H12399

NOAA Form 76-35A

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Survey

DESCRIPTIVE REPORT

Type of Survey: Navigable Area

Registry Number: H12399

LOCALITY

State: Alaska

General Locality: Nushagak Bay

Sub-locality: Coffee Point to Ekuk

2012

CHIEF OF PARTY
Marta Krynytzky

LIBRARY & ARCHIVES

Date:

NOAA FORM 77-28 (11-72)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBER:
HYDROGRAPHIC TITLE SHEET		**H12399**

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

State:	**Alaska**
General Locality:	**Nushagak Bay**
Sub-Locality:	**Coffee Point to Ekuk**
Scale:	**1: 40,000**
Dates of Survey:	**05/24/2012 to 8/14/2012**
Instructions Dated:	**03/22/2012**
Project Number:	**OPR-R306-KR-12**
Field Unit:	**TERRASOND PERSONNEL**
Chief of Party:	**Marta Krynytzky**
Soundings by:	**ECHO SOUNDER -- HULL MOUNTED**
Imagery by:	
Verification by:	**Pacific Hydrographic Branch**
Soundings Acquired in:	**Meters at Mean Lower Low Water**
H-Cell Compilation Units:	**Meters at Mean Lower Low Water**

Remarks:

Horizontal Coordinate System: UTM Zone 4N. 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. All pertinent records for this survey, including the Descriptive Report, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via http://www.ngdc.noaa.gov/.

A. Area Surveyed

A navigable area survey was conducted from Coffee Point to Ekuk, Alaska, in accordance with the NOAA, National Ocean Service, *Statement of Work* (SOW), OPR-R306-KR-12, dated May 4, 2012 and *Hydrographic Survey Project Instructions* dated March 22, 2012. Survey data collection for H12399 began May 24, 2012 and ended August 14, 2012.

At the time of this survey, the largest scale (1:100,000) chart (number 16322 8th edition, March 2004) covers Nushagak Bay and its Approaches. The chart is out of date with wide scale inaccuracies evident.

The survey is in an Arctic area that is partially frozen for a large portion of the year. Strong currents are always prevalent and can be extreme due to the combination of both river and tidal constituents. The tide range is high, on the order of 4-6 meters (m) daily. Unfavorable weather conditions and sea states are common, even in the summer.

The ice free season is typically mid-May to early October. During this time, many tug-and-barge vessels, which draft up to 4 m, transit the area heading to Dillingham hauling fuel, gravel and other supplies. A fishing fleet of several hundred vessels operate in the area fishing the various salmon openers (May through August). Approximately half a dozen large tenders and processors inhabit the project area throughout the fishing season, anchoring where needed, to service the fishing fleet. Fishing vessels from Dillingham not only harvest in Nushagak River and Nushagak Bay, but also transit to other areas of Bristol Bay to fish. Still more fishing vessels migrate to Nushagak Bay from Seattle, Bellingham and other ports outside Alaska. Fishing vessels operating in the area are typically no more than 10 m in length with drafts of 1-2 m.

Vertical beam echo sounder (VBES) data was collected on this project at 100 m line spacing. Mainscheme lines were normally collected perpendicular to the channel direction and current and were carried into the 2 m curve when conditions allowed.

The area is shallow and highly changeable. Some areas have numerous shifting sandbars and shoals, while other areas remain relatively consistent. Changes in bottom depth and topography were common over the course of the survey.

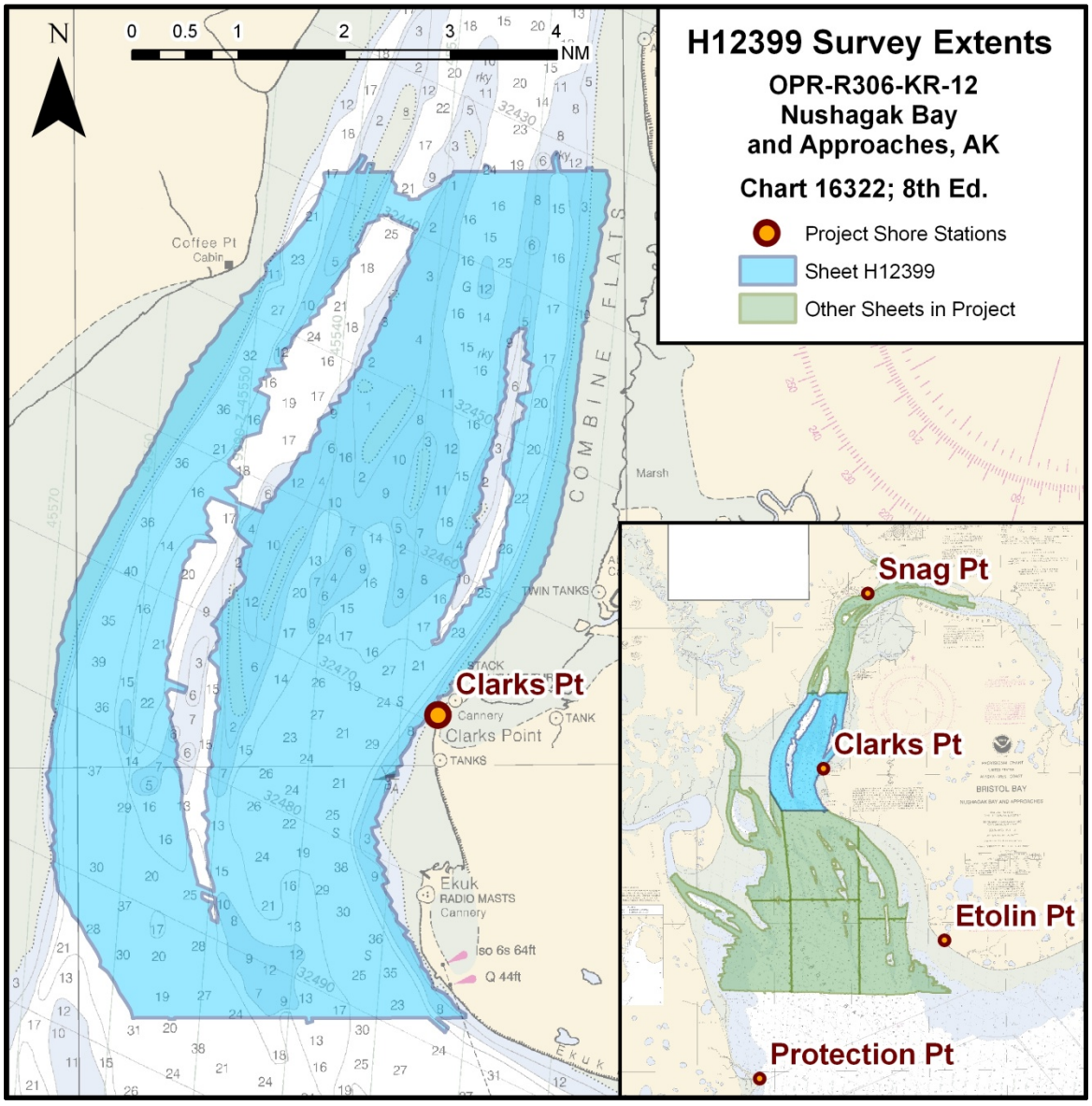

Figure 1 – H12399 Survey Extents

Acquisition Item	*MV Latent Sea*	*MV It Sea*	Survey Total
Linear Nautical Miles of Single Beam (All)	521.71	37.87	553.58
Linear Nautical Miles of Single Beam Crosslines	50.27	0.00	50.27
Bottom Samples	6	0	**6**
Items Investigated	1	0	**1**
Square Nautical Miles of Single Beam			**24.2**

Table 1 – Acquisition Statistics.

Dates of Acquisition
May: 24, 25 June: 3, 8, 9, 17, 18, 21, 28, 30 July: 1, 2, 3, 5, 6, 8, 11, 12, 14, 15, 16, 18, 19, 20, 21, 22, 23, 24, 28, 29, 31(bottom samples & hydro) August: 1, 5, 6, 7 (shoreline and hydro), 9, 14

Table 2 – Specific Dates of Data Acquisition.

Complete survey limits and the final progress sketch are available in *Separate II: Digital Data* included with this report.

