H12631

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

DESCRIPTIVE REPORT

Type of Survey:	Navigable Area
Registry Number:	H12631

LOCALITY

State(s):	Alaska
General Locality:	Bechevin Bay, AK
Sub-locality:	Bechevin Bay

2014

CHIEF OF PARTY
Andrew Orthmann

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Date:

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

REGISTRY NUMBER:

HYDROGRAPHIC TITLE SHEET

H12631

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(s):	**Alaska**
General Locality:	**Bechevin Bay, AK**
Sub-Locality:	**Bechevin Bay**
Scale:	**40000**
Dates of Survey:	**06/07/2014 to 08/15/2014**
Instructions Dated:	**01/08/2014**
Project Number:	**OPR-R315-KR-14**
Field Unit:	**Terrasond Limited**
Chief of Party:	**Andrew Orthmann**
Soundings by:	**Multibeam Echosounder Singlebeam Echosounder**
Imagery by:	
Verification by:	**Pacific Hydrographic Branch**
Soundings Acquired in:	**meters at Mean Lower Low Water**

Remarks:

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. 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/.

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Descriptive Report to Accompany Survey H12631

Project: OPR-R315-KR-14

Locality: Bechevin Bay, AK

Sublocality: Bechevin Bay

Scale: 1:40000

June 2014 - August 2014

Terrasond Limited

Chief of Party: Andrew Orthmann

A. Area Surveyed

A navigable area survey (H12631) was conducted within Bechevin Bay, Alaska, in accordance with the NOAA, National Ocean Service, Statement of Work (SOW), OPR-R315-KR-14, dated January 23rd, 2014, and Hydrographic Survey Project Instructions dated January 8th, 2014. Hydrographic survey data collection began June 7th, 2014 and ended August 15th, 2014. Supporting tide data was collected from May 16th, 2014 through September 6th, 2014.

Multibeam echosounder (MBES) and single beam echosounder (SBES) operations were conducted in accordance with the project instructions, which specified a combination of set line spacing and complete coverage. Requirements called for 100 m set line spacing SBES (or MBES) from the inshore limit to 8 m water depth with reduced spacing as directed by the NOAA COR up to a maximum of 1,075 linear nautical miles (LNM) to be acquired project-wide. Complete MBES with concurrent backscatter was required for depths greater than 8 m.

The inshore limit was the navigational area limit line (NALL), which is defined as the farthest offshore of: 1) the 4 m depth contour, 2) a line defined by the distance seaward from the observed MHW line equivalent to 0.8 mm at the scale of the largest scale nautical chart intersecting the area (64 m for this survey using chart 16535, with a scale of 1:80,000), or 3) the inshore limit of safe navigation as determined by the Chief of Party.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
55° 5' 13.91" N 163° 32' 4.43" W	54° 56' 32.84" N 163° 16' 47.4" W

Table 1: Survey Limits

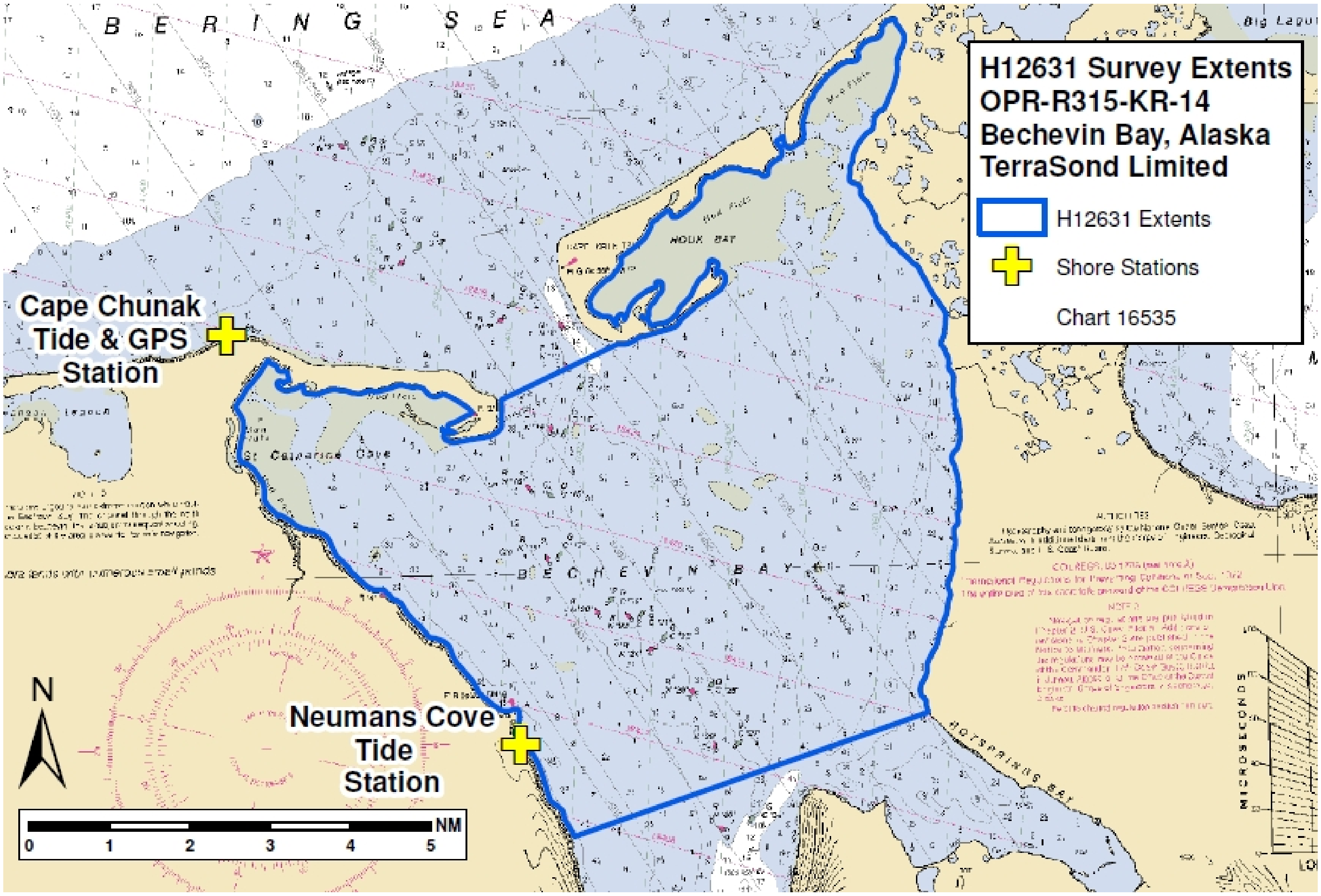

Figure 1: Survey extents and overview.

Survey limits were generally achieved. The inshore limit (4 m depth or NALL for set line spacing, 8 m for complete coverage) was achieved except in isolated cases where it was deemed unsafe to approach closer. In rare cases, application of final tide correctors shifted data deeper, which caused some soundings that initially met the 4 m or 8 m minimum depth requirements based on preliminary tide data to no longer meet the requirement.

Note that much of the planned area was shoaler then 4 m and was therefore not surveyed. However, some selected areas inshore of the NALL (shoaler then 4 m) did receive limited additional survey. These were primarily areas selected by NOAA where suspected alternate channels, albeit shoaler then 4 m, might exist, as well as areas where submerged features were investigated with single beam during shoreline verification.

A.2 Survey Purpose

The purpose of this project is to provide an updated survey for Bechevin Bay. It addresses approximately 45 square nautical miles (SQNM) of area identified “Critical” in the 2012 NOAA Hydrographic Survey

Priorities (NHSP) document. The best scale chart at the time of this survey (16535) is out of date, with source soundings acquired from 1924 to 1957.

The area, commonly known as False Pass, is the first pass between the Bering Sea and Pacific Ocean encountered as vessels transit down the Alaska Peninsula, and delineates the beginning of the Aleutian Island chain. Relatively shallow drafted vessels (drafts of 4 m or less) frequently transit the area while traveling to ports in Bristol Bay or beyond. Deeper drafted vessels normally take the longer but deeper route through Unimak Pass to the west. Small vessels from the nearby community of False Pass (2010 population 35) also frequent the area, usually navigating with local knowledge - indeed during survey operations local boats were observed taking shortcuts across the many shoals in the area, usually at high tide and commonly touching bottom.

Inclement, fast-changing weather is normal. At the confluence between the relatively cold Bering Sea and warm Pacific Ocean, the area frequently experiences wind, sea, and atmospheric conditions (including fog) that are unfavorable for vessel navigation. Tidal current divergent to wind direction can cause significant localized stacking of seas.

Anchorages exist but provide marginal protection at best due to the shallow and open nature of the area. Better anchorages are found outside the limits of this survey, to the south in Hotsprings Bay or in the vicinity of False Pass.

Tides are complex and tidal currents extreme, making navigation especially difficult through the narrow passes between shoals. Current can frequently exceed 6 knots, resulting in whirlpools and sudden changes in vessel trackline when dissimilar current streams are intersected.

The area is also subject to a high degree of bottom change and migration of shoals due to current-induced sediment transport. During operations, significant change (1 to 2 m in some cases) was observed in subsequent soundings acquired during time periods as little as 1-2 weeks apart. Change is most significant through narrow constrictions where tidal current is greatest.

Due to bottom change, the USCG must resurvey the main channel through the area each spring to ensure optimal placement of navigational buoys that mark the channel edges. The buoys, which are removed each fall to avoid loss or damage from winter ice flows, frequently cannot be relocated at the same position as the previous year due to channel and shoal migration.

