H11727

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey Hydrographic/Lidar

Field No. N/A

Registry No. H11727

LOCALITY

State Alaska

General Locality Keku Strait

Sublocality High Island to Southern Entrance of Keku

2007

CHIEF OF PARTY

Dushan Arumugam

LIBRARY & ARCHIVES

DATE

NOAA FORM 77-28 (11-72)

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

REGISTRY No

HYDROGRAPHIC TITLE SHEET

H11727

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

FIELD No

N/A

State Alaska

General Locality Keku Strait

Sub-Locality High Island to the Southern Entrance of Keku Strait

Scale 1:10,000 **Date of Survey** 8/5/2007 - 8/25/2007

Instructions dated 2/8/2006 **Project No.** OPR-O180-KRL-06

Vessel Tenix LADS Aircraft, VH-LCL

Chief of party Dushan Arumugam

Surveyed by Tenix LADS Personnel

Soundings by echo sounder, hand lead, pole Laser Airborne Depth Sounder
Reson SeaBat 7125

Graphic record scaled by N/A

Graphic record checked by N/A **Automated Plot** N/A

Sar by Toshi Wozumi Compilation by Sarah Wolfskeil, Kurt Brown

Soundings in Feet at MLLW

REMARKS: All times are UTC. UTM Zone 8

The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. Revisions and end notes in red were generated during office processing.

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/.

NOAA FORM 77-28 SUPERSEDES FORM C&GS-537

A – AREA SURVEYED

This Descriptive Report pertains to survey registry number H11727 (Sheet A), in Keku Strait, Alaska.[1] Survey H11727 was referenced as Sheet "A" in the letter of instructions dated June 25th, 2007 of project OPR-O180-KRL-07, but modified by the COTR on November 26th, 2007 to include the survey areas referenced as H11728 (Sheet B) and H11729 (Sheet C).

The survey area is bounded by the coordinate listing in Table 1, and encompasses the area from High Island to the Southern Entrance of Keku Strait, Alaska. The including survey limits for H11727 does not cover the entire extension of Sheet A as displayed graphically in Figure 1 on the following page.

Table 1 - H11727 Sheet Limits

Sheet Limits Task Order # T0001 H11727 Sheet A Scale 1:10,000		
Point #	Positions on NAD83	
	Degrees Latitude	Degrees Longitude
1	56º43'34.068"N	133º47'39.228"W
2	56º43'34.068"N	133º40'10.596"W
3	56°39'15.037"N	133º40'10.596"W
4	56°39'15.037"N	133°37'51.351"W
5	56°34'54.851"N	133°45'19.735"W
6	56°34'54.851"N	133°39'07.016"W
7	56°29'33.918"N	133°39'07.016"W
8	56°29'33.918"N	133°46'34.663"W
9	56°34'58.797"N	133°46'34.663"W
10	56°34'58.797"N	133°45'19.735"W
11	56º39'14.148" N	133°45'19.735"W
12	56º39'14.148"N	133º47'39.228"W

A sketch showing the LiDAR data coverage and line miles flown on this project are shown in APPENDIX C – FINAL PROGRESS SKETCH. Total statistical numbers for LIDAR survey is summarized as follows:

Mainscheme LNM	1945.36
Crosslines LNM	24.45
Mainscheme SqNM	51.60

LiDAR survey flights began on August 5th, 2007 and ended on August 25th, 2007 (UTC time).