B. Data Acquisition and Processing

B.1. Equipment

Bathymetry for this survey was acquired using the vessels *Latent Sea and It Sea.* Survey system models and configurations were setup identically between the vessels.

Latent Sea

The *Latent Sea* is an aluminum-hulled vessel, 7 meters length overall with a 2.6 meter beam and a 0.5 meter draft. It was outfitted to acquire single beam data with a hull mounted transducer. Major systems used on the *Latent Sea* are listed in the table below.

Latent Sea **LOA: 7 m, BEAM 2.6 m, DRAFT: 0.5 m**	
Equipment	**Manufacturer & Model**
Single beam sonar	Odom CV100
Positioning & Heave	Trimble 5700
Vessel Attitude	Hemisphere V111
Sound speed	Applied Microsystems SVplus, Odom Digibar

Table 3 – Major systems used aboard the Latent Sea.

It Sea

The *It Sea* is fiberglass-hulled jet drive vessel, 4.7 meters length overall with a 2.1 meter beam and a 0.3 meter draft. It was outfitted to acquire single beam data with a hull mounted transducer. Major systems used on the *It Sea* are listed in the table below.

It Sea **LOA: 4.7 m, BEAM 2.1 m, DRAFT: 0.3 m**	
Equipment	**Manufacturer & Model**
Single beam sonar	Odom CV100
Positioning & Heave	Trimble 5700
Vessel Attitude	Hemisphere V111
Sound speed	Odom Digibar

Table 4 – Major systems used aboard the It Sea.

Additional information, photos, and equipment performance details are provided in the Data Acquisition and Processing Report (DAPR), Section A: Equipment and Section B: Quality Control.

B.2. Quality Control

Internal data consistency and quality was good. Regular confidence checks on survey systems returned good results when collected in close proximity in time due to bottom changes, usually comparing to 0.20 m, or better. Refer to the DAPR for details and results of the various confidence checks.

B.2.1. Crosslines

Crosslines were compared to a 4 m BASE surface created from the mainscheme data. Each crossline was individually compared to the mainscheme surface. Of the 553.6 nautical miles of single beam data collected, 50.3 nautical miles were crosslines. This translates into 10.0% of the single beam mileage, which exceeds the 8.0% specified in the *2012 Hydrographic Survey Specifications and Deliverables* (HSSD) for set line spacing crosslines.

The crossline analysis was conducted using CARIS HIPS QC Report routine. Each crossline was selected and run through the process, which calculated the difference between each accepted crossline sounding and a BASE surface created from the mainscheme data.

The vast majority of crossline soundings pass QC, comparing to the surface within IHO Order 1 at the 95% confidence interval, or better. However, of 26 crosslines, seven fail with less than 95% of the beams comparing to the surface within IHO Order 1. Six appear to be bottom change due to the length of time between acquisition of the mainscheme data and the crossline data. The remaining crossline is run along a slope where bottom change is also likely. The following table summarizes the results. Refer to *Separate II: Digital Data* for the detailed QC Reports.

Crossline	Beams Passing IHO Order 1	Observations
1-145_BA0950	93.9 %	Crossline is along a slope
1-146_BXL001	86.9 %	Crossline crosses lines spanning from JD 145 to 227, some bottom change likely
1BXL-2012LA2202233	87.8 %	Crossline crosses lines spanning from JD 145 to 218, some bottom change likely
1BXL-2012LA2222118A	91.3 %	Crossline crosses lines spanning from JD 115 to 211, some bottom change likely
1BXL-2012LA2222155	93.4 %	Crossline crosses lines spanning from JD 155 to 222, some bottom change likely
1BXL-2012LA2222205	94.6 %	Crossline crosses lines spanning from JD 155 to 222, some bottom change likely
1BXX-2012LA1552109	83.5 %	Crossline crosses lines spanning from JD 155 to 222, some bottom change likely

Table 5 – QC Report Summary.

B.2.2. Uncertainty Values

All soundings were assigned a horizontal and vertical uncertainty value. The parameters used during computation of sounding uncertainty are detailed in the project DAPR. No deviations from this report occurred except as follows:

- Uncertainty associated with sound speed was entered as 1.41 m/s during TPU computation. This value was determined by analyzing the difference between subsequent casts taken at approximately 24-hour intervals (once per shift) and calculating the standard deviation.
- Uncertainty associated with tide zoning was computed by assigning estimated error by zone within the tide zone ZDF file and utilizing the "Compute Error" feature of CARIS HIPS when loading tides. Values ranged from 0.057 to 0.294 m for zones used for the survey area. These values were estimated for each zone based on a comparison with PPK water levels. See the Horizontal and Vertical Control Report (HVCR) for more information regarding tides and tide uncertainty.

Surfaces were finalized in CARIS HIPS so that the final uncertainty value for the each grid cell is the greater of either standard deviation or uncertainty. The uncertainty layer of the final surface was then examined for areas of uncertainty that exceeded IHO Order 1.

For the final surface, the average uncertainty of the grid cells was 0.295 m. Relatively few exceed IHO Order 1. Maximum uncertainty was 0.927 m. Those that exceeded IHO Order 1 were found to be on steep slopes and/or in sand wave areas showing bottom change and rough topography, creating a high standard deviation of the soundings contributing to the grid cell, especially considering the relatively large (4 m) bin size used. Despite a high uncertainty of these grid cells, the contributing soundings have TPU's that are within IHO Order 1. The following figure shows the distribution of surface uncertainty.

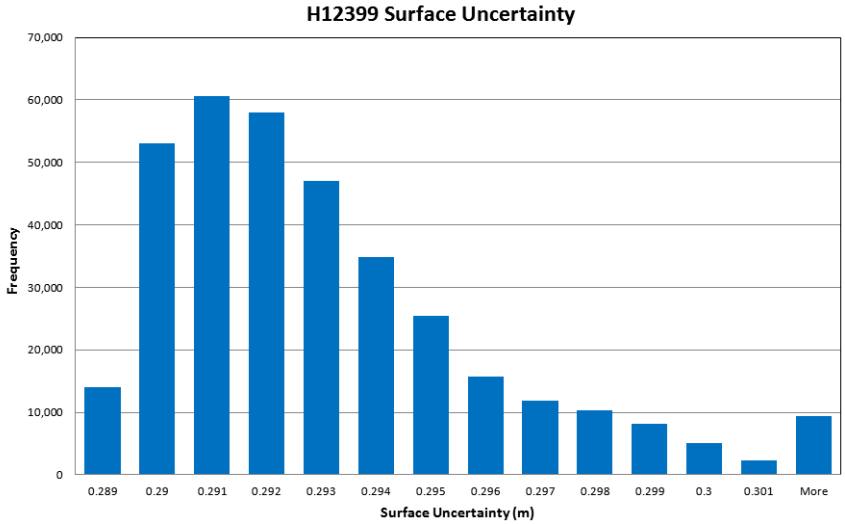

Figure 2 – H12399 Surface Uncertainty Distribution

B.2.3. Contemporary Survey Junctions

This survey junctions with three other contemporary surveys. The junctions are described in the following table and figure.

Survey Registry Number	Project Number	Scale	Date	Junction with H12399 Edge
H12398	OPR-R306-KR-12	1:40,000	August 2012	North
H12400	OPR-R306-KR-12	1:40,000	August 2012	South
H12404	OPR-R306-KR-12	1:40,000	August 2012	South

Table 6 – Contemporary survey junctions with H12399.