Figure 2: RV Qualifier 105 in Bechevin Bay.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

A.4 Survey Coverage

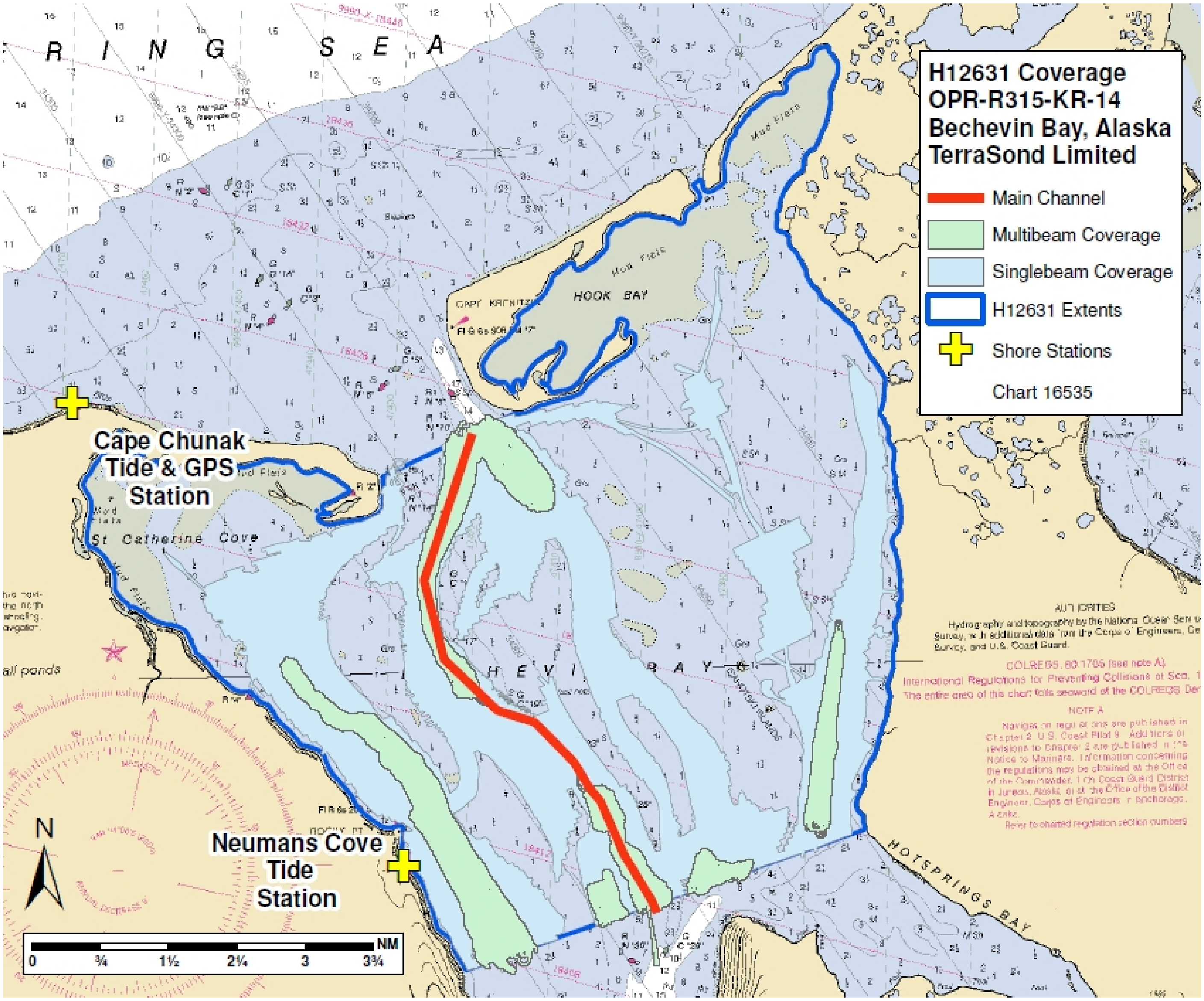

Figure 3: Overview of coverage.

The 100 m spacing requirement for set line spacing for 8 m depth to the inshore limit (normally 4 m depth) was met. In the northeast part of the bay, singlebeam recon lines found depths greater then 4 m and some mainscheme lines at 100 m spacing were subsequently acquired, but the area was not fully developed with 100 m spacing because 1) the area was shoaler then 4 m on all approaches, 2) the area was not navigationally significant and was found to be commonly choked with sea grass, and 3) the project-wide line budget of 1,075 had been exceeded when acquiring 100 m spaced lines here.

Following acquisition of 100 m set line spacing, additional lines were collected between existing lines in selected areas per NOAA guidance to increase data density, bringing the final set line spacing interval to 25 m or 50 m in these areas. In this sheet, the main channel and adjacent area (between 8 m and 4 m depth) received additional lines, as well as St Catherine Cove (as a potential anchorage).

The work instructions called for a project-wide (all survey sheets) maximum of 1,075 LNM of set-spaced lines to be acquired in the area from the inshore limit to 8 m depth. In total, 1,293 LNM were acquired project-wide. The additional LNM was acquired to compensate for mileage unintentionally acquired in areas deeper than 8 m that were designated for complete coverage, as well as crossline mileage exceeding the 8% requirement for set line spacing. Single beam splits on shoals or charted soundings were not undertaken because the nature of the bottom in the area reduced the likelihood of pinnacles or shoals between lines.

The requirement for complete multibeam coverage in depths greater than 8 m was met, except in cases where it was deemed unsafe to proceed further inshore or nearby shoals made safe vessel maneuvering questionable. These include some areas on tight bends in the channels and the back of "dead-end" multibeam areas. Some pockets of water deeper than 8 m identified during single beam data collection did not receive multibeam coverage because the presence of nearby shoals.

Note that multibeam coverage is not continuous from north to south through this sheet due to the 8 m minimum depth limit. Instead, the main channel--where it is shoaler then 8 m--received 25 m-spaced single beam coverage to increase sounding density there.

Survey limits were generally achieved. The inshore limit (4 m depth or NALL for set line spacing, 8 m for complete coverage) was achieved except in isolated cases where it was deemed unsafe to approach closer. In rare cases, application of final tide correctors shifted data deeper, which caused some soundings that initially met the 4 m or 8 m minimum depth requirements based on preliminary tide data to no longer meet the requirement.

Much of the planned area was shoaler then 4 m and was therefore not surveyed. However, some selected areas inshore of the NALL (shoaler then 4 m) did receive limited additional survey by skiff. These were primarily areas selected by NOAA where suspected alternate channels, albeit shoaler then 4 m, might exist. No channels preferable to the known main channel (shown in figure 3) were found, although the additional work did open alternate routes.

A.5 Survey Statistics

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

	HULL ID	*Qualifier 105*	*Cutwater*	*Spare RHIB*	*Total*
LNM	**SBES Mainscheme**	0	479	58	537
	MBES Mainscheme	326	0	0	326
	Lidar Mainscheme	0	0	0	0
	SSS Mainscheme	0	0	0	0
	SBES/SSS Mainscheme	0	0	0	0
	MBES/SSS Mainscheme	0	0	0	0
	SBES/MBES Crosslines	18	53	14	85
	Lidar Crosslines	0	0	0	0
Number of Bottom Samples					9
Number of AWOIS Items Investigated					0
Number Maritime Boundary Points Investigated					0
Number of DPs					26
Number of Items Investigated by Dive Ops					0
Total SNM					18.7

Table 2: Hydrographic Survey Statistics

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

Survey Dates	Day of the Year
06/07/2014	158
06/08/2014	159
06/09/2014	160
06/10/2014	161
06/11/2014	162
06/12/2014	163
06/13/2014	164
06/14/2014	165
06/16/2014	167
06/17/2014	168
06/18/2014	169
06/19/2014	170
06/20/2014	171
06/21/2014	172
06/22/2014	173
06/26/2014	177
06/27/2014	178
06/28/2014	179
06/29/2014	180
07/01/2014	182
07/02/2014	183
07/03/2014	184
07/04/2014	185
07/07/2014	188
07/08/2014	189
07/09/2014	190
07/10/2014	191
07/19/2014	200
07/20/2014	201
07/26/2014	207
07/27/2014	208
07/28/2014	209
07/29/2014	210
07/30/2014	211
07/31/2014	212

The number of dates listed exceeds the table's length. The following Julian Day Numbers should also be included in the days of hydrography: 212, 213, 214, 216, 219, 220, 221, 222, 223, 224, 225, 226, 227.

B. Data Acquisition and Processing

B.1 Equipment and Vessels

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

B.1.1 Vessels

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

Hull ID	***Qualifier 105***	***Cutwater***	***Spare RHIB***
LOA	32 meters	12.2 meters	6.4 meters
Draft	1.8 meters	1.1 meters	0.5 meters

Table 4: Vessels Used

The Qualifier 105 (Q105) is a 32 m aluminum hull vessel owned and operated by Support Vessels of Alaska (SVA). The Q105 acquired all multibeam data and provided housing and facilities for on-site data processing. The vessel also provided fuel and support for the smaller survey vessels, collected bottom samples, deployed Seabird tide gauges, and deployed/recovered the shoreline skiff (Spare RHIB) as necessary.

The Cutwater is a 12.2 m aluminum hull that is also owned and operated by SVA. The Cutwater acquired all single beam data in this sheet. The vessel also collected bottom samples in the shoaler portions of the survey area.

The Spare RHIB is a 6.4 m rigid haul inflatable boat (RHIB) with a fiberglass haul. It is owned and operated by TerraSond. The vessel was primarily used to conduct shoreline verification. It also collected limited amounts of single beam data, restricted to the shoalest portions of the survey area not readily accessible by the other survey vessels.

