

H12281

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.* N/A

*Registry No.* H12281

### LOCALITY

*State* Washington

*General Locality* Central Puget Sound

*Sublocality* Fletcher Bay to Point White

2011

CHIEF OF PARTY  
CAPT David O. Neander, NOAA

### LIBRARY & ARCHIVES

DATE

<p style="text-align: center;">U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION</p> <p style="text-align: center;"><b>HYDROGRAPHIC TITLE SHEET</b></p>	<p>REGISTRY No</p> <p style="text-align: center;"><b>H12281</b></p>
<p><b>INSTRUCTIONS</b> – The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.</p>	<p>FIELD No: N/A</p>
<p>State <u>Washington</u></p> <hr/> <p>General Locality <u>Central Puget Sound</u></p> <hr/> <p>Sub-Locality <u>Fletcher Bay to Point White</u></p> <hr/> <p>Scale <u>1:10,000</u> Date of Survey <u>March 23 to April 8, 2011</u></p> <hr/> <p>Instructions dated <u>2/15/2011</u> Project No. <u>OPR-N395-FA-11</u></p> <hr/> <p>Vessel <u>2805, 2807, 2808</u></p> <hr/> <p>Chief of party <u>CAPT David O. Neander, NOAA</u></p> <hr/> <p>Surveyed by <u>FAIRWEATHER Personnel</u></p> <hr/> <p>Soundings by <u>Reson SeaBat 7125</u></p> <hr/> <p>SAR by <u>Grant Froelich</u> Compilation by <u>Toshi Wozumi</u></p> <hr/> <p>Soundings compiled in <u>Feet</u></p> <hr/>	
<p>REMARKS: <u>All times are UTC. UTM Zone 10</u></p> <hr/> <p><u>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. The processing branch concurs with all information and recommendations in the DR unless otherwise noted. Page numbering may be interrupted or non sequential.</u></p> <hr/> <p><u>All pertinent records for this survey, including the Descriptive Report, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via <a href="http://www.ngdc.noaa.gov/">http://www.ngdc.noaa.gov/</a>.</u></p> <hr/>	

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## Descriptive Report to Accompany Survey H12281

Project: OPR-N395-FA-11

Locality: Central Puget Sound, WA

Sublocality: Fletcher Bay to Point White

Scale: 1:10000

March 2011 - April 2011

**NOAA Ship *Fairweather***

Chief of Party: CAPT David O. Neander, NOAA

### A. Area Surveyed

The survey area is located in Central Puget Sound, WA, within the sub-locality of Fletcher Bay to Point White.

#### A.1 Survey Limits

Data was acquired within the following survey limits:

<b>Northeast Limit</b>	<b>Southwest Limit</b>
47.39 N 122.35 W	47.35 N 122.36 W

*Table 1: Survey Limits*

Launch 2808 extended data acquisition beyond the defined survey limits on DN084, on the lower SW end, North of Pt. White.

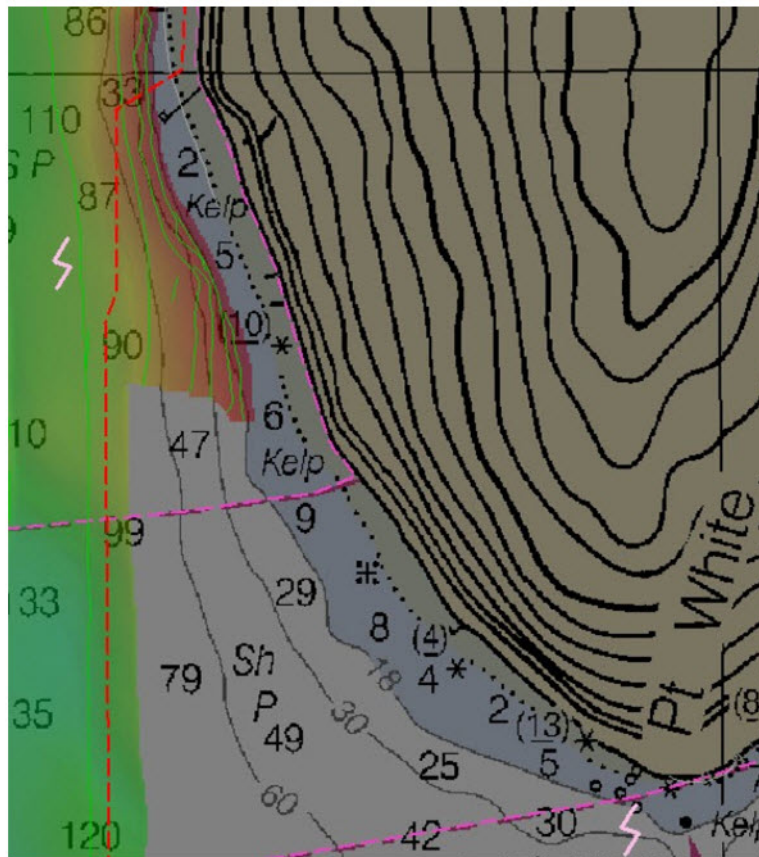


Figure 1: Extra Coverage - Red outline indicates assigned survey boundary with extra coverage to the SW

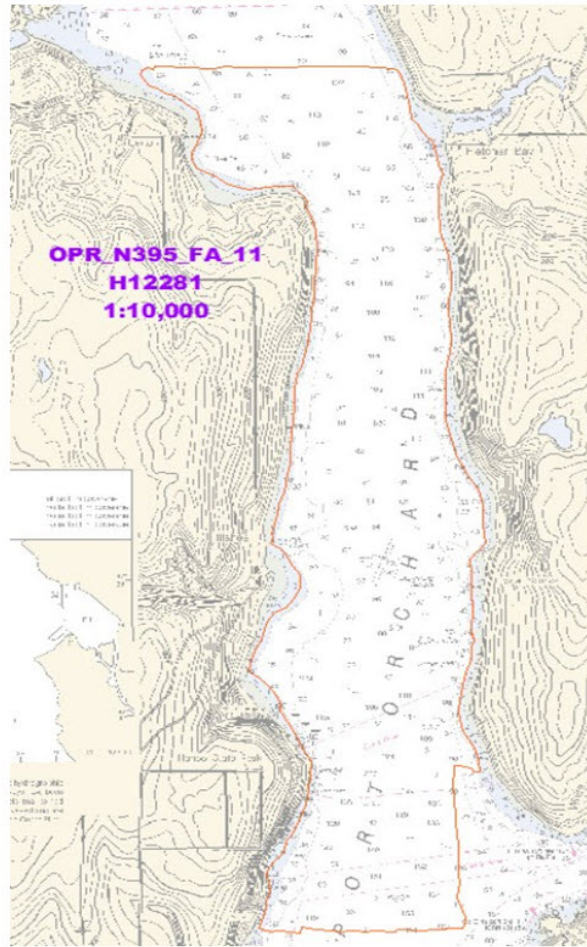
## A.2 Survey Purpose

The primary purpose of this project is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. The secondary purpose of this project is to support HSD by assisting with the mobilization of two GPS tide buoys.

## A.3 Survey Quality

The entire survey is adequate to supersede previous data.

## A.4 Survey Coverage



*Figure 2: H12281 Survey Outline*

Survey Coverage was in accordance with the requirements in the Project Instructions and the HSSD.

## A.5 Survey Statistics

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

	<b>HULL ID</b>	<b>2808</b>	<b>2807</b>	<b>2805</b>	<b>Total</b>
<b>LNM</b>	<b>SBES Mainscheme</b>	0	0	0	0
	<b>MBES Mainscheme</b>	56.53	14.19	5.65	76.37
	<b>Lidar Mainscheme</b>	0	0	0	0
	<b>SSS Mainscheme</b>	0	0	0	0
	<b>SBES/MBES Combo Mainscheme</b>	0	0	0	0
	<b>SBES/SSS Combo Mainscheme</b>	0	0	0	0
	<b>MBES/SSS Combo Mainscheme</b>	0	0	0	0
	<b>SBES/MBES Combo Crosslines</b>	0	3.48	0.92	4.40
	<b>Lidar Crosslines</b>	0	0	0	0
	<b>Number of Bottom Samples</b>				3
<b>Number of DPs</b>				16	
<b>Number of Items Items Investigated by Dive Ops</b>				0	
<b>Total Number of SNM</b>				2.64	

*Table 2: Hydrographic Survey Statistics*

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

<b>Survey Dates</b>
03/23/2011
03/25/2011
03/31/2011
04/01/2011
04/05/2011
04/08/2011

*Table 3: Dates of Hydrography*



## A.6 Shoreline

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

## A.7 Bottom Samples

Bottom Samples were acquired in accordance with the Project Instructions or the HSSD.

