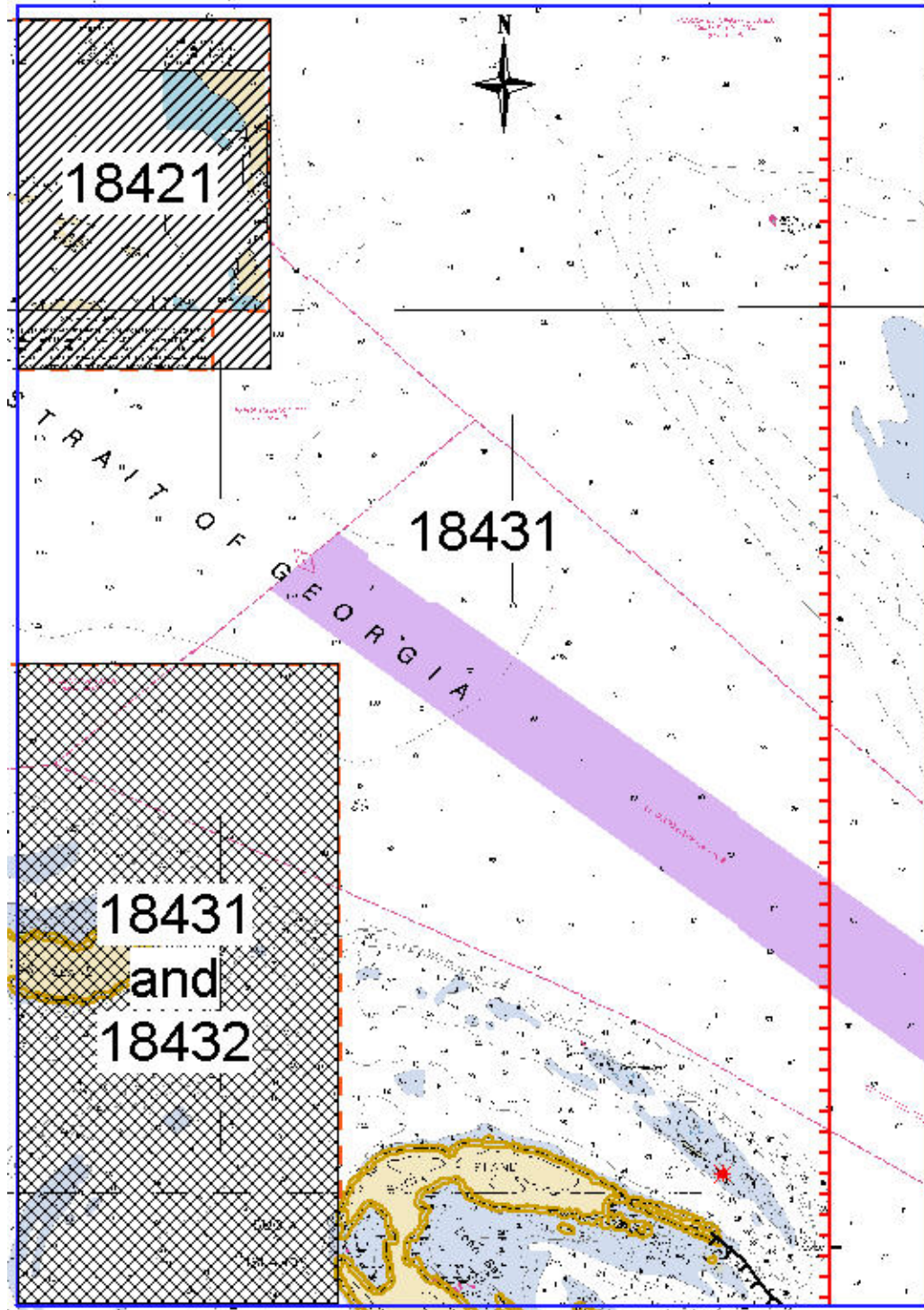


Figure 7: Chart comparison areas for H11631. The single hatched area in the NW corner is compared to chart 18421 only. The double hatched area in the SW corner is compared to both chart 18431 and 18432 (both 1:25,000 scale). The area to the east of the red line was covered by adjacent survey H11632. The remainder of the survey area was compared only to chart 18431.

Chart 18431

Over the majority of the survey area soundings agreed with charted depths to within 1 fathom.¹¹ There are a few important exceptions.

In the vicinity of the northeast area of Alden Bank a few soundings were found to be up to 1.5 fathoms shoaler than nearby charted soundings (see figure below).¹² The 12 fathom sounding circled in red was submitted as a DTON on November 8, 2006.¹³