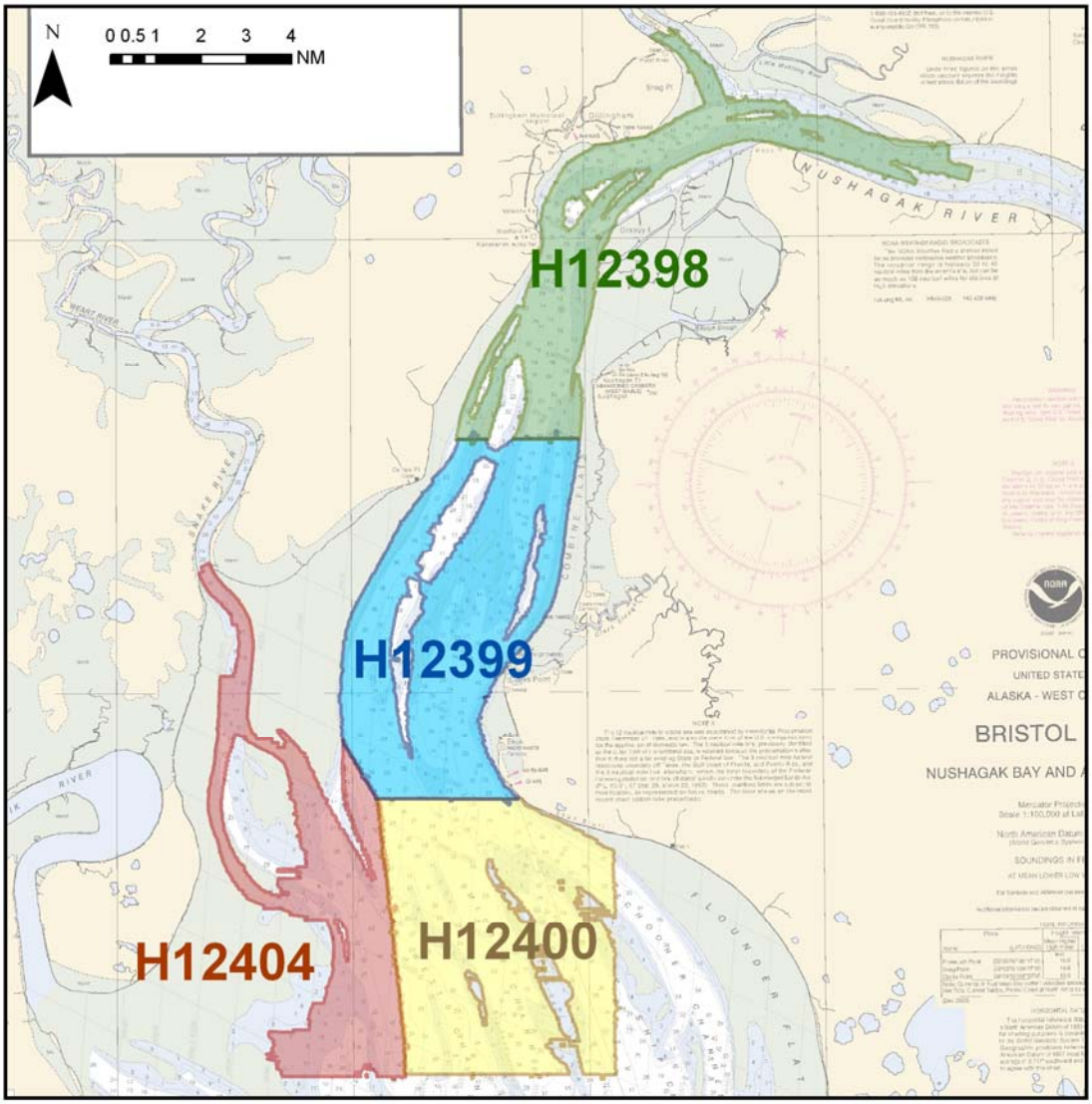

Figure 3 – Junctions of H12398 (green), this survey H12399 (blue), H12400 (yellow), and H12404 (red) on chart 16322.

In CARIS HIPS, the finalized BASE surfaces for each survey sheet were opened. The tool tip feature was then used to spot check the differences between sounding values for each sheet at multiple locations along the survey junction. A difference surface was also utilized. Significant differences (greater than 0.20 m) were examined further. Most differences over 0.20 m were due to imprecise overlap of the single beam soundings on rough bottom.

For the junction with H12398, the surfaces are in good general agreement between the surveys, with the majority of checked grid cells agreeing to better then 0.20 m. The two largest differences (0.27 and 0.61) are associated with lines 34 and 65 days apart respectively, indicating bottom change over time.

For the junction with H12400, the surfaces are in good general agreement between the surveys, with the majority of checked grid cells agreeing to better then 0.20 m. The largest difference (0.23 m) is associated with lines run 65 days apart, indicating bottom change over time.

For the junction with H12404, the surfaces are in good general agreement between the surveys, with the majority of checked grid cells agreeing to better than 0.20 m. A few differences are in the high range from 0.41 to 0.56 m. However, with times of collection differing from 4 to 21 days in this area and large amounts of sand waves obvious in the area, the difference is attributable to bottom change.

B.2.4. Sonar System Quality Control Checks

Echo sounder confidence checks were performed, normally weekly. These were accomplished by either having all vessels run the same line, lead line, or bar check. Often strong currents, shoal depths and poor weather prevented effective sonar checks, or increased the interval to more than the desired once-weekly. Additionally, due to vessel issues occasionally not all vessels were available to run the same line at the same time.

Six bar checks were completed, at least two per vessel. Results were good with CARIS HIPS depths agreeing with bar depth within 0.05 m.

Three lead lines were completed. A number of other lead lines were attempted, but the results rejected. This was due to persistent current combined with sand wave/rough bottom topography yielding poor results in general for lead lines. Successful lead lines agreed with the echo sounder data within 0.10 to 0.30 m.

Normally on a weekly basis, all vessels would run the same survey line twice. Comparisons of the overlapping echo sounder data were then made by examining the agreement in CARIS HIPS subset mode. Comparisons were inexact due to the fact that single beam soundings seldom overlapped perfectly on the rough terrain. However, the vessels echo sounder data typically compared to 0.20 m, or better, where they overlap.

Refer to the lead line and bar check result logs available in *Separate I: Acquisition and Processing Logs* for specific results. More information detailing the procedures used to acquire and process the sonar system quality control checks (and other QC checks) is available in the DAPR.

B.2.5. Unusual Conditions Encountered and Data Quality Issues

In general, the survey equipment used during this survey performed well. No major conditions with the potential for adversely affecting data integrity were encountered with the survey equipment, except as noted below.

- An intermittent issue occurred whereby Hypack was incorrectly time stamping data due to a misconfiguration of Windows 7 on the acquisition PCs. All timestamps within all lines were scanned for the problem. On this sheet, no lines were found to be affected. Further details regarding detection and repair of “un-synced” lines are available in the DAPR.

Environmental issues existed which caused some adverse impacts to data quality. These are itemized below.

The following positioning issue had an adverse effect on data quality:

- Some isolated tide busts between adjacent lines are not easily attributable to sediment transport because of their close proximity in time. It was not always possible to pinpoint the cause but was likely due to tide or tide zoning error, which is a common source of error in this riverine environment with 4-6 m daily tides and numerous constrictions due to sand bars and shoals that affect water levels differently over localized areas. These are also not always easily distinguishable from sediment transport-related bottom change, which can also occur over short periods of time as sand waves can shift relatively quickly with changes in tide and current. Despite the mismatches, these typically did not exceed 0.30 m, within specifications.

  On a case-by-case basis these were investigated by examining a copy of the data corrected using ellipsoid-referenced surveying (ERS) methods. This was possible since all lines are loaded with accurate post-processed kinematic GPS altitudes. Most lines with tide bust – when corrected using ERS to MLLW – show better matchup than tide-corrected lines.

  Note that per the work instructions, all lines were corrected to MLLW using discrete tide zones during the final merge process. However, the "GPSTide" record within all CARIS HIPS lines was computed using an ellipsoid-MLLW separation model developed for this project (supplied with the CARIS deliverables) and can be used for comparison and troubleshooting purposes.

B.2.6. Sound Speed

Nushagak Bay and Approaches is a dynamic area with strong river, tidal and wind driven currents. Sound speed measurements throughout the area varied both spatially and temporally. To minimize sound speed errors, sound speed casts were taken normally every twelve hours (once per shift) during single beam acquisition. This frequency was determined in the field by review of data quality and sound speed profile variance. Variance between subsequent sound speed profiles was minimal and consistent with well mixed conditions. Sound speed profiles were taken as deep as possible; in most cases, extending to the river bottom or sea floor.

Sound speed profiles were applied with the "nearest in distance within time" method in CARIS HIPS, with time set to twelve hours when applying final corrections, with the following exceptions for this sheet.

Vessel	Day	Lines	Exception
Latent Sea	JD 211	All	Processed Nearest in Distance within time 24 hours
Latent Sea	JD 213	All	Processed Nearest in Distance within time 24 hours

Table 7 – Sound Speed Profile application exceptions for survey H12399.