# B. Data Acquisition and Processing

## B.1 Equipment and Vessels

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

### B.1.1 Vessels

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

<b>Hull ID</b>	<b>2805</b>	<b>2807</b>	<b>2808</b>
<b>LOA</b>	8.64 meters	8.64 meters	8.64 meters
<b>Draft</b>	1.12 meters	1.12 meters	1.12 meters

*Table 4: Vessels Used*

## B.1.2 Equipment

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

<b>Manufacturer</b>	<b>Model</b>	<b>Type</b>
RESON	7125	MBES
SeaBird	SBE 19plus	Sound Speed System
RESON	SVP71	Sound Speed System
Applanix	POS/MV V4	Sound Speed System
Applanix	POS/MV V4	Positioning System

*Table 5: Major Systems Used*

## B.2 Quality Control

### B.2.1 Crosslines

Surface differencing in CARIS Bathymetry Data Base was used to assess crossline agreement with main scheme lines. An analysis was performed by differencing a 4-meter main scheme surface with a 4-meter crossline surface. The results of the analysis shows that crosslines agree within IHO requirements, which is depicted in Figure 3. The areas with the greatest disagreement between crosslines and main scheme lines are with data collected with launch 2808 (Figure 5). Once again, the differences meet IHO requirements.

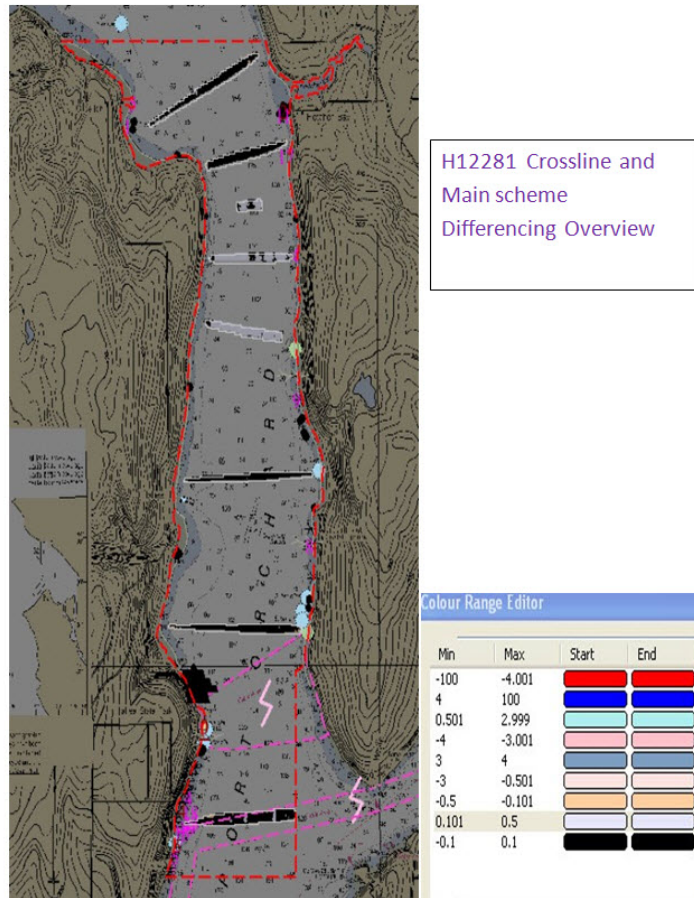


Figure 3: XL Overview

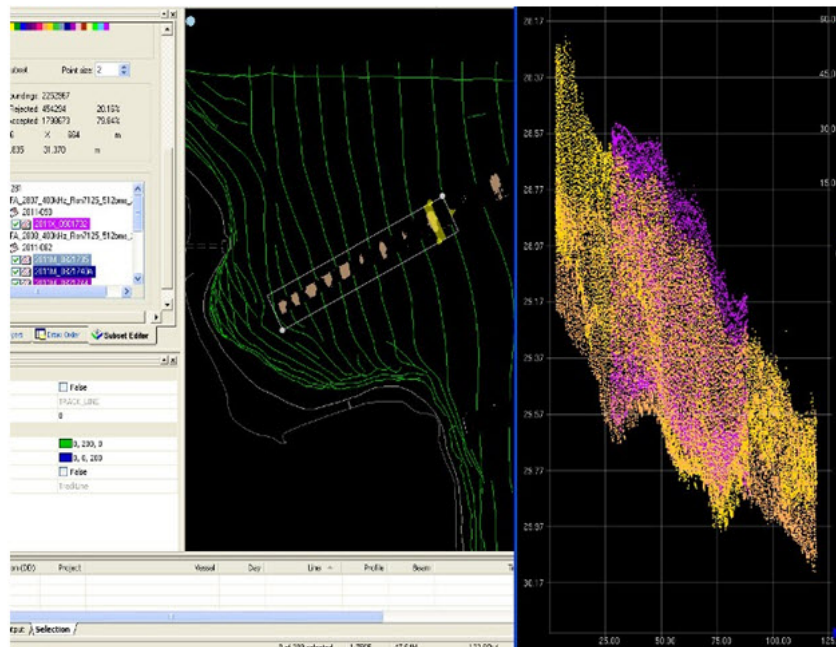


Figure 4: XL difference of 0.12m

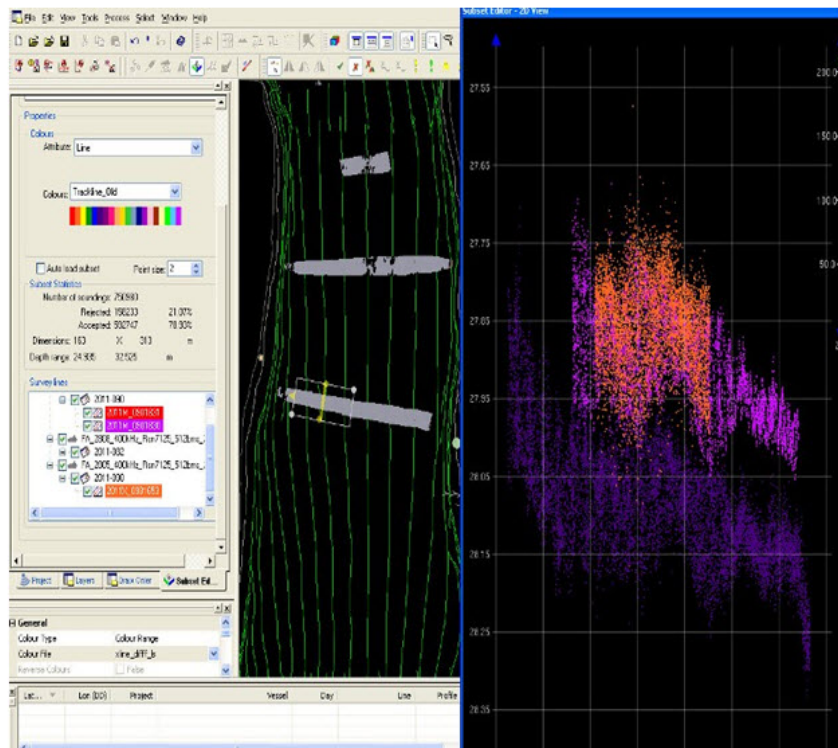


Figure 5: XL difference 2805 and 2807 match, 2808 offset

### B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning
0.095 0	0.12 0.095

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
2808	2.00		0.50
2807	2.00		0.50
2805	2.00		0.50

Table 7: Survey Specific Sound Speed TPU Values

A tide uncertainty value of 0.095 meters was used to account for the VDatum transformation uncertainty. Reference Appendix V for project correspondence related to this issue.

