

H11855

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. .... H11855

### LOCALITY

State ..... Oregon

General Locality ..... Columbia River

Sublocality ..... Wallace Island to Walker Island

**2008 - 2009**

### CHIEF OF PARTY

Jonathan L. Dasler, PE (OR), PLS (OR, CA)

David Evans and Associates, Inc.

### LIBRARY & ARCHIVES

DATE .....

## HYDROGRAPHIC TITLE SHEET

H11855

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 OregonGeneral Locality Columbia RiverSublocality Wallace Island to Walker IslandScale 1:10,000Date of Survey October 8, 2008 - March 4, 2009Instructions Dated 4/1/2008Project No. OPR-N338-KR-08Vessel R/V Theory, R/V PrestonChief of Party Jonathan L. Dasler, PE (OR), PLS (OR, CA)Surveyed by David Evans and Associates, Inc.Soundings taken by echo sounder RESON 7125, RESON 8101, Odom Cv100Graphic record scaled by N/AGraphic record checked by N/AEvaluation by N. Forfinski Automated plot by N/AVerification by N. Forfinski, K. ReserSoundings in Feet at Columbia River Datum (CRD)REMARKS: Time in UTC. UTM Projection Zone 10

Revisions and annotations appearing as endnotes were  
generated during office processing.

As a result, page numbering may be interrupted or non-sequential

All separates are filed with the hydrographic data.

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## **Descriptive Report to Accompany Hydrographic Survey H11855**

Project OPR-N338-KR-08  
Columbia River, Oregon  
Wallace Island to Walker Island  
Scale 1:10,000  
October 2008 – March 2009

**David Evans and Associates, Inc.**

Lead Hydrographers: Jonathan L. Dasler, Jason C. Creech

### **A. AREA SURVEYED**

David Evans and Associates, Inc. (DEA) conducted hydrographic survey operations on the Columbia River, Oregon. The survey area (Figure 1) extends from Columbia River Mile (CRM) 48 in Westport Channel to CRM 62 on the east and west sides of Walker Island.

Survey H11855 was conducted in accordance with the *Statement of Work* for OPR-N338-KR-08; dated April 1, 2008 with the exception of tides and water levels requirements. Due to the Columbia River Datum (CRD), the project chart datum, being a non-tidal gradient datum and the complex hydrodynamics of the Columbia River, OPR-N338-KR-08 was approved as a pilot project for the use of Global Positioning System (GPS) water levels acquired directly at the survey vessel. This change was approved after the receipt of the *Statement of Work*.<sup>1</sup>

The project instructions required three categories of multibeam coverage: Complete, Object Detection, and Set Line Spacing. In water depths greater than four meters, complete multibeam coverage was required. Automated Wreck and Obstruction Information System (AWOIS) items and the main shipping channel were acquired to meet object detection coverage requirements. Twenty-five (25) meter set line spaced multibeam bathymetry was required from the four meter water depths to the "inshore limit of hydrography". The inshore limit of hydrography was defined as the seaward most extent of either the two meter contour or the equivalent to 0.8 millimeters at the scale of the largest scale nautical chart from the mean high water (MHW) line. Though not required by contract, multibeam side scan data was acquired but not processed.

Fourteen (14) bottom samples were acquired for H11855. Two AWOIS item investigations were assigned to this survey.

Data acquisition was conducted from October 8, 2008 (DN282) to March 4, 2009 (DN063). Table 1 lists specific dates of acquisition.

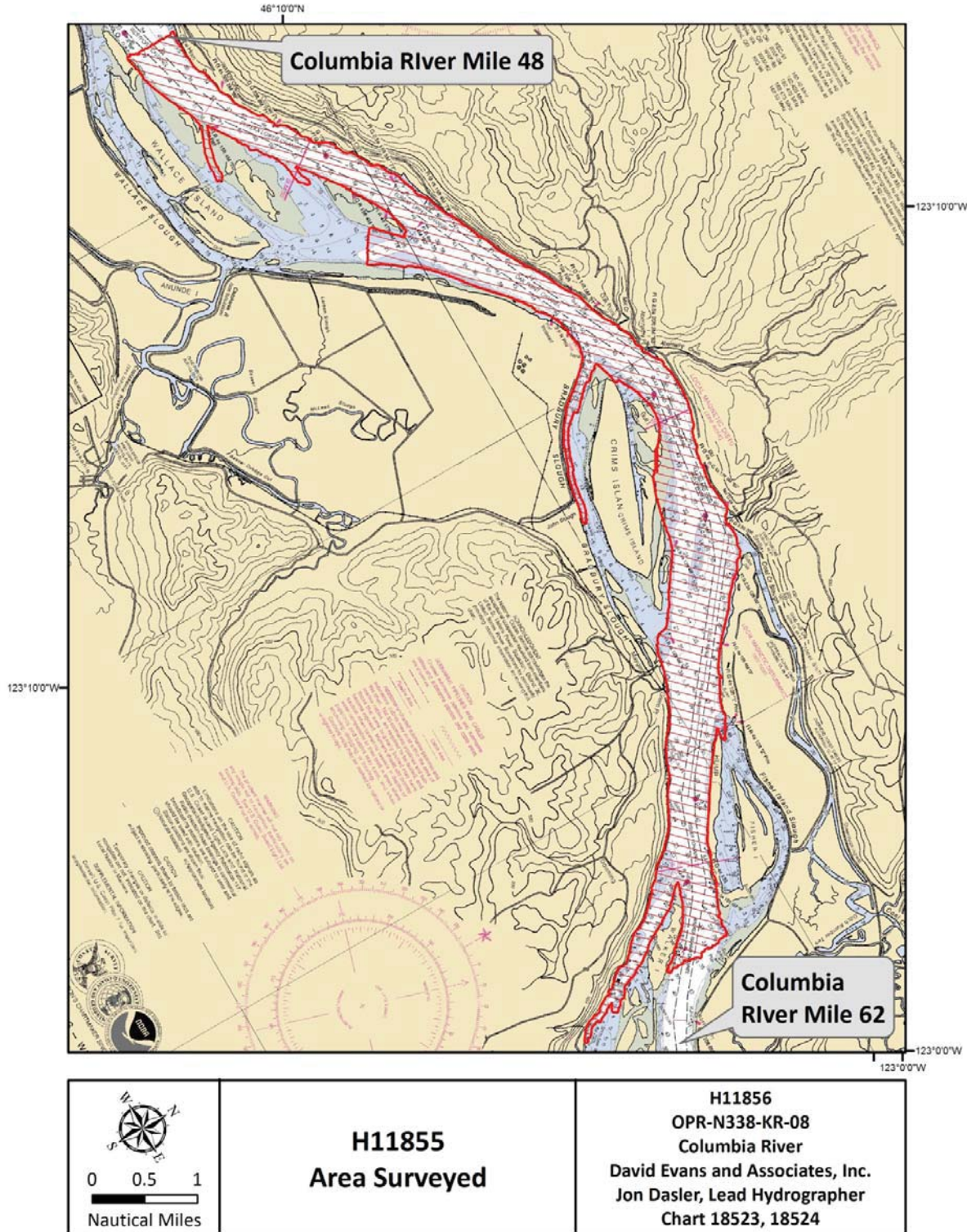


Figure 1. H11855 Survey Area

**Table 1. H11855 Days of Acquisition**

<b>Dates of Acquisition</b>	
<b>Month</b>	<b>Dates</b>
October 2008	8, 11-22, 24-27
February 2009	27
March 2009	2, 4

Detailed survey statistics of H11855 are provided in Table 2.

**Table 2. H11855 Survey Statistics**


<b>Survey Statistics</b>	<b>Research Vessels (R/V) THEORY and PRESTON</b>
<b>MBES (mainscheme nm)</b>	391.64
<b>Crosslines (MBES nm)</b>	27.65
<b>Developments (MBES nm)</b>	1.19
<b>VBES Mainscheme (nm)</b>	4.04
<b>VBES Crosslines (nm)</b>	0.84
<b>Number of Item Investigations that required additional survey effort</b>	25
<b>Total number of square nautical miles</b>	5.30

**B. DATA ACQUISITION AND PROCESSING**


**B1. Equipment**

Equipment and vessels used for data acquisition and survey operations during this survey are listed below in Tables 3 and 4.

*Table 3. R/V Theory Equipment and vessel specifications*

<b>R/V THEORY</b>	
	
<b>Hull Registration Number</b>	IAR34CATA808
<b>Official Number (O/N)</b>	1217549
<b>Builder</b>	Armstrong Marine
<b>Design</b>	Catamaran
<b>Year Built</b>	2008
<b>Length Overall</b>	36'
<b>Beam</b>	13'
<b>Draft, Maximum</b>	3'
<b>Cruising Speed</b>	26 knots
<b>Max Survey Speed</b>	9 knots
<b>Primary Echosounder</b>	RESON 7125-B
<b>Sound Velocity Equipment</b>	Brooke Ocean MVP-30 Reson SVP-70 Sea-Bird SEACAT SB-19 CTD Profiler
<b>Positioning &amp; Attitude</b>	Applanix POS/MV 320 v4

**Table 4. R/V Preston equipment and vessel specifications**

<b>R/V Preston</b>	
	
<b>Hull Registration Number</b>	ABTJOHNB3090
<b>Official Number (O/N)</b>	WN0437NX
<b>Builder</b>	Action Boats Inc.
<b>Design</b>	Custom Monohull Jet
<b>Year Built</b>	1990
<b>Length Overall</b>	31'
<b>Beam</b>	8.5'
<b>Draft, Maximum</b>	16"
<b>Cruising Speed</b>	24 knots
<b>Max Survey Speed</b>	7 knots
<b>Primary Echosounder</b>	RESON 8101
<b>Sound Velocity Equipment</b>	Sea-Bird SEACAT SB-19 CTD Profiler AML SV Plus
<b>Positioning &amp; Attitude</b>	Applanix POS/MV 320 v4 RTK compatible

There were no vessel or equipment configurations used during data acquisition that deviated from those described in the *OPR-N338-KR-08 Data Acquisition and Processing Report (DAPR)*.<sup>2</sup>

## **B2. Quality Control**

Quality control is discussed in detail in Section B of the DAPR. The results from the positioning system comparison and bar check comparison is included in *Separate I Acquisition and Processing Logs* and the sound velocity profile sensor weekly evaluation table can be found in *Separate II Sound Speed Data* section of this report.<sup>3</sup> Data were reviewed at multiple levels of data processing including CARIS Hydrographic Information Processing System (HIPS)

conversion, subset editing, and analysis of anomalies revealed in combined uncertainty and bathymetry estimator (CUBE) surfaces. Both baring and submerged significant features identified during survey were noted in the acquisition logs and saved to Hypack target files or Isis Cursor log files and then displayed during HIPS editing to aid in the interpretation of data and act as a check during feature compilation.

### **B2.a Crosslines**

A total of 30.6 nautical miles of crosslines, or 7.82%, of mainscheme lines, were run for analysis of survey accuracy. Crosslines were run perpendicular to mainscheme lines across the entire surveyed area providing a good representation for analysis of consistency.

Due to the dynamic shifting of sand waves, data acquired significantly later than the majority of the mainscheme bathymetry, specifically fill from February 27, March 2, and March 4, 2009 (DN058, DN061, and DN063), and the crosslines listed in Table 5 were not included in the *R/V Preston* crossline analysis for H11855.