B.1.2 Equipment

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

Manufacturer	Model	Type
Teledyne Odom	Echotrac CV100	SBES
Teledyne Reson	Seabat 7101	MBES
Applanix	POSMV 320 V5	Positioning and Attitude
Hemisphere	Vector V113	Positioning and Attitude
AML Oceanographic	AML SV+	Sound Speed Profiler
Teledyne Odom	Digibar Pro	Sound Speed Profiler
Valeport	Rapid SVT 200Bar	Sound Speed Profiler
Teledyne Oceanscience	Underway SV400	Sound Speed Profiler Deployment System
Trimble	5700	Base Station
Trimble	NETRS	Base Station
Sea-Bird Electronics	SBE 26+	Submerged Tide Gauge
Xylem-WaterLOG	DAA H350XL Bubbler	Tide Gauge

Table 5: Major Systems Used

Equipment configurations and operations as well as data acquisition and processing are described in the DAPR.

B.2 Quality Control

B.2.1 Crosslines

Crosslines acquired for this survey totaled 10% of mainscheme acquisition.

Multibeam and single beam (set line spacing) crosslines were collected to meet, respectively, the 4% and 8% of mainscheme requirements required in the HSSD. The crossline percentage for multibeam totaled 5.7% of mainscheme mileage, while the crossline percentage for single beam totaled 12.5% of mainscheme mileage.

Effort was made to ensure crosslines were geographically distributed across the survey area. Crosslines were run perpendicular to mainscheme lines whenever possible to ensure higher quality nadir beams crossed lower quality outer beams. In portions of the survey area where vessel maneuverability was restricted, zig-zag multibeam crosslines were collected that were not perpendicular to the mainscheme, but were more than adequate for QC purposes.

The crossline analysis was conducted using CARIS HIPS “QC Report” routine. Each crossline was selected and run through the process, which calculated the vertical difference between each accepted crossline sounding and a QC BASE (CUBE-type) surface’s depth layer created from the mainscheme data. QC BASE surfaces were created with the same CUBE parameters and resolutions as the final BASE surfaces, with the important distinction that the QC BASE surfaces did not include crosslines so as to not bias the QC report results. Differences in depth were grouped by beam number and statistics computed, which included the percentage of soundings with differences from the BASE surface falling within IHO Order 1. When at least 95% of the soundings exceed IHO Order 1, the crossline was considered to “pass,” but when less than 95% of the soundings compare within IHO Order 1, the crossline was considered to “fail.”

Agreement between the BASE surfaces and crossline soundings was good for all vessels. The vast majority of crossline comparisons pass with 95% (or more) of soundings comparing to within IHO Order 1. 3 of 12 multibeam crosslines had failures, with results ranging from 81% to 92%. 5 of 48 singlebeam crosslines had failures, with results ranging from 73% to 94%.

Failures were investigated and found to be attributable mainly to bottom change frequently observed in this dynamic area, especially when collection periods were separated by many days or weeks. An additional source of failures were steep slopes and very rugged terrain, wherein sounding to surface comparisons often failed even though the underlying soundings and surface were within specifications. An example of a crossline failing QC is shown in the following figure.

Refer to Separate II: Digital Data for the detailed Crossline QC Reports.

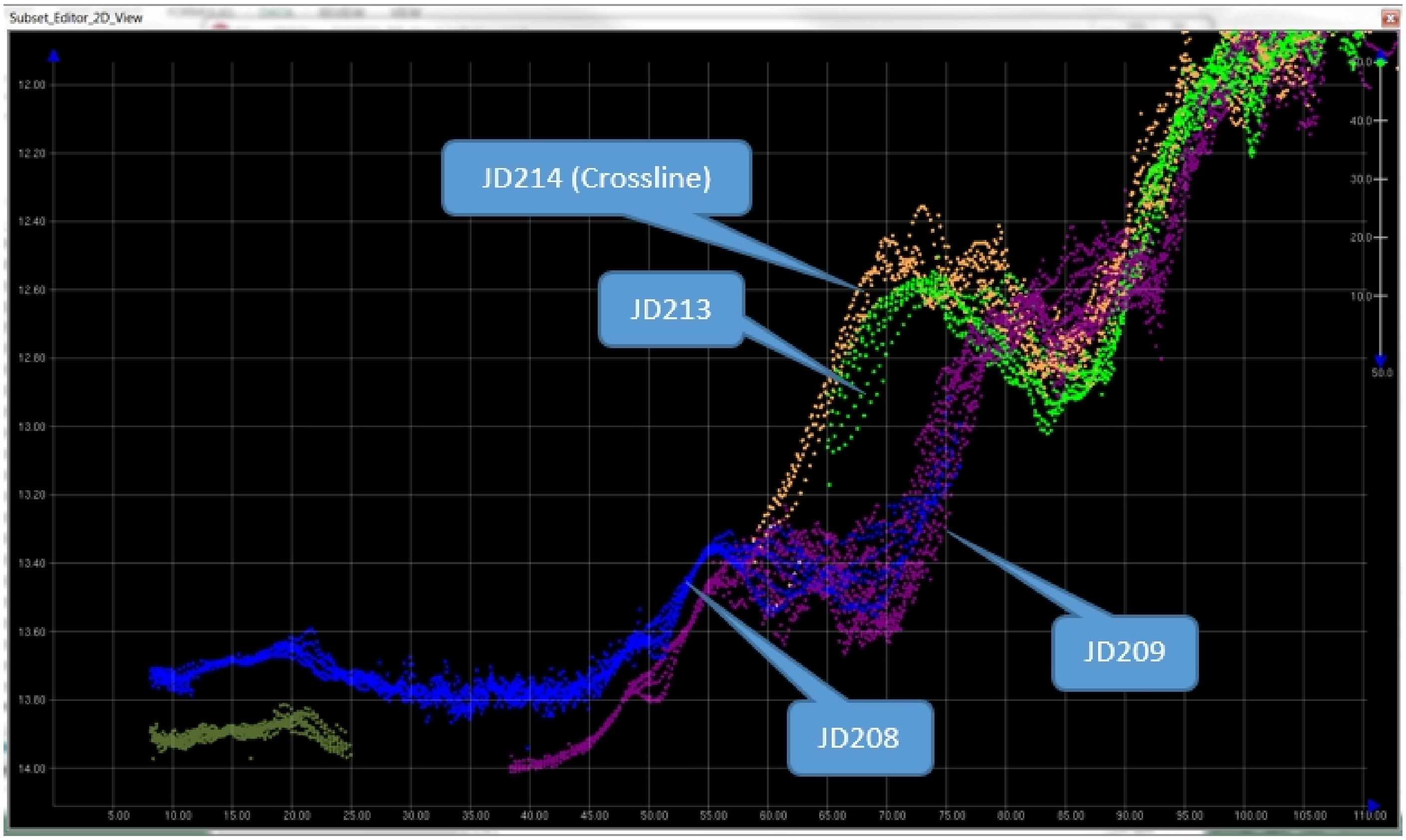

Figure 4: Example of a QC failure due to bottom change - line 1276-214-2B1XL (orange), run on JD214, agrees fairly well with an overlapping line run on JD213 but is offset up to 1 m from lines run earlier on JD208 and JD209.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Measured	Zoning
0 meters	0 meters

Table 6: Survey Specific Tide TPU Values

Hull ID	Measured - CTD	Measured - MVP	Surface
Qualifier 105	0 meters/second	1.6 meters/second	0.025 meters/second
Cutwater	1.72 meters/second	0 meters/second	0 meters/second
Spare RHIB	1.72 meters/second	0 meters/second	0 meters/second

Table 7: Survey Specific Sound Speed TPU Values

All soundings were assigned a horizontal and vertical value for estimated total propagated uncertainty (TPU). Tidal error was computed based on gauge and zone error estimates in the tide zone definition file (ZDF). The parameters and methods used for computation of sounding uncertainty are detailed in the project DAPR.

The BASE surfaces were finalized in CARIS HIPS so that the final uncertainty value for 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.

Uncertainty for the SBES surface ranged from 0.11 m to 0.89 m. Uncertainty for the MBES surfaces ranged from 0.12 m to 0.96 m. Few exceeded IHO Order 1.

Highest uncertainties were found in areas of varying bottom topography such as slopes and sand waves where high standard deviations are caused by the wide depth ranges of sounding contributing to each grid cell, outer edges of multibeam swathes without adjacent line overlap, and areas exhibiting bottom change. Despite elevated TPU values for these grid cells, the data is within specifications.

B.2.3 Junctions

This survey junctions with one contemporary survey, which was collected concurrent with this sheet. Junctions were compared by way of difference surfaces. Surfaces were created at 2 m resolution for multibeam and 4 m for single beam for each area, and the depth layer was differenced from each other. Results were extracted and analyzed.