*After email correspondence with Corey Allen at HSD-OPS, the tide uncertainty value (0.095) was moved from "Tide Measured" to "Tide Zoning". The initial "Tide Zoning" value (0.12 m) was removed and the "Tide Measured" value was zeroed out.*

### B.2.3 Junctions

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12280	1:10000	2011	NOAA Ship FAIRWEATHER	N
H10797	1:10000	1998	NOAA Ship RAINIER	SE

Table 8: Junctioning Surveys

#### H12280

~~Junction analysis is in H12280 Descriptive Report.~~

*See Figure 6 for junction analysis results.*

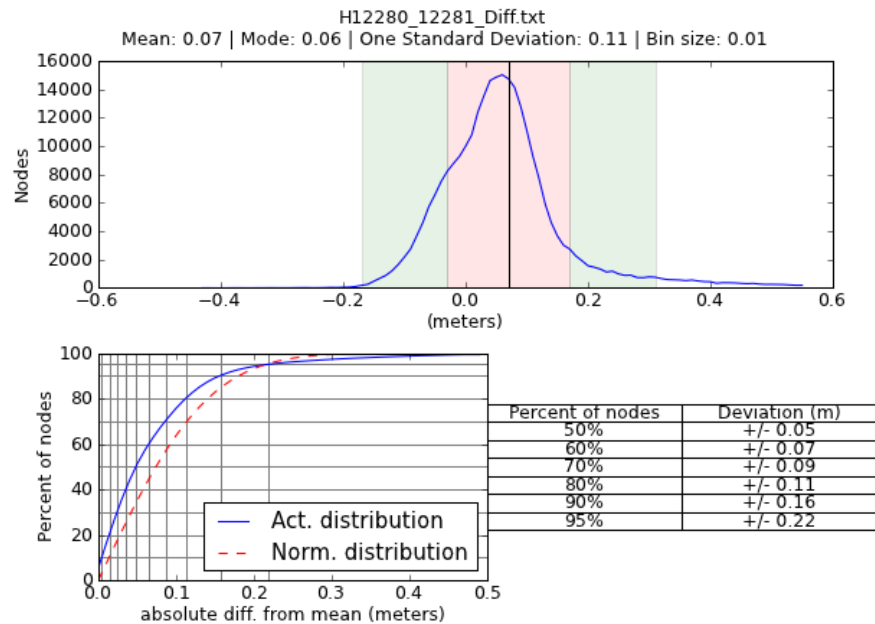


Figure 6: H12280 - H12281 Junction Analysis

### H10797

The areas of overlap between the adjacent sheets were manually reviewed by visually comparing soundings. The soundings are in agreement within one meter. The junction agreement is within the total allowable vertical and horizontal uncertainty in their common areas and depths. The .tiff image sent with the Project Instructions was in NAD 27.

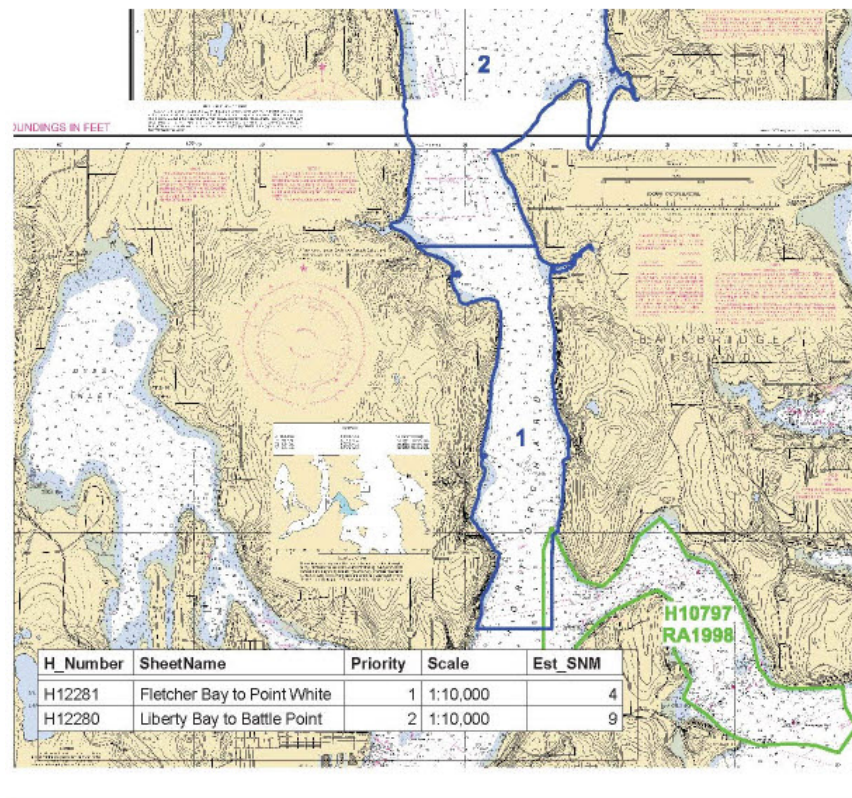


Figure 7: Survey Junctions

#### B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the quality control section of the DAPR.

#### B.2.5 Equipment Effectiveness

*No issues were reported by the hydrographer.*

#### B.2.6 Factors Affecting Soundings

*No issues were reported by the hydrographer.*

#### B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Sound speed measurements were conducted and applied as discussed in the Corrections to Echo Soundings section of the DAPR.



### **B.2.8 Coverage Equipment and Methods**

All Equipment and survey methods were used as detailed in the DAPR.

### **B.2.9 Depth Threshold**

H12281 deviates from the DAPR in reference to the surface resolution of object detection coverage. Upon review of the BASE surfaces it was discovered that the finalized surfaces were not honoring a particular designated sounding which was chosen on a wreck. The wreck lays on the cusp of the 50cm and 1m resolution surfaces. To ensure that the designated sounding is honored the depth range of the 1-meter surface was changed to 18-40 meters. Now the least depth of the wreck is honored in both the surface and the final feature file.

### **B.2.10 IHO Uncertainty**

All data meet the data accuracy specifications as stated in the NOS Hydrographic Surveys Specifications and Deliverables (HSSD) dated April 2011.

It was found that 100% of nodes in each finalized surface met or exceeded the IHO Order 1 specifications for all depths of survey H12281. To assess vertical accuracy standards, a child layer titled "IHO\_1" was created for each of the 0.5-meter, 1-meter and 4-meter finalized surfaces using the equation as stated in section 2.1 of the DAPR. See H12281\_Standards\_Compliance\_Review.pdf in Appendix V.

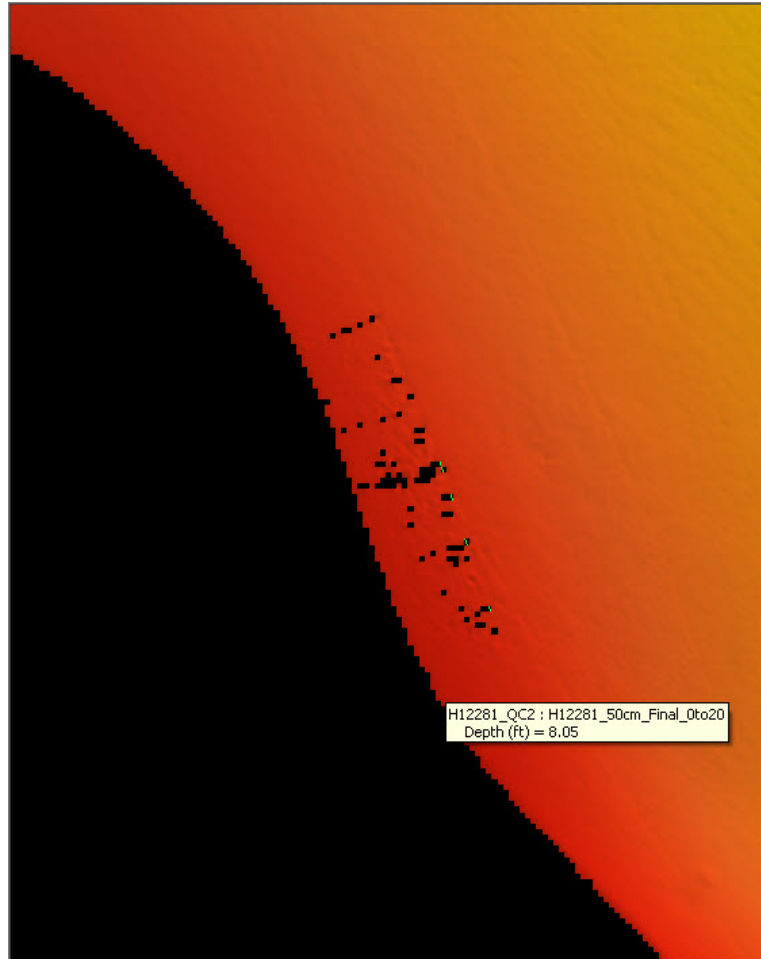
### **B.2.11 Density**

Density requirements for H12281 were achieved with at least 95% of finalized surface nodes containing five or more soundings for the 1-meter and 4-meter surface resolutions. A 0.5-meter surface was not created or reviewed during acquisition, therefore density holidays exist in that surface. The 0.5-meter surface achieved 89% of finalized surface nodes containing five or more soundings. See H12281\_Standards\_Compliance\_Review.pdf in Appendix V.