B.2.7. Requirements for Set Line Spacing

Single beam operations were conducted in accordance with the project work instructions, which specified set line spacing at 100 m in depths greater than 2 m.

To achieve 100 m line spacing, a line plan with lines perpendicular to the channel and spaced at 95 m was established and ran. 95 m was selected to allow for line driving variance/difficulties. The 100 m line spacing requirement was generally met, however, in isolated cases, lines may vary to slightly over 100 m apart in instances of line driving "wobble" when current or weather made line tracking problematic.

To achieve 2 m depth contour, lines were run toward the shore or shoal areas slowly until the acquisition software – Hypack – reported a tide and draft corrected depth of 2 m or less, at which point the survey vessel would reverse and proceed to the next line. Real time tide estimations to MLLW were enabled by the use of RTK corrections and a preliminary ellipsoid-MLLW separation value, which was entered into Hypack.

During acquisition, vessel speed was kept low—typically below 8 knots—to maximize along-track ping density. A coverage grid updated in real time by Hypack acquisition was used to confirm along-track data coverage.

Following processing and cleaning of erroneous soundings, CARIS BASE surfaces with a resolution of 4 m were created and examined to confirm line coverage and minimal depth achievement. CUBE parameters that ensured a maximum propagation distance of the grid resolution divided by √2 were used in creating the surface. Single beam "splits" were not acquired for this survey since at the scale of chart (16322 at 1:100,000) charted soundings did not fall fully between 100 m spaced single beam lines.

Note that during field processing, a preliminary MLLW to ellipsoid separation model was applied in CARIS HIPS to assist with determining when the required MLLW depth (2 m) had been achieved. The model was provided by JOA Surveys, LLC (JOA). The model used the best data available at the time, but was limited by short tidal data series and lack of computed tide datums for the area. After the field season ended and all tide data became available, JOA provided final tide zones that were based on full data series and additional data points that were not available for the preliminary. The application of the final tides pushed some areas shoaler, but others deeper, sometimes substantially so. In this sheet, a small number final soundings may no longer meet the minimum depth requirements and stop just short of 2 m. Refer to the project HVCR for more information regarding tides.

B.3. Corrections to Echo Soundings

Survey H12399 was performed in conjunction with seven other surveys in Project OPR-R306-KR-12. Corrections applied to echo soundings are described in detail in the project DAPR. Individual line edits and exceptions are tracked in the line log sheets, available in *Separate I.* No deviations from the DAPR occurred except those listed in the table below.

Vessel	Day	Lines	Exception
Latent Sea	*184*	*1B-2012LA1841004*	V111 heave used due to large gap in PPK heave.
Latent Sea	*184*	*1B-2012LA1841045*	V111 heave used due to large gap in PPK heave.
Latent Sea	*184*	*1B-2012LA1841400*	V111 heave used due to large gap in PPK heave.
Latent Sea	*200*	*1B-2012LA2001813*	V111 heave used due to large gap in PPK heave.
Latent Sea	*200*	*1B-2012LA2001826*	V111 heave used due to large gap in PPK heave.
Latent Sea	*203*	*1B-2012LA2032112*	V111 heave used due to large gap in PPK heave.
Latent Sea	*219*	*1B-2012LA2190211*	V111 heave used due to large gap in PPK heave.

Table 8 – Lines with acquisition or processing exceptions.

B.4. Data Processing

The final depth information for this survey was submitted as a CARIS BASE surface which best represented the sea floor at the time of the 2012 survey. The surface was created from fully processed soundings with all final corrections applied.

The surface was created using CUBE parameters that ensured a maximum propagation distance of the grid resolution divided by √2. 4 m was selected as the resolution, per the requirements for set line spaced single beam in the HSSD.

The BASE surface was created with a horizontal projection of UTM Zone 4 North, NAD 1983.

Data Type	Surface Type	Resolution	Vertical Datum	Name
Single beam	CUBE	4 m	MLLW	H12399_4m _MLLW_1of1

Table 9– Finalized BASE surfaces included with the survey deliverables.

A single CARIS HOB file was submitted (H12399_Final_Feature_File.HOB) with the survey deliverables as well. The HOB file contains feature information and meta-data not represented in the depth grid, including nature of the seabed from bottom samples, shoreline verification data and any assigned features. Each feature is encoded with

mandatory S-57 attributes, additional attributes and NOAA Extended Attributes (2012 version) as outlined in the HSSD.

The DAPR contains more detailed discussion of the steps followed when acquiring and processing the 2012 survey data, including the surface creation and finalizing processes.

C. Vertical and Horizontal Control

The vertical control datum of this project is mean lower low water (MLLW). The horizontal control datum is the North American Datum of 1983 (NAD83). All soundings are therefore corrected to MLLW, and all positions are on NAD83. Fieldsheets were projected into UTM Zone 4 North (NAD83).

Preliminary positions were determined using Real Time Kinematic (RTK) GPS. NAD83-based position corrections were broadcast from project base stations. The base stations also logged dual frequency GPS data at a 1 Hz interval, which was periodically downloaded and used to post-process the positions.

Final positions were post-processed in Applanix POSPac POSGNSS, which utilized dual frequency GPS data logged continuously on the survey vessels along with the base station data to produce post-processed kinematic (PPK) navigation files in text format. These navigation files were loaded into all survey lines without exception using CARIS Generic Data Parser (GDP). This replaced all RTK navigation and GPS heights with the PPK solution.

Per the work instructions, all lines were corrected to MLLW using discrete tide zones during the final merge process. Tide zones were not provided by NOAA for this project. The tide zones were computed using data from three project tide stations and zoning seabird deployments.

Note that the "GPSTide" record within all CARIS HIPS lines was computed using an ellipsoid-MLLW separation model developed for this project (supplied with the CARIS deliverables) and can be used for comparison and troubleshooting purposes. The GPSTide record was not applied during the final merge and therefore does not affect the final soundings and BASE surfaces.

Refer to the project DAPR for more information regarding PPK processing methods. Refer to the project HVCR for details regarding derivation of tide zones. Abstract of Times of Hydrography and CO-OPS transmittal letters can be found in Appendix I. Navigation files (.TXT format), tide zones (.ZDF format) and gauge files (.TID) are available with the project deliverables.

D. Results And Recommendations

D.1. Chart Comparison

The chart comparison for H12399 was performed by examining all Raster Navigational Charts (RNCs) and Electronic Navigation Charts (ENCs) in the survey area.

Discrepancies are discussed in context of the largest scale chart available and assumed to apply to the smaller scale charts unless specifically mentioned. Survey data was compared to the data published in the RNCs and ENCs listed in the table below.

Chart	Type	Scale	Edition	Issue Date	NM / LNM Updates Through
16322	RNC	1:100,000	8th	March 2004	NM – Oct. 28, 2011 LNM – Oct. 25, 2011
US4AK88M	ENC	1:100,000	7th	Jan. 13th, 2011	Jan. 13th, 2011

Table 50 – Charts examined during chart comparisons.

Notices to Mariners (NM) and Local Notice to Mariners (LNM) that were issued from May 2012 through August 2012 (from issuance of SOW to completion of survey) that overlap with this survey were examined as well, ending with NM and LNM 35/12. No discrepancies were found.

The chart comparison was accomplished by overlaying the finalized BASE surfaces and final feature file on the latest edition NOAA charts. The general agreement between charted soundings and H12399 soundings was then examined and a more detailed comparison was undertaken for any shoals or other dangerous features. Results are shown in the following sections.

Dramatic change is evident between the chart and survey data, therefore, changes and features are only detailed in general terms. Because of the widespread change, in all cases of discrepancy it is recommended that this survey supersede charted data where they overlap.

The following figure shows the survey soundings and un-surveyed areas overlaid on the chart.