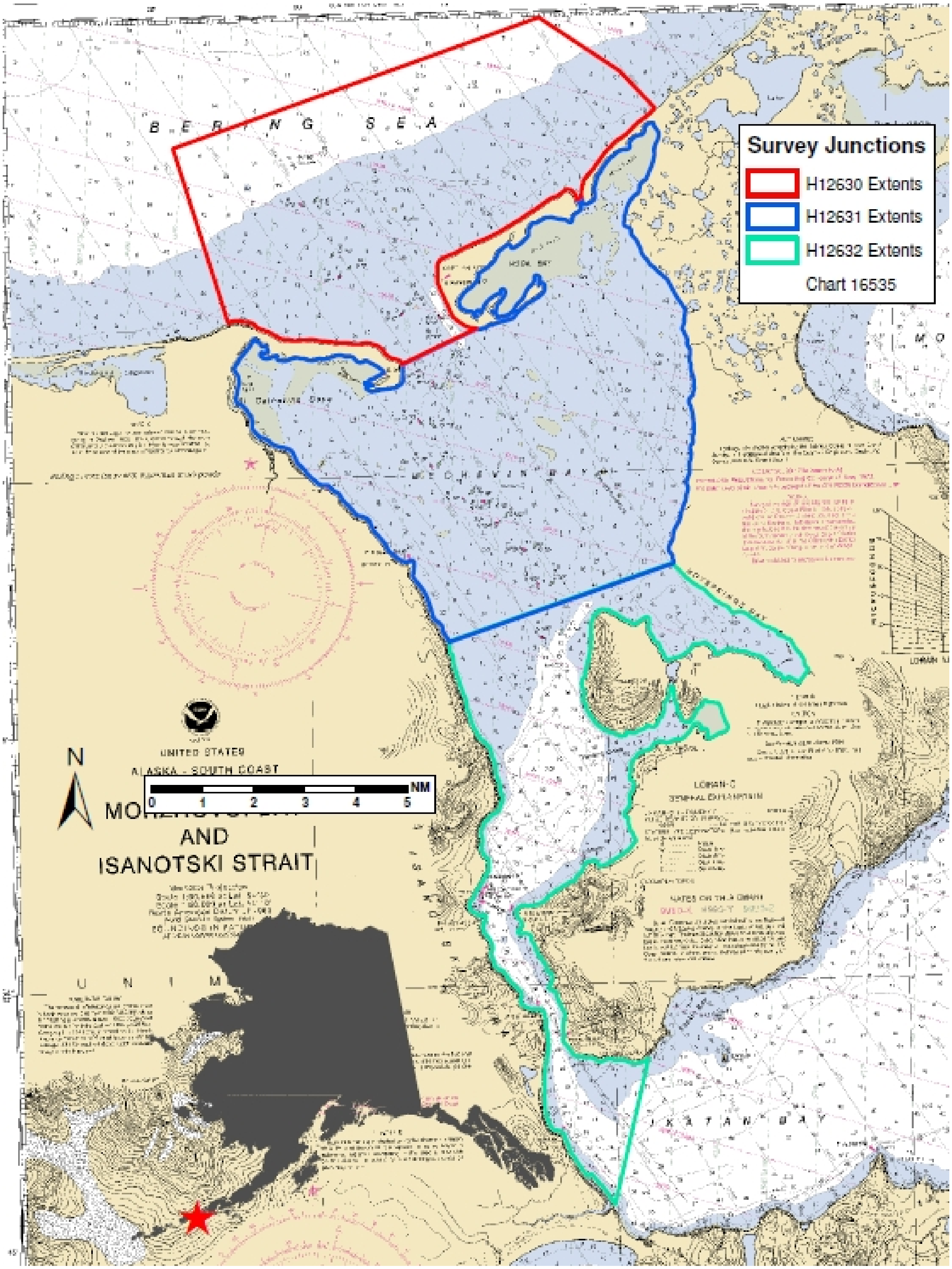

Figure 5: Survey junctions with this sheet.

The following junctions were made with this survey:

Registry Number	Scale	Year	Field Unit	Relative Location
H12632	1:40000	2014	TerraSond	S
H12630	1:40000	2014	TerraSond	N

Table 8: Junctioning Surveys

H12632

Multibeam agreement is good, averaging 0.007 m, with a standard deviation of 0.084 m, falling in a range of -1.178 m to 1.128 m. Single beam agreement is also good, averaging 0.023 m, with a standard deviation of 0.108 m, falling in a range of -1.002 m to 0.611 m.The larger differences were examined and found to be due to bottom change, normally in sand wave areas.

In review, the depth differences between H12631 and H12632 were found to differ from the hydrographer's. The mean depth difference was found to be 0.07m, with a min/max range of -1.7m to 0.771m and standard deviation of 0.122m.

H12630

Multibeam agreement is good, averaging 0.036 m, with a standard deviation of 0.180 m, falling in a range of -1.423 m to 1.774 m. The larger differences were examined and found to be due to bottom change, normally in sand wave areas.

A single beam comparison was not undertaken as the two single beam data sets do not have significant overlap.

In review, the depth differences between H12631 and H12630 were found to differ from the hydrographer's. The mean depth difference was found to be 0.045m, with a min/max range of -2.96m to 2.03m and standard deviation of 0.213m.
The opening sentence of section B.2.3 states incorrectly that H12631 junctions with one contemporary survey; it junctions with two. Both junction areas have been adequately reviewed and analyzed in the DR, with the reviewer having confirmed the results. Another statement that needs correction is that the multibeam surfaces were created at 1m resolution, and not 2m resolutions as stated at the beginning of this section.

B.2.4 Sonar QC Checks

Echosounder confidence checks consisting of bar checks, lead lines, and acoustic comparisons between vessels were undertaken on this project.

Two bar checks were completed for the multibeam system on the Q105, while three were completed for the single beam system on the Cutwater. The Spare RHIB single beam system received one bar check. Bar checks served as a check on both real-time as well as processed depth accuracy, and were also used to determine and refine the sonar acoustic center offsets. Results were good, with processed sonar depths comparing on average to 0.05 m (or better) of the actual bar depth.

Lead line comparisons were also undertaken. Over the course of the project, four were completed successfully on the Q105, three on the Cutwater, and four on the Spare RHIB. Sonar versus lead line depth differences ranged from -0.01 m to 0.12 m on the Q105, -0.23 m to 0.16 m on the Cutwater, and -0.03 m to 0.06 m on the Spare RHIB. Results were deemed acceptable given the variables associated with lead line checks.

Acoustic comparisons between Q105 multibeam, Cutwater single beam, and Spare RHIB single beam data were also undertaken. Effort was made in the field to ensure significant overlap between the three survey vessels for comparison purposes. To compare the data sets, CUBE BASE surfaces at 2 m resolution were created for each vessel and differenced from each other. Differences were extracted and analyzed. For this sheet, results are good, with the Cutwater single beam 0.085 m shoaler on average then the Q105 multibeam data, with a standard deviation of 0.229 m. Spare RHIB single beam is 0.094 m shoaler then Q105 multibeam data, with a standard deviation of 0.160 m. Cutwater and Spare RHIB have an average difference of 0.001 m, with a standard deviation of 0.176 m. Differences are attributable to bottom change in this dynamic area occurring between acquisition of the three data sets, which differed by 8-10 weeks in places. Also, both single beam data sets average slightly shoaler then the multibeam data set, which is expected in varying sea floor terrain given the wider beam width of the single beam systems.

Refer to the bar check and lead line logs available in Separate I: Acquisition and Processing Logs for specific results. Refer to the project DAPR for more information regarding the QC checks.

B.2.5 Equipment Effectiveness

Single Beam Bottom Tracking Issue (Sea Grass)

The northeastern part of Bechevin Bay had large areas covered in sea grass, which interfered with bottom tracking on the single beam systems used there. Effort was made in acquisition to tune out the sea grass but the density was great enough that the single beam systems often tracked the vegetation instead of the bottom, resulting in erroneous soundings shoaler then the actual bottom depth. Erroneous soundings were rejected in processing, but this frequently resulted in along-track coverage gaps in affected areas. Gaps due to sea grass were not rerun.

B.2.6 Factors Affecting Soundings

Sound Speed Error

A general downward or upward across-track cupping in multibeam data, indicative of sound speed error, is present periodically in the data set. This is more evident in flatter, offshore parts of the survey area. The sound speed error adversely affected outer beams by up to 0.20 m in places. To minimize the error sound speed profiles were collected every 3 hours during multibeam operations, line spacing was reduced to 2.5 times water depth to allow generous overlap, and filters were used in processing to remove the outermost (5-10°) beams. Due to the significant overlap and filtering the effect of sound speed error on final surfaces is relatively minor, normally not exceeding 0.10 m, which is within specifications.

Tide Error

Vertical offsets or “busts”, indicative of tide error, is present sporadically in the data set. The majority of lines show excellent matchup with adjacent lines but periodically show busts up to 0.20 m that are attributable to tide error. Four tide stations and seven zoning stations were deployed project-wide to model and correct for the movement of tides across the area, but some residual error remains since discrete tide zones cannot always compensate fully for all tide conditions. The observed amount of tide error was deemed acceptable given the complexity of the tidal regime in the area, which experiences current exceeding 6 knots at ebb and flood in constricted areas and a daily tide range of about 1.5 m. Despite the error, data is within specifications.