### **B.2.12 Holiday Assessment**

Due to acquisition methods not changing for object detection requirements in depths up to 40 meters and surfaces not being finalized to those thresholds while on project, many significant holidays appeared in the 0.5-meter and 1-meter finalized surfaces. These layers were interpolated and corresponding pseudo-sidescan data examined for holiday assessment. No navigationally significant items were found, therefore, the least depths of all navigationally significant features are represented by H12281.





*Figure 8: Example of 0.5-meter surface holidays*

## **B.3 Echo Sounding Corrections**

### **B.3.1 Corrections to Echo Soundings**

All Data reductions procedures conform to those detailed in the DAPR.

### **B.3.2 Calibrations**

All sounding systems were calibrated as detailed in the DAPR.

## **B.4 Backscatter**

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

## B.5 Data Processing

### B.5.1 Software Updates

The following software updates occurred after the submission of the DAPR:

Manufacturer	Name	Version	Service Pack	Hotfix	Installation Date	Use
Caris	HIPS/SIPS	7.0	2	5	02/25/2011	Processing
Caris	Notebook	3.1	0	3	02/25/2011	Acquisition and Processing

*Table 9: Software Updates*

The following Feature Object Catalog was used: Version 2

### B.5.2 Surfaces

The following CARIS surfaces were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12281_4m_Combined	CUBE	4 meters	0 meters - 9999 meters	N/A	SBES Set Line Spacing
H12281_4m_Final_36plus	CUBE	4 meters	36 meters - 9999 meters	NOAA_4m	Complete MBES
H12281_1m_Final_18to40	CUBE	1 meters	18 meters - 40 meters	NOAA_1m	Object Detection
H12281_50cm_Final_0to20	CUBE	0.5 meters	0 meters - 20 meters	NOAA_0.5m	Object Detection
H12281_4m	CUBE	4 meters	0 meters - 9999 meters	NOAA_4m	Complete MBES
H12281_1m	CUBE	1 meters	0 meters - 9999 meters	NOAA_1m	Object Detection
H12281_50cm	CUBE	0.5 meters	0 meters - 9999 meters	NOAA_0.5m	Object Detection

*Table 10: CARIS Surfaces*

All field sheet extents were adjusted using the Base 16 Calculator tool to ensure coincident nodes among all bathymetric surfaces regardless of the field sheet in which they are contained given the standard surface

resolutions of one-half, one and four meters. The NOAA CUBE parameters mandated in HSSD were used for the creation of all CUBE BASE surfaces in Survey H12281.

The surfaces have been reviewed where noisy data, or 'fliers' are incorporated into the gridded solution causing the surface to be shoaler than the true sea floor. Where these spurious soundings cause the gridded surface to be shoaler, than the reliably measured seabed by greater than the maximum allowable TVU at that depth, the noisy data have been rejected and the surface recomputed.

### **B.5.3 Data Logs**

Data acquisition and processing notes are included in the acquisition and processing logs, and additional processing such as final tide and sound velocity application is noted in the H12281 Data Log spreadsheet. All data logs are submitted digitally in the Separates I folder.

### **B.5.4 Critical Soundings**

Designation of soundings followed procedures as outlined in section 5.2.1.2 of the HSSD.

Survey H12281 requires 29 designated soundings. All the designated soundings were required to accurately represent the sea floor and honor the shoalest reliable sounding on features.

*Concur with clarification, after office review 20 Designated and 1 Outstanding soundings were retained in the data set.*

## **C. Vertical and Horizontal Control**

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

### **C.1 Vertical Control**

The vertical datum for this project is Mean lower low water.

Non-Standard Vertical Control Methods Used:

VDatum

Ellipsoid to Chart Datum Separation File:

2001\_N395\_VDatum\_Ellip-MLLW\_SEP.xyz

VDatum was the vertical transformation tool used for data referenced to the ellipsoid being brought back to MLLW. All soundings were merged in CARIS HIPS and SIPS using the apply GPS tide button and Compute TPU was performed to account for the new VDatum uncertainty value. All final soundings in H12281 are referenced using the VDatum model.

## C.2 Horizontal Control

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

The following PPK methods were used for horizontal control:

### Smart Base

PPK is the primary method of horizontal positioning of MBES soundings on H12281. Resultant data from SmartBase processing were used for post processing all vessel-day POSMV files. Smooth Best Estimate of Trajectory (SBET) files were applied to all MBES data in CARIS HIPS. For further details see the SBET and SMRMSG (error) processing logs for the particular days located with the SBET GNSS data submitted.

All data from H12281 can be referenced to ellipsoid.

The following CORS Stations were used for horizontal control:

<b>HVCR Site ID</b>	<b>Base Station ID</b>
Seattle	SEAT
Robinson Point 6	RPT6
Tumwater	TWHL
Pacific Beach	PABH
Neah Bay	NEAH
Whidbey Island 6	WHD6

*Table 11: CORS Base Stations*

DGPS was used during H12281 for real-time acquisition of MBES data. All positioning of detached positions (DP) and bottom samples were collected and submitted in DGPS mode as there is currently no functionality for applying SBET or base station files to these types of data.

The following DGPS Stations were used for horizontal control:

DGPS Stations
Robinson Point, WA - 323 kHz

*Table 12: USCG DGPS Stations*

## D. Results and Recommendations

### D.1 Chart Comparison

#### D.1.1 Raster Charts

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

Chart	Scale	Edition	Edition Date	LNМ Date	NM Date
18449	1:25000	18	10/2003	09/09/2003	10/04/2003

*Table 13: Largest Scale Raster Charts*

#### 18449

Soundings from survey H12281 generally agreed within one to five meters with charted depths on chart 18449. Contours generated in CARIS HIPS closely approximated the charted 18, 30 and 60 foot contours.

#### D.1.2 AWOIS Items

Number of AWOIS Items Addressed: 1

Number of AWOIS Items Not Addressed: 0

Assigned AWOIS position was disproved and a new AWOIS location is located in the surveys Final Feature File.

*See attachment for AWOIS report*

#### D.1.3 Charted Features

All charted features which are investigated are included in the surveys Final Feature File.

#### **D.1.4 Uncharted Features**

During acquisition new wrecks and obstructions were identified and investigated. Information for these features is located in the surveys Final Feature File.

#### **D.1.5 Dangers to Navigation**

None Exist

#### **D.1.6 Shoal and Hazardous Features**

None Exist

#### **D.1.7 Channels**

None Exist

### **D.2 Additional Results**

#### **D.2.1 Shoreline**

Fairweather personnel conducted limited shoreline verification and reconnaissance at times near predicted low tides within the survey limits. Annotations, information, and diagrams collected on DP forms and boat sheets during field operations are scanned and included in the digital Separates I folder. Shoreline verification procedures for survey H12281 conform to those detailed in the DAPR.

The Hydrographer recommends that the shoreline depicted in the CARIS Notebook files and final sounding files supersede and complement shoreline information compiled on the CSF and charts.

#### **D.2.2 Prior Surveys**

Prior survey comparisons were not conducted by the field.

#### **D.2.3 Aids to Navigation**

Survey H12281 included two aids to navigation (ATONs) which were assigned for positioning by the Project Instructions. Both ATONs were found to serve their intended purposes. See the OPR-N395-FA-11 Horizontal and Vertical Control Report regarding further information on positioned ATONs.

**D.2.4 Overhead Features**

None Exist

**D.2.5 Submarine Features**

Retain cable areas and deperming ranges as charted. Charted fish haven (FOID US 0000009566 00001) located by MBES, refer to Final Feature File. The Hydrographer recommends further investigation of permitted documentation/location as the charted position does not agree with the MBES surveyed extents of debris.

**D.2.6 Ferry Routes and Terminals**

None Exist

**D.2.7 Platforms**

None Exist

**D.2.8 Significant Features**

None Exist

**D.2.9 Construction and Dredging**

None Exist

**D.2.10.1 Interim Deliverables**

OPR-N395-FA-11 project instructions included an appendix of two interim deliverables related to waterline measurements. The first, recommendation on VDatum ERS vs TCARI Non-ERS vertical transformation technique using crossline data, was met at the time of writing this DR. The second, compare VDatum derived MLLW surface versus ERZT derived MLLW surface, was not addressed as the ERZT functionality does not exist at the time of writing this DR. Please reference all correspondence of this issue in Appendix V.


## E Approval Sheet

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

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

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys and Specifications Deliverables Manual, Field Procedures Manual, Standing and Letter Instructions, and all HSD Technical Directives. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required with the exception of deficiencies noted in the Descriptive Report.