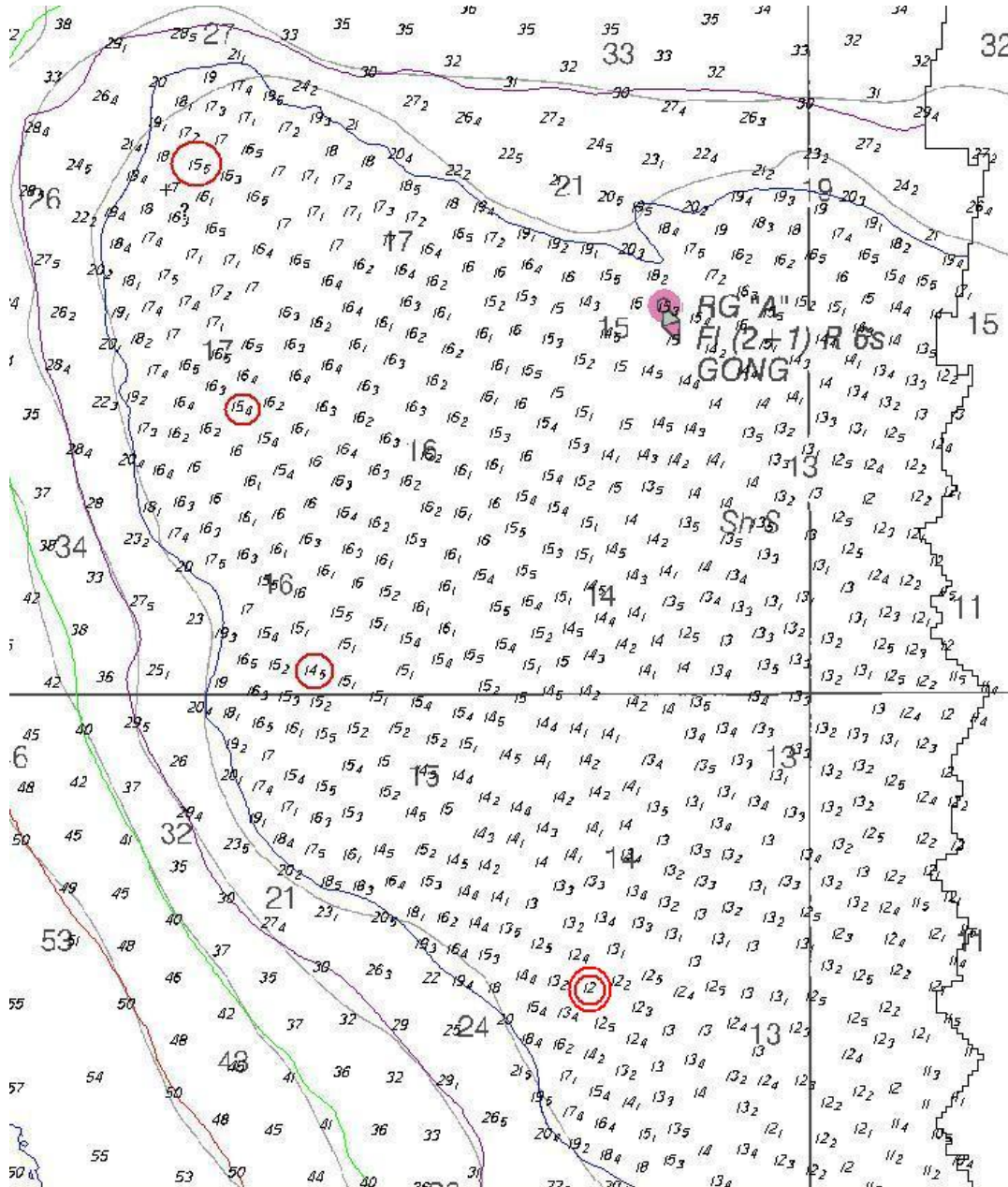


Figure 8: Sounding found by survey H11631 around the north eastern area of Alden Bank overlaid on chart 18431. Shoaler sounding found by Survey H11631 are circled in red. Reported DTONS are double circled.

In the vicinity of Clements Reef a few soundings were found to be up to 4 fathoms shoaler than charted depths.¹⁴ This is noticed particularly on the NW and SE edges of shoals of the reef. Additionally, this survey found shoaler depths on two of the shoals west of Clements reef. See figure 9 and 10 below.

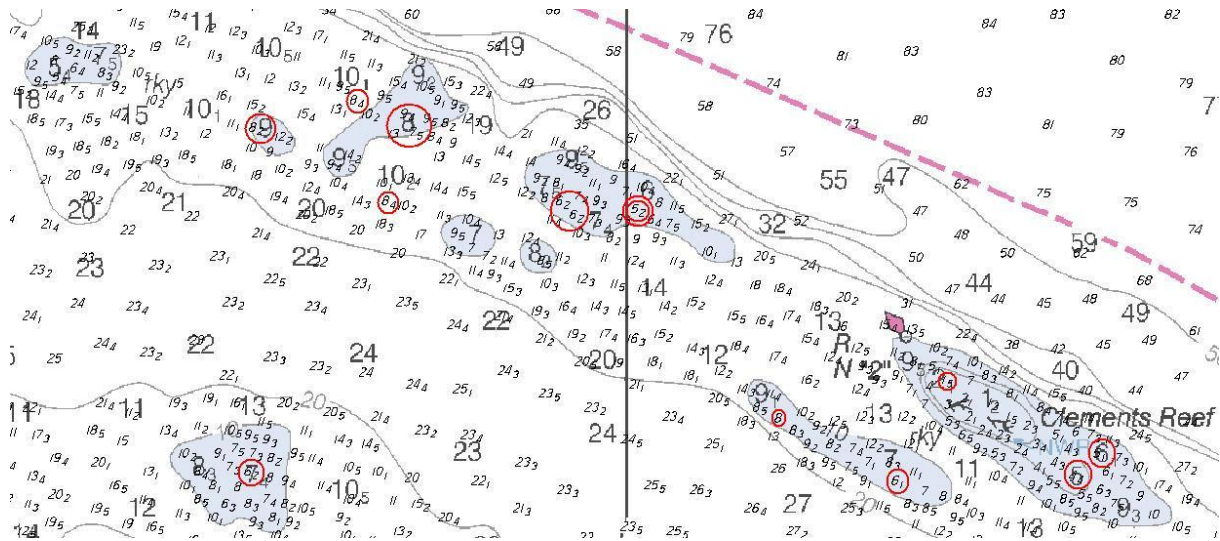


Figure 9: Sounding found by survey H11631 around the northern area of Clements Reef overlaid on chart 18431. Shoaler sounding found by Survey H11631 are circled in red. The 5.2 ftm sounding double circled was reported as a DTON on November 8, 2006.