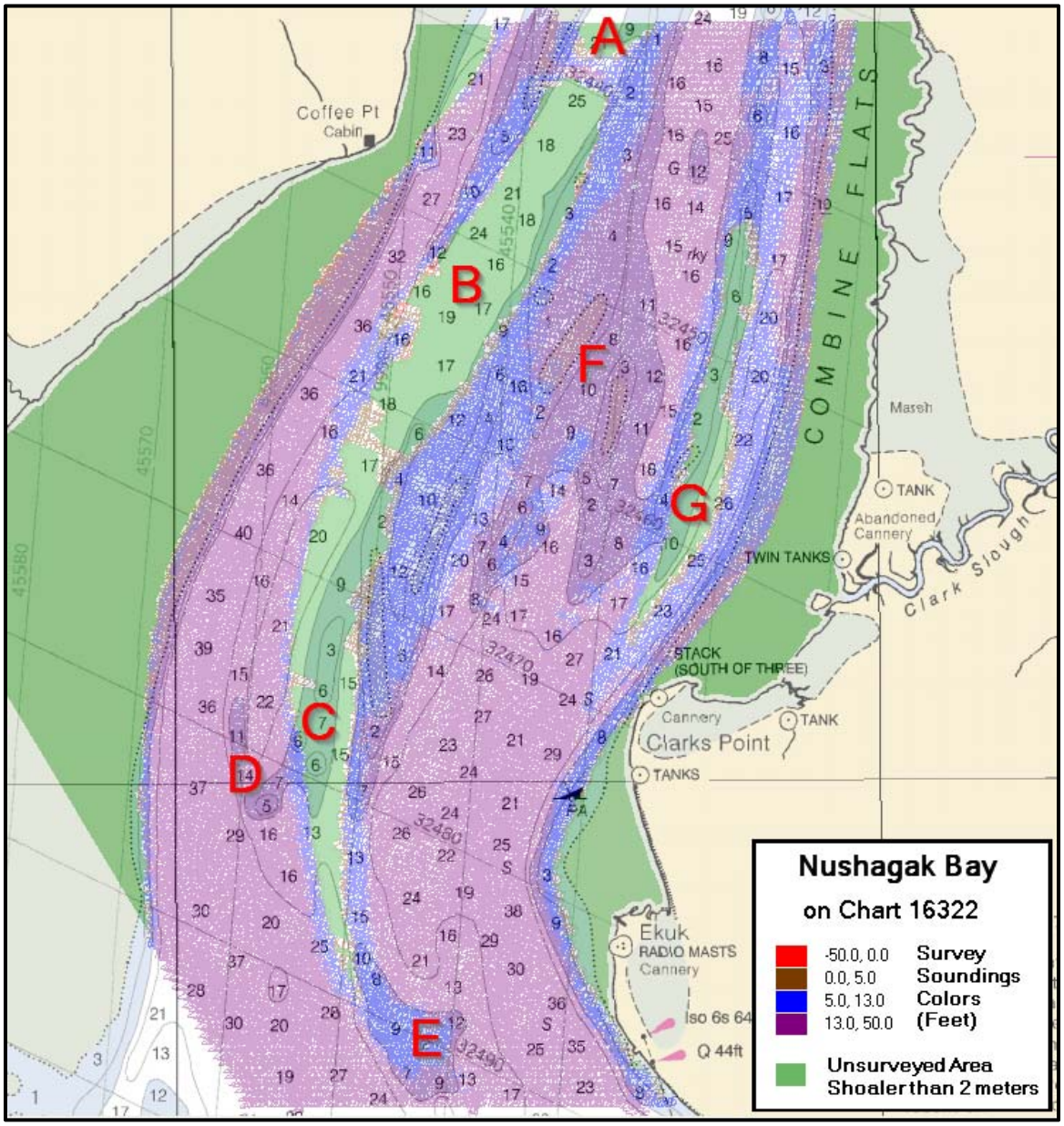

Figure 4 – Overview of survey area with colored survey soundings and unsurveyed areas on chart 16322.

D.1.1. Shoals and Channels

Migration and changes to both shoals and channels were observed throughout this survey area. Areas of significant change are discussed for the above figure in Table 11.[1]

Item	Description
A	A shoal of less than 6 feet has developed over a charted channel with depth of 21 feet. This shoal extends into adjacent survey H12398.
B	Significant changes have resulted in a shoal of less than 6 feet over a charted channel with charted depths greater than 15 feet. This shoal runs in the northeast to southwest direction and extends from north of Coffee Point to south of Clark's Point.
C	A charted shoal of 3-7 feet west of Clarks Point was not surveyed, due to depths less than 6 feet. Un-surveyed area, with depths less than 6 feet, is part of the large shoal in item B.
D	Two charted shoals of 5 and 11 feet west of Clarks Point have surveyed depths of over 13 feet.
E	A mid-channel shoal southwest of Ekuk agrees moderately well with the chart, but should be updated as it connects to the more significant north trending shoal noted in items B and C.
F	Several charted mid-channel shoals to the northwest of Clarks Point were surveyed with depths greater than 13 feet. Depth changes are significant in the surrounding area.
G	A charted shoal north of Clarks Point has moderately elongated both to the north and to the south. This un-surveyed area has depth less than 6 feet.

Table 11 – Descriptions of items shown in Figure 4.

D.1.2. Soundings

Very few charted soundings compare well to this survey. No overall trend is apparent with agreement varying on a sounding by sounding basis. It is recommended that soundings from this survey supersede charted soundings where they overlap.

Many charted soundings did not receive single beam coverage due to their location in areas now shoaler than the 2 meter project minimum depth requirement. In these cases, it is recommended the charted soundings be removed and a depth or shoal area be charted in their place, using the survey minimum depth limits as a guide.[2]

D.1.3. Submitted DTONs

After consultation with Pacific Hydrographic Branch (PHB) regarding the widespread change observed on this and other OPR-R306-KR-12 surveys, it was decided that one general DTON was to be submitted for the entire project area (encompassing sheets H12398 to H12405).

This DTON was submitted to PHB on November 27, 2012, as an S-57 format file with a caution area that encompasses the entire survey extents. The recommendation was made within that a chart note be added with the following text: "NOS hydrographic surveys in 2012 indicate significant changes in the charted location of channels and shoals from Nushagak Bay to Dillingham. Mariners should use extreme caution navigating this area."

Correspondence relating to this DTON is available in Appendix II.[3]

D.1.4. Currents and Water Turbulence

One water turbulence feature was added offshore of Ekuk. During fieldwork this area had the most dramatic currents and turbulence, especially during ebb flows.[4]

D.1.5. Assigned Feature File

A composite source file (CSF) was provided for this survey. One object in the CSF intersected this survey. The object was charted as a wreck "showing any portion of hull or superstructure" with position approximate (at 58-49-52.22 N, 158-34-22.98 W). A single beam star pattern was run centered at this position with an approximate diameter of 250 m. No sign of the wreck was found in soundings or noted protruding above the water surface. However, due to the incomplete nature of single beam echo sounder coverage, set line spacing of 100 m, and the object's position ambiguity, the hydrographer recommends retaining the wreck as charted. This object is included in the Final Feature File for this survey. See figure below for survey soundings and navigation in the vicinity of the object.[5]