**Table 5. Crosslines Excluded from Analysis**

Crosslines Excluded from Analysis
2008PR2931627_XL
2008PR2931729_XL
2008PR2931648_XL
2008PR2931620_XL
2008PR2931641_XL
2008PR2931634_XL
2008PR2931655_XL
2008PR2892010_XL

Crossline analysis was performed using the CARIS HIPS QC Report tool, which compares crossline data to a gridded surface and reports results by beam number. Crosslines were compared to a 50-centimeter CUBE surface that encompassed the entire survey area. This surface was not included with the deliverables due to its file size. The QC Report tabular output and plots are included in Separate IV *Crossline Comparisons*.<sup>4</sup> The results of the analysis meet the requirements as stated in the National Ocean Service (NOS) *Hydrographic Surveys Specifications and Deliverables* (April 2007).<sup>5</sup>

### **B2.b Uncertainty**

The calculated uncertainty values of all nodes within the unfinalized CUBE surface range from 0.116 meters to 0.377 meters.



During HIPS processing, the "greater of the two" option was selected, where the calculated uncertainty from total propagated error (TPE) is compared to the standard deviation of the soundings influencing the node, and the greater value is assigned as the final uncertainty of the node. As a result, the uncertainty of the finalized surface and associated Bathymetric Attributed Grids (BAGs) increased for nodes where the standard deviation of the node was greater than the calculated uncertainty. No area within the survey exceeds International Hydrographic Organization (IHO) Order 1 specifications for depth accuracy.<sup>6</sup>

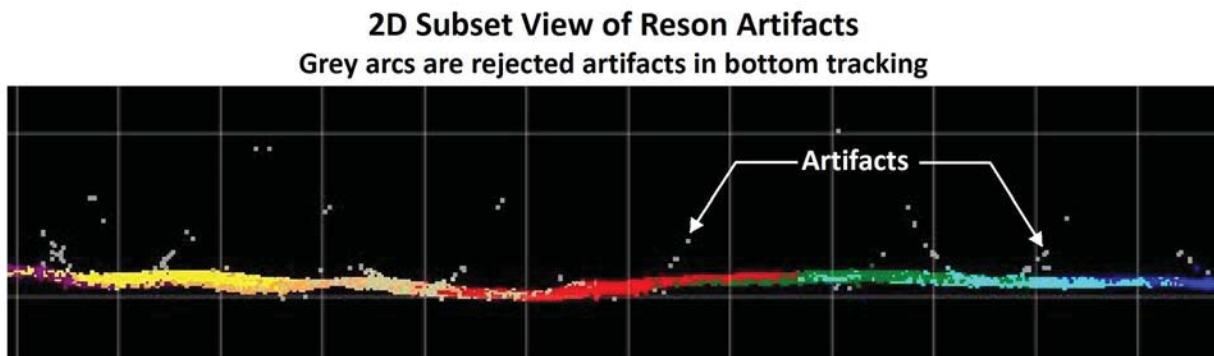
### **B2.c Junctions**

H11855 junctions with survey H11854 to the west and with survey H11856 to the east. The H11856 junction is referenced in the H11856 *Descriptive Report*. Junctions were visually reviewed in Caris HIPS subset mode and a difference analysis was performed using Caris Bathy DataBASE.

In general, the depth differences between H11854 and H11855 are within 10cm with the greatest differences correlating to the natural migration of sand waves mid-channel of the river.<sup>7</sup> Due to the dynamic shifting of sand waves, data acquired significantly later than the majority of the mainscheme bathymetry, specifically fill from March 4, 2009 (DN064), were not used in the junction analysis.

### **B2.d Unusual Conditions or Data Degradation**

There is an error in the Reson 7125 bottom tracking algorithm that causes bottom detection (beams 86-115 and 140-168) to lock on to stronger sonar returns bleeding over from more nadir returns. This may be related to the amplitude bottom detection used near nadir and the bottom detection locking on to the strong nadir return signal, rather than the actual bottom return for that designated beam area. These artifacts occur in two areas near nadir and are more prevalent on a hard bottom, when the amplitude of the nadir return is the strongest. The artifacts run along track and can exceed 20 centimeters in the raw soundings, but are reduced to 5 to 10 centimeters in the CUBE surface (Figure 2).<sup>8</sup> Attempts to remove these artifacts during survey operations with changes in sonar settings were unsuccessful. Reson is aware of this issue and is working towards a resolution with a different bottom tracking algorithm.



**Figure 2. Artifacts in Reson 7125 bottom tracking algorithm**

Snags and deadheads are common along the Columbia River. Any feature, submerged or baring that was determined to be seasonal or transient in nature was removed from the data.

### ***B2.e Object Detection and Coverage Requirements***

Survey speeds were maintained at less than 9 knots so that object detection requirements were exceeded throughout the survey.<sup>9</sup>

High resolution, 50-centimeter CUBE surfaces were created over the entire survey area. The disambiguation method selected to create all 50-centimeter CUBE surfaces was “Shoal,” which corresponds to the NOS *Hydrographic Surveys Specifications and Deliverables* (April 2007) Object Detection Coverage requirements. Survey coverage was reviewed to ensure that no data gaps (more than 3 connected open nodes) were present within AWOIS radii and maintained navigation channels.

Outside maintained navigation channels Complete Coverage requirements were demonstrated by creating one meter CUBE surfaces with “Deep” disambiguation method selected, which corresponds to the NOS *Hydrographic Surveys Specifications and Deliverables* (April 2007) Complete Coverage requirements. Survey coverage was reviewed to ensure that no data holidays (more than 3 connected open nodes) were present. In a telephone conversation on January 7, 2009 between the Pacific Hydrographic Branch (PHB) and DEA it was agreed that the one meter surfaces would be created and reviewed by DEA hydrographers, but not submitted with the delivered dataset in order to reduce data storage needs.

## **B3. Corrections to Echo Soundings**

Data reduction procedures for survey H11855 are detailed in the OPR-N338-KR-08 DAPR, submitted under separate cover. The multibeam swath angle filter that was applied to each survey day varied depending on location, conditions, and sonar type. In general, Reson 7125 survey lines were unfiltered and used the entire 128 degree swath. Reson 8101 survey lines were filtered at a 60/60-degree angle from nadir for mainscheme hydrography and 60/90 or 60/75 for survey lines along the shoreline. For detailed information pertaining to applied filters please refer to the multibeam processing logs in Separate I *Acquisition and Processing Logs*.<sup>10</sup>

The survey area for H11855 contained numerous bearing features. The least depths of bearing features were marked as “Examined” and the rest of the structure was flagged as "Rejected" to the mudline. The use of the examined sounding flag to track bearing items aided hydrographers during the feature management compilation process. Baring features are not included in the finalized bathymetric sounding set. This was done to ensure that the generated surface represented the true river bottom and submerged features.

### ***B3.a Deviations from DAPR***

The post-survey calibration report for Applied Microsystems AML SV Plus (serial number 3591) has not yet been received from the manufacturer. The AML 3591 was compared to another AML SV Plus (Serial Number 3592) as well as both AML Smart SV&Ps (Serial Numbers 5110 and

5111) as part of a weekly confidence check for sound speed determination. All comparisons passed within the National Oceanic and Atmospheric Administration (NOAA) specifications.<sup>11</sup>

Multibeam swath coverage images of sun illuminated depth and uncertainty layers have not been submitted as this requirement has been dropped from recent versions of NOS *Hydrographic Surveys Specifications and Deliverables*. These layers have been submitted in both BAG and CUBE format.<sup>12</sup>

There are no other deviations from the OPR-N338-KR-08 DAPR.

### ***B3.b Additional Calibration Tests***

The initial system calibration tests for the R/V Theory and R/V Preston were performed on August 15, 2008 (DN228) and August 29, 2008 (DN242), respectively. Additional tests were performed periodically to verify the adequacy of the known system biases and document changes in alignment offsets due to sensor re-mounting and sonar strikes on submerged objects. Additional discussion on calibration tests can be found in the OPR-N338-KR-08 DAPR.

## **B4. Data Processing (Data Representation)**

### ***B4.a Single Beam***

A single, two-meter uncertainty weighted surface of the single beam data is delivered with the complete single beam data set.

### ***B4.b Multibeam***

CUBE surface resolutions and depth ranges were set in accordance with the NOS *Hydrographic Surveys Specifications and Deliverables* (April 2007). Final CUBE surfaces were created at a 50-centimeter resolution to meet Object Detection requirements. Some data gaps exist in the 50-centimeter grids; however, the grids still meet coverage requirements for the survey. Near shore coverage, in some areas less than 4 meters used, Set Line spacing and gaps are present between survey lines. Additionally, coverage outside of the maintained channel only required a one meter resolution and small data gaps may be visible in the 50-centimeter surfaces, but still meet requirements in these areas.<sup>13</sup> Complete Coverage requirements were met and all data gaps, three nodes or greater, were filled prior to ceasing survey operations.

In order to keep CUBE surfaces at a manageable size, the main survey area was broken up into eight Field Sheets organized by corresponding Columbia River mile (H11855\_CRM\_48-50, etc.). When combined the Fields Sheets encompass the entire area of acquired multibeam bathymetry. A BAG was created for each finalized CUBE surface and both the CUBE and BAG surfaces have been included with the digital data.

## C. HORIZONTAL AND VERTICAL CONTROL

Due to the CRD, the project chart datum, being a non-tidal gradient datum and the complex hydrodynamics of the Columbia River, the project chart datum, OPR-N338-KR-08 was approved as a pilot project for the use of GPS water levels acquired directly at the survey vessel. With the exception of tide reduction of baring features, traditional zoning from water level stations was not used for this project though zoning provided by Center for Operational Oceanographic Products and Services (CO-OPS) and verified water level files for the survey have been included with the digital deliverables

Prior to survey acquisition, three GPS base stations with a dual frequency (L1/L2) receiver were established in Washington at Kalama and Longview and in Oregon at the Beaver Army Terminal. The base stations logged raw dual frequency (L1/L2) GPS observables at one second epochs as well as broadcast real-time kinematic (RTK) corrections to the survey vessels. The base station closest to the area surveyed broadcast the RTK correctors. This base station was later used to post-process the navigation data. Base station positions relative to the North American Datum of 1983 (NAD83) (CORS96) (Epic 2002) were derived from the NGS (National Geodetic Survey) On-line Positioning User Service (OPUS) and were based on a 24-hour data file, with one second-epoch logging prior to commencement of survey operations.

A separation model of CRD relative to NAD83 was created and formatted to allow for direct integration with Hypack and Caris HIPS. The model input used a river profile of CRD relative to North American Vertical Datum of 1988 (NAVD88) provided by the U.S. Army Corps of Engineers (USACE), Portland District (the designated stewards of CRD). GEOID 03 was used to transfer the NAVD88 to CRD relationship directly to the NAD83 ellipsoid, which allowed direct computation of GPS water levels from ellipsoid heights recorded at the survey vessel. The model file (.bin) used to compute GPS water levels in HIPS, has been included with the digital deliverables.

RTK navigation was logged during acquisition and applied during preliminary data processing, but ultimately overwritten with a post-processed Inertially-Aided Kinematic Ambiguity Resolution (IAKAR) navigation solution. The HIPS Load Attitude and Navigation tool was used to load position, GPS height, and attitude data from a smoothed best estimate trajectory (SBET) file create from Applanix POSPac.

A complete description of horizontal and vertical control for survey H11855 can be found in the OPR-N338-KR-08 *Horizontal and Vertical Control Report*, submitted under separate cover.<sup>14</sup> A summary of horizontal and vertical control for this survey follows.