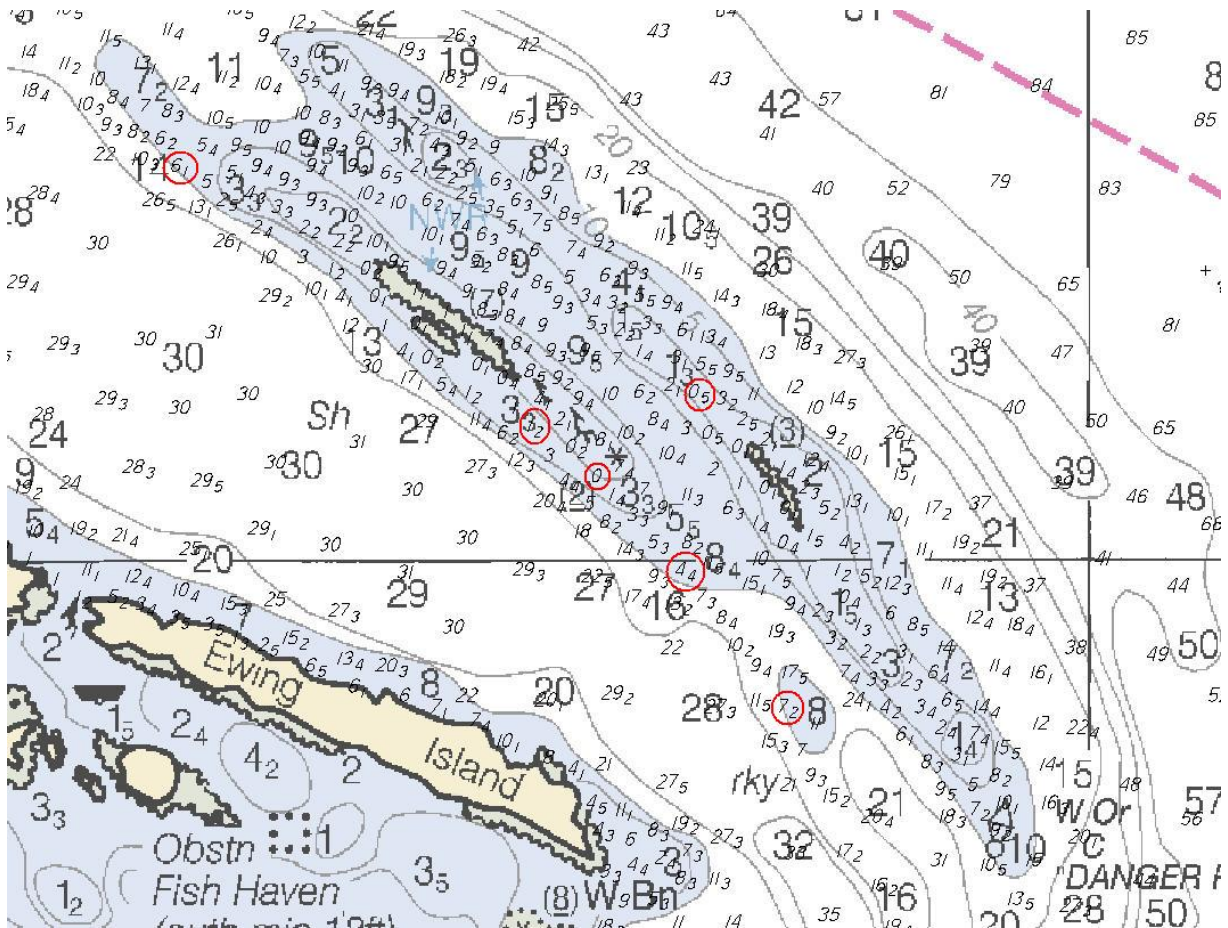


Figure 10: Sounding found by survey H11631 around the southern area of Clements Reef overlaid on chart 18431. Shoaler sounding found by Survey H11631 are circled in red.

Chart 18432

Agreement was within 2 fathoms with the exception of one DTON.¹⁵ See section D.1.b for additional information regarding all DTONs.

Chart 18421

Agreement was within 2 fathoms.¹⁶

D.1.b. Dangers to Navigation

Three (3) Dangers to Navigation (DTONs) were found on survey H11631, and reported to the Marine Chart Division via email on November 8, 2006. The original DTON submission package is included in Appendix IV. Descriptions of each DTON are included in the Survey Feature Report in Appendix II.¹⁷

D.1.c. Other Features

Automated Wreck and Obstruction Information System (AWOIS) Investigations

One (1) AWOIS item falls the within the survey limits of H11631. It was investigated fully. A description the AWOIS item investigation is included in the Survey Feature Report in Appendix II.¹⁸

Additional Items

Numerous rocks were found in the bathymetry just north of Patos Island. Where the least depth of these rocks was not represented in the BASE surfaces, designated soundings have been flagged in Caris. Additionally, for field sheet H11631_50cm _F, the half meter resolution surface was finalized to the 25 m depth contour to better represent the bathymetry in this area. The one meter resolution surface was finalized to depths of 14 – 30 m in accordance with the Field Procedures Manual. These soundings do not represent cartographically distinct features, and have not been imported into Pydro.¹⁹ The hydrographer recommends charting a “rocky” notation in this area rather than a charted rock symbol for each designated feature.²⁰

D.2. Additional Results

D.2.a. Prior Survey Comparison

Prior survey comparison with H11631 was not performed.

D.2.b. Shoreline Verification

Shoreline Source

The single source for shoreline was the ENC’s US5WA41M (issue date 08-09-2006) converted into a hydrographic object binary (HOB) files for use in CARIS Notebook 2.2.

Shoreline Verification

A zero or negative tide window did not occur during daylight hours while RAINIER was in the OPR-N161-RA06 project area. 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)
279	October 6 th , 2006	1527	0.88	0.54
		1630		
280	October 7 th , 2006	1800	0.78	0.10
		1930		
282	October 9 th , 2006	1545	2.1	1.8
		1702		

Table 4: Dates, times, and tidal heights of shoreline verification acquired on H11631.