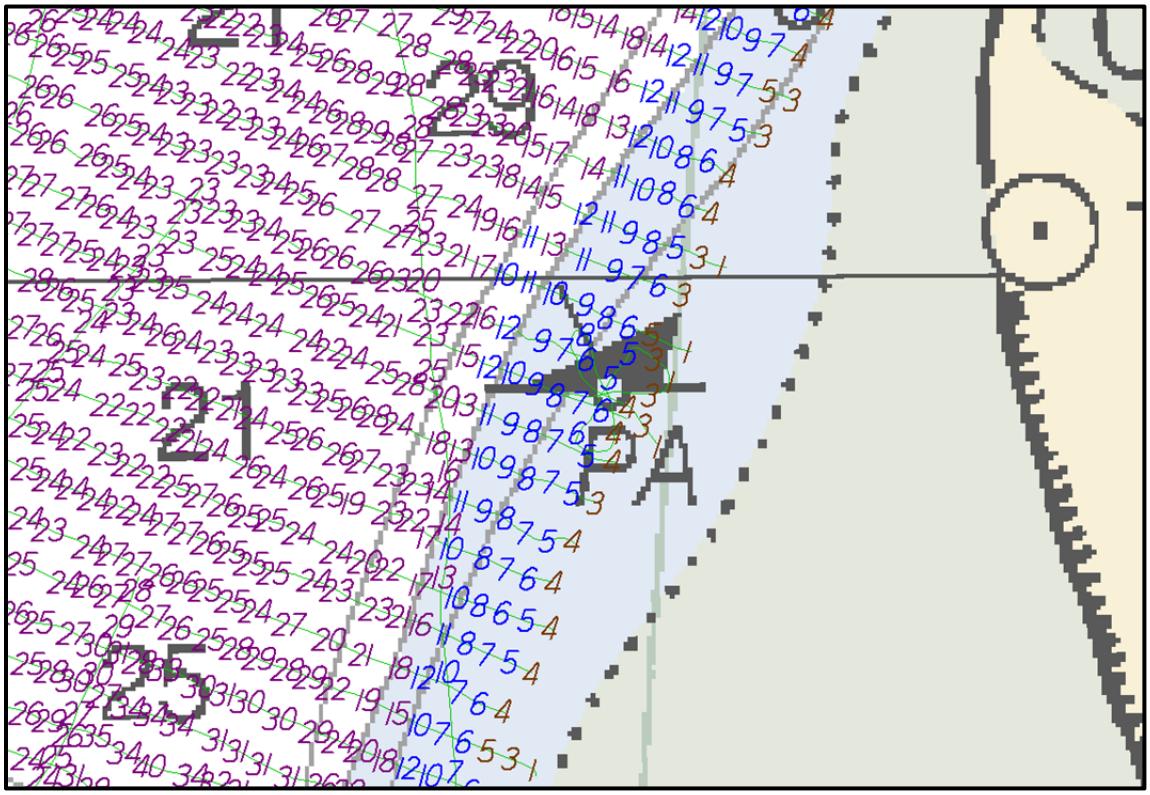

Figure 5 – Assigned feature as charted on chart 16322. Survey soundings in brown, blue and purple. Survey line navigation data shown as green lines. Soundings are in feet.

The log sheet for this feature investigation is included in Separates I. The CSF is provided along with the Project Reference File (PRF) with the S-57 deliverables for this survey. Cultural shoreline features were delineated as described below in Section D.2.

D.1.6. AWOIS Items Summary

As stated in the project instructions, no Automated Wreck and Obstruction Information System (AWOIS) items were assigned for this survey. The PA Wreck discussed in Section D.1.5 was not found in the AWOIS database; it is recommended it be added.

D.1.7. Features Labeled PA, ED, PD or rep.

There is one charted feature labeled PA, ED, PD, or "rep." within the survey extents. This feature was assigned in the composite source file and is discussed in section D.1.5.

D.2. Additional Results

D.2.1. Shoreline Verification

Limited shoreline verification was tasked for this project. However, per correspondence with the COTR, this was limited to delineating only cultural features in the vicinity of Clarks Point. Only the waterfront in the immediate area of the abandoned Trident

Seafoods Cannery was investigated. No other cultural features were apparent on the Clarks Point shoreline.

Correspondence relating to shoreline verification is included in Appendix II.[6]

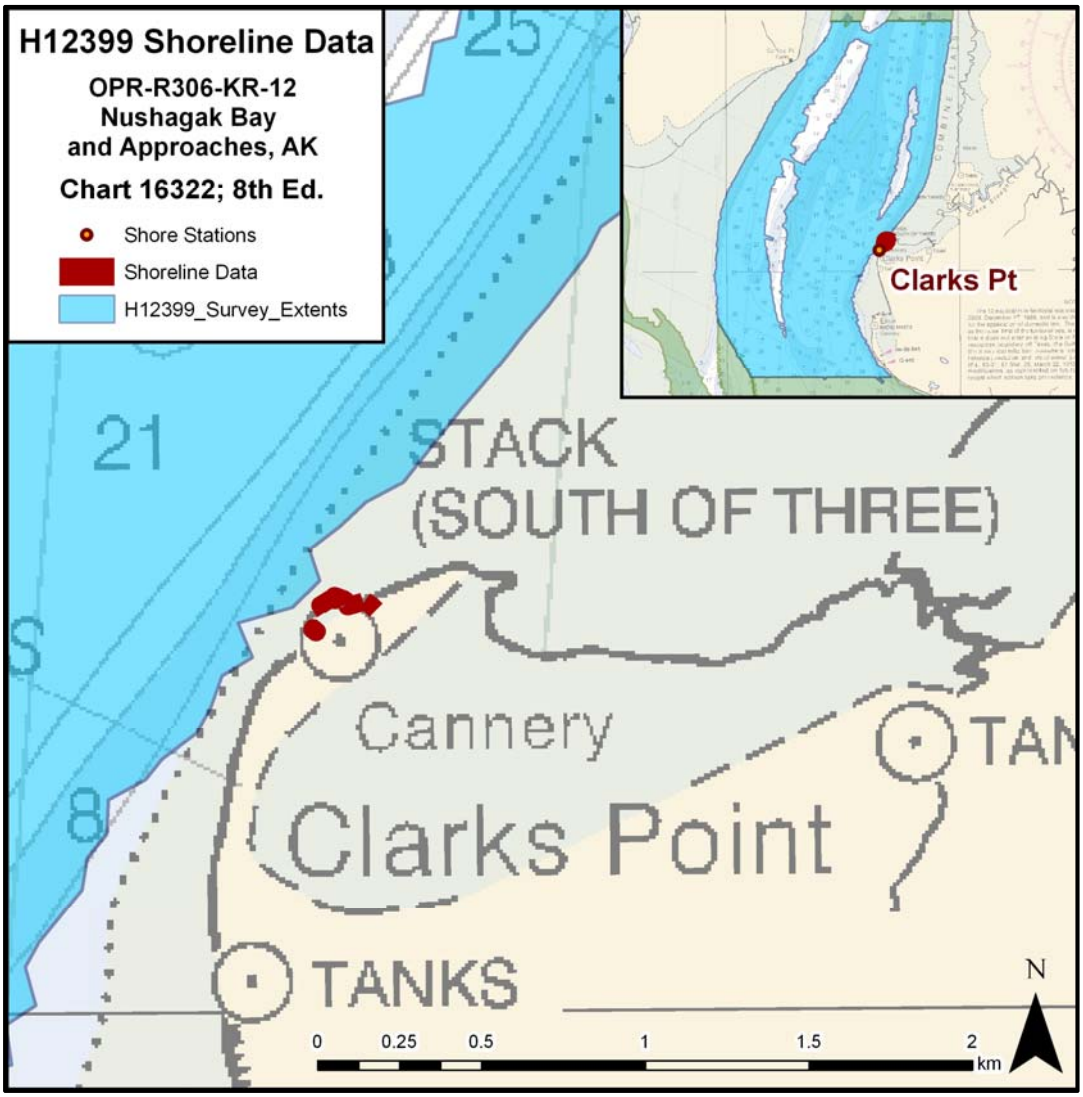

Figure 6 – Extents of Clarks Point waterfront shoreline verification.

The work was accomplished on August 7, 2012 (JD 220).

The equipment used was setup in a Trimble backpack design. A Trimble 5700 receiver was interfaced with a Trimble Zephyr Geodetic GPS antenna and mounted on a survey rod. The Trimble was set to log continuously and a field book was kept to note the exact times the antenna occupied specific points. Digital photos were also taken and picture numbers noted in the field book. Data was only acquired for cultural features.

Data was corrected and processed with PPK methods using Applanix POSGNSS software. Altitudes were corrected for height of instrument within the POSGNSS. Positions from exact occupation times were extracted and exported to a text file.

The data points were imported into CARIS Notebook 3.1 and used in conjunction with the field notes and photos to build the appropriate S-57 shoreline objects. These included various types of shoreline construction and dock areas.

A summary of shoreline data and supporting documentation:

- The final feature file (FFF) "H12399_FFF.HOB" included with the survey deliverables contains the compiled shoreline detail from this survey.
- The Excel file "Shoreline_Points_and_Photos.xlsx" contains field notes combined with data positions exported from Applanix POSGNSS is included with the final feature file.
- The photos are located in the Multimedia folder.
- The scanned fieldbooks are included with the final feature file.
- The Excel file "H12399_S-57_Featues.xlsx" contains a list of shoreline verification objects.