Report Name	Report Date Sent
Hydrographic Systems Readiness Review	2011-08-26
Data Acquisition and Processing Report	2011-09-08
Horizontal and Vertical Control Report	2011-09-16
ATON Report for OPR-N395-FA-11	2011-09-08

Approver Name	Approver Title	Approval Date	Signature
CAPT David O. Neander, NOAA	Chief of Party	09/16/2011	 2011.09.19 09:55:42 -08'00'
SST Lillian Stuart	Sheet Manager	09/16/2011	 Digitally signed by David Moehl Date: 2011.09.19 17:15:22 Z
SST David T. Moehl	Assistant Sheet Manager	09/16/2011	 Digitally signed by David Moehl Date: 2011.09.19 17:15:50 Z
CST Lynnette V. Morgan	Chief Survey Technician	09/16/2011	 Digitally signed by Weston Renoud Date: 2011.09.19 10:30:24 -08'00'
LT Matthew J. Jaskoski, NOAA	Field Operations Officer	09/16/2011	 Caryn M. Zacharias 2011.09.19 18:43:39 Z



## F. Table of Acronyms

<b>Acronym</b>	<b>Definition</b>
<b>AFF</b>	Assigned Features File
<b>AHB</b>	Atlantic Hydrographic Branch
<b>AST</b>	Assistant Survey Technician
<b>ATON</b>	Aid to Navigation
<b>AWOIS</b>	Automated Wreck and Obstruction Information System
<b>BAG</b>	Bathymetric Attributed Grid
<b>BASE</b>	Bathymetry Associated with Statistical Error
<b>CO</b>	Commanding Officer
<b>CO-OPS</b>	Center for Operational Products and Services
<b>CORS</b>	Continually Operating Reference Station
<b>CTD</b>	Conductivity Temperature Depth
<b>CEF</b>	Chart Evaluation File
<b>CSF</b>	Composite Source File
<b>CST</b>	Chief Survey Technician
<b>CUBE</b>	Combined Uncertainty and Bathymetry Estimator
<b>DAPR</b>	Data Acquisition and Processing Report
<b>DGPS</b>	Differential Global Positioning System
<b>DP</b>	Discrete Position
<b>DR</b>	Descriptive Report
<b>DTON</b>	Danger to Navigation
<b>ENC</b>	Electronic Navigational Chart
<b>ERS</b>	Ellipsoidal Referenced Survey
<b>ERZT</b>	Ellipsoidally Referenced Zoned Tides
<b>FOO</b>	Field Operations Officer
<b>FPM</b>	Field Procedures Manual
<b>GAMS</b>	GPS Azimuth Measurement Subsystem
<b>GC</b>	Geographic Cell
<b>GPS</b>	Global Positioning System
<b>HIPS</b>	Hydrographic Information Processing System
<b>HSD</b>	Hydrographic Surveys Division
<b>HSSDM</b>	Hydrographic Survey Specifications and Deliverables Manual

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

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

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MVP

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NetAPPs

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O322-Chatham (2)

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## VDatum MCU for OPR-N395-FA-11

X Inbox X

[J. Corey Allen](#) Matt, HSD OPS failed to provide on the project CD the uncertainty valu 11:42 AM (1 hour ago)[FOO](#) Thanks Corey, Jasko -- Matthew Jaskoski LT/NOAA Field Operations Officer NO/ 11:55 AM (1 hour ago)[J. Corey Allen](#) to \_OMAO, \_OMAO [show details](#) 12:57 PM (2 minutes ago) [Reply](#)

Matt,

In my haste to get these out quickly, whilst doing the exact same thing for a TJ project, I juxtaposed the numbers for the two projects. FA should be using an MCU of 0.095m.

Here is the same text with correct MCU values for your archival, apologies.

HSD OPS failed to provide on the project CD the uncertainty values the FA should be using when evaluating VDatum for OPR-N395-FA-11. Please use the following maximum cumulative uncertainty (MCU) for VDatum transformations, 0.095m. This value should be placed in the "measured" tide uncertainty field during the ComputeTPU step in CARIS to account for the VDatum transformation uncertainty when performing ERS. Additional guidance has been placed into the 2011 FPM and into the ERS SOP Chapter 4 Appendix of the 2011 FPM. Please do not hesitate to contact myself or Jack Riley if you have any questions regarding calculation or application of this uncertainty value. Additionally, please document this email as official correspondence for the OPR-N395-FA-11 project.

For reference, published VDatum MCU values can be found at [http://vdatum.noaa.gov/docs/est\\_uncertainties.html](http://vdatum.noaa.gov/docs/est_uncertainties.html).

Regards, Corey

- Show quoted text -

[Reply](#)[Reply to all](#)[Forward](#)**Your message has been sent.**[FOO](#) to Corey, \_OMAO [show details](#) 1:00 PM (0 minutes ago) [Reply](#)

Corey,  
thanks I'll update the info  
Jasko

- Show quoted text -

- Show quoted text -

[New window](#)[Print all](#)[Expand all](#)[Forward all](#)

From "ops.fairweather" <ops.fairweather@noaa.gov>

Sent Monday, September 19, 2011 4:43 pm

To [david.t.moehl@noaa.gov](mailto:david.t.moehl@noaa.gov)

Cc

Bcc

Subject Fwd: OPR-N395-FA-11 (Puget Sound) Survey outlines

Attachments	<a href="#">H12280_Survey_Outline.gml</a>	6K	<a href="#">H12280_Survey_Outline.xsd</a>	4K	<a href="#">H12280_Survey_Outline.hob</a>	2K
	<a href="#">H12281_Survey_Outline.gml</a>	7K	<a href="#">H12281_Survey_Outline.xsd</a>	4K	<a href="#">H12281_Survey_Outline.hob</a>	2K

----- Original Message -----

**Subject:**OPR-N395-FA-11 (Puget Sound) Survey outlines

**Date:**Sat, 09 Jul 2011 21:34:41 +0000

**From:**XO Fairweather (Jaskoski) <[XO.Fairweather@noaa.gov](mailto:XO.Fairweather@noaa.gov)>

**To:**[survey.outlines@noaa.gov](mailto:survey.outlines@noaa.gov), NOAA Mark Friese <[Mark.Friese@noaa.gov](mailto:Mark.Friese@noaa.gov)>, NOAA Foo Fairweather <[OPS.Fairweather@noaa.gov](mailto:OPS.Fairweather@noaa.gov)>

Mark et al.,  
attached survey outlines for N395

Jasko

Matthew Jaskoski LT/NOAA  
Executive Officer  
NOAA Ship Fairweather (S-220)  
1010 Stedman St  
Ketchikan, AK 99901  
Ship Cell: 907-254-2842  
XO Cell: 907-254-2837  
Iridium: 808-659-0054

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From "[ops.fairweather](#)" <[ops.fairweather@noaa.gov](mailto:ops.fairweather@noaa.gov)>

Sent Monday, September 19, 2011 4:54 pm

To [david.t.moehl@noaa.gov](mailto:david.t.moehl@noaa.gov)

Cc

Bcc

Subject Fwd: Re: Request for final tides OPR-N395-FA-11, H12280, H12281

----- Original Message -----

**Subject:**Re: Request for final tides OPR-N395-FA-11, H12280, H12281

**Date:**Wed, 25 May 2011 17:46:11 -0400

**From:**Final Tides <[Final.Tides@noaa.gov](mailto:Final.Tides@noaa.gov)>

**To:**FOO <[ops.fairweather@noaa.gov](mailto:ops.fairweather@noaa.gov)>

Got them. Thanks.

-HPT

On 5/20/2011 5:54 PM, FOO wrote:

- > Attached requests for final discrete zoning for:
- > OPR-N395-FA-11 Central Puget Sound
- > H12280
- > H12281
- >
- > Regards,
- > Matt
- >
- >



From ["ops.fairweather" <ops.fairweather@noaa.gov>](mailto:ops.fairweather@noaa.gov)  
Sent Monday, September 19, 2011 5:00 pm  
To [david.t.moehl@noaa.gov](mailto:david.t.moehl@noaa.gov)  
Cc  
Bcc  
Subject Fwd: N395 Vdatum evaluation and reco  
Attachments [OPR-N395 Intrim Deliverables Memo.pdf](#)

573K

----- Original Message -----

**Subject:** N395 Vdatum evaluation and reco  
**Date:** Tue, 30 Aug 2011 09:39:04 -0800  
**From:** CAPT David Neander [co.fairweather@noaa.gov](mailto:co.fairweather@noaa.gov)  
**To:** Jeffrey Ferguson [Jeffrey.Ferguson@noaa.gov](mailto:Jeffrey.Ferguson@noaa.gov)  
**CC:** Gary Nelson [Gary.Nelson@noaa.gov](mailto:Gary.Nelson@noaa.gov), chiefst Fairweather [chiefst.fairweather@noaa.gov](mailto:chiefst.fairweather@noaa.gov), \_OMAO MOP OPS Fairweather [ops.fairweather@noaa.gov](mailto:ops.fairweather@noaa.gov), Weston Renoud [weston.renoud@noaa.gov](mailto:weston.renoud@noaa.gov)

Jeff - see attached subject memo.