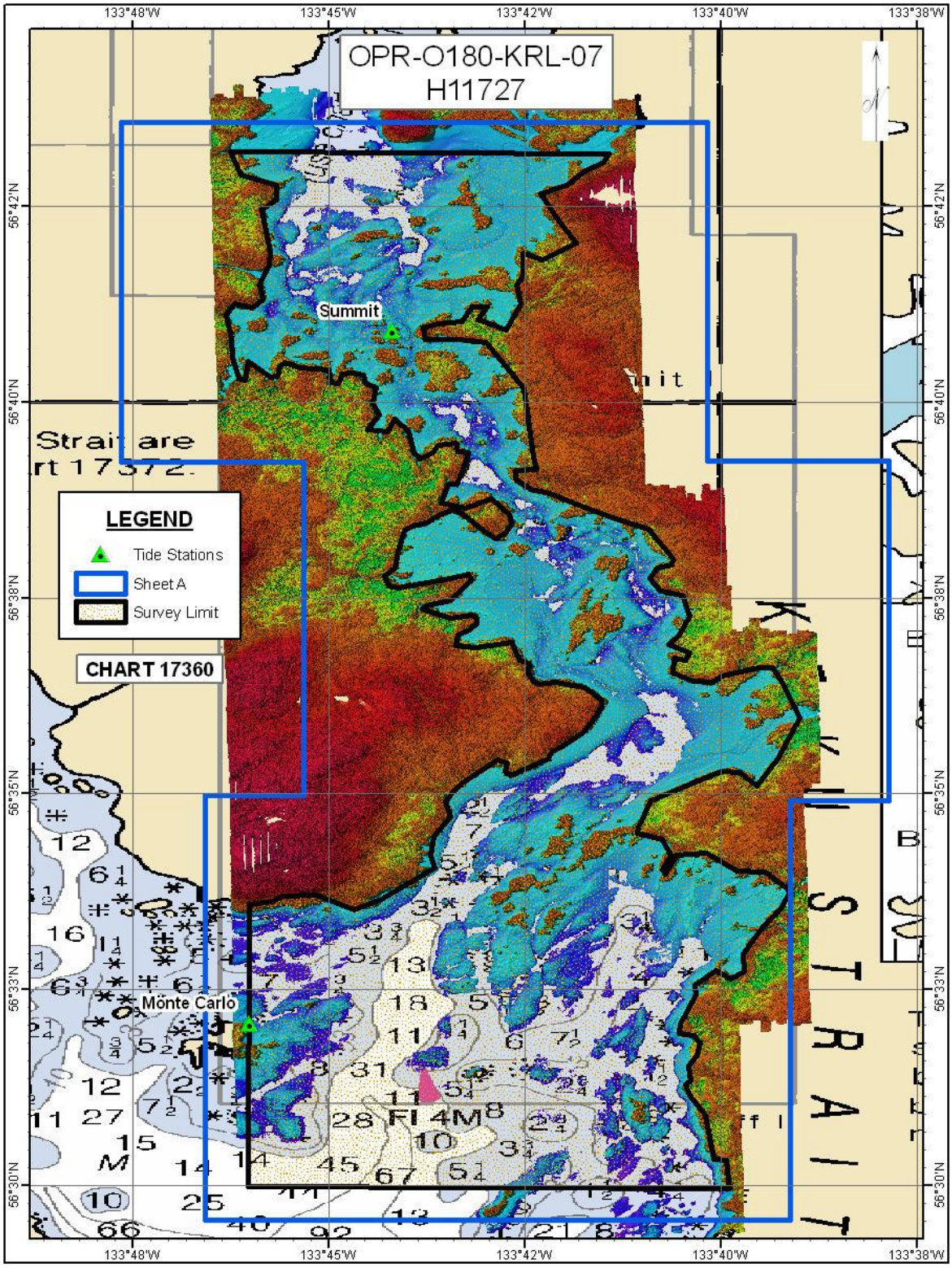


Figure 1 – H11727 survey limits and LIDAR data coverage.

B – DATA ACQUISITION AND PROCESSING

The detailed descriptions of all equipment, survey platforms, LiDAR suite, processing procedures and quality control features are discussed in the Data Acquisition and Processing Report (DAPR) for OPR-O180-KR-07. Refer to the Project DAPR for detailed information. Items specific to this survey and any deviations from the Data Acquisition and Processing Report are discussed in the following sections.

B1 – Equipment

The Beechcraft King Air 90 (call sign N89F) acquired all LiDAR data for H11727. The aircraft is 35 feet 6 inches in length with a wing span of 47 feet 10.5 inches. It was equipped with the SHOALS-1000T Bathymetric and Topographic LiDAR System. Aircraft motion was measured with an Applanix Position and Orientation System for Airborne Surveys (POS/AV 410), an OmniStar 3500LR DGPS receiver was used for Airborne Positioning. Raw data was collected in Optech's propriety file formats.

Refer to OPR-O180-KRL-07 Data Acquisition & Processing Report for a complete listing of equipment and vessel