The composite source file (CSF), chart 16322, and ENC US4K88M have minimal and outdated shoreline detail for Clark's Point to compare to this survey. It is recommended to update chart 16322 and ENC US4K88M to include the shoreline detail provided in the accompanying final feature file.[7]

Features from the CSF that were investigated and not found during this survey are included in the FFF with the "descrp" attribute set to "delete." Features from the CSF that were found to be substantially different are included in the FFF with modification recommendations and the "descrp" attribute set to "modify." Features from the CSF that were not addressed by this survey are not included in the FFF.

D.2.2. Aids to Navigation

No ATON investigations were specifically assigned for this project.

Two lights bordering the southeast corner of this survey -- Ekuk Range Front Light (58-47-56.235 N, 158-33-15.738 W) and Ekuk Range Rear Light (58-48-07.689 N, 158-33-23.484W) marking the navigable channel to the south of Ekuk were observed by vessel from the survey area and appeared to be in working order. The USCG Light List shows these lights as white in color, however they were observed from the survey vessel to be red.

The navigable channel marked by the range lights is no longer entirely accurate, therefore the hydrographer recommends adjustment of light orientation based on the results of surveys H12400, H12402, and H12404.

The Ekuk Range Line on chart 16322 marking the navigable channel guided by the Ekuk Range Lights has minimal overlap with this survey. As charted the range line primarily

lies within surveys H12400, H12402 and H12403. See the DRs for those surveys for recommendations regarding the Ekuk Range Line.

D.2.3. Drilling Structures

An investigation of drilling structures was not required for this survey. Drilling structures did not exist within the project area.

D.2.4. Comparison with Prior Surveys

A comparison with prior surveys was not required under this Task Order. See Section D.1 of this report for a comparison to the existing nautical charts.

D.2.5. Bottom Samples

Six bottom samples were collected in H12399. The assigned project wide distribution of forty bottom samples in the PRF was modified after the bathymetric limits of the survey area were determined, ultimately resulting in six bottom samples in H12399.[8]

A listing and description of the bottom samples and related correspondence are provided in Appendix II of this report. The bottom samples are also portrayed as seabed area (SBDARE) objects in the accompanying final feature file. Photos of the bottom samples are located in the "Multimedia" directory with the final feature file.

D.2.6. Bridges and Overhead Cables

There were no bridges or overhead cables in the survey area.

D.2.7. Submarine Cables and Pipelines

There were no charted submarine cables in the survey area.

D.2.8. Additional Information

There is no additional information to note.

D.2.9. Additional Recommendations

This hydrographic survey was completed in an area with highly changeable bottom. To increase its value to vessels transiting or operating in the area, it is recommended that the chart be updated with the results of this survey as expediently as possible.

APPROVAL SHEET

For

H12399

This report and the accompanying digital data are respectfully submitted.

Field operations contributing to the completion of survey H12399 were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report, digital data, and accompanying records have been closely reviewed and are considered complete and adequate per the *Statement of Work*. Other reports submitted with this survey include the Data Acquisition and Processing Report and the Horizontal and Vertical Control Report.

This survey is complete and adequate for its intended purpose.

Marta Krynytzky

Digitally signed by Marta Krynytzky
DN: CN = Marta Krynytzky, C = US, O = TerraSond Ltd
Reason: I attest to the accuracy and integrity of this document
Location: Palmer, AK
Date: 2012.12.20 08:34:10 -09'00'

Marta Krynytzky
ACSM Certified Hydrographer (2012), Certificate No. 273
Lead Hydrographer
TerraSond Ltd.

Andrew Orthmann

Digitally signed by Andrew Orthmann
DN: CN = Andrew Orthmann, C = US, O = TerraSond Ltd
Reason: I attest to the accuracy and integrity of this document
Date: 2012.12.20 08:01:34 -09'00'

Andrew Orthmann
ACSM Certified Hydrographer (2005), Certificate No. 225
Charting Program Manager
TerraSond Ltd.

Revisions and corrections performed during office processing and certification.

[1] The shoal areas described in this section were reviewed and included in the chart update product as appropriate and soundings in these areas were recommended to be removed from the chart.
[2] The charted soundings in shoal areas were recommended to be removed from the chart.
[3] The email correspondence is attached to this report.
[4] The water turbulence feature was included in the chart update product.
[5] The wreck was included in the chart update product and recommended to be retained.
[6] Correspondence is attached to this report.
[7] Concur with clarification. The submitted hob files were used in the compilation of H12399. During compilation, some modifications were made to accommodate features to chart scale. Chart features as depicted in H12399.
[8] Six bottom samples from the survey were included in the chart update product and two were imported from the ENC to be retained.

Andrew Orthmann

From: Andrew Orthmann
Sent: Tuesday, November 27, 2012 10:49
To: 'phb.dton@noaa.gov'
Cc: 'Mark.T.Lathrop@noaa.gov'; Marta Krynytzky
Subject: FW: nushagak river DTON
Attachments: OPR-R306-KR-12_DTON_112712.zip

Please see attached DTON for OPR-R306-KR-12 (Nushagak River) and included correspondence regarding the DTON.

Thank you,

Andrew Orthmann, C.H.
Charting Program Manager

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Precision Geospatial Solutions ®
1617 South Industrial Way Suite 3, Palmer, Alaska 99645
(907) 745-7215 Office (907) 745-7273 FAX (907) 982-5231 Cell
aorthmann@terrasond.com www.terrasond.com

From: Andrew Orthmann
Sent: Tuesday, November 27, 2012 10:15
To: 'Mark.T.Lathrop@noaa.gov'
Cc: Marta Krynytzky
Subject: nushagak river DTON

Hi Mark,

Attached is a single DTON for Nushagak. It is an S57 file with a caution area that encompasses the entire survey extents.

Looks like in the end PHB decided one chart note would cover the potential DTONs until the chart can be updated (see below from Dave Zezula).

We haven't submitted many DTONs the past couple years and looks like the requirements in the specs have changed; appears the correct route is to submit this to you in S-57 format with the required attributes set. Please let me know if this is incorrect or needs to be changed in any way.

Thanks Mark,

Andy

From: David Zezula - NOAA Federal [mailto:david.j.zezula@noaa.gov]
Sent: Monday, November 26, 2012 11:32
To: Andrew Orthmann

Cc: crescent.moegling@noaa.gov
Subject: Re: FW: nushagak river DTONs

Andy,

I discussed this with MCD and we decided rather than spend time and energy posting dozens of DTONs, which would only result in a chart that displays shoal soundings and no channels at all, we would like to have Terrasond submit one DTON report with a recommendation to add a chart note. In addition, once we receive the surveys we will discuss with MCD the possibility of giving them a high priority so chart 16322 can be updated sooner rather than later.

Chart note language recommendation:

"NOS hydrographic surveys in 2012 indicate significant changes in the charted location of channels and shoals from Nushagak Bay to Dillingham. Mariners should use extreme caution navigating this area."

This should allow us to convey the significant changes in the area but not unduly burden the DTON process.

DZ

On Mon, Nov 26, 2012 at 12:13 PM, Andrew Orthmann <aorthmann@terrasond.com> wrote:

Hi Dave, I'm not sure if you received this email so I am resending it.

From: Andrew Orthmann
Sent: Saturday, November 10, 2012 16:13
To: 'david.j.zezula@noaa.gov'
Cc: 'crescent.moegling@noaa.gov'
Subject: Re: nushagak river DTONs

Hi Dave,

I haven't heard back concerning this, but I apologize because I should have followed up sooner. This has come up now again because we are beginning our chart comparison process to complete the DRs.

Does it look like this chart update will be fast tracked? Should we pursue issuing any DTONs for these common radical shifts in the river, such as the one shown in the figure below? We will submit the data to you mid-December, and with the river frozen over until May I'm not sure if you want to just get the whole data set and then update the chart.

Please advise,

Andy

From: Andrew Orthmann
Sent: Thursday, August 02, 2012 11:02
To: David Zezula
Subject: RE: nushagak river DTONs

Okay thanks Dave.

We should be able to submit these surveys to you by mid-December at the latest if you decide that the best route is to wait for the full data set to be submitted.

Andy

From: David Zezula [mailto:david.j.zezula@noaa.gov]
Sent: Thursday, August 02, 2012 10:10 AM
To: Andrew Orthmann
Cc: Crescent Moegling
Subject: Re: nushagak river DTONs

Andrew,

Definitely see your point. Let me talk to MCD and if we can get this chart update on the fast track we can probably minimize the DTONs we process and prevent the existing chart from becoming a solid stream of shoal soundings. I'll get back with you.