### C1. Vertical Control

The vertical datum for this project is the CRD, an adopted low-water gradient datum relative to NAVD88. There are known problems in the NGS level lines between Oregon and Washington due to the long level runs without the ability to run tie lines across the Columbia River. GPS observations have documented large vertical differences in published bench mark elevations across the Columbia River. Whereas CO-OPS water level gauges are located in Oregon and Washington and are directly referenced to NGS published bench mark elevations, and the known

issue with the level lines between Oregon and Washington, a decision was jointly made by the USACE and NOAA to use NGS OPUS solutions to establish vertical consistency in the relationship of CRD relative to NAVD88. The USACE, Portland District (designated stewards of CRD) conducted surveys that established OPUS derived NAVD88 elevations on historic bench marks referencing CRD. A result of these surveys was a profile of CRD relative to OPUS derived NAVD 88 elevations which were consistent across the Columbia River. The profile defined CRD relative to NAVD88 for each River Mile (RM) from RM 23 to RM 145 on the Columbia River and RM 0 to RM 26 on the Willamette River. This profile is used by the Portland District for hydrographic surveys and dredging operations to maintain the Federal Channel on the Columbia and Willamette rivers.

To improve vertical accuracy of this survey, soundings were reduced to CRD using GPS water levels measured at the survey vessel. Water levels were derived from post processed GPS heights and application of a separation model of the CRD to NAD83 ellipsoid relationship. Data reduction procedures, including detailed discussions of the CRD model generation and GPS water levels computations, for survey H11856 are detailed in the OPR-N338-KR-08 DAPR.

To verify GPS water levels, a comparison was made by vessel static observations adjacent to the CO-OPS water level stations 9440422 located in Longview, WA and 9439099 located in Wauna, OR. To obtain water levels relative to the CO-OPS defined CRD, the Hydrographer selected Station Datum when downloading data from the CO-OPS web site. This is consistent with obtaining CRD values for any CO-OPS station on the Columbia River above river mile 23. Adjustments were required to correct CO-OPS water level data to CRD based on the updated USACE CRD profile used to maintain the Columbia and Willamette rivers. An additional adjustment was applied to correct local tidal bench marks with orthometric heights based on NGS level lines to OPUS derived NAVD88 elevations to match the USACE profile and eliminate errors from distorted level lines.

As a result of these comparisons, the hydrographer discovered a large deviation from the CO-OPS data reported from station 9440422 in Longview, WA. After running digital levels and recording a 1 hour-series of water level observations with an optical level, it has been determined that the CO-OPS water level station in Longview, WA (9440422) is incorrectly reporting water levels relative to the station tidal bench marks and should be corrected by -0.071 meters to match CO-OPS tidal bench marks. CO-OPS is aware of this issue and is working toward resolving the problem.

It should be noted that these adjustments were applied to CO-OPS water level data for comparison purposes of water level data relative to the revised USACE profile relative to OPUS derived NAVD88 elevations. This method was approved for project OPR-N388-KR-08 by the Office of Coast Survey, Hydrographic Surveys Division Chief as it is consistent with the USACE, Portland District, methods for maintaining the Federal Channel in the Columbia and Willamette rivers. Further, CO-OPS should adjust water level stations on CRD and part of the Columbia PORTS® system to be consistent with the defined CRD profile by the USACE, Portland District. Tables 6 and 7 list corrections to be applied to CO-OPS data to be consistent with the USACE, Portland District CRD profile.

**Table 6. Corrections Applied to 9440422 Longview, Washington**

Description of Adjustment	Adjustment (m)
Revised CRD Value to 0.804m NAVD88 from CO-OPS 0.764m NAVD88	-0.040
Adjustment to OPUS elevation for Tidal Bench Mark SA 89 MON 4	-0.052
CO-OPS Gauge Correction Based on Optical Level Water Surface Observations	-0.071
<b>Total Adjustment to CO-OPS Data in Longview, WA</b>	<b>-0.163</b>

**Table 7. Corrections Applied to 9439099 Wauna, Oregon**

Description of Adjustment	Adjustment (m)
Revised CRD Value to 0.398m NAVD88 from CO-OPS 0.469m NAVD88	0.071
Adjustment to OPUS elevation for Tidal Bench Mark 9099H 1994	-0.033
<b>Total Adjustment to CO-OPS Data in Wauna, OR</b>	<b>0.038</b>

Water level observations, OPUS position results and gauge comparison data may be found in Appendix IV. No configurations used during data acquisition deviated from those described in the OPR-N338-KR-08 DAPR.

**C2. Discussion of GPS Tides**

The coordinates of the GPS base stations used during acquisition and processing of H11855 are included in Table 8. The reference base stations used for both RTK and post processing are listed in the survey acquisition logs and POSpac processing logs included in Separate I *Acquisition and Processing Logs*.

**Table 8. H11855 NAD83 Base Stations Positions**

RTK Base Station	Latitude (N)	Longitude (W)	Ellipsoid Height
KLMA	46 00 20.45579	122 50 50.13183	-11.153 m
PLVW	46 07 26.23898	122 58 49.89723	-11.143 m
BEVR	46 10 13.97257	123 09 26.40353	-15.766 m

As discussed in the OPR-N338-KR-08 DAPR, the use of GPS water levels eliminated large errors associated with discrete zoning and significantly reduced vertical uncertainty for this survey. Typical tide zoning artifacts for the survey area could exceed 30 centimeters, but as a result of using GPS water levels there are no visual tidal artifacts present in this survey.

### **C3. Horizontal Control**

The horizontal datum for this project is the NAD83. Differential GPS (DGPS) and RTK positioning were used simultaneously throughout acquisition with DGPS positions only used for a real-time confidence check. DGPS corrections were received from the U.S. Coast Guard beacon at Fort Stevens, Washington (287 kHz) or from the secondary beacon at Appleton, Washington (300 kHz). Some DGPS outages from the primary beacon occurred during survey operations. The system was set up to automatically switch to the secondary beacon when the primary signal was lost, so all of the secondary navigation data were collected in DGPS mode.

Navigation and attitude data were post-processed using Applanix POSPac MMS software, which produced an IAKAR navigation solution relative to NAD83. The GPS reference station and position used during post-processing were identical to those used for RTK broadcast during acquisition.

The real-time navigation and attitude logged during acquisition was overwritten with post-processed data during HIPS processing. Post-processed navigation, attitude and GPS heights were applied to all HIPS data. No real-time sensor data applied to H11855.

## **D. RESULTS AND RECOMMENDATIONS**

### **D1. Chart Comparison**

#### ***D1.a Survey Agreement with Chart***

During the course of data acquisition and processing H11855 was compared to the largest scale raster and electronic navigation charts (RNC and ENC). The results of these comparisons are described below, as well as in Sections D1.b through D1.f of this report.

Contours and soundings used during the chart comparison were generated from combined HIPS product surfaces. Soundings and contours were generated from a 5 meter HIPS product surface (1:10,000) of the entire survey area, which was compiled from all finalized CUBE surfaces for the survey. The product surfaces, contours, and soundings were created solely for quality assurance and chart comparison and have not been submitted as a final deliverable.

H11855 contours and soundings were compared in CARIS HIPS to the depths and contours on the charts listed in Table 9.

*Table 9. Charts compared to H11855*

Chart	Scale	Edition	Edition Date	Issue Date	Latest LNM	Cleared Through Date
18523	1:40,000	56	10/01/2006	05/23/2009	18/09	05/02/2009
18524	1:40,000	36	12/01/2006	03/03/2009	09/09	04/21/2009
US50OR12M	---	35	---	04/28/2009	---	---
US50OR13M	---	33	---	04/28/2009	---	---

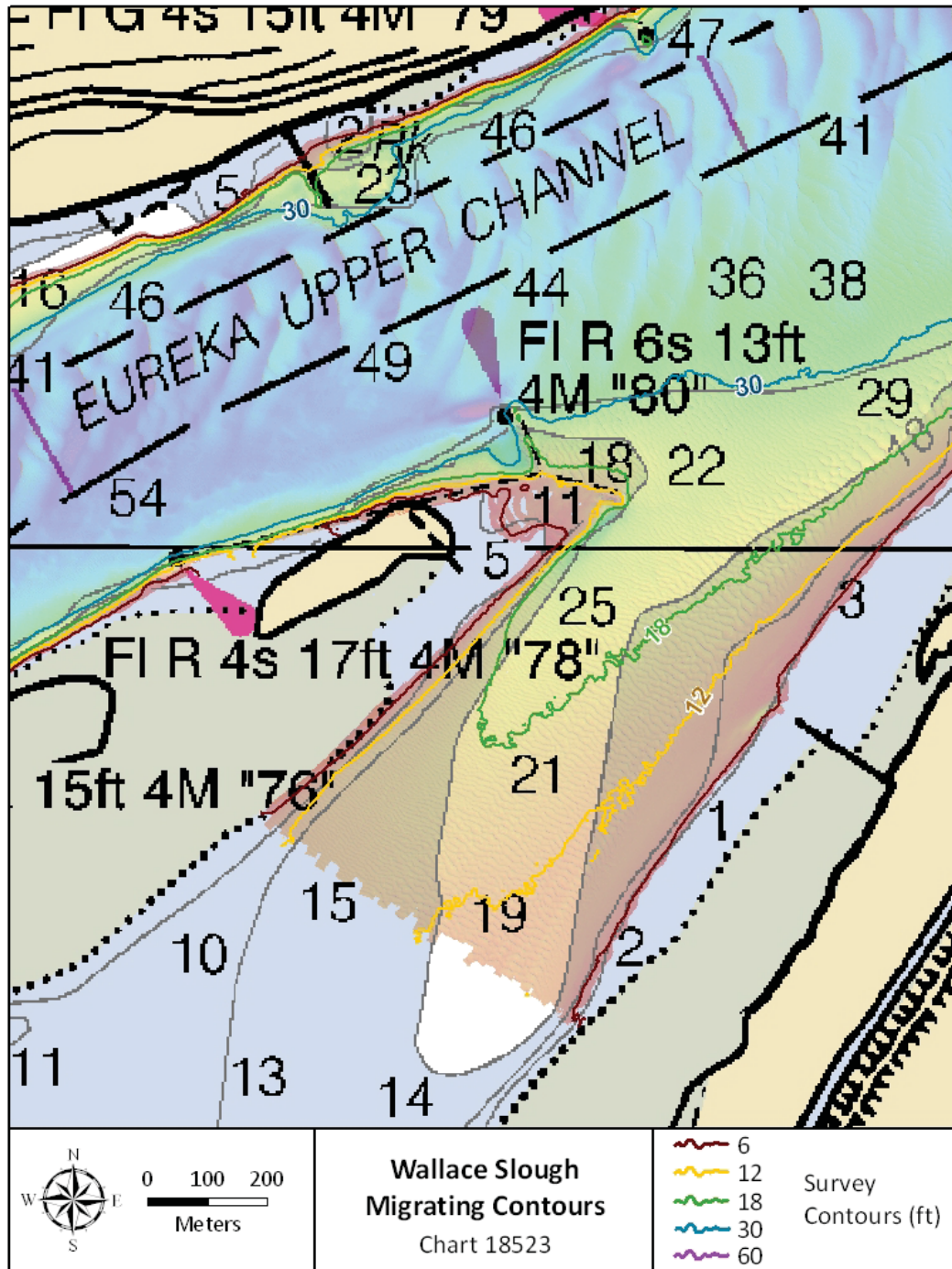
Survey H11855 depths were compared to the charted soundings on Charts 18523 and 18524 and the corresponding ENCs US50R12M and US50R13M. In general there is good agreement between depths from survey H11855 and the chart. Based on the distribution of the differences, the hydrographer believes that the changes are the result of natural shoaling. Discrepancies are discussed below.