Dave




**UNITED STATES DEPARTMENT OF COMMERCE**

National Oceanic and Atmospheric Administration  
NOAA Marine and Aviation Operations  
NOAA Ship FAIRWEATHER S-220  
1010 Stedman Street  
Ketchikan, AK 99901

August 29, 2011

MEMORANDUM FOR: Jeffrey Ferguson  
Chief, Hydrographic Survey Branch

FROM: CAPT David O. Neander, NOAA  2011.08.30  
Commanding Officer 09:20:08 -08'00'

TITLE: OPR-N395-FA-11 VDatum Evaluation and Deliverable  
Recommendation

*Fairweather* personnel conducted a comparison of VDatum ERS versus discrete tidal zoning vertical transformation techniques using crossline data per the Hydrographic Survey Project Instructions (PI). Results and analysis of the comparison are in the attached report.

Based on the comparison results, *Fairweather* personnel recommend proceeding with data reduction utilizing the VDatum ERS vertical transformation technique as per Appendix 1.2 Final Deliverables of the PI.

While VDatum reduction is a novel technique and the *Fairweather* has modified naming conventions for surfaces referenced to the NAD83 ellipsoid with this technique in the past, *Fairweather* personnel do not believe it to be necessary in this case. Since all deliverable products will be referenced to MLLW as per standard convention, the *Fairweather* will not include any indication of the alternate technique in the naming of surfaces.

Attachment





# OPR-N395-FA-11

## *ERS VDatum Evaluation - Interim Deliverable*

---

This document is intended to satisfy the VDATUM component of the Vertical Control Requirements of the Hydrographic Survey Project Instructions (PI) for OPR-N395-FA-11.

This is a comparison of discrete tidal zoning and VDATUM as methods for vertical transformation. Given that discrete tidal zoning is the conventional and accepted method it is regarded as a baseline for this evaluation.

### Procedure

The VDatum evaluation was conducted according to the instructions in Appendix 1 of the PI. Additionally guidance found in the Pydro 11.7 (r3563) distribution (Pydro\Lib\site-packages\HSTP\Pydro\PostAcqTools\_CompareTSeries.docx) was followed for the direct comparison of data.

Project crossline data was reference to MLLW via conventional discrete tidal zoning and separately via VDATUM. Time series data for the MiddlePD sensor (nadir depth) was extracted from both data sets and differenced using the Pydro PostAcq toolset.

### Results

Minor biases were found on H12280 but overall the comparison shows strong agreement between the two methods.

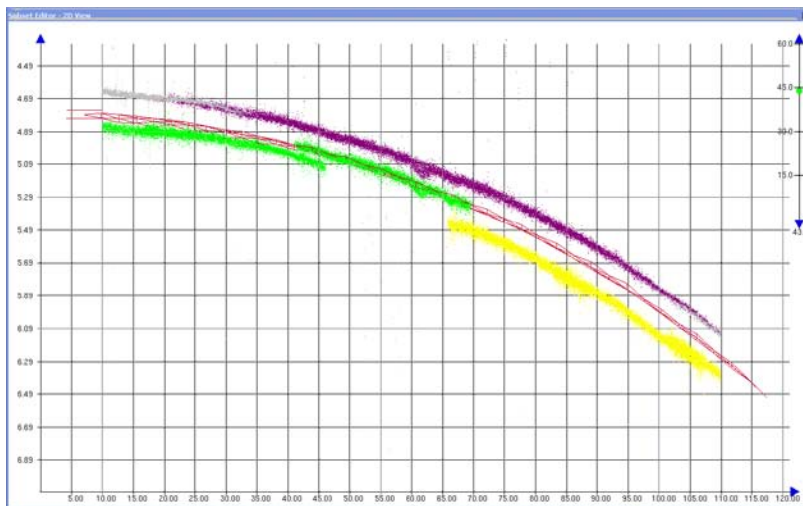
Registry Number	Vessel HVF Designation	Depth Samples	Mean Difference (meters)	Standard Deviation (meters)
<b>H12280</b>		<b>98,477</b>	<b>-0.016</b>	<b>0.081</b>
	FA_2805_400kHz_Rsn7125_512bms_2011	61,924	-0.068	0.052
	FA_2807_400kHz_Rsn7125_512bms_2011	36,553	0.073	0.031
<b>H12281</b>		<b>15,663</b>	<b>0.017</b>	<b>0.023</b>
	FA_2805_400kHz_Rsn7125_512bms_2011	3,136	0.020	0.022
	FA_2807_400kHz_Rsn7125_512bms_2011	12,527	0.016	0.023
<b>Composite Results:</b>		<b>114,140</b>	<b>-0.011</b>	<b>0.077</b>

Table 1: Compare Time Series Results (Zoned minus VDATUM)

## Discussion

The biases in H12280 are believed to be due to a minor timing offset in the zoned tides because of a strong correlation of the biases to the tide state. For the crossline data on H12280 Launch FA 2805 collected all crossline data during a flooding tide while Launch FA 2807 data was collected during an ebbing tide.

A visual review of main scheme data transformed with zoned tides method and crossline data transformed with both methods was performed in Liberty Bay, see figure 1. The area of Liberty Bay had the most extreme biases of up to  $\pm 0.2$  meters likely due to the constricted entrance. The review found the zoned data biased either shoal or deep relative to the VDATUM crosslines, with the biases correlated to flooding or ebbing respectively. Data collected during slack tide had little perceivable biases.



**Figure 1: Subset of data in Liberty Bay**  
**Purple – crossline data collected during flood,**  
**Yellow – main scheme collected during ebb,**  
**Green – main scheme collected during high and low slack,**  
**Red – VDATUM transformed crossline data as wireframe surface**

## Recommendation

Given the strong agreement between the two reduction methods and the greater internal consistency of the data transformed with the VDATUM method the Hydrographer recommends proceeding with the VDATUM method for all data reduction on OPR- N395-FA-11.

From "ops.fairweather" <ops.fairweather@noaa.gov>

Sent Monday, September 19, 2011 4:59 pm

To david.t.moehl@noaa.gov

Cc

Bcc

Subject Fwd: [Fwd: RE: [Fwd: N395 Vdatum evaluation and reco]]

Attachments OPR-N395\_VDatum\_Approval\_Memo.pdf

150K

----- Original Message -----

Subject:[Fwd: RE: [Fwd: N395 Vdatum evaluation and reco]]

Date:Fri, 09 Sep 2011 08:31:47 -0800

From:CAPT David Neander <co.fairweather@noaa.gov>

To:chiefst Fairweather <chiefst.fairweather@noaa.gov>, \_OMAO MOP OPS Fairweather <ops.fairweather@noaa.gov>

fyi

----- Original Message -----

Subject: RE: [Fwd: N395 Vdatum evaluation and reco]

Date: Fri, 09 Sep 2011 10:14:05 -0400

From: Jeffrey Ferguson <Jeffrey.Ferguson@noaa.gov>

To: 'CAPT David Neander' <co.fairweather@noaa.gov>

CC: 'James M Crocker' <James.M.Crocker@noaa.gov>, 'Mike Brown'

<Mike.Brown@noaa.gov>, "'J. Corey Allen'" <Corey.Allen@noaa.gov>

References: <4E61858B.2070905@noaa.gov>

Dave,

Sorry for the slow response. Yes, proceed with the reco. Attached is the signed memo making it official.

Thanks,  
Jeff

-----Original Message-----

From: CAPT David Neander [mailto:CO.Fairweather@noaa.gov]

Sent: Friday, September 02, 2011 9:40 PM

To: Jeffrey Ferguson

Subject: [Fwd: N395 Vdatum evaluation and reco]

Any reason not to proceed with reco?