Detached positions (DPs) acquired during shoreline verification were recorded in HYPACK and on DP forms, then 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 H11631_Notebook contains the following:

HOB File	Purpose and Contents
H11631_Comp_Source_orig.hob	Original Source data as filtered from ENC cell US5WA41M
H11631_Reference_orig.hob	Survey outline and limit lines, and AWOIS item position and radius
H11631_field_verified_Comp_Source.hob	Field verified source features and shoreline, including edits and updates not requiring DPs
H11631_pydro_updates.hob	New or modified items processed through Pydro, including DPs and Bottom Samples
H11631_Pydro_removals.hob	Deleted items processed through Pydro

Table 5. 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. The *pydro_removals.hob* table depicts all disproved or modified features. The *field_verified_Comp_Source.hob* reflects unchanged features that were noted in the field and additional kelp patches seen during shoreline verification.²¹

Source Shoreline Changes and New Features

Expect as noted below, items for survey H11631 that require further discussion and are associated with a detached position, have been flagged “Report” in Pydro in H11631.pss. Investigation methods and recommendations are listed in the Remarks and Recommendation tabs. These features are included in the Survey Feature Report in Appendix I.²²

Rock/ Islet Deconfliction

In the shoreline source, there is a rock (UWTROC) in a similar location as an islet (COALINE) on the north side of Sucia Island (see figure below). The rock appears to have been digitized from the raster chart, while the islet was compiled from an original source. The rock’s FOID is US 0134981287 0305-7 and the SORIND is 18431. The islet’s FOID is US 0134980604 03057 and the SORIND is report DD-6569. Visual shoreline investigation indicated that this feature is an islet. Furthermore, 100% SWMB was acquired at the position of the rock. The hydrographer recommends removing the charted rock, and retaining the islet as charted.²³ The rock has been removed from the *field_verified_Comp_Source.hob* file.

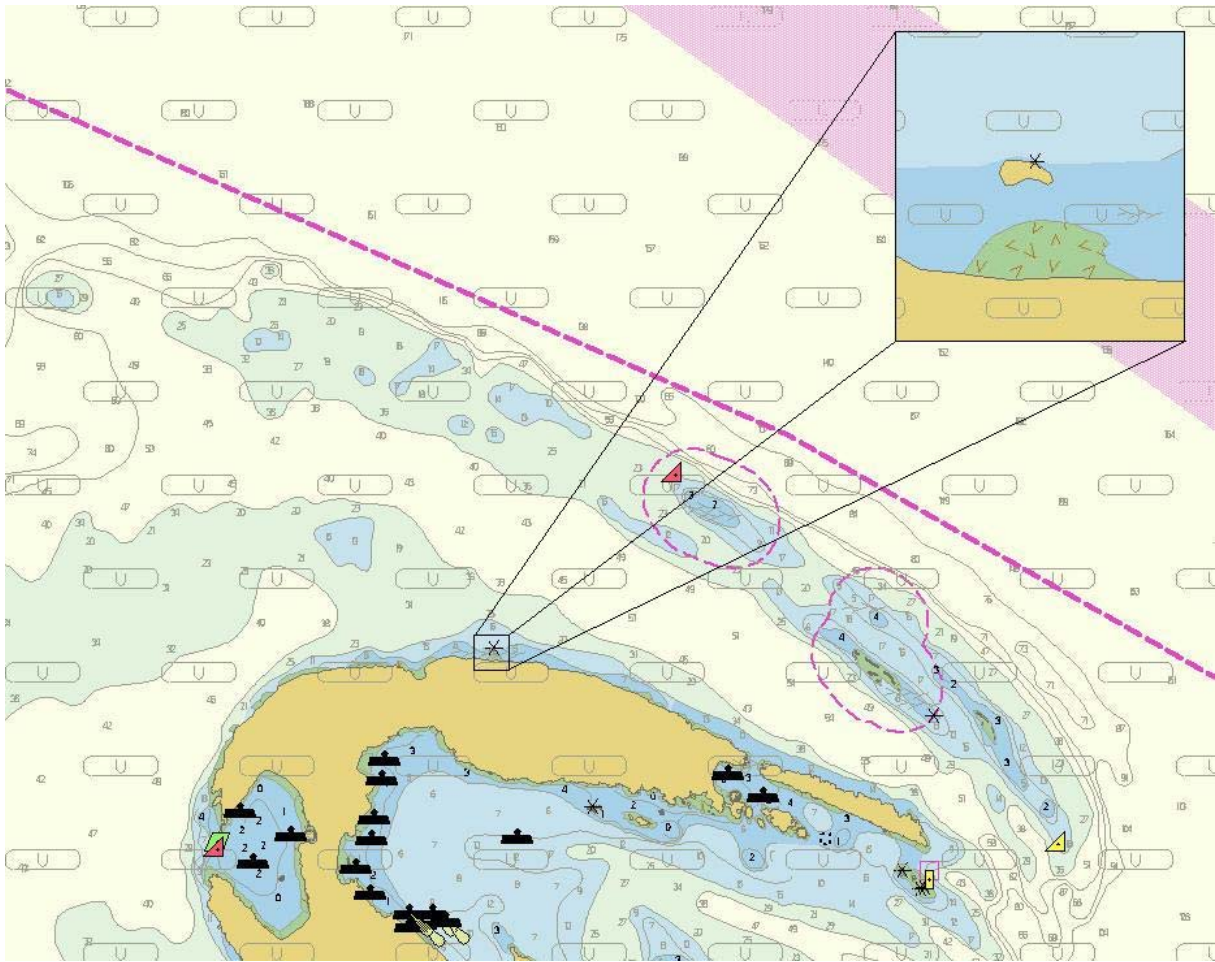


Figure 11: ENC US5WA41M with conflicting islet and rock are shown in detail.