DZ

On Thu, Aug 2, 2012 at 10:44 AM, Andrew Orthmann <aorthmann@terrasond.com> wrote:

Hello Dave,

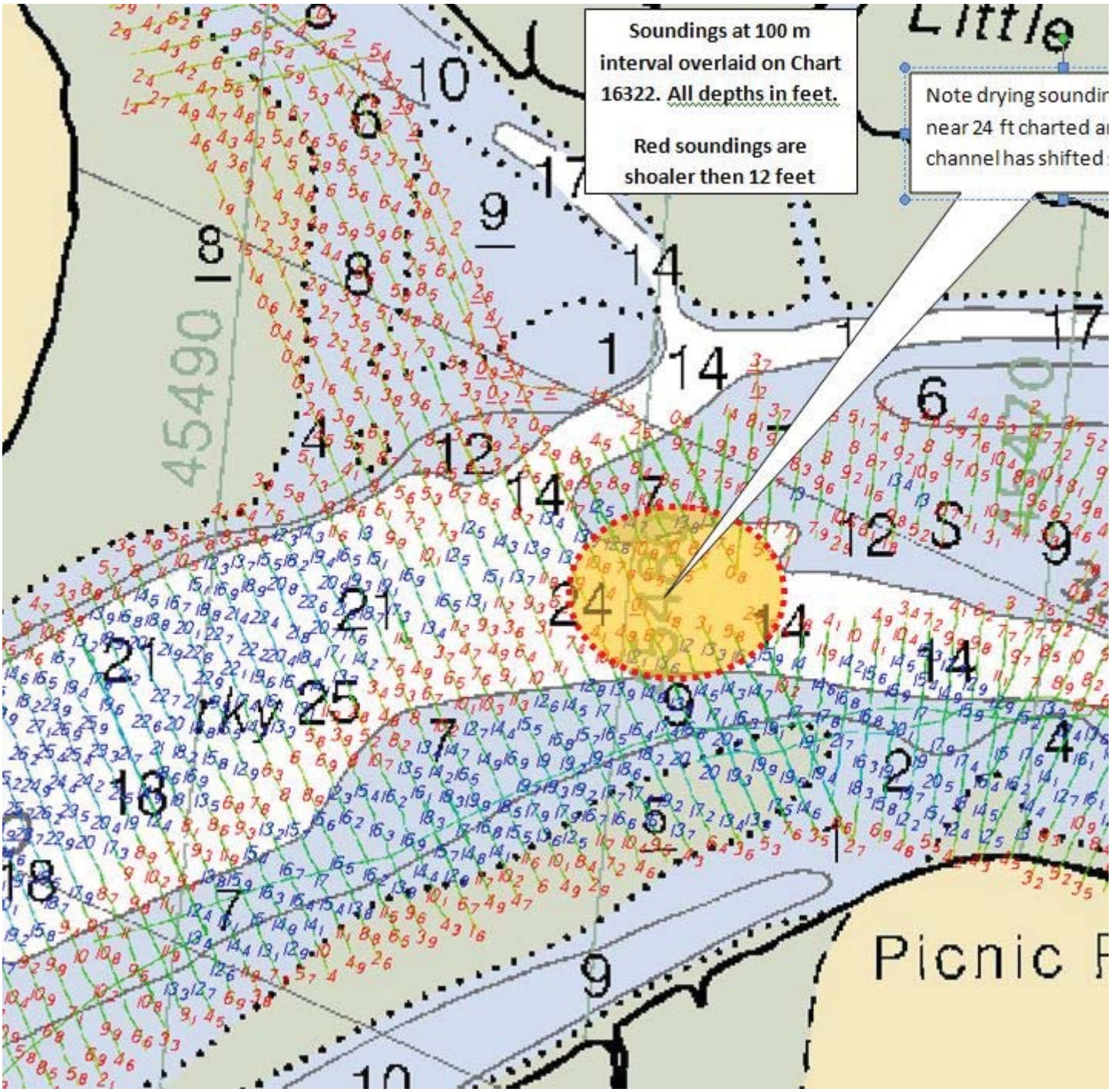
In our survey of the Nushagak River and Approaches we are finding many discrepancies from the chart -- in fact the chart and results from this survey bear little resemblance in many places. It's no surprise given that the area is highly changeable and it has been so long since prior surveys.

If strict reporting criteria are used it would trigger an awful lot of DTONs. As it is now, mariners navigate the area using local knowledge.

One suggestion has been to only report the most "outstanding" changes as DTONs. However in many cases, using the 3mm at chart scale requirement in the HSSD, this might result in a chart update that "closes" the river since the affected chart is small scale (16322, at 1:100,000) and the river is narrow. It also wouldn't tell the whole story, since usually a new shoal area is accompanied by a new channel or deep area which wouldn't typically be reported on as part of a DTON submission.

Few of these are point features, nearly all are area features that would close or narrow the charted navigable areas without subsequent repotting of the deep or channel areas.

How would you like to see DTONs handled in these cases? A good example is shown below, where reporting on the 0 sounding / changes in the 2 fathom curve wouldn't also show the new channel to the south:



Andrew Orthmann, C.H.
Charting Program Manager

From: Mark Lathrop [mark.t.lathrop@noaa.gov]

To: Andrew Orthmann

Sent: Thu 8/2/2012 10:37 AM

Subject: Re: regarding limited shoreline verification and assigned features

Andy,

The "limited shoreline verification" for Nushagak Bay consists of delineating the cultural features only, unless rocks or ledges occur in the survey area. Due to the nature of the survey area (low-lying sedimentary beaches and mudflats, delineating shoreline in these areas would be difficult and of little value).

Investigate the assigned items as best you can. If they are unreachable or appear to have been buried in the shifting shoals, please indicate in the DR.

There is no need to investigate features outside of the survey limits. You are surveying to the 2-meter curve so there is no need to investigate the zero contour limit.

Mark

On Fri, Jul 27, 2012 at 8:34 PM, Andrew Orthmann <aorthmann@terrasond.com> wrote:

Hi Mark,

We discussed briefly during your visit here but I just wanted to recap this in an email for the report.

Can you verify again please that the "limited shoreline verification" described in the work instructions regarding the provided CSF file consists of verifying and/or delineating the extents of cultural shoreline features only (for example, permanent docks and seawalls at Dillingham and Clarks Point)?

There are also four items marked in the CSF with assignment flag = "Assigned" (three rocks and a charted wreck), some of which appear that they will be outside the limits of hydrography -- can you verify if we are to investigate these if they land outside of the limits of hydrography?

The CSF contains MHW for the entire survey area which is impractical to verify with survey vessels due to extensive mudflats. It also contains seemingly extraneous cultural features outside of the survey extents including towers, chimneys, buildings, and tanks. There is also a zero contour limit which frequently meanders outside the survey extents. Can you verify that we are not required to investigate these features?

Thanks a lot,

Andy

Andrew Orthmann, C.H.
Charting Program Manager

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aorthmann@terrasond.com www.terrasond.com

From: Mark Lathrop [mailto:mark.t.lathrop@noaa.gov]
Sent: Wednesday, April 25, 2012 8:54 AM
To: Andrew Orthmann
Subject: Re: project status 4/23/12

Andy,

I've attached a couple of hob files for your survey. The CSF shows features from the ENC. The PRF has the sheet limits to the high water buffer and recommended bottom sample locations. Of course the changeable nature of the Nushigak will dictate where your bottom samples will be. We're just looking for some variety of locations and of course potential anchorages.

Mark

APPROVAL PAGE

H12399

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

- H12399_DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12399_GeoImage.pdf

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

Approved: Digitally signed by BROWN.KURT.E.1156712600 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=BROWN.KURT.E.1156712600 Date: 2013.05.31 09:50:31 -07'00'

Kurt Brown
Physical Scientist, Pacific Hydrographic Branch

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

Approved: David J Zezula CDR/NOAA David Zezula 2013.05.31 10:15:52 -07'00'

CDR David J. Zezula, NOAA
Chief, Pacific Hydrographic Branch