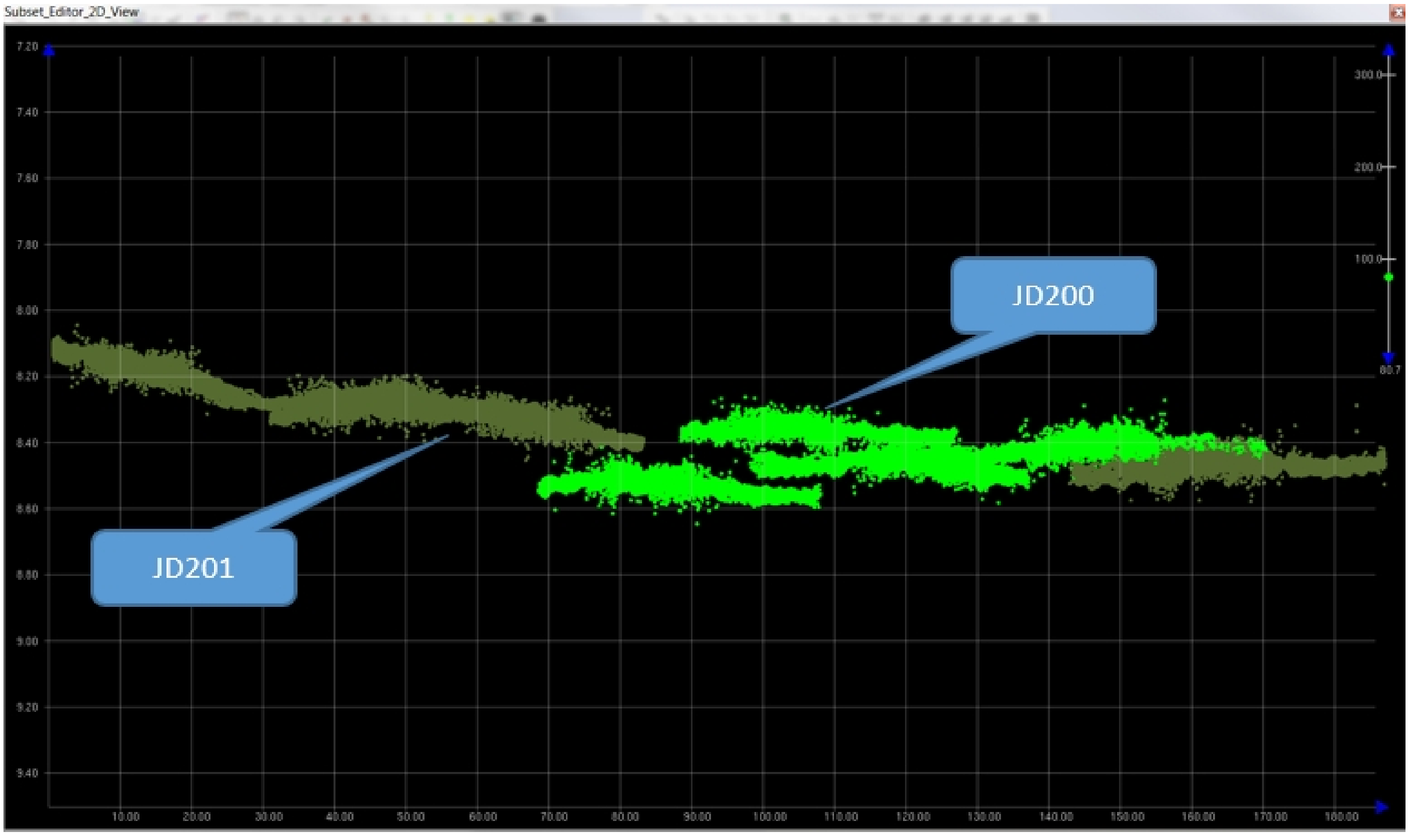

Figure 6: Example of tide busts in western Bechevin Bay. Light green lines were run within hours of each other but have vertical busts of up to 0.20 m, indicating tide error instead of bottom change.

Bottom Change

Bottom change due to sediment transport was a common occurrence on this survey. Bottom change is indicated by vertical busts between adjacent lines, often with an accompanying change in the shape of the bottom. The sea floor in the area is dynamic with migrating shoals and sand waves evident on the sea floor, especially in constricted areas where current commonly exceeds 6 knots during ebb and flood tides. During operations it was not always possible to survey an area to completion, necessitating a return to the area days to weeks later (to acquire crosslines, infills, or to continue working toward a contour for example), which often resulted in a different bottom. Bottom change could be minor (0.10 m or less) or major, up to 1.5 m in some cases along slopes or sand waves. Note that no additional action was taken in acquisition or processing in bottom change areas to re-run or edit soundings since the bottom return was deemed accurate and within specifications at the time of survey, and bottom change in this dynamic area was anticipated. Refer to figure 4 earlier in this report for an example of bottom change that affected crossline comparison results.

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: 3 hours for multibeam, 12 hours for singlebeam

For multibeam operations on the Q105, sound speed profiles were taken with an Oceanscience Underway SV system, which utilized a Valeport sound speed profiler. Profiles were taken on a 3-hour interval. The profiler was deployed while underway during survey operations. The profiler was lowered as close as possible to the sea floor, and then retracted to the vessel and downloaded.

For single beam operations on the Cutwater and Spare RHIB, sound speed profiles were taken with an AML Oceanographic SV+ or Odom Digibar Pro profiler. Profiles were taken on a 6-12 hour interval. The profiler was deployed by lowering it to the sea floor manually.

Up and down portions of the profiles were averaged and a combined profile at a standardized 0.10 m depth increment was output to CARIS SVP format with time and position. Sound speed profiles were applied with the “nearest in distance within time” method in CARIS HIPS, with time set to 3 hours for multibeam and 12 hours for single beam.

B.2.8 Coverage Equipment and Methods

Set Line Spacing (Single Beam) Set line spacing requirements called for 100 m spaced lines from 8 m depth to the inshore limit (generally the 4 m contour in this area), with a project-wide maximum of 1,075 LNM to be collected. Following completion of the 100 m lines, remaining line budget would be utilized by running additional lines between the existing 100 m lines per NOAA guidance in areas of navigational significance until the line budget was expended. This resulted in final single beam line spacing in some areas of 25 m to 50 m, such as in the main channel.

The Cutwater acquired the majority of single beam data for this sheet. Initial lines were collected within channels, parallel to the coast and shoals in order to provide recon and provide a starting point for survey. HYPACK acquisition software was utilized, which logged data and plotted the vessel position in real-time relative to background layers which included the chart, survey extents, coverage, and pre-plotted lines.

Following completion of the channel lines, a pre-plot line plan was navigated with lines perpendicular to the coast and shoals. The Cutwater would survey each line by proceeding slowly downline towards shoaler water, backing up and breaking offline once the tide and draft corrected depth read 4 m or less.

Late in the project, the vessel Spare RHIB was used to acquire additional single beam data in portions of the survey area inshore of the NALL per NOAA's request. Alternate channels were suspected to exist in these areas, possibly allowing for navigation between previously "dead-end" regions, albeit in depths shoaler then 4 m. The Spare RHIB utilized existing Cutwater coverage and current-derived bathymetric information (provided by NOAA) displayed in QPS QINSy during scouting of the suspected channels.

Data density requirements were met by surveying at slow rates, averaging 6 knots or less, and maximizing ping rates. Note that small along-track gaps are present on occasion where HYPACK dropped 1-2 seconds of data at Julian day rollovers as it automatically changed files. This was a common occurrence since the JD rollover occurred at 16:00 local time during prime daylight survey hours. Gaps were minor and normally not rerun unless there was an indication of shoaling. Gaps were also caused by echosounder interference caused by dense sea grass, especially in the northeastern part of the bay.

Note that although a project-wide set line spacing maximum of 1,075 LNM was in place, 1,293 LNM were actually acquired. The additional LNM were acquired after an analysis of excess mileage to compensate for mileage unintentionally acquired in areas deeper than 8 m that were designated for complete coverage, as well as crossline mileage exceeding the 8% requirement for set line spacing.

Complete Coverage (Multibeam)

Complete coverage was required in depths greater than 8 m. The 8 m contour was initially established during single beam operations by completion of the 100 m set line spacing scheme on the Cutwater.

The Q105 acquired all multibeam data for this sheet. QPS QINSy acquisition software was utilized, which logged data and plotted the vessel position in real-time relative to background layers, which included the chart, survey extents, existing coverage, and pre-plotted lines. The Q105 ran lines parallel to the coast and shoals, proceeding from the survey limits to the 8 m contour previously established by the single beam data.

Survey speed was minimized, averaging 8 knots or less, to maximize along-track ping density. Line spacing was normally held at 2.5 times water depth, which provided ample overlap between lines to minimize the effect of outer beam errors and ensure data density requirements were met. The Reson 7101 system was operated in a mid-density mode that provided 339 beams per swath, which provided good across-track resolution and data density meeting HSSD requirements without unnecessary data volume generated from higher beam modes.

Coverage Checks

Coverage was analyzed in the field by data processing. BASE surfaces were generated at the HSSD specified resolutions and analyzed to ensure requirements for data density and holidays were met. Re-runs and infills were identified and carried out by the acquisition vessels as necessary, except in areas where required coverage was not achieved for safety reasons.

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

Corrections applied to echo soundings are detailed in the project DAPR. No deviations occurred, with the following exceptions:

Spare RHIB V113 Heave and PPK Navigation

As described in the DAPR, post-processed kinematic (PPK) GPS methods were used to derive heave data and final navigation for the vessel Spare RHIB. However, a raw GPS file necessary for both records was corrupted on JD220, making this data unavailable for approximately 2.5 hours of lines. Backup heave and DGPS navigation provided by the less-accurate Hemisphere V113 system was used on these lines instead. Lines affected are vessel Spare RHIB, JD220, lines 0030_-_3B2-0000 through 0044_-_3B2-6150. Data is within specifications despite the use of the Hemisphere records. See the DAPR for more information.

Cutwater Lines Without TrueHeave, SBETs, or SMRMSGs

POS files were not logged for part of JD162 on the Cutwater. This made the raw data necessary for TrueHeave, post-processed navigation and attitude (SBET files), and post-processed error estimates (SMRMSG files) unavailable for about 6 hours of lines. The real-time POSMV solution was retained on these lines instead of replacing with PPK data and TrueHeave. Error estimates for TPU computation utilized the static entries in the HVF instead of the dynamic error estimates from SMRMSG files. Lines affected are vessel Cutwater, JD162, lines 1B-2014CU1621735 through 1B-2014CU1622356. RTK reception from the nearby Cape Chunak base station was good during this time. The data is within specifications.