Recommendations

The hydrographer recommends that the shoreline as depicted in the Notebook .HOB files supersede and complement shoreline information compiled on charts as described above.²⁴

D.2.c. Aids to Navigation

Detached positions were taken on each ATON for check purposes only.

Survey H11631 included five aids to navigation (ATONs). Each ATON's position was visually checked in the field against the digital raster chart, verified by detached position, and is included in the Survey Feature Report forms for H11631. All ATONs were found to be serving their intended purpose and were positioned within an appropriate walk radius.²⁵ All ATONs were correctly attributed in the *H11631_Comp_Source_orig.hob* file with the exception of the following:

The Clements Reef Danger Buoy (Light List #19860) was not properly attributed in the shoreline source data. In the *field_verified_Comp_Source.hob* file, the Clements Reef Danger

Bouy was associated with a rhombus topmark (TOPMAR). This buoy is a white conical buoy with no topmark (see Figure 12). The Light List describes this buoy as “white with orange bands; nun, and orange diamond worded DANGER REEF” in Light List volume VI. This buoy has been included in the *field_verified_Comp_Source.hob* with the proper attributes.²⁶



Figure 12: Clements Reef Danger Buoy (Light List # 19860). Note the absence of a topmark.

D.2.d. Overhead Features

There are no overhead features within the limits of survey H11631.²⁷

D.2.e. Submarine Cables and Pipelines

There are no submarine cables or pipelines charted within the limits of H11631, and none were detected by the survey.²⁸

D.2.f. Ferry Routes

There are no charted ferry routes within the limits of H11631. The Alaska Marine Highway System operates ferry service between Bellingham and ports in southeast Alaska which crosses the H11631 survey area within the traffic separation scheme.²⁹

D.2.g. Bottom Samples

Twelve bottom samples were collected in water less than 100 meters deep and no more than 2000 meters away from another bottom sample. Of these samples 1 agreed with charted bottom type, 4 disagreed with the charted bottom type, and 7 samples were collected at positions without a charted bottom type. Refer to the Survey Feature Report in Appendix II for details and recommendations for each bottom sample.³⁰

D.2.h. Other Findings


Shallow Bay, a small boat harbor on the west side of Sucia Island was found to have eight public use mooring buoys. Three mooring buoys are charted in this bay. None of the charted mooring buoys correspond to the surveyed mooring buoys positions. Charting each buoy individually on the raster chart would unduly obstruct depiction of bathymetry in the bay. The hydrographer recommends that the charted buoys be retained on the raster chart, with notation added to indicate that the charted buoys represent generalized positions and additional buoys are present.³¹ On the ENC, the hydrographer recommends removal of the charted mooring buoys, and addition of all surveyed buoys. For further details refer to Survey Feature Report in Appendix II.³²

E. APPROVAL

As Chief of Party, Field operations for hydrographic survey H11631 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 October 2006. These data are adequate to supersede charted data in their common. 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-O-RA-05	February 2, 2007	N/CS34
Coast Pilot Report for OPR- N161-RA-06	March 13, 2007	N/CS26


Approved and Forwarded:  Guy Noll
I am approving this document
2007.03.22 17:51:07 -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: **Marta Krynytzky** Digitally signed by Marta Krynytzky
DN: cn=Marta Krynytzky, o=US, ou=NOAA, ou=NOAA
ship RAINIER, email=marta.krynytzky@noaa.gov
Reason: I am the author of this document
Date: 2007.03.22 14:53:15 Z

Marta I. Krynytzky
Assistant Survey Technician, NOAA

Chief Survey Technician:  James B Jacobson
2007.03.22 17:46:34 Z

James B. Jacobson
Chief Survey Technician, NOAA Ship RAINIER

Field Operations Officer:  LT Benjamin K. Evans, NOAA
I have reviewed this document
2007.03.22 15:21:11 Z

Benjamin K. Evans
Lieutenant, NOAA

¹ Filed with the project records.

² Concur.

³ Filed with project records.

⁴ H11631 junctions with H11632, submitted in April 2010. H11631's eastern border was clipped to form a common junction with survey H11632

⁵ Concur.

⁶ Concur.

⁷ Concur.

⁸ Concur.

⁹ Concur.

¹⁰ Concur.

¹¹ Concur.

¹² Concur.

¹³ DtoN has been applied to the most recent version of chart 18431

¹⁴ Concur.

¹⁵ Concur.

¹⁶ Concur.

¹⁷ DTON reports are attached to this report.

¹⁸ See attached AWOIS report.

¹⁹ Concur.

²⁰ Concur.

²¹ Concur.

²² Features described in the H11631 Shoreline Features Report do not represent a complete listing of features compiled to the HCell. Additional features were added, some removed, and some modified in characterization for depiction at chart scale. A final accounting of features addressed by the survey and/or compiled to the HCell are included as Blue Notes (see attached HCell Report, Section 7, Blue Notes), and as NINFOM attributes for all features.

²³ Concur.

²⁴ Concur.

²⁵ Chart according to latest ATONIS information.

²⁶ Concur with clarification. Raster has already been updated with this information.

²⁷ Concur.

²⁸ Concur.

²⁹ Concur.

³⁰ 10 of the 12 bottom samples from survey H11631 were included in the HCell and 10 were blue noted to be retained as charted.

³¹ Recommend charting four of the surveyed buoys.

³² Concur with clarification. Eight mooring buoys were surveyed by H11631 and four are included in the HCell. The previously charted positions of three mooring buoys in Shallow Bay are inaccurate and four of the new buoys were chosen to better represent the locations of these buoys.