The latest electronic and raster versions of the relevant charts were reviewed to ensure that all U.S. Coast Guard Local Notice to Mariners (LNM) issued during survey acquisition, impacting the survey area, were applied and addressed by this survey.



**Chart 18523**

Shoaling has occurred at the upstream entrance to Wallace Slough at CRM 51.5. Both the 12 foot and 18 foot contours have migrated northwest into the channel (Figure 3).<sup>15</sup>



**Figure 3. Migrating 12ft and 18ft contours in upstream entrance to Wallace Slough**

In the vicinity of Stella Range Rear Light (CRM 56.2), the charted depth is 27 feet and surveyed depths range from 3 to 19 feet (Figure 4).<sup>16</sup>

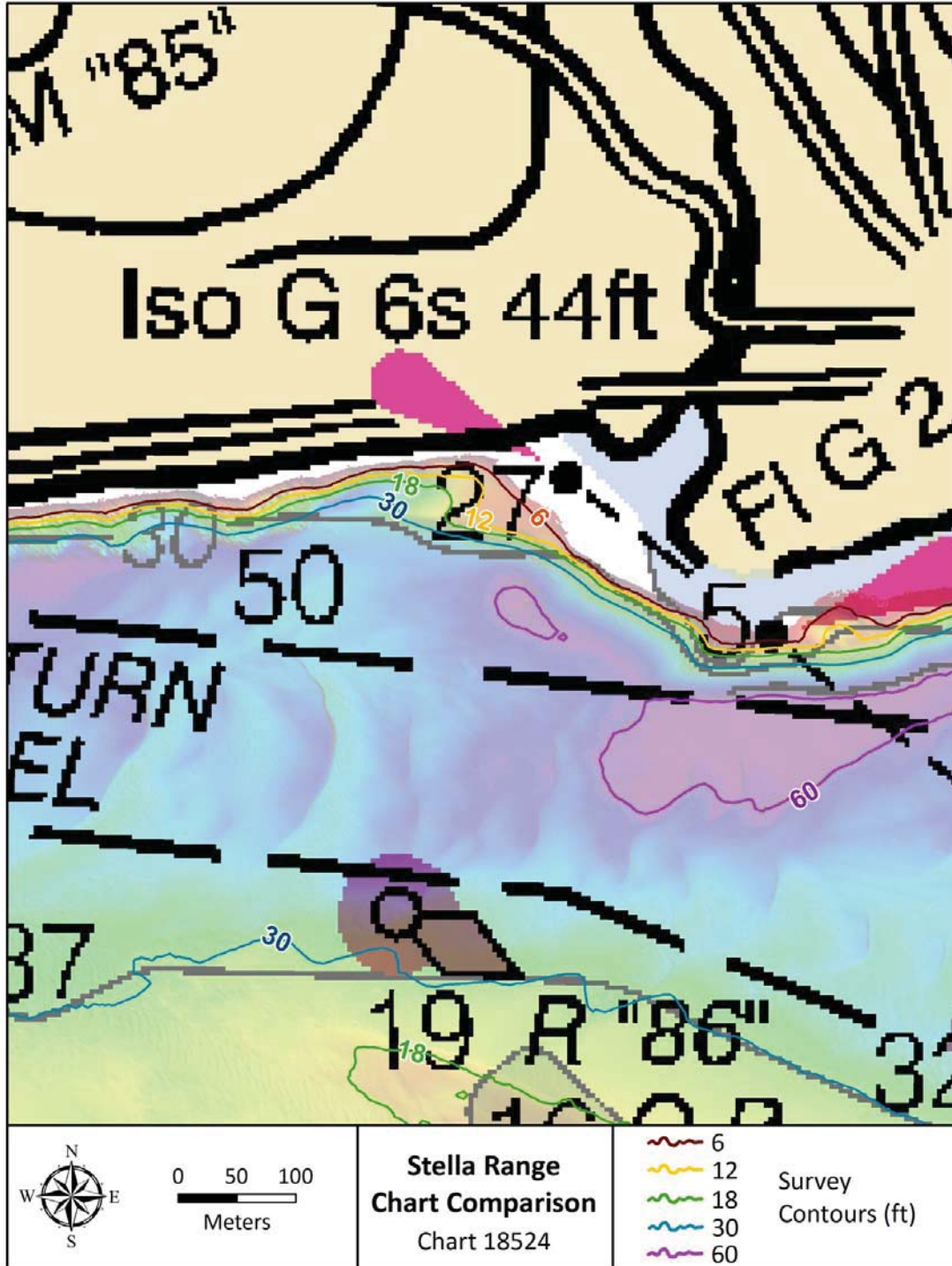


Figure 4. Shoaling near Stella Range Rear Light

There is shoaling throughout Bradbury Slough, with extreme differences of approximately 10ft at 46/10/28.578N, 123/09/43.464W and 46/10/09.581N, 123/08/28.961W (Figure 5).<sup>17</sup>

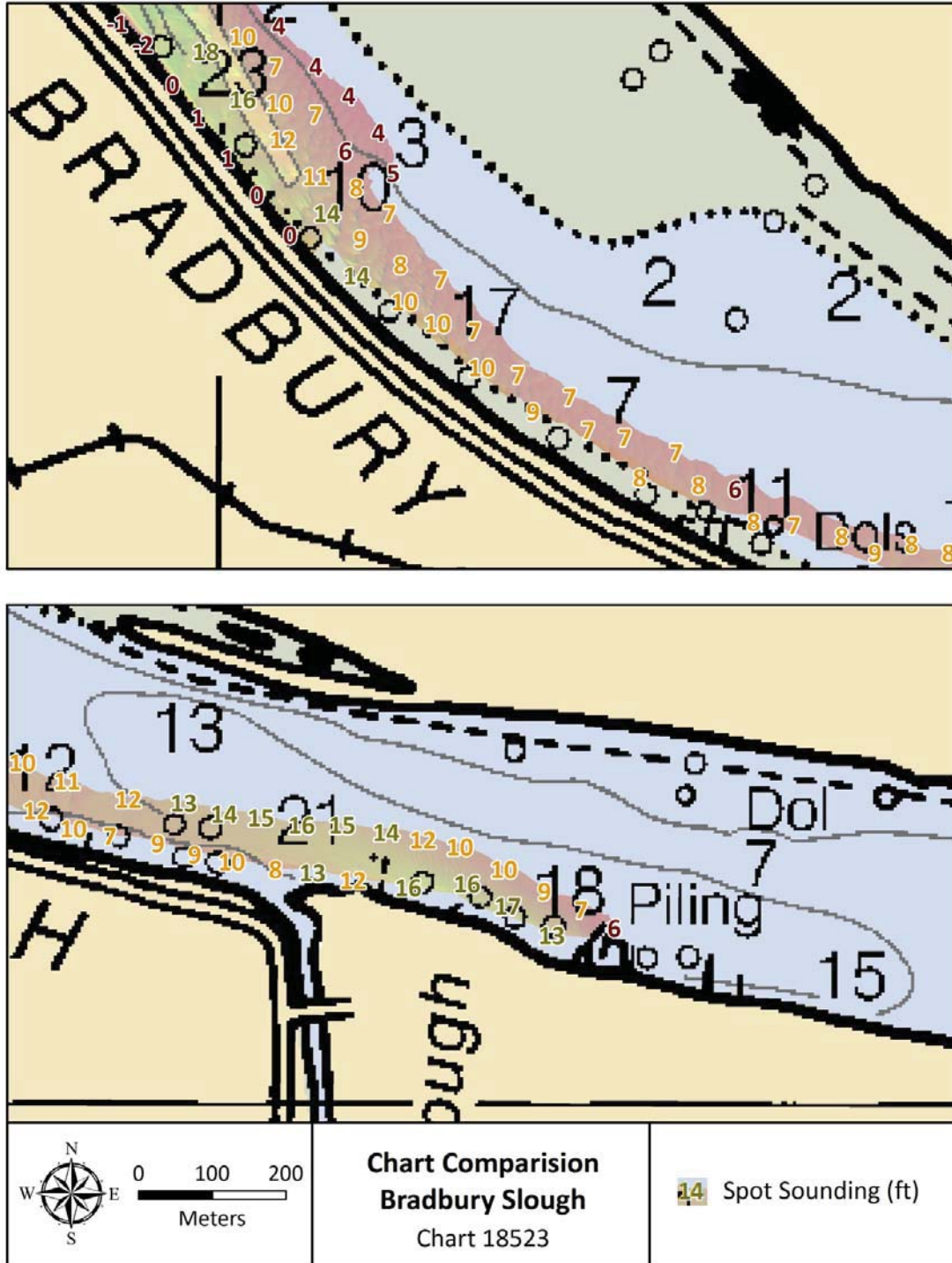
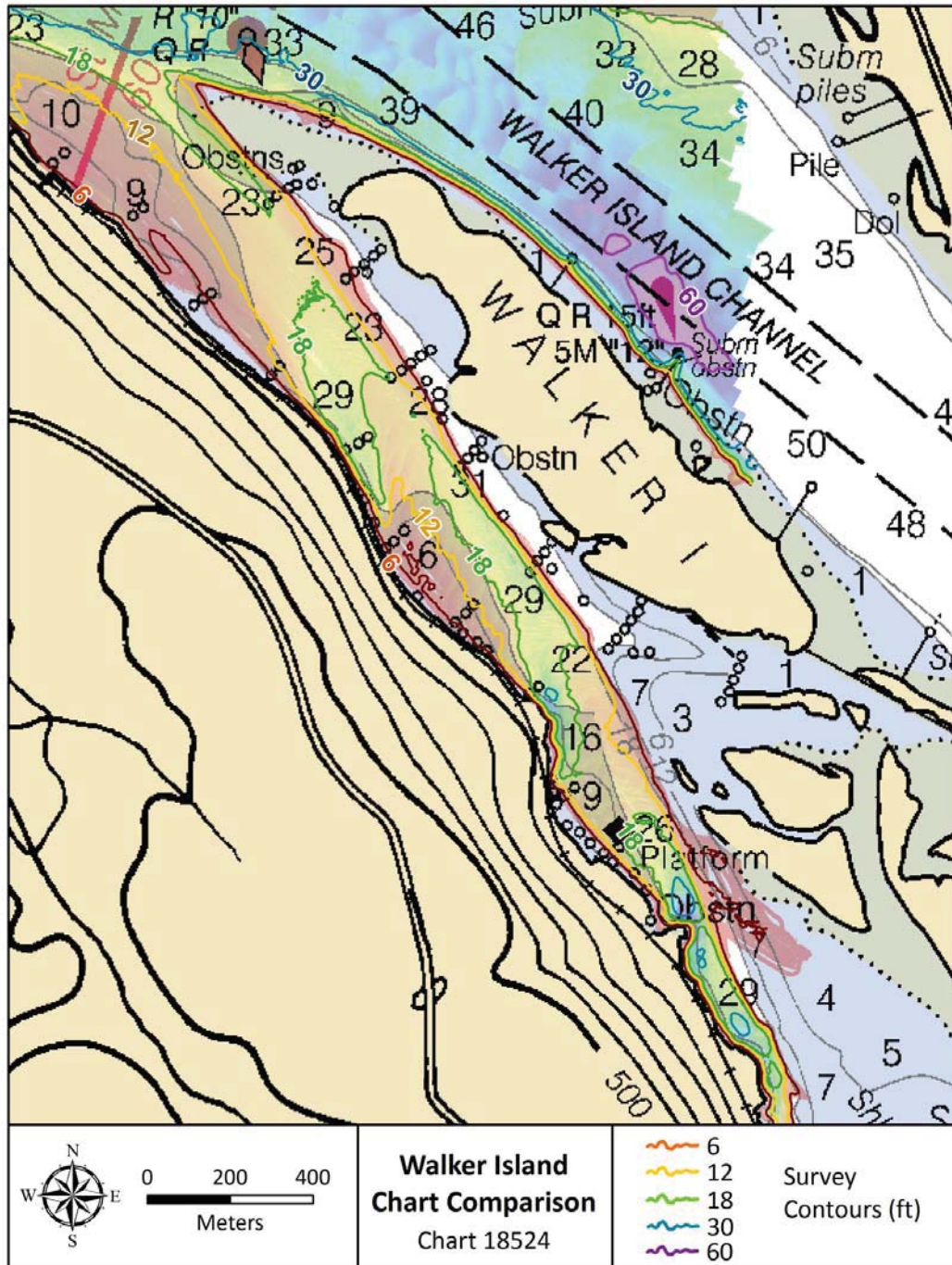