Dynamic Draft Exceptions

Cutwater – As described in the DAPR, Cutwater engine RPM data was manually noted in TerraLog software for later use during dynamic draft corrections. The following lines were missing logged RPM data, and instead received dynamic draft values from closest in time RPM entries:

SheetB\Cutwater\2014-163\1B-2014CU1630054
SheetB\Cutwater\2014-170\1B-2014CU1702107
SheetB\Cutwater\2014-182\1B-2014CU1822013
SheetB\Cutwater\2014-182\1B-2014CU1822141
SheetB\Cutwater\2014-183\1B-2014CU1830030
SheetB\Cutwater\2014-220\1B-2014CU2201718
SheetB\Cutwater\2014-220\1B-2014CU2201922
SheetB\Cutwater\2014-225\1B-2014CU2251938
SheetB\Cutwater\2014-226\1B-2014CU2261936
SheetB\Cutwater\2014-226\1B-2014CU2261955
SheetB\Cutwater\2014-226\1B-2014CU2262003
SheetB\Cutwater\2014-226\1B-2014CU2262139

B.3.2 Calibrations

Calibrations were undertaken as described in the DAPR, no deviations occurred.

B.4 Backscatter

Multibeam backscatter was logged during this survey, but not processed. The vessel Q105 multibeam DB and XTF files contain the backscatter records.

The hydrographer acquired backscatter data with a Reson 7101, and delivered that backscatter in XTF format. The current work flow cannot process mosaics from 7101 sonars, so there are no mosaics or .GSF files containing backscatter data from this survey.

B.5 Data Processing

B.5.1 Software Updates

There were no software configuration changes after the DAPR was submitted.

The following Feature Object Catalog was used: V5.3.2

There were no software configuration changes after the DAPR was submitted.

B.5.2 Surfaces

The following surfaces and/or BAGs were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H12631_MB_1m_MLLW	MBES	1 meters	0 meters - 20 meters	NOAA_1m	MBES Complete Coverage
H12631_MB_2m_MLLW	MBES	2 meters	18 meters - 40 meters	NOAA_2m	MBES Complete Coverage
H12631_SB_4m_MLLW	SBES	4 meters	0 meters - 40 meters	NOAA_4m	SBES Set Line Spacing

Table 9: Submitted Surfaces

The final depth information for this survey was submitted as three CARIS BASE surfaces which best represented the sea floor at the time of the 2014 survey. The surfaces were created from fully processed soundings with all final corrections applied.

The surfaces were created using CUBE parameters that ensured a maximum sounding propagation distance of the grid resolution divided by #2. Resolutions of 1 m, 2 m, or 4 m were selected based on the requirement by depth for complete multibeam coverage and set line spaced single beam described in the HSSD. Surfaces were finalized according to the same depth thresholds, and designated soundings were applied. Horizontal projection was selected as UTM Zone 3 North, NAD 1983.

A CARIS HOB file was submitted (H12631_FFF.HOB) with the survey deliverables as well. The final feature file (FFF) contains meta-data and other data not readily represented by the final surfaces, such as bottom samples and shoreline features (where applicable). Objects are encoded with mandatory S-57 attributes and NOAA Extended Attributes (V#5.3.2).

Note that a large number of small rocks are apparent in the multibeam data in some channels, especially the main channel. The 1 m surface captures the least depth on the majority of the rocks within 1/2 of the maximum allowable TVU at these depths (about 0.25 m). However, some exist that exceed 1/2 of the maximum allowable TVU. When the scale of the survey (1:40,000) is considered, most are within 80 m (2 mm at survey scale) of the slope (or a shoaler feature) and were therefore not designated. Areas with numerous discrete submerged rocks were included in SBDARE objects in the FFF with NATSUR encoded as "rock" per the HSSD.

Refer to the DAPR for more detailed discussion of the steps followed when acquiring and processing the 2014 survey data.

The hydrographer states in the third paragraph of section B.5.2 that the maximum grid propagation distance of the grid would be the resolution divided by #2. This should instead read the square root of two, which properly describes the distance from a square grid's center to it's corner.

C. Vertical and Horizontal Control

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

C.1 Vertical Control

The vertical datum for this project is Mean Lower Low Water.

Standard Vertical Control Methods Used:

Discrete Zoning

The following National Water Level Observation Network (NWLON) stations served as datum control for this survey:

Station Name	Station ID
Unalaska	9462620
Port Moller	9463502
King Cove	9459881

Table 10: NWLON Tide Stations

The following subordinate water level stations were established for this survey:

Station Name	Station ID
Cape Chunak	9462941
Neumans Cove	9462948
False Pass	9462955
Isanotski Strait	9462961

Table 11: Subordinate Tide Stations

File Name	Status
9462620.tid	Final Approved
9462941.tid	Final Approved
9462948.tid	Final Approved
9462955.tid	Final Approved
9462961.tid	Final Approved

Table 12: Water Level Files (.tid)

File Name	Status
OPR-R315-KR-14_20141121.zdf	Final

Table 13: Tide Correctors (.zdf or .tc)

In addition to four subordinate tide stations installed to support the project, submerged BMPG (bottom mounted pressure gauges) were also deployed throughout the survey area to capture zoning characteristics. Data from all stations were used to derive the tide zones. Preliminary tide zones were not provided for this project.

C.2 Horizontal Control

The horizontal datum for this project is NAD83.

The projection used for this project is UTM Zone 3N.

<u>The following PPK methods were used for horizontal control:</u>

Single Base

Base stations at False Pass (FALS) and Cape Chunak (OUTE) also broadcast RTK corrections for real-time and preliminary positioning. Project base stations continuously logged data at 1 Hz, enabling PPK processing. All real-time positions were replaced in processing with PPK positions, except where noted previously in this report.

The following user installed stations were used for horizontal control:

HVCR Site ID	Base Station ID
FALS	False Pass
OUTE	Cape Chunak NETRS
5240	Cape Chunak T5700

Table 14: User Installed Base Stations

D. Results and Recommendations

D.1 Chart Comparison

The chart comparison was performed by examining all Raster Navigational Charts (RNCs) and Electronic Navigational Charts (ENCs) that intersect the survey area.

The chart comparison was accomplished by overlaying the finalized BASE surfaces with shoal-biased soundings, and final feature file on the charts in CARIS HIPS. The general agreement between charted soundings and survey 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.

It is recommended that this survey supersede charted data where they overlap.

USCG Notice to Mariners (NM) and USCG Local Notice to Mariners were checked for updates affecting the area. None were found that were issued subsequent to issuance date of the project instructions.

D.1.1 Raster Charts

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

Chart	Scale	Edition	Edition Date	LNM Date	NM Date
16535	1:80660	12	11/2000	11/04/2014	11/15/2014

Table 15: Largest Scale Raster Charts

<u>16535</u>

Sounding agreement varies widely, from poor to excellent on a sounding by sounding basis. Many soundings agree surprisingly well, given the age of the charted data and the dynamic nature of the sea floor in this area. No general trends are apparent in the changes. The channels through the area were also found to be peculiarly stable, with changes within and along edges, but are still located at the same general locations.

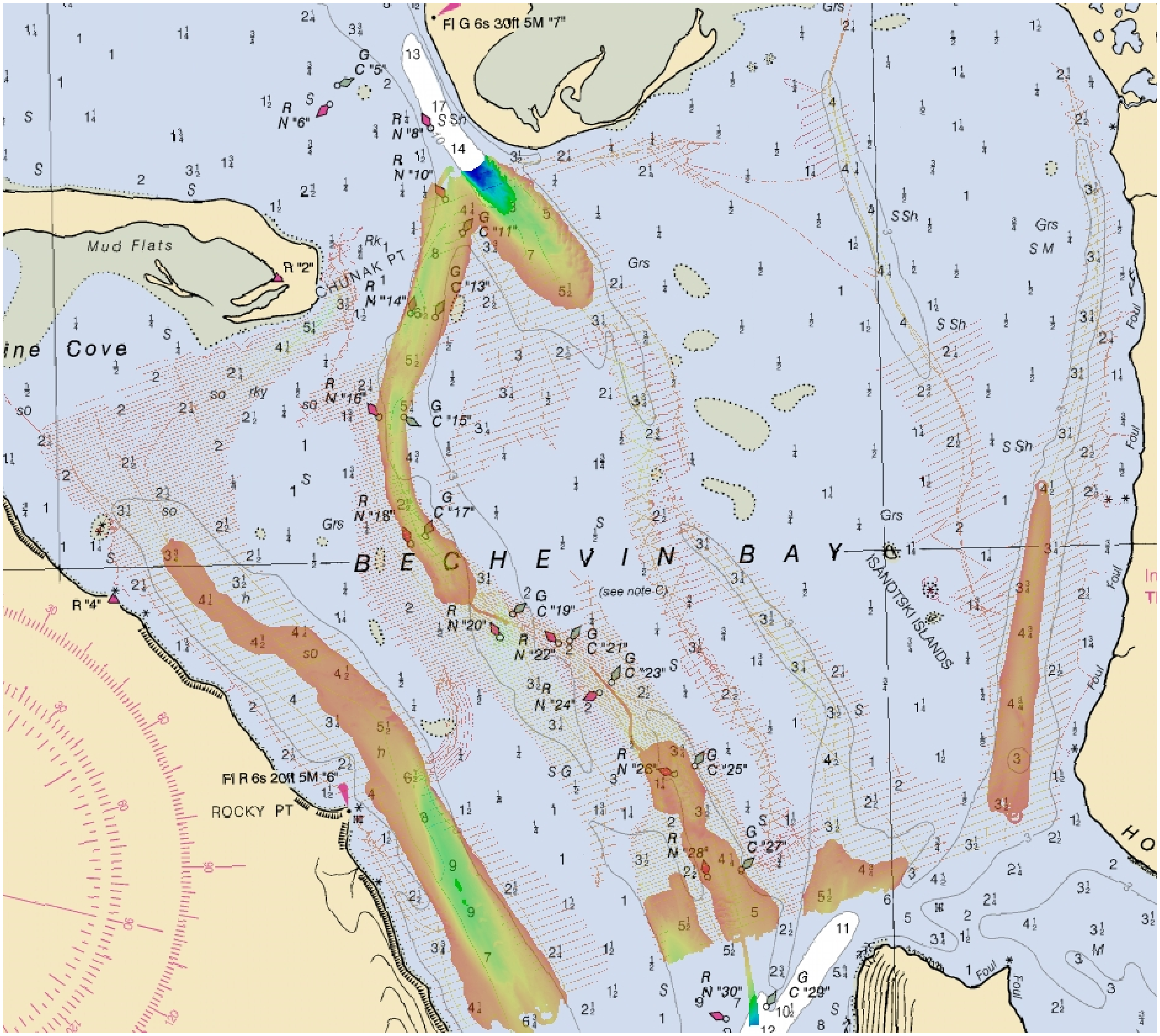

Figure 7: Chart comparison overview.