----- Original Message -----

Subject: N395 Vdatum evaluation and reco

Date: Tue, 30 Aug 2011 09:39:04 -0800

From: CAPT David Neander <co.fairweather@noaa.gov>

To: Jeffrey Ferguson <Jeffrey.Ferguson@noaa.gov>

CC: Gary Nelson <Gary.Nelson@noaa.gov>, chiefst Fairweather

<chiefst.fairweather@noaa.gov>, \_OMAO MOP OPS Fairweather <ops.fairweather@noaa.gov>, Weston Renoud <weston.renoud@noaa.gov>

Jeff - see attached subject memo.


Dave



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL OCEAN SERVICE  
Office of Coast Survey  
Silver Spring, Maryland 20910-3282

September 9, 2011

MEMORANDUM FOR: CDR David Neander, NOAA  
Commanding Officer, NOAA Ship *Fairweather*  
2011.09.09

FROM: Jeffrey Ferguson  10:08:13 -04'00'  
Chief, Hydrographic Surveys Division

SUBJECT: Vertical Datum Transformation Technique,  
OPR-N395-FA-11, Central Puget Sound, WA

Hydrographic surveys H12280 & H12281 are approved for vertical reduction to chart datum, Mean Lower Low Water (MLLW), using the NOAA Vertical Datum Transformation (VDatum) (<http://vdatum.noaa.gov>) derived separation (SEP) model provided on the project CD/DVD.

Approval of VDatum, in lieu of the NOAA Center for Operational Oceanographic Products and Services (CO-OPS) discrete zoning package as per the Project Instructions, is based on your recommendation and the review of comparison results you included in your attached memo from August 29, 2011, Subject "OPR-N395\_Interim\_Deliverables\_Memo".

The results of the data analysis show that ellipsoidally referenced survey (ERS) techniques with VDatum used as the vertical datum reducer to MLLW in this area indicate a better internal consistency of the survey data and produces final sounding values that meet or exceed horizontal and vertical specifications for hydrographic surveys.

The comparison techniques are in line with the procedures that were developed and approved as part of the CSDL Ellipsoidally Referenced Survey (ERS) project. These procedures and deliverables were recently added to the April 2011 edition of the NOS Hydrographic Surveys Specifications and Deliverables document.

You shall include a description of your ERS processing procedures and the comparisons you conducted between ERS and traditional tides in the appropriate Descriptive Report (DR), Horizontal and Vertical Control Report and/or Data Acquisition and Processing Report.

This memo and your memo, shall be included in the supplemental correspondence Appendix of the DR.



**3.1) GP No. - 022600000510001 from H12281 / Survey\_Files / Misc / H12281\_Final\_Feature\_File.000**

**Survey Summary**

**Survey Position:** 47° 38' 27.2" N, 122° 36' 05.5" W  
**Least Depth:** [None]  
**TPU (±1.96σ):** THU (TPEh) [None] ; TVU (TPEv) [None]  
**Timestamp:** 2011-095.17:43:13.000 (04/05/2011)  
**GP Dataset:** H12281 / Survey\_Files / Misc / H12281\_Final\_Feature\_File.000  
**GP No.:** 022600000510001  
**Charts Affected:** 18449\_1, 18474\_1, 18441\_1, 18445\_1, 18440\_1, 18003\_1, 18007\_1, 501\_1, 530\_1, 50\_1

**Remarks:**

PILPNT/remrks: AWOIS\_53929 - new GPS position of charted (18449) pile (group of two) found by field operations. Additionally, area covered by complete MBES.

**Feature Correlation**

Address	Feature	Range	Azimuth	Status
H12281/Survey_Files/Misc/H12281_Final_Feature_File.000	022600000510001	0.00	000.0	Primary

**Hydrographer Recommendations**

Reposition pile (group of two) to new surveyed position.

**S-57 Data**

**Geo object 1:** Pile (PILPNT)  
**Attributes:** CATPLE - 3:post  
 SORDAT - 20110408  
 SORIND - US,US,graph,H12281

**Office Notes**

Concur with clarification, remove charted pile and "Piles PA" (AWOIS #53929) located in 47-38-30.94N, 122-36-07.25W. Chart new pile in the surveyed location and update AWOIS database.



### Feature Images



Figure 3.1.1

**2.3) GP No. - 0226000026450001 from H12281 / Survey\_Files / Misc / H12281\_Final\_Feature\_File.000**

**Survey Summary**

**Survey Position:** 47° 38' 23.0" N, 122° 35' 52.5" W  
**Least Depth:** 7.41 m (= 24.29 ft = 4.049 fm = 4 fm 0.29 ft)  
**TPU (±1.96σ):** THU (TPEh) [None] ; TVU (TPEv) [None]  
**Timestamp:** 2011-098.00:00:00.000 (04/08/2011)  
**GP Dataset:** H12281 / Survey\_Files / Misc / H12281\_Final\_Feature\_File.000  
**GP No.:** 0226000026450001  
**Charts Affected:** 18449\_1, 18474\_1, 18441\_1, 18445\_1, 18440\_1, 18003\_1, 18007\_1, 501\_1, 530\_1, 50\_1

**Remarks:**

WRECKS/remrks: new wreck, 9.03mx3.54m, 1.6m above seafloor

**Feature Correlation**

Address	Feature	Range	Azimuth	Status
H12281/Survey_Files/Misc/H12281_Final_Feature_File.000	0226000026450001	0.00	000.0	Primary

**Hydrographer Recommendations**

[None]

**Cartographically-Rounded Depth (Affected Charts):**

- 24ft (18449\_1)
- 4fm (18441\_1, 18440\_1, 18003\_1, 18007\_1, 530\_1)
- 4fm 0ft (18474\_1, 18445\_1)
- 7.4m (501\_1, 50\_1)

**S-57 Data**

**Geo object 1:** Wreck (WRECKS)  
**Attributes:** CATWRK - 1:non-dangerous wreck  
 QUASOU - 6:least depth known  
 SORDAT - 20110408  
 SORIND - US,US\_graph,H12281