Figure 5. Shoaling in Bradbury Slough

**Chart 18524**

There is shoaling in the channel on the west side of Walker Island and Lord Island represented by the migration of the 18 foot contour towards the center of the channel (Figure 6).<sup>18</sup>



**Figure 6. Migrating 18ft contour behind Walker Island and Lord Island**

The latest electronic and raster versions of the relevant charts were reviewed to ensure that all U.S. Coast Guard Local Notice to Mariners (LNM) issued during survey acquisition and impacting the survey area were applied and addressed by this survey.

***D1.b Comparison to Significant Shoals***

In the area between CRM 54.9 and 55.6 the 18 foot contour has shifted between 70 and 138 meters out from shore.<sup>19</sup>

The shoal between Coal Creek Slough and Crims Island marked by buoy 86 at CRM 56, has lengthened along the channel, by 123m on the north end and 95m on the south end with a least depth of 3 feet.<sup>20</sup>

***D1.c Comparison to Charted Features***

Two (2) AWOIS investigations were assigned within survey H11855 (Figure 7). A complete description is available in Appendix 2 *Feature Reports*.

- The charted rock (AWOIS 53011) at 046/10/22.7N, 123/13/16.7W, was located with 100% shallow water multibeam within the AWOIS radius. The Hydrographer recommends charting the rock based on current hydrography.<sup>21</sup>
- The charted submerged piles (AWOIS 53012) at 046/11/08.9N, 123/11/08.2W were disproved with 100% shallow water multibeam. There were no significant features detected in the MBES within the AWOIS radius. The hydrographer recommends removing the Submerged Piles notation from applicable charts and updating the AWOIS database.<sup>22</sup>

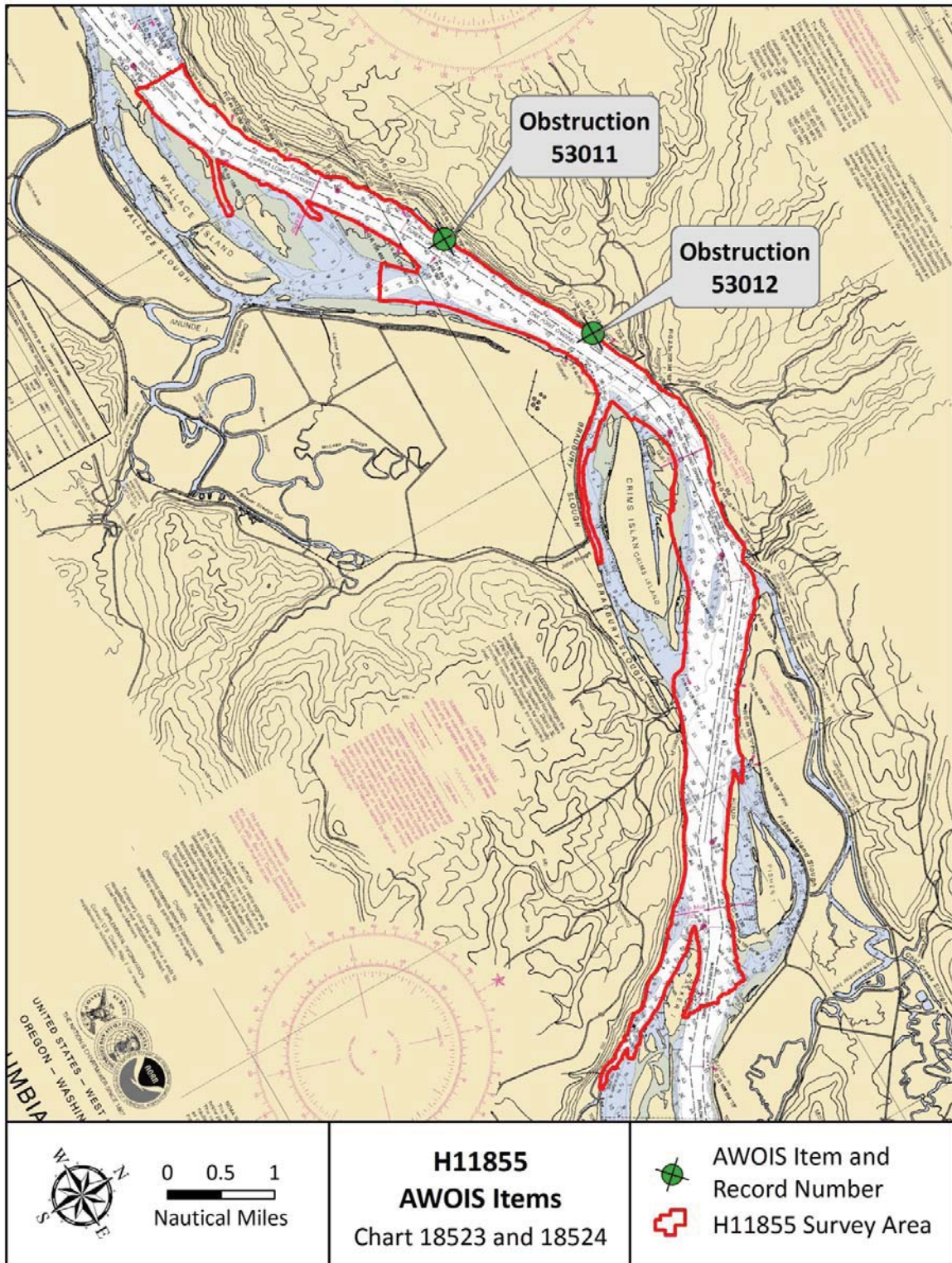


Figure 7. H11855 AWOIS Investigations

There is a pile dike approximately 270 meters upstream from CRM 50 on the Oregon side. It is charted on ENC US50OR12M but not on RNC 18523. This pile dike is approximately 186 meters in length, oriented northwest to southeast. The southeast end was surveyed with MBES and is located at position 46/09/28.053N, 123/14/20.951W.<sup>23</sup>

A complete description is available in *Appendix 2 - Feature Reports*.

**DI.d Comparison of Soundings in Designated Anchorages and Along Channels**

There are no anchorage grounds in survey H11855.<sup>24</sup>

There are eight named Columbia River Channel sections within survey H11855. The project depth is 40 feet for all eight channels and survey H11855 depths are generally deeper. The most recent channel survey is reported to have occurred in February 2009 at which time a minimum depth of 37 feet was found in the left outside quarter of the Stella Range. Table 10 lists the Columbia River channels affected by survey H11855.

**Table 10. Columbia River Channels and Minimum Depths**

Name of Channel	Project Depth (ft)	Controlling Depth (ft)	H11856 Minimum Survey Depth (ft)
Westport Channel (partial)	40	38	39
Eureka Lower Channel	40	46	43
Eureka Upper Channel	40	40	40
Oak Point Channel	40	40	41
Gull Island Turn and Channel	40	40	36
Stella Range	40	37	36
Fisher Island Channel	40	41	40
Walker Island Channel	40	41	39

Six (6) of the eight (8) channels, though generally deeper than the project depth, had shoaler soundings than 40ft.<sup>25</sup>

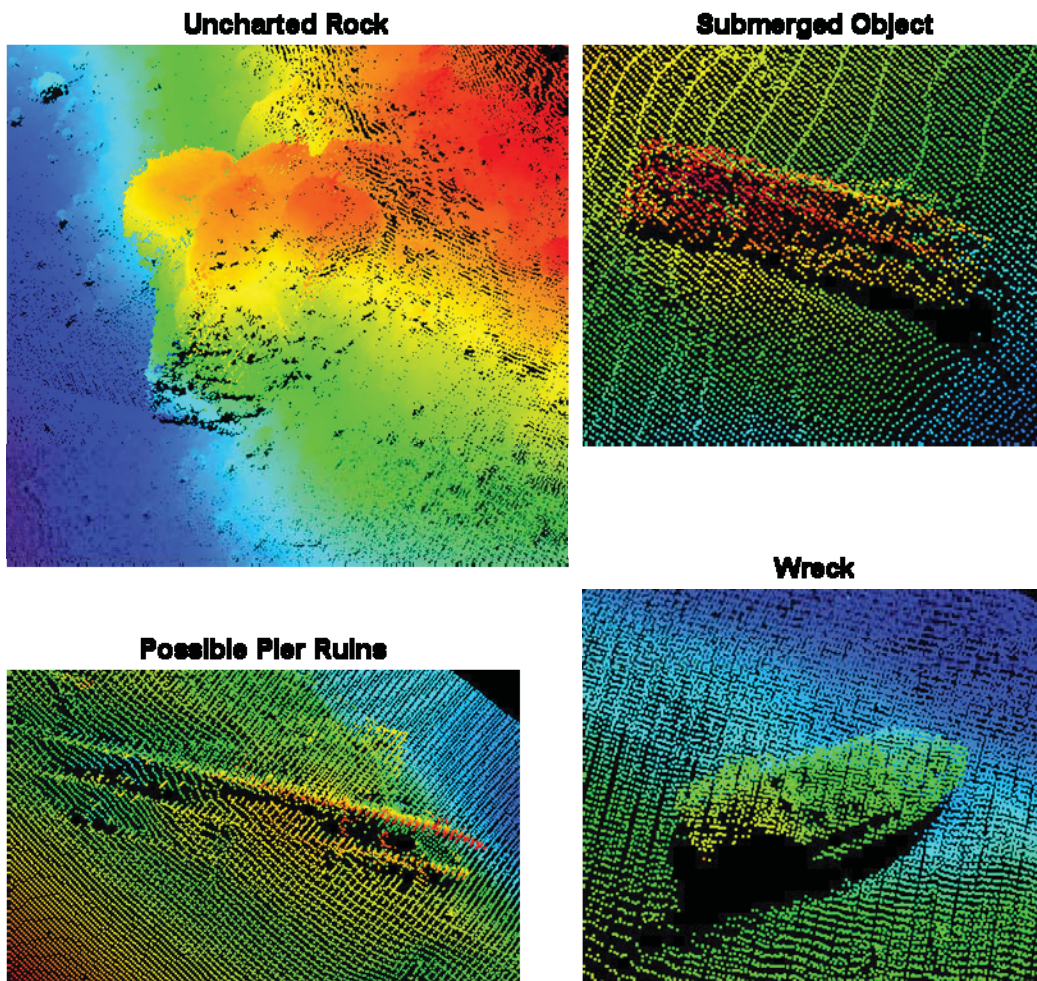
- Surveyed depths of 39ft (11.89m) were found in Westport Channel at 46/08/52.510N, 123/16/39.227W, 46/08/57.595N, 123/16/12.680W, and 46/08/46.974N, 123/16/50.387W.
- Surveyed depth of 36ft (11.81m) was found in the right outside quarter for Gull Island Turn and Channel at 46/11/18.961N, 123/09/34.507W.
- Surveyed depth of 36ft (11.38m) was found in the right outside quarter of Stella Range at 46/10/08.608N, 123/05/16.881W.
- Surveyed depths of 39ft (11.88m) was found in the right outside quarter of Walker Island Channel at 46/09/18.620N, 123/03/25.839W, 46/09/13.118N, 123/03/11.614W, and 46/09/10.582N, 123/03/07.416W.