D.1.2 Electronic Navigational Charts

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

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US4AK5CM	1:80660	2	08/09/2011	08/06/2014	NO

Table 16: Largest Scale ENCs

US4AK5CM

The same differences observed for the RNC apply to this ENC.

D.1.3 AWOIS Items

No AWOIS items intersected the survey area.

D.1.4 Maritime Boundary Points

No maritime boundary points were assigned for this survey.

D.1.5 Charted Features

There are no charted features labeled PA, ED, PD, or Rep. within the survey extents.

D.1.6 Uncharted Features

No uncharted features were found during this survey.

D.1.7 Dangers to Navigation

No specific DTONs were found during this survey, though change is widespread. ‘Note C’ is still valid and should be retained (“Mariners are urged to use extreme caution while navigating in Bechevin Bay. The channel through the north entrance and Bechevin Bay is subject to frequent shoaling. Local knowledge of the area is essential for safe navigation.”

D.1.8 Shoal and Hazardous Features

Shoals consisting of sand and gravel bars exist in areas shoaler than 4 m and unsurveyed areas. This survey was not tasked with obtaining least depths on the many shoals of less than 4 m depth or delineating their extents, but their positions can be generalized by the absence of single beam data where the survey vessel reached the 4 m contour and stopped.

During shoreline verification a fix was taken for one particularly dangerous shoal near Chunak Pt at 55-01-48.15 N, 163-26-15.96 W. This feature and other near-shore features discovered during shoreline verification are included in the final feature file (FFF) with the survey deliverables.

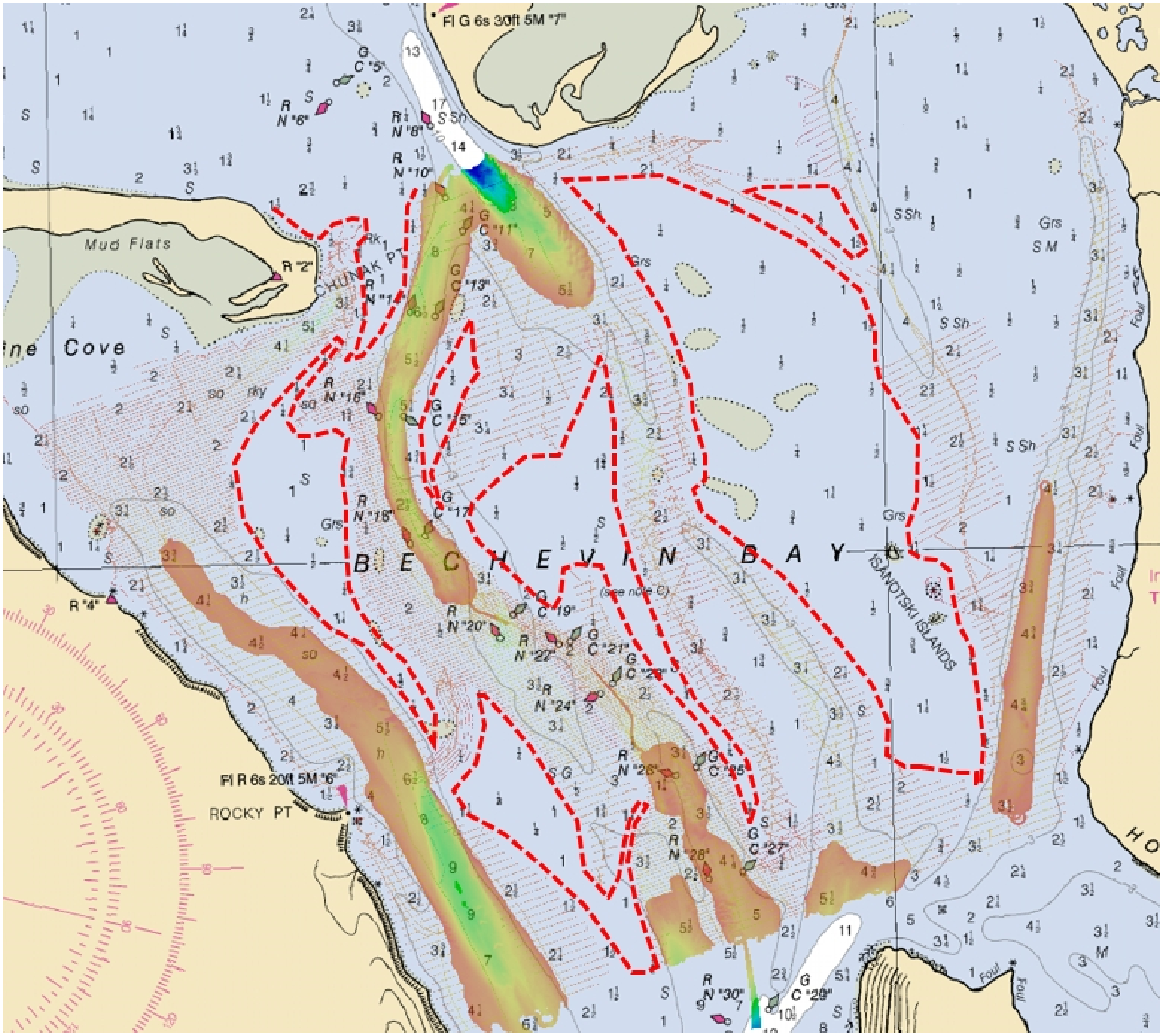

Figure 8: Unsurveyed areas, usually shoaler then 4 m are outlined. Exposed sand and gravel bars were often observed within these areas at low water.

D.1.9 Channels

A primary channel is chosen by the USCG each spring and marked with buoys. Buoys are removed prior to winter to avoid loss or damage from ice flows. The channel is not dredged or otherwise maintained and shifts position annually. It is recommended that updated positions of buoys be obtained from the USCG for charting purposes.

As the primary navigable route through the area, this "main" channel received multibeam coverage in areas deeper then 8 m, and single beam coverage at 25 m spacing in depths less then 8 m, as well as 25 m to 50 m spacing along its margins in depths less then 8 m.

Side-channels with entrances and exits less then 4 m deep were explored and surveyed with single beam at 100 m spacing when possible, even though their approaches were shoaler then project specification, per NOAA request. At least two additional routes were found and subsequently surveyed in this manner. See the following figure for the general location of all channels. Note that the channels in northeastern Bechevin Bay were not fully developed to 4 m for the following reasons: 1) the area was shoaler then 4 m on all approaches, 2) the area was not navigationally significant and was found to be commonly choked with sea grass, and 3) the project-wide line budget of 1,075 had been exceeded when acquiring 100 m spaced lines here.

The ability to navigate all channels in this area is highly dependent on vessel draft and tide state.

It should be noted that mariners often navigate over the shoals as shortcuts between channels with local knowledge. During operations, fishing vessels were often observed transiting across the unsurveyed shoal areas at or near high water, though some were also observed grounding during the process.