TECSOU - 3:found by multi-beam

VALSOU - 7.405 m

WATLEV - 3:always under water/submerged



### Feature Images

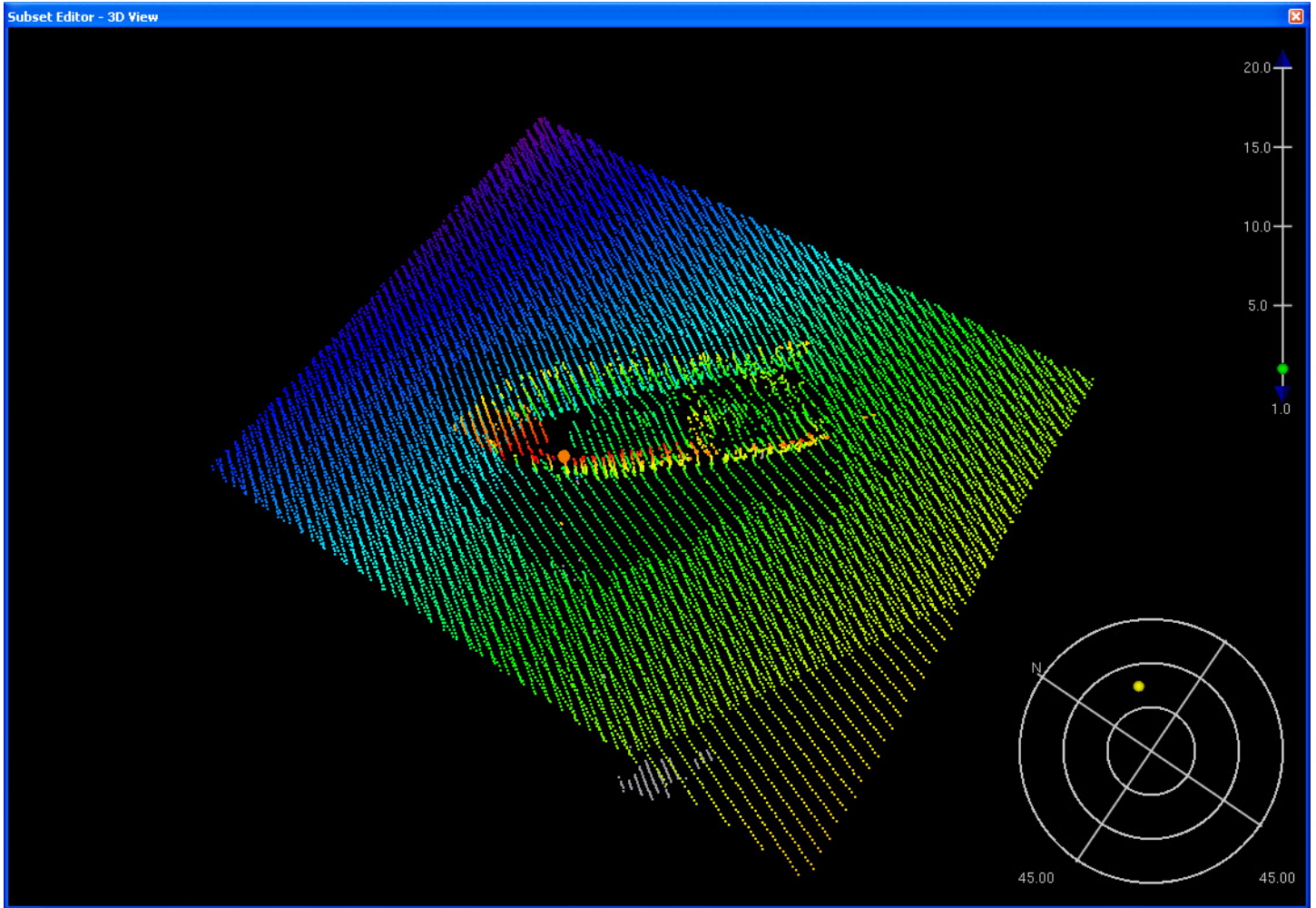


Figure 2.3.1

**2.14) GP No. - 0226000026460001 from H12281 / Survey\_Files / Misc / H12281\_Final\_Feature\_File.000**

**Survey Summary**

**Survey Position:** 47° 37' 31.2" N, 122° 35' 26.8" W  
**Least Depth:** 18.36 m (= 60.24 ft = 10.040 fm = 10 fm 0.24 ft)  
**TPU (±1.96σ):** **THU (TPEh)** [None] ; **TVU (TPEv)** [None]  
**Timestamp:** 2011-098.00:00:00.000 (04/08/2011)  
**GP Dataset:** H12281 / Survey\_Files / Misc / H12281\_Final\_Feature\_File.000  
**GP No.:** 0226000026460001  
**Charts Affected:** 18449\_1, 18474\_1, 18441\_1, 18445\_1, 18440\_1, 18003\_1, 18007\_1, 501\_1, 530\_1, 50\_1

**Remarks:**

WRECKS/remrks: new wreck, 9.76mx3.68m, 4.76m above seafloor

**Feature Correlation**

Address	Feature	Range	Azimuth	Status
H12281/Survey_Files/Misc/H12281_Final_Feature_File.000	0226000026460001	0.00	000.0	Primary

**Hydrographer Recommendations**

[None]

**Cartographically-Rounded Depth (Affected Charts):**

- 60ft (18449\_1)
- 10fm (18441\_1, 18440\_1, 18003\_1, 18007\_1, 530\_1)
- 10fm 0ft (18474\_1, 18445\_1)
- 18.4m (501\_1, 50\_1)

**S-57 Data**

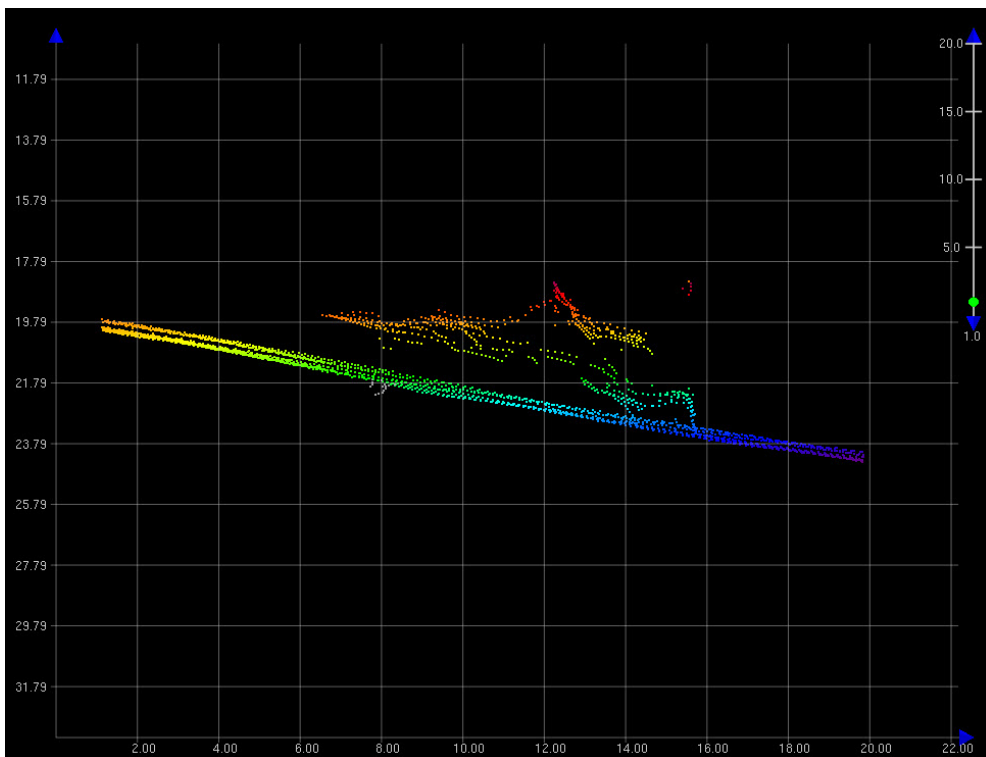
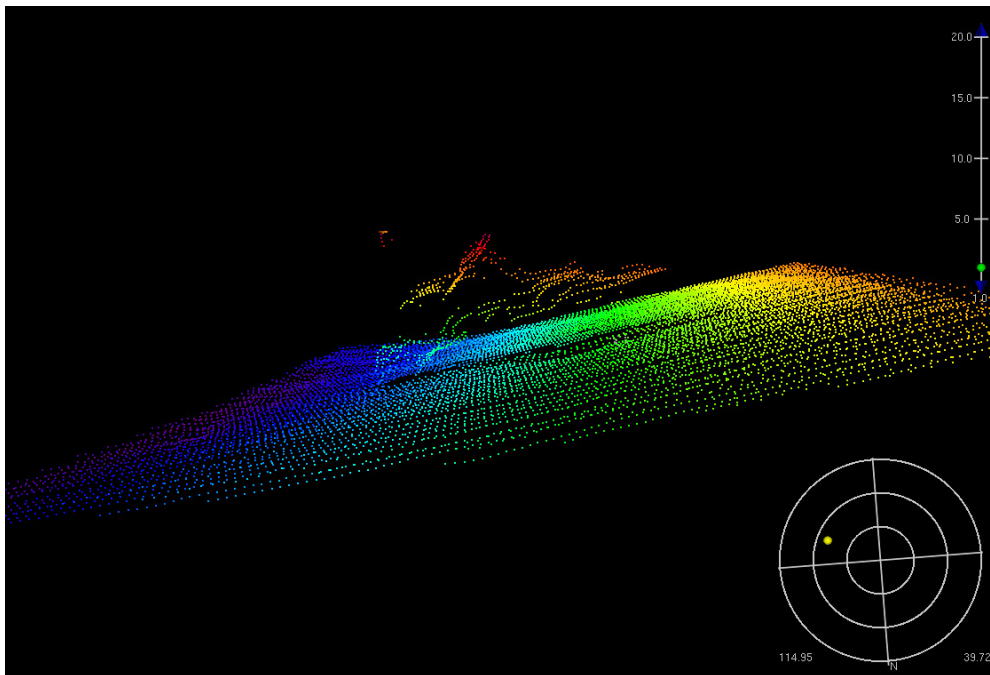
**Geo object 1:** Wreck (WRECKS)  
**Attributes:** CATWRK - 1:non-dangerous wreck  
 QUASOU - 6:least depth known  
 SORDAT - 20110408  
 SORIND - US,US\_graph,H12281

TECSOU - 3:found by multi-beam

VALSOU - 18.361 m

WATLEV - 3:always under water/submerged

### Feature Images



APPROVAL PAGE

H12281

Data meet or exceed current specifications as certified by the OCS survey acceptance review process. Descriptive Report and survey data except where noted are adequate to supersede prior surveys and nautical charts in the common area.

The following products will be sent to NGDC for archive

- H12281\_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12281\_GeoImage.pdf

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

Approved: \_\_\_\_\_

**Peter Holmberg**

Physical Scientist, Pacific Hydrographic Branch

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

Approved: \_\_\_\_\_

**LCDR David J. Zezula, NOAA**

Chief, Pacific Hydrographic Branch