### ***DI.e New Submerged Features***

New submerged features are listed in tabular format in Appendix II *Survey Feature Report*.<sup>26</sup> Several new items of interest are discussed below and are shown in Figure 8.<sup>27</sup>

Along the Washington shore, three features of interest were found:

- There is an uncharted rock at CRM 50.1, approximately 287 meters upriver from a charted rock.
- There is a large object approximately 34 meters long x 10 meters wide located 87 meters from shore at CRM 50.6.<sup>28</sup>
- There are possible pier ruins 150 meters from shore at CRM 56.7.<sup>29</sup>
- Along the Oregon shore, a wreck was found 23.5 meters northwest of the charted pier at Green Point, at CRM 58.<sup>30</sup>



**Figure 8. 3-D Subset views of new submerged features**



### ***D1.f Dangers to Navigation (DtoN)***

No DtoNs were located during survey H11855.<sup>31</sup>

## **D.2 Additional Results**

### ***D2.a Shoreline Investigations***

Shoreline verification was not required for survey H11855. A new private dock was observed on the Washington shore at CRM 49. The Hydrographer recommends that the charted shoreline and shoreline features be updated.<sup>32</sup>

### ***D2.b Comparison with Prior Surveys***

Comparison with prior surveys was not required under this task order.

### ***D2.c Aids to Navigation (AtoN)***

All U.S. Coast Guard aids to navigation (AtoN) within the survey limits were found to be correctly charted and serving their intended purpose with the following exception<sup>33</sup>:

- A private aid charted at 46/11/06.000N, 123/11/12.000W, was located approximately 63m to the southwest at 46/11/05.605N, 123/11/15.072W.<sup>34</sup>

### ***D2.d Overhead Clearance***

There are no overhead obstructions impacting survey H11855.

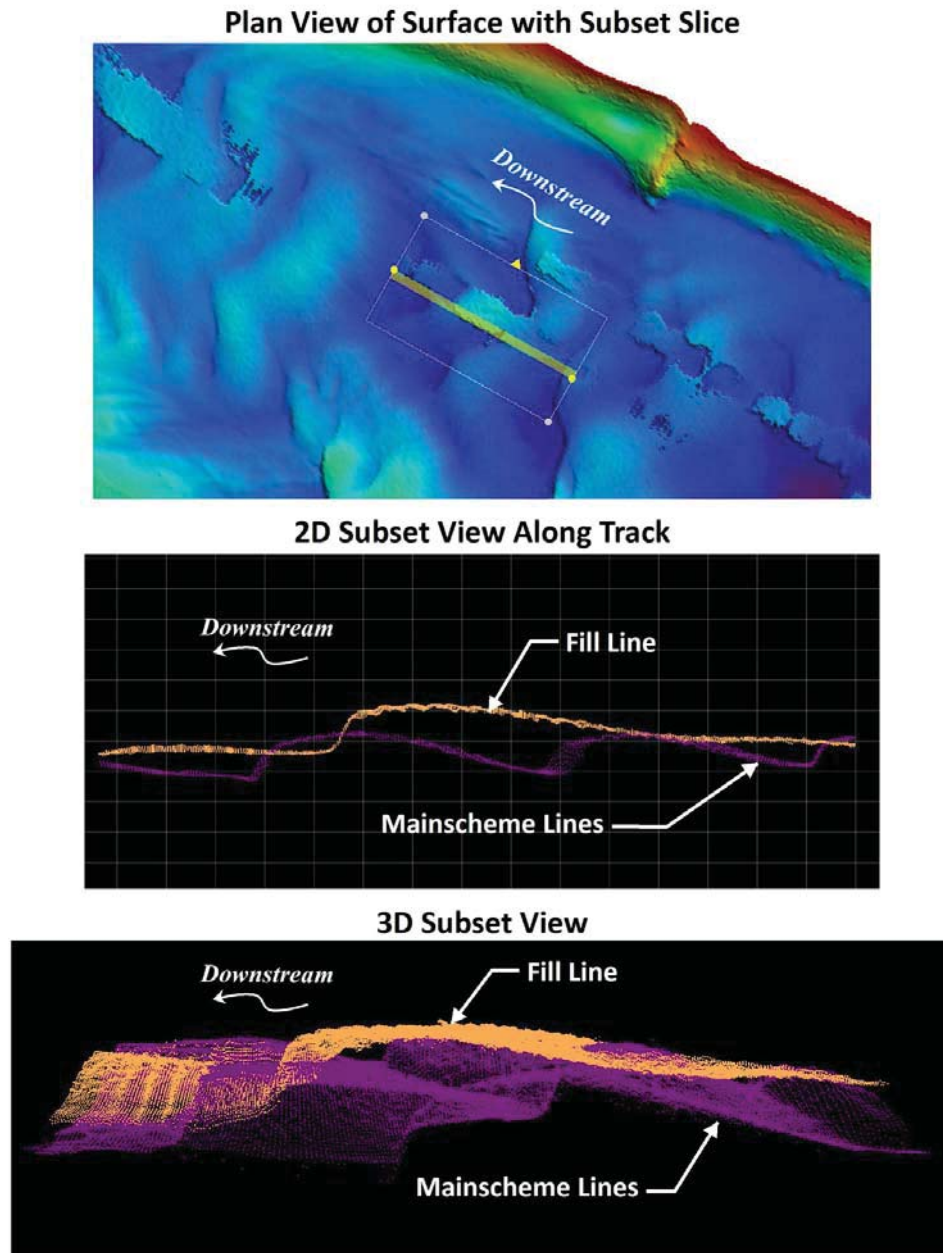
### ***D2.e Cables, Pipelines and Offshore Structures***

A charted pipeline area 300 meters wide spans the river at CRM 54. Just off of the Oregon shore, a 56 meter long section of buried pipe is visible in the multibeam data oriented perpendicular to the shoreline.<sup>35</sup>

### ***D2.f Environmental Conditions Impacting the Quality of the Survey***

Although the survey exceeds IHO Order 1 accuracy requirements, environmental conditions degraded the quality of the survey data. Due to the dynamic nature of the Columbia River with its heavy sediment transport, sand wave migration (up to one meter of downstream migration per day), has altered the river bottom over time, creating an offset between fill and mainscheme data.<sup>36</sup>

The difference in offset varies over the survey, depending upon the local sand wave formation and the time between fill and mainscheme data collection. Figure 9 shows an example of downstream sand wave migration impacting agreement between mainscheme and fill data.



**Figure 9. Sand Wave Migration**

### **D2.g Construction Projects**

Dredge pipes were visible in the multibeam data between CRM 56-57 off the Oregon shore on DNs 287, 288, and 290. One pipe extends from 46/10/36.082N, 123/07/12.952W to 46/10/41.069N, 123/07/03.296W and is approximately 242 meters long. A pair of pipes 3 meters apart extend from 46/10/42.815N, 123/07/20.930W to 46/10/40.550N, 123/07/22.893W and are approximately 82 meters long. The pipes were removed from the dataset.<sup>37</sup>

### **D2.h Bottom Characteristics**

Fourteen (14) bottom samples were obtained on September 29, 2008 (DN273) and are included in the S-57 attributed feature file in the *Supporting Data* folder.<sup>38</sup> A table listing the position and description of each bottom sample is included in Appendix 5 *Supplemental Survey Records and Correspondence*, along with photographs of each sample.<sup>39</sup>

## **E. LETTER OF APPROVAL**

The letter of approval for this report and accompanying data follows on the next page.



## LETTER OF APPROVAL

OPR-N338-KR-08  
REGISTRY NO. H11855

This report and the accompanying data are respectfully submitted.

Field operations contributing to the accomplishment of survey H11855 were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report and associated data have been closely reviewed and are considered complete and adequate as per the OPR-N338-KR-08 *Statement of Work*, dated April 1, 2008.

A handwritten signature in black ink that reads 'Jon L. Dasler'.

Digitally signed by Jon Dasler  
DN: cn=Jon Dasler, email=jld@deainc.com,  
o=David Evans and Associates, Inc., c=US  
Date: 2009.06.19 17:11:55 -07'00'

---

Jonathan L. Dasler, PE (OR), PLS (OR, CA)  
ACSM/THSOA Certified Hydrographer  
Chief of Party

A handwritten signature in black ink that reads 'Jason Creech'.

Digitally signed by Jason Creech  
DN: cn=Jason Creech, email=jasc@deainc.  
com, o=David Evans and Associates, Inc., c=US  
Date: 2009.06.19 17:12:35 -07'00'

---

Jason Creech  
Lead Hydrographer

David Evans and Associates, Inc.  
March 2009

## F. SUPPLEMENTAL REPORTS

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

<b><u>Title</u></b>	<b><u>Submittal Date</u></b>
OPR-N338-KR-08 Data Acquisition and Processing Report	June 17, 2009
OPR-N338-KR-08 Horizontal and Vertical Control Report	TBD <sup>40</sup>

## **Revisions and Corrections Compiled During Office Processing and Certification**

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<sup>1</sup> See the Horizontal and Vertical Control Report filed with project records.

<sup>2</sup> Filed with project records.

<sup>3</sup> Separates are filed with hydrographic records.

<sup>4</sup> Filed with hydrographic records.

<sup>5</sup> Concur.

<sup>6</sup> Concur. These data are adequate to supersede charted data in the common area.

<sup>7</sup> Concur. Compiler recommends a note be added to the charts stating that mariners use caution when navigating outside the maintained channels.

<sup>8</sup> Despite the artifacts from the bottom tracking algorithm, the data meets specification.

<sup>9</sup> Concur.

<sup>10</sup> Filed with hydrographic records.

<sup>11</sup> Concur.

<sup>12</sup> Concur.

<sup>13</sup> Concur.

<sup>14</sup> Filed with project records.

<sup>15</sup> Concur. Updated soundings are included in HCell H11855. Recommend charted contours be updated accordingly.

<sup>16</sup> Concur. Updated soundings are included in HCell H11855.

<sup>17</sup> Concur. Updated soundings are included in HCell H11855. Recommend charted contours be updated accordingly.

<sup>18</sup> Concur. Updated soundings are included in HCell H11855. Recommend charted contours be updated accordingly.

<sup>19</sup> Recommend charted contours be updated based on new survey data.

<sup>20</sup> Concur. Updated soundings are included in HCell H11855. Recommend charted contours be updated accordingly.