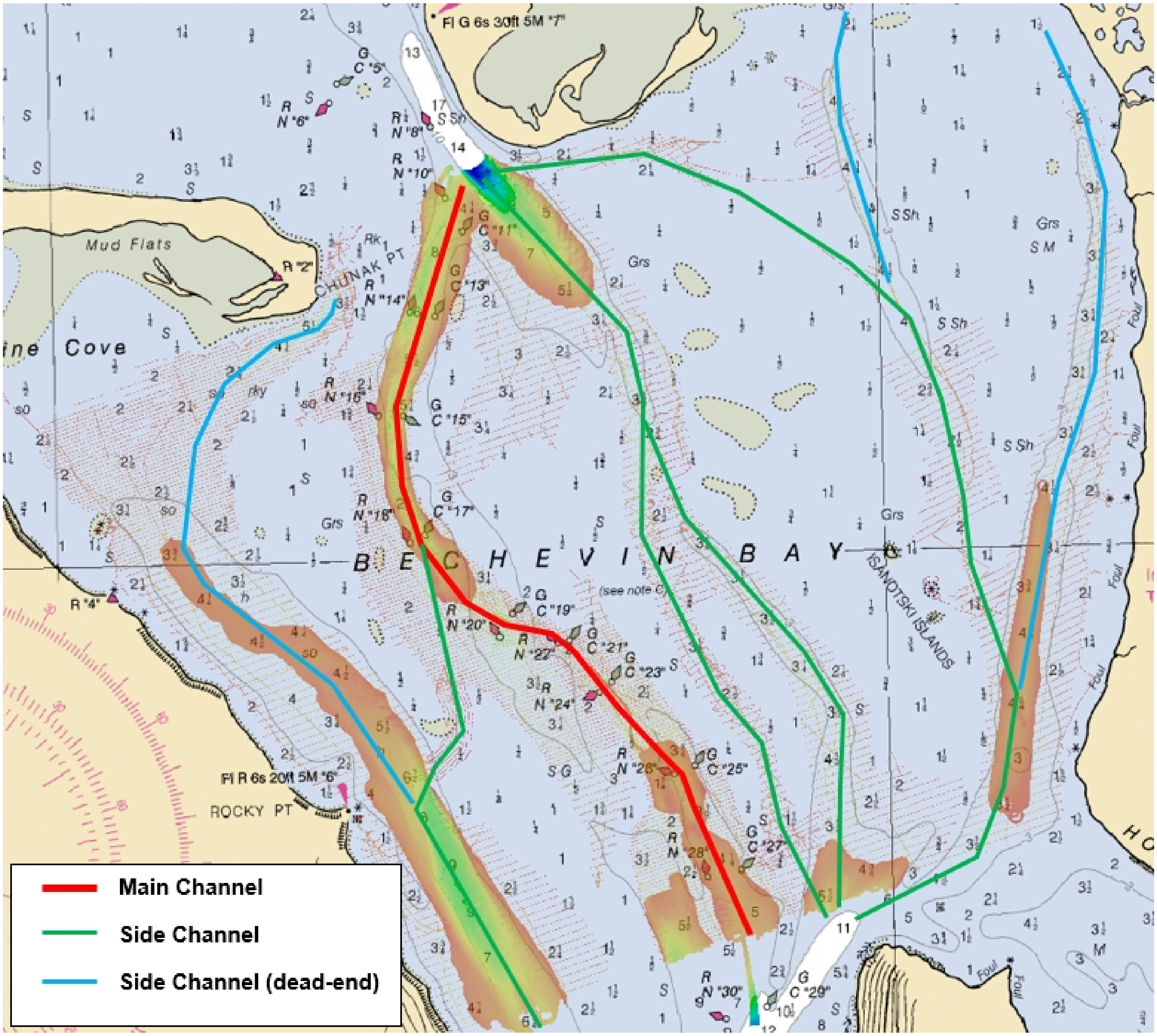

Figure 9: Channels found during this survey. Ability to navigate the channels is highly dependent on vessel draft and tide state.

D.1.10 Bottom Samples

Bottom samples were collected for this survey. Most samples returned sand and shells. The eastern channel in the bay also returned pebbles and rock. A sample in St Catherine's Cove was the only sample returning silt and mid. Bottom characteristics are encoded as SBDARE objects in the FFF included with the survey deliverables.

D.2 Additional Results

D.2.1 Shoreline

Limited shoreline verification was accomplished for this project.

A Composite Source S-57 File (CSF) was provided with the project instructions that included "Assigned" features for investigation (Acronym "asgnmt", name "Assignment flag", Value="Assigned").

Assigned features were assigned an index number (AF#) for tracking purposes and systematically investigated using the vessel Spare RHIB. Features were approached as close as possible, and a Detached Position (DP) was obtained: If the feature was observed, a photo was taken as well as a navigation fix, range, bearing, and estimated height. If the feature was not observed and there was a possibility it was submerged, a singlebeam search was undertaken of the area if possible. During investigation of the assigned features, new features were also investigated and a DP obtained if they had navigational significance.

In processing, DPs were tide-corrected and imported into CARIS Notebook, where mandatory NOAA S-57 attributes and charting recommendations were assigned. Note that a value of 1.233 m was used for the MHW reference plane for the purpose of islet-rock determinations - this value is the computed MLLW-MHW offset at the closest tide station, Neumans Cove.

Most assigned features were found to exist, though some required modifications to position and height. Clusters of islets were usually found not to exist and were likely mis-digitized MLLW from the raster chart. Many new (uncharted) rocks and islets were also found.

Refer to the FFF included with the survey deliverables for specific results. A "multimedia" directory is included with the FFF that contains feature photos. Each feature is attributed with correlating DP numbers in the "INFORM" field, which refers to an accompanying DP form (PDF format), which can be viewed for more information if required. A HOB-format file, "Field_Fixes(Reference-Only)", is also included for reference purposes, which contains the raw field fix information.

D.2.2 Prior Surveys

Comparison with prior surveys was not required. See Section D.1 for comparison to the existing nautical charts.

D.2.3 Aids to Navigation

ATONs were not specifically assigned for investigation. Charted buoys marking the channel were observed during operations, but are seasonal and were not investigated. The light at Rocky Pt (Fl R 6s 20ft 5m '6') was observed at the charted location and was serving its intended purpose.

D.2.4 Overhead Features

No overhead features existed within the survey area.

D.2.5 Submarine Features

No submarine features of note were found, though large sand waves interspersed with rocks are are a common feature, especially along the main channel where current is greatest.

D.2.6 Ferry Routes and Terminals

Ferry routes and terminals do not exist within the survey area.

D.2.7 Platforms

Platforms do not exist within the survey area.

D.2.8 Significant Features

Swift current often exceeding 6 knots was common during this survey, through the main channel as well as side channels. The area is a narrow constriction at the confluence of the Bering Sea and Pacific Ocean, and subsequently experiences a large volume of water flowing through the area during each tide cycle. It is recommended that "Note C" be amended to include the text "Tidal current regularly exceeds 6 knots through channels and Isanotski Strait near Whirl Pt."

Sea grass, noted as "Grs" symbols on the chart in the northeastern part of the bay, was confirmed by this survey and should be retained. The sea grass was dense enough at times to interfere with survey operations as noted earlier in this report.

All other significant features and conditions encountered have been described previously.

D.2.9 Construction and Dredging

No construction or dredging was occurring within the survey extents, nor are there any known future plans for construction or dredging in the survey area.

D.2.10 New Survey Recommendation

No new surveys are recommended in this area.

D.2.11 Inset Recommendation

No new chart insets are recommended in this area.

E. Approval Sheet

Field operations contributing to the completion of survey H12631 were conducted under my direct supervision with frequent personal checks of progress, integrity, and adequacy.

This report, digital data, and all other accompanying records are approved. All records are respectfully submitted and forwarded for final review.

The survey data was collected in accordance with the Statement of Work and meets or exceeds the requirements set in the 2013 NOS Hydrographic Surveys and Specifications Deliverables document. This data is adequate to supersede charted data in common areas. This survey is complete and no additional work is required with the exception of any deficiencies noted in the Descriptive Report.

Report Name	Report Date Sent
OPR-R315-KR-14 Zoning Report	2014-12-12
Coast Pilot Review (CPB9_E32_C06_20141031)	2014-11-06
Removal report for 9462941 Cape Chunak	2014-10-30
Removal report for 9462955 False Pass, Isanotski Strait	2014-10-21
Removal report for 9462961 Isanotski Strait Entrance	2014-10-20
Removal report for 9462948 Neumans Cove	2014-10-17

Approver Name	Approver Title	Approval Date	Signature
Andrew Orthmann, C.H.	TerraSond Charting Program Manager	12/22/2014	Andrew Orthmann 2014.12.23 18:17:38 -09'00' Palmer, AK

F. Table of Acronyms

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

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

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

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Center for Operational Oceanographic Products and Services
Silver Spring, MD 20910

Date: February 19, 2015

TO: LCDR Michael Gonsalves
Chief, Operations Branch
Hydrographic Services Division
Office of Coast Survey

FROM: Gerald Hovis
Chief, Products and Services Branch
Oceanographic Division
CO-OPS

RE: Validation of Zoning supplied in support of OPR-R315-KR-2014, Bechevin Bay and Vicinity, AK

JOA Surveys submitted discrete tidal zoning for validation by CO-OPS based on subordinate water level data collected at Isanotski Strait Entrance, AK (946-2961), False Pass, AK (946-2955), Neumans Cove, AK (946-2948) and Cape Chunak, AK (946-2941). CO-OPS finds the water level data as well as discrete zoning submitted in support of OPR-R315-KR-2014 to be valid and meet the requirements under NOS Specifications and Deliverables.

CO-OPS bases its validation of the contractor supplied zoning on the following reasons:

1. JOA's method to develop final zoning geometry and tide correctors is reasonable
2. The estimate of total propagated error within the survey area using JOA's final tidal zoning and provided zoning station water level data (Whirl Point, Trader's Cove, Hot Spring Bay, NE Bechevin Bay, Chunak Point, and Bering Sea, NE of Bechevin Bay) is within 0.33 meters.

CC:
Patrick Burke
Michael Brown
Matthew Jaskoski
Castle "Gene" Parker
LCDR Ben Evans
Laura Rear McLaughlin
Corey Allen
Cristina Urizar
Grant Froelich
Colleen Fanelli
Lucy Hick

APPROVAL PAGE

H12631

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

- H12631 DR.pdf
- Collection of depth varied resolution BAGS
- Processed survey data and records
- H12631_GeoImage.pdf

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

Digitally signed by
HOLMBERG.PETER.SCOTT.1365886101
DN: c=US, o=U.S. Government, ou=DoD,
ou=PKI, ou=OTHER,
cn=HOLMBERG.PETER.SCOTT.1365886101
Date: 2015.09.03 15:04:20 -07'00'

Approved:____

Peter Holmberg
Cartographic Team Lead, Pacific Hydrographic Branch

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

Digitally signed by
EVANS.BENJAMIN.K.1237217094
Reason: I am approving this document
Date: 2015.09.03 15:49:11 -07'00'

Approved:____

CDR, Benjamin K. Evans, NOAA
Chief, Pacific Hydrographic Branch