H11631 DTON Report

Registry Number: H11631
State: Washinton
Locality: Approaches to Anacortes and Bellingham
Sub-locality: Vicinity of Patos and Sucia Islands
Project Number: OPR-N161-RA-06
Survey Dates: 09/13/2006 - 10/23/2006

Charts Affected

Number	Version	Date	Scale
18431	7th Ed.	04/01/2005	1:25000
18432	6th Ed.	04/01/2005	1:25000
18421	47th Ed.	05/01/2005	1:80000
18423	35th Ed.	05/01/2005	1:80000
18400	46th Ed.	05/01/2005	1:200000
18003	19th Ed.	03/01/2003	1:736560
18007	32nd Ed.	07/01/2005	1:1200000
501	12th Ed.	11/01/2002	1:3500000
530	31st Ed.	06/01/2005	1:4860700
50	6th Ed.	06/01/2003	1:10000000

Features

No.	Feature Type	Survey Depth	Survey Latitude	Survey Longitude
1.1	Shoal	22.07 m	048° 49' 42.208" N	122° 52' 20.390" W
1.2	Shoal	7.56 m	048° 45' 47.195" N	122° 57' 21.304" W
1.3	Shoal	9.85 m	048° 46' 48.732" N	122° 53' 58.538" W

1 - Danger To Navigation

1.1) Profile/Beam - 1316/101 from h11631 / 1006_reson8101_hvf / 2006-296 / 312_1812

DANGER TO NAVIGATION

Survey Summary

Survey Position: 048° 49' 42.208" N, 122° 52' 20.390" W
Least Depth: 22.07 m
Timestamp: 2006-296.18:17:11.884 (10/23/2006)
Survey Line: h11631 / 1006_reson8101_hvf / 2006-296 / 312_1812
Profile/Beam: 1316/101
Charts Affected: 18431_1, 18421_1, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

Shoal Sounding

Feature Correlation

Address	Feature	Range	Azimuth	Status
h11631/1006_reson8101_hvf/2006-296/312_1812	1316/101	0.00	000.0	Primary

Hydrographer Recommendations

Chart shoal sounding

Cartographically-Rounded Depth (Affected Charts):

12fm (18421_1, 18400_1, 18003_1, 18007_1, 530_1)

12fm (18431_1)

22m (501_1, 50_1)

S-57 Data

Geo object 1: Sounding (SOUNDG)
Attributes: EXPSOU - 2:shoaler than range of depth of the surrounding depth area
 QUASOU - 1:depth known
 SORDAT - 20061024
 STATUS - 1:permanent

TECSOU - 3:found by multi-beam

VERDAT - 5:Mean low water

1.2) Profile/Beam - 883/192 from h11631 / 1016_reson8125_hvf / 2006-256 / 455_1957

DANGER TO NAVIGATION

Survey Summary

Survey Position: 048° 45' 47.195" N, 122° 57' 21.304" W
Least Depth: 7.56 m
Timestamp: 2006-256.19:58:36.484 (09/13/2006)
Survey Line: h11631 / 1016_reson8125_hvf / 2006-256 / 455_1957
Profile/Beam: 883/192
Charts Affected: 18431_1, 18432_1, 18421_1, 18423_8, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

Shoal Sounding

Feature Correlation

Address	Feature	Range	Azimuth	Status
h11631/1016_reson8125_hvf/2006-256/455_1957	883/192	0.00	000.0	Primary

Hydrographer Recommendations

Chart shoal sounding

Cartographically-Rounded Depth (Affected Charts):

4fm (18432_1, 18421_1, 18400_1, 18003_1, 18007_1, 530_1)

4fm 1ft (18431_1, 18423_8)

7.5m (501_1, 50_1)

S-57 Data

Geo object 1: Sounding (SOUNDG)
Attributes: EXPSOU - 2:shoaler than range of depth of the surrounding depth area
 QUASOU - 1:depth known
 SORDAT - 20061024
 STATUS - 1:permanent

TECSOU - 3:found by multi-beam

VERDAT - 5:Mean low water

1.3) Profile/Beam - 576/119 from h11631 / 1016_reson8125_hvf / 2006-282 / 361_1610

DANGER TO NAVIGATION

Survey Summary

Survey Position: 048° 46' 48.732" N, 122° 53' 58.538" W
Least Depth: 9.85 m
Timestamp: 2006-282.16:10:35.985 (10/09/2006)
Survey Line: h11631 / 1016_reson8125_hvf / 2006-282 / 361_1610
Profile/Beam: 576/119
Charts Affected: 18431_1, 18421_1, 18423_8, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

Shoal Sounding

Feature Correlation

Address	Feature	Range	Azimuth	Status
h11631/1016_reson8125_hvf/2006-282/361_1610	576/119	0.00	000.0	Primary

Hydrographer Recommendations

Chart shoal sounding

Cartographically-Rounded Depth (Affected Charts):

5 ¼fm (18421_1, 18400_1, 18003_1, 18007_1, 530_1)

5fm 2ft (18431_1, 18423_8)

9.8m (501_1, 50_1)

S-57 Data

Geo object 1: Sounding (SOUNDG)
Attributes: EXPSOU - 2:shoaler than range of depth of the surrounding depth area
 QUASOU - 1:depth known
 SORDAT - 20061024
 STATUS - 1:permanent

TECSOU - 3:found by multi-beam

VERDAT - 5:Mean low water

3 - AWOIS Features

3.1) Profile/Beam - 110/1 from h11631 / 1103_singlebeam_hvf / 2006-282 / 206_1615

Primary Feature for AWOIS Item #53503

Search Position: 048° 46' 04.920" N, 122° 52' 33.950" 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. 48/46/4.92 N LONG. 122/52/33.95 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

Survey Position: 048° 46' 04.403" N, 122° 52' 34.890" W
Least Depth: -0.46 m
Timestamp: 2006-282.16:15:14.635 (10/09/2006)
Survey Line: h11631 / 1103_singlebeam_hvf / 2006-282 / 206_1615
Profile/Beam: 110/1
Charts Affected: 18431_1, 18421_1, 18423_8, 18400_1, 18003_1, 18007_1, 501_1, 530_1, 50_1

Remarks:

Shoal sounding on rock (AWOIS #53503) found by VBES search. AWOIS search radius was covered by MBES and VBES search. Actual position of rock is 25 m SW of CHD position.

Feature Correlation

Address	Feature	Range	Azimuth	Status
h11631/1103_singlebeam_hvf/2006-282/206_1615	110/1	0.00	000.0	Primary
OPR-N161-RA-06	AWOIS # 53503	24.88	230.0	Secondary

Hydrographer Recommendations

Remove AWOIS rk from CHD (18431) position and chart at this position.

Cartographically-Rounded Depth (Affected Charts):

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

0fm 1ft (18431_1, 18423_8)

-.5m (501_1, 50_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)

Attributes: VALSOU - -0.459 m



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: H11631

LOCALITY: Vicinity of Patos and Sucia Islands, WA
TIME PERIOD: September 12 - October 11, 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

REMARKS: RECOMMENDED ZONING

Use zone(s) identified as: PS258, PS301, PS302, PS306 & PS307

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).

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 16:45:27 -04'00'

CHIEF, PRODUCTS AND SERVICES DIVISION



Final Tidal Zoning OPR-N161-RA-2006, H11631 Vicinity of Patos and Sucia Islands

PS307
Time Corrector +36 mins
Range Corrector x1.15
Reference 944-9880

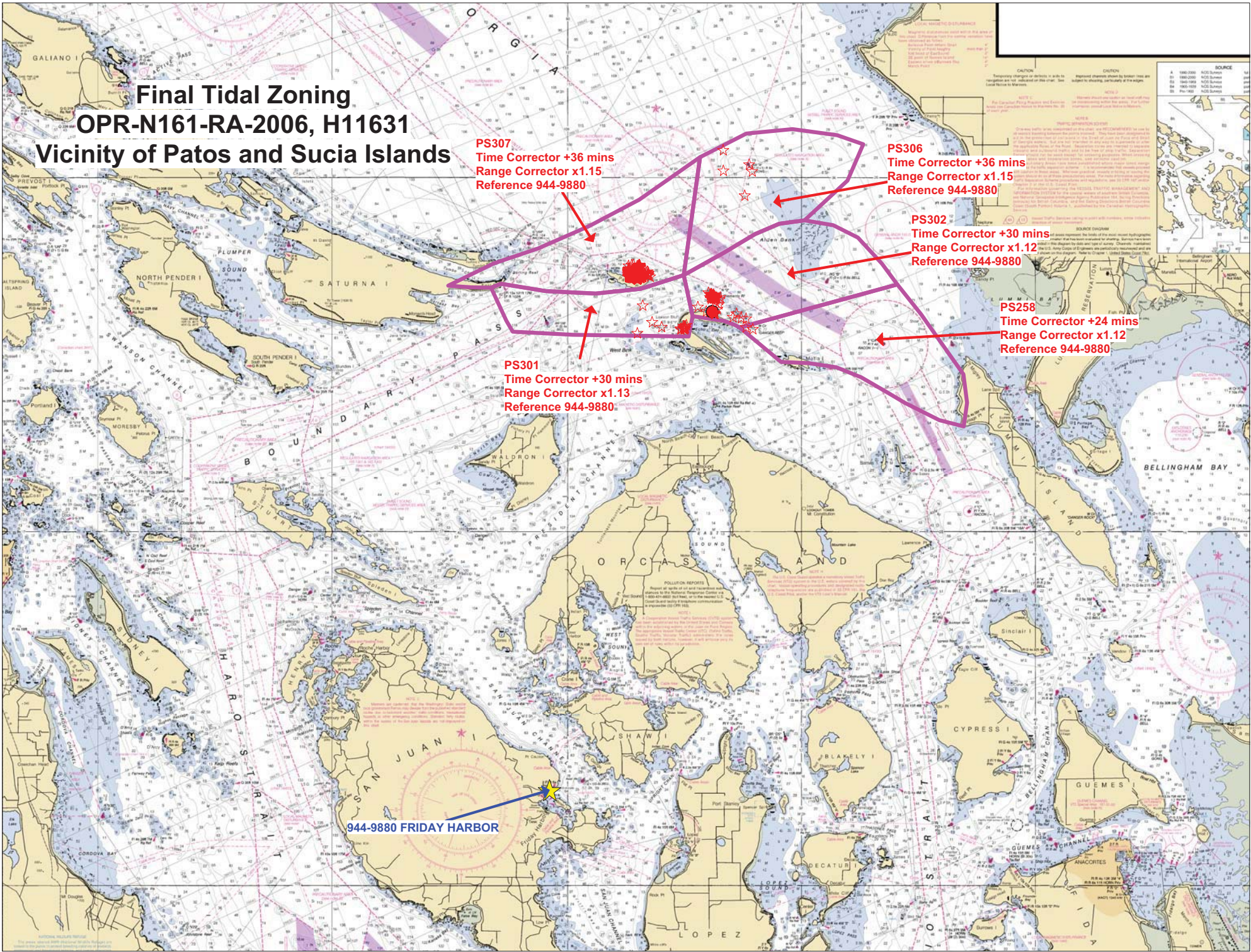
PS306
Time Corrector +36 mins
Range Corrector x1.15
Reference 944-9880

PS302
Time Corrector +30 mins
Range Corrector x1.12
Reference 944-9880

PS258
Time Corrector +24 mins
Range Corrector x1.12
Reference 944-9880

PS301
Time Corrector +30 mins
Range Corrector x1.13
Reference 944-9880

944-9880 FRIDAY HARBOR



CAUTION
Temporary changes or omissions, or shifts in scale to complete are not indicated on this chart. Use Local Notice to Mariners.

CAUTION
Reprinted charts shown by broken lines are subject to change, particularly at the edges.

NOTES
1. This chart is published under the authority of the Hydrographic Office, U.S. Navy, and is subject to change without notice. It is not to be used for navigation unless it is accompanied by the appropriate notices to mariners.

SOURCE
A 1980-2000 ADC Survey
B1 1980-2000 ADC Survey
S4 1980-1989 ADC Survey
S5 1980-1989 ADC Survey

SOURCE DIAGRAM
This diagram represents the beds of the most recent hydrographic soundings that have been prepared for printing. Soundings are shown in the diagram by their own type of survey. Charted soundings are shown in the diagram by their own type of survey. Charted soundings are shown in the diagram by their own type of survey.

CAUTION
This chart is published under the authority of the Hydrographic Office, U.S. Navy, and is subject to change without notice. It is not to be used for navigation unless it is accompanied by the appropriate notices to mariners.

CAUTION
Reprinted charts shown by broken lines are subject to change, particularly at the edges.

NOTES
1. This chart is published under the authority of the Hydrographic Office, U.S. Navy, and is subject to change without notice. It is not to be used for navigation unless it is accompanied by the appropriate notices to mariners.

SOURCE
A 1980-2000 ADC Survey
B1 1980-2000 ADC Survey
S4 1980-1989 ADC Survey
S5 1980-1989 ADC Survey

SOURCE DIAGRAM
This diagram represents the beds of the most recent hydrographic soundings that have been prepared for printing. Soundings are shown in the diagram by their own type of survey. Charted soundings are shown in the diagram by their own type of survey.

H11631 HCell Report
Andrew Clos, Hydrographer Intern
Pacific Hydrographic Branch

1. Specifications, Standards and Guidance Used in HCell Compilation

HCell compilation of survey H11631 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 H11631 were compiled to the largest scale chart in the region, shown below

Chart	Scale	Edition	Edition Date	NTM Date
18431	1:25,000	7th	4/01/2005	04/23/2005

The following ENC's were also used during the compilation.

Chart	Scale
US5WA41M	1:25,000
US3WA02M	1:200,000

3. Soundings

A survey-scale sounding (SOUNDG) feature object layer was built from the 10-meter Combined Surface in CARIS BASE Editor. A shoal-biased selection was made at 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)
0	10	3
10	20	4
20	50	4.5
50	200	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.

4. Depth Contours

Depth contours at the intervals on the largest scale chart are included in the H11631_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 Fathoms from Chart 18431	Metric Equivalent to Chart Fathoms, Arithmetically Rounded	Metric Equivalent of Chart Fathoms, with NOAA Rounding Applied	Fathoms with NOAA Rounding Applied	Fathoms with NOAA Rounding Removed for Display on H11409_SS.000
0	0	0.2286	0	0
1	1.8288	2.0574	1.125	1
2	3.6576	3.8862	2.125	2
3	5.4864	5.715	3.125	3
5	9.144	9.3726	9.125	5
10	18.288	18.517	10.125	10
20	36.576	37.9476	20.125	20
30	54.864	56.236	30.75	30
40	73.152	74.5236	40.75	40
50	91.44	92.812	50.75	50
100	182.88	184.252	100.75	100

With the exception of the zero contours included in the H11631_CS file, contours have not been deconflicted against shoreline features, soundings and hydrography, as all other features in the H11631_CS file and soundings in the H11631_SS have been. This may result in conflicts between the H11631_SS file contours and HCell features at or near the survey limits. Conflicts with M_QUAL, COALNE and SBDARE objects, and with DEPCNT objects representing MLLW, should be expected. HCell features should be honored over H11631_SS.000 file contours in all cases where conflicts are found.

5. Meta Areas

The following Meta object areas are included in HCell H11631:

M_QUAL

Meta area objects were constructed on the basis of the limits of the hydrography. (See 3.1 *Depth Areas*.)

6. Features

6.1 Generalization of Features to Chart Scale

Features addressed by the field units are delivered to PHB where they are deconflicted 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 is 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 H11631_CS HCell contains the following Objects:

\$CSYMB	Blue Notes
DEPCNT	Modified GC MLLW
M_QUAL	Data quality Meta object
SBDARE	Modified GC ledges and reefs, bottom samples, and rocky seabed areas
SOUNDG	Soundings at the chart scale density
UWTROC	Rock features
WEDKLP	New and retained kelp areas
MORFAC	Updated mooring facilities

The H11631_SS HCell contains the following Objects:

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

All S-57 Feature Objects in the H11631_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.

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, 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

H11631 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

H11631_CS.000	Base Cell File, Chart Units, Soundings and features compiled to 1:25,000
H11631_SS.000	Base Cell File, Chart Units, Soundings and Contours compiled to 1:10,000
H11631_DR.doc	Descriptive Report including end notes compiled during office processing and certification, the HCell Report, and supplemental items
H11631_outline.gml	Survey outline to populate SURDEX
H11631_outline.xsd	Survey outline to populate SURDEX

11.2 Software

CARIS HIPS Ver. 6.1	Inspection of Combined BASE Surfaces
CARIS BASE Editor Ver. 2.3	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. 2.1	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.

12. Contacts

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

Andrew Clos
Hydrographer Intern
Pacific Hydrographic Branch
Seattle, WA
206-526-6871
andrew.clos@noaa.gov.

APPROVAL SHEET
H11631

Initial Approvals:

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.