<sup>21</sup> Concur with clarification. The verified rock and updated soundings are included in HCell H11855; however, the AWOIS report for this item does not properly depict the actual feature and investigation because the rock is not shown in the images. Recommend using the description of the item in the Descriptive Report for updating the AWOIS database.

<sup>22</sup> Concur. The submerged piles notation has been blue noted to be removed in HCell H11855.

<sup>23</sup> The dyke feature has been imported from ENC US5OR12M with an indication in the NINFOM field to be added to raster chart 18523.

<sup>24</sup> Concur.

<sup>25</sup> The US Army Corps of Engineers Portland District has been contacted and have been made aware of the survey results. Given the fact that the Columbia River Channels are continually being dredged, it is recommended that the tabulated depths for each channel be updated with the latest survey information.

<sup>26</sup> See attached feature report.

<sup>27</sup> The submerged features discussed below are included in the HCell as UWTRC, WRECKS and OBSTRN features.

<sup>28</sup> Recommend adding submerged object located at 46-11-06.7708N, 123-06-53.8711W to the AWOIS database.

<sup>29</sup> Recommend adding possible pier ruins located at 46-10-01.4218N, 123-14-09.5780W to the AWOIS database.

<sup>30</sup> Recommend adding new wreck located at 46-10-03.2840N, 123-05-58.2997W to the AWOIS database.

<sup>31</sup> Concur.

<sup>32</sup> Do not concur. The new private dock is not included in HCell H11855 because it was not included in either the feature report or the submitted feature file. In any case, at the given location, it is not likely that the dock could be adequately depicted at chart scale. Recommend reviewing RSD shoreline when applying HCell H11855 to the charts.

<sup>33</sup> Chart ATONs using latest ATONIS information.

<sup>34</sup> An uncharted private aid was found during H11855 located at 46-10-19.873N, 123-05-18.941W. The new private aid is included in the HCell at the surveyed position.

<sup>35</sup> Since the uncharted section of pipeline is located within a charted pipeline area, it is not included in HCell H11855.

<sup>36</sup> These data are adequate to supersede charted data in the common area despite the shifting nature of the sandwaves. Compiler recommends a note be added to the chart stating that mariners use caution when navigating outside the maintained channels.

<sup>37</sup> Concur.

<sup>38</sup> Fourteen bottom samples were collected during H11855 and all are included in the HCell. No charted bottom samples were retained.

<sup>39</sup> Filed with hydrographic records.

<sup>40</sup> The Horizontal and Vertical Control Report was submitted July 22, 2009.

**APPENDIX II**  
**SURVEY FEATURE REPORT**





**Registry Number:** H11855  
**State:** Oregon  
**Locality:** Columbia River  
**Sub-locality:** Wallace Island to Walker Island  
**Project Number:** OPR-N338-KR-08  
**Survey Date:** October 8, 2008 – March 4, 2009

**List of Features**

AWOIS # 53011 .....	2
AWOIS # 53012 .....	3

**AWOIS # 53011**

**REPORTED**

FEATURE	RADIUS	LATITUDE (N)	LONGITUDE (W)
AWOIS #53011	75m	046/10/22.7N	123/13/16.7W

**SURVEYED**

FEATURE	LEAST DEPTH	LATITUDE (N)	LONGITUDE (W)
OBSTRUCTION 20.8ft	(6.34m)	46/10/21.348N	123/13/16.197W

**Remarks:**

The charted rock, (AWOIS 53011) at 046/10/22.7N, 123/13/16.7W was found with 100% shallow water multibeam within the AWOIS radius. The multibeam least depth of 6.34 m (20.8ft.) was located at 46/10/21.348N, 123/13/16.197W. The AWOIS item is located between a charted rock and the charted 18ft contour. There is a ridge located approximately 25m outside the AWOIS radius with a least depth of 6.06m (19.9ft).

**Hydrographer Recommendation:**

The hydrographer recommends charting the rock based on current hydrography.

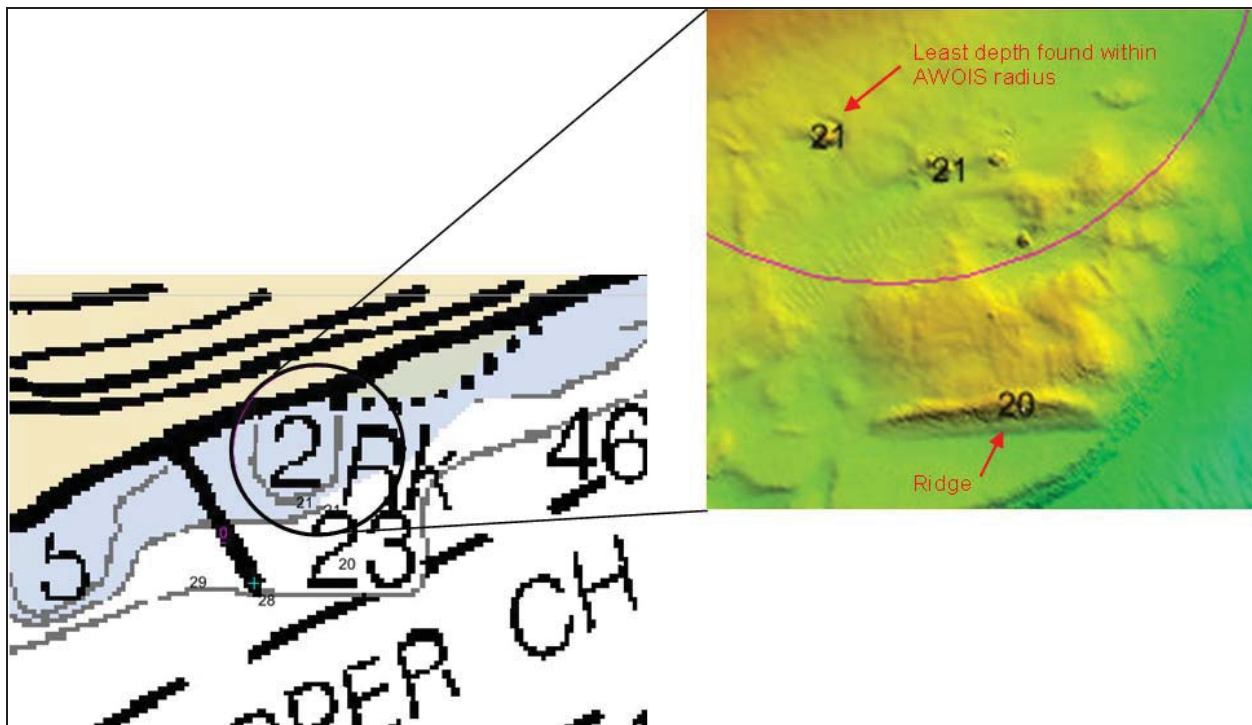


Figure 1: AWOIS search radius, chart 18523, and multibeam coverage.

**AWOIS # 53012**

**REPORTED**

FEATURE	RADIUS	LATITUDE (N)	LONGITUDE (W)
AWOIS #53012	100m	046/11/08.9N	123/11/08.2W

**SURVEYED**

FEATURE	LEAST DEPTH	LATITUDE (N)	LONGITUDE (W)
DISPROVAL N/A		N/A	N/A

**Remarks:**

Charted submerged piles (AW OIS 53012) at 0 46/11/08.9N, 123/11/08.2W were disproved with 100% shallow water m ultibeam. There were no significant features det ected in th e multibeam coverage within the AWOIS radius.

**Hydrographer Recommendation:**

The hydrographer recommends removing the submerged piles annotation and updating the AWOIS database as disproved.

**Appendix II**  
**S-57 Features**

OPR-N338-KR-08  
H11855  
Survey Features  
MORFAC

**Disproved:**

ENC Latitude (N)	ENC Longitude (W)	Surveyed Latitude (N)	Surveyed Longitude (W)	Remarks
46-09-44.397	123-05-10.703	--	--	Disproved

**New:**

ENC Latitude (N)	ENC Longitude (W)	Surveyed Latitude (N)	Surveyed Longitude (W)	Remarks
--	--	46-09-09.665	123-03-55.478	New dolphin
--	--	46-09-11.461	123-03-57.304	New dolphin
--	--	46-10-31.199	123-09-54.083	New dolphin
--	--	46-10-31.670	123-09-54.796	Charted as PILPNT on RNC 18523 and ENC US5OR12M, feature is a dolphin.
--	--	46-10-32.236	123-09-55.458	New dolphin
--	--	46-10-32.750	123-09-56.052	New dolphin
--	--	46-10-33.287	123-09-56.668	New dolphin
--	--	46-10-33.838	123-09-57.283	New dolphin
--	--	46-10-34.421	123-09-57.928	New dolphin
--	--	46-10-34.939	123-09-58.522	New dolphin
--	--	46-10-35.522	123-09-59.252	Charted as PILPNT on RNC 18523 and ENC US5OR12M, feature is a dolphin.
--	--	46-10-36.091	123-09-59.915	New dolphin
--	--	46-10-36.671	123-10-00.527	New dolphin
--	--	46-10-37.247	123-10-01.175	New dolphin
--	--	46-10-37.772	123-10-01.754	New dolphin
--	--	46-10-38.298	123-10-02.348	New dolphin
--	--	46-10-38.849	123-10-02.950	New dolphin
--	--	46-10-39.367	123-10-03.572	New dolphin
--	--	46-10-39.990	123-10-04.246	Charted as PILPNT on RNC 18523 and ENC US5OR12M, feature is a dolphin.
--	--	46-10-40.505	123-10-04.822	New dolphin
--	--	46-10-41.045	123-10-05.434	New dolphin
--	--	46-10-41.552	123-10-06.006	New dolphin
--	--	46-10-42.103	123-10-06.625	New dolphin

OPR-N338-KR-08  
 H11855  
 Survey Features  
 MORFAC

New:

ENC Latitude (N)	ENC Longitude (W)	Surveyed Latitude (N)	Surveyed Longitude (W)	Remarks
--	--	46-10-42.643	123-10-07.234	New dolphin
--	--	46-10-43.223	123-10-07.896	Charted as PILPNT on RNC 18523 and ENC US5OR12M, feature is a dolphin.
--	--	46-10-43.774	123-10-08.638	New dolphin
--	--	46-10-44.245	123-10-09.264	New dolphin
--	--	46-10-44.782	123-10-09.966	New dolphin
--	--	46-10-45.268	123-10-10.618	New dolphin
--	--	46-10-45.804	123-10-11.323	New dolphin
--	--	46-10-46.301	123-10-11.989	New dolphin
--	--	46-10-46.816	123-10-12.662	Charted as PILPNT on RNC 18523 and ENC US5OR12M, feature is a dolphin.
--	--	46-10-47.309	123-10-13.321	New dolphin
--	--	46-10-47.816	123-10-14.002	New dolphin
--	--	46-10-48.328	123-10-14.693	New dolphin
--	--	46-10-48.839	123-10-15.370	Charted as PILPNT ENC US5OR12M, feature is a dolphin.
--	--	46-10-49.350	123-10-16.061	New dolphin
--	--	46-10-49.897	123-10-16.810	New dolphin
--	--	46-10-12.892	123-13-49.144	New dolphin
--	--	46-10-12.253	123-13-50.259	New dolphin

OPR-N338-KR-08  
 H11855  
 Survey Features  
 OBSTRN

**Disproved:**

ENC Latitude (N)	ENC Longitude (W)	Surveyed Latitude (N)	Surveyed Longitude (W)	Remarks
46-09-20.233	123-02-40.187	--	--	Disproved
46-09-30.248	123-04-33.040	--	--	Disproved

**New:**

ENC Latitude (N)	ENC Longitude (W)	Surveyed Latitude (N)	Surveyed Longitude (W)	Remarks
--	--	46-08-07.706	123-02-42.414	Snag/stump
--	--	46-08-55.579	123-03-18.677	Snag/stump
--	--	46-08-54.484	123-03-29.601	Snag/stump
--	--	46-09-12.576	123-03-37.494	Submerged pile
--	--	46-11-06.771	123-06-53.871	Debris
--	--	46-11-03.664	123-08-38.835	Snag/stump; covers and uncovers
--	--	46-10-01.422	123-14-09.578	Submerged object

OPR-N338-KR-08  
H11855  
Survey Features  
PILPNT

**Disproved:**

ENC Latitude (N)	ENC Longitude (W)	Surveyed Latitude (N)	Surveyed Longitude (W)	Remarks
46-08-10.994	123-02-45.702	--	--	Disproved
46-08-17.744	123-02-52.761	--	--	Disproved
46-08-25.566	123-02-56.779	--	--	Disproved
46-08-25.017	123-02-57.690	--	--	Disproved
46-10-55.316	123-07-28.413	--	--	Disproved
46-10-07.935	123-08-30.032	--	--	Disproved
46-11-04.408	123-08-31.629	--	--	Disproved
46-10-09.214	123-08-34.713	--	--	Disproved
46-10-09.870	123-08-38.362	--	--	Disproved
46-10-12.246	123-08-51.867	--	--	Disproved
46-10-12.389	123-08-54.036	--	--	Disproved
46-10-31.640	123-09-54.327	--	--	Disproved
46-10-35.711	123-09-58.436	--	--	Disproved
46-10-40.054	123-10-03.754	--	--	Disproved
46-10-43.450	123-10-07.922	--	--	Disproved
46-10-46.852	123-10-12.292	--	--	Disproved
46-10-49.112	123-10-15.279	--	--	Disproved
46-10-54.403	123-10-58.338	--	--	Disproved
46-10-34.191	123-12-39.974	--	--	Disproved

**New:**

ENC Latitude (N)	ENC Longitude (W)	Surveyed Latitude (N)	Surveyed Longitude (W)	Remarks
--	--	46-07-43.075	123-02-21.628	New pile
--	--	46-07-45.714	123-02-26.185	New pile
--	--	46-08-31.290	123-02-52.667	Baring snag
--	--	46-09-06.055	123-03-45.421	New pile
--	--	46-09-08.273	123-03-49.576	New pile



OPR-N338-KR-08  
 H11855  
 Survey Features  
 PILPNT

**New:**

ENC Latitude (N)	ENC Longitude (W)	Surveyed Latitude (N)	Surveyed Longitude (W)	Remarks
--	--	46-10-00.178	123-05-46.748	New pile
--	--	46-10-01.293	123-05-50.776	New pile
--	--	46-11-20.810	123-07-36.537	New pile
--	--	46-11-22.056	123-07-39.680	New pile
--	--	46-11-21.827	123-07-41.695	New pile
--	--	46-11-32.860	123-09-13.198	New pile
--	--	46-11-22.910	123-10-20.175	New pile
--	--	46-10-03.562	123-14-07.325	Eastern extent of group of piles
--	--	46-10-02.788	123-14-08.898	Center of group of piles
--	--	46-10-02.525	123-14-09.586	Western extent of group of piles
--	--	46-10-01.024	123-14-14.543	New pile
--	--	46-10-00.786	123-14-15.166	New pile
--	--	46-10-00.721	123-14-15.900	New pile
--	--	46-09-12.271	123-15-55.038	Group of three piles
--	--	46-09-07.841	123-16-16.054	Eastern extent of group of piles
--	--	46-09-07.549	123-16-17.476	Western extent of group of piles

OPR-N338-KR-08  
H11855  
Survey Features  
UTWROC

**New:**

ENC Latitude (N)	ENC Longitude (W)	Surveyed Latitude (N)	Surveyed Longitude (W)	Remarks
--	--	46-09-44.118	123-14-43.242	Uncharted submerged rock
--	--	6-10-22.999	123-13-15.497	New least depth
--	--	6-09-37.412	123-14-53.640	New least depth

OPR-N338-KR-08  
H11855  
Survey Features  
WRECKS

**New:**

ENC Latitude (N)	ENC Longitude (W)	Surveyed Latitude (N)	Surveyed Longitude (W)	Remarks
--	--	46-10-03.284	123-05-58.300	Uncharted wreck

OPR-N338-KR-08  
H11855  
Survey Features  
BOYSPP

**New:**

ENC Latitude (N)	ENC Longitude (W)	Surveyed Latitude (N)	Surveyed Longitude (W)	Remarks
--	--	46-10-19.873	123-05-18.941	Uncharted private buoy

OPR-N338-KR-08  
H11855  
Survey Features  
PIPSOL

**New:**

Surveyed SOL Latitude (N)	Surveyed SOL Longitude (W)	Surveyed EOL Latitude (N)	Surveyed EOL Longitude (W)	Remarks
46-10-55.985	123-10-33.548	46-10-57.654	123-10-34.560	new pipeline; length 56m

**H11855 HCell Report**  
Katie Reser, Physical Scientist  
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 US5OR12M and US5OR13M, and NOAA RNC's 18523 and 18524.

HCell compilation of survey H11855 used Pacific Hydrographic Branch HCell Reference Guide Version 2.0-Draft.

**1. Compilation Scale**

Depths for HCell H11855 were compiled to the largest scale charts in the region, 18523 (56<sup>th</sup> Ed., October 2006, 1:40,000) and 18524 (36<sup>th</sup> Ed., December 2006, 1:40,000). The density and distribution of soundings from H11855 were selected to emulate the distribution on the charts. Non-bathymetric features have been generalized to chart scale.

**2. Soundings**

A survey-scale sounding (SOUNDG) feature object layer was built from the 0.5-meter combined surface, **H11855\_50cm\_Combined**, and the 2-meter VBES surface, **H11855\_VBES\_Uncertainty\_2m\_Final**, in CARIS BASE Editor. A shoal-biased selection was made at 1:10,000 scale for the main chart area using a Radius Table file with values shown in the table, below.

Upper limit (m)	Lower limit (m)	Radius (mm)
0 10		3
10 20		4
20 50		4.5
50	500	5

In CARIS BASE Editor soundings were manually selected from the high density sounding layers and imported into a new layer created to accommodate chart and inset 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 \*\_SS HCell for MCD raster charting division to use for guidance in creating chart contours. The generalized metric and feet equivalent contour values are shown in the table below.

Chart Contours in Feet	Metric Equivalent of Chart Contours	Metric Equivalent of Chart Contours NOAA Rounded	Actual Value of Chart Contours
0 0.00		0.2286	0.75
6 1.829		2.0574	6.75
12 3.658		3.8862	12.75
18 5.486		5.715	18.75
30 9.144		9.3726	30.75
60 18.288		18.5166	60.75

Contours delivered in the \*\_SS file have not been de-conflicted against shoreline features, soundings and hydrography as all other features in the \*\_CS file and soundings in the \*\_SS have been. This results in conflicts between the \*\_SS file contours and HCell features at or near the survey limits. HCell features should be honored over \*\_SS.000 file contours in all cases where conflicts are found.

#### 4. Meta Areas

The following Meta object areas are included in HCell 11855:

M\_QUAL

Meta area objects were constructed on the basis of the limits of the hydrography. Due to the complexity of the extents generated during contour creation from the **H11855\_50cm\_Combined** and **H11855\_VBES\_Uncertainty\_2m\_Final** surfaces, the limits of the coverage area were derived from a combination of auto-generating from the surface and hand digitizing.

#### 5. Features

Shoreline features for H11855 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 the chart and hydrography during office processing.

There were no DTONs reported from survey H11855.

There were two AWOIS items in the limits of H11855 and both were investigated. One AWOIS item was verified and is included in the HCell. The other item was disproved and has been blue noted to be removed.

Fourteen bottom samples were collected during H11855 and all are included in the HCell. No charted bottom samples were retained.

The source of all features included in the H11855 HCell can be determined by the SORIND field.

## 6. S-57 Objects and Attributes

The \*\_CS HCell contains the following Objects:

SOUNDG	Chart scale soundings
UWTROC	Rock features
OBSTRN	Foul areas and obstructions
BOYSPP	Private ATON
PILPNT	Piles
MORFAC	Dolphins
SLCONS	Line of dolphins
SBDARE Bottom	samples
DYKCON Pile	dyke
M_QUAL	Data quality Meta object
\$CSYMB	Blue notes
\$LINES	Linear blue note features

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 PHB HCell Reference Guide.

## 7. Blue Notes

Notes to the RNC and ENC chart compilers are included in the HCell as \$CSYMB features with the blue note information and charting disposition located in the NINFOM field. In this HCell, linear blue notes were also submitted as \$LINES to indicate areas where charted shoreline or linear features require modification based on new survey data. Blue note information and charting disposition for the linear features are also located in the NINFOM field.

## 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 CRD (1983-2001 NTDE) sounding datums.



## 8.2 Horizontal and Vertical Units

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

Chart Unit Base Cell Units:

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

During creation of the HCell in CARIS BASE Editor and CARIS S-57 Composer, all soundings and features are maintained in metric units with as high precision as possible. Depth units for soundings measured with sonar maintain millimeter precision. Depths on rocks above CRD 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

Conversion to charting units and application of NOAA rounding is completed in the same step, at the end of the HCell compilation process.

Conversion to feet charting units with NOAA rounding ensures that:

- All depths display as whole feet.
- 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.

## 9. Data Processing Notes

### 9.1 Junctions

H11855 junctions with surveys H11854 and H11856. H11854 has already been compiled and a junction was made between the surveys. A common junction will be made with survey H11856 when it is compiled.

### 9.2 Conflicts between Shoreline and Hydrography

There are instances of charted shoreline in conflict with hydrography. These were examined using the highest resolution Surfaces. Conflicts were given a blue note with a recommendation to adjust the charted shoreline using the new survey data.

## 10. QA/QC and ENC Validation Checks

H11855 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

- H11855 Base Cell File, Chart Units, Soundings compiled to 1:40,000
- H11855 Base Cell File, Chart Units, Soundings compiled to 1:10,000
- H11855 Base Cell File, Metric Units, Features compiled to 1:10,000
- H11855 Descriptive Report including end notes compiled during office processing and certification, the HCell Report, and supplemental items
- H11855 Survey Outline to populate SURDEX

### 11.2 File Naming Conventions

- Chart units base cell file, chart scale soundings H11855\_CS.000
- Chart units base cell file, survey scale soundings H11855\_SS.000
- Metric base cell file, survey scale features H11855\_Features.000
- Descriptive Report package H11855\_DR.pdf
- Survey outline H11855\_Outlin e.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.
HydroService AS, 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:


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APPROVAL SHEET  
H11855


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

 Katie Reser  
2010.05.04  
09:22:00 -07'00'

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

 Digitally signed by Pete Holmberg  
DN: cn=Pete Holmberg, o=NOAA,  
ou=PHB,  
email=peter.holmberg@noaa.gov,  
c=US  
Date: 2010.05.04 13:13:22 -07'00'

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.

 Gary C. Nelson  
2010.05.04  
09:54:06 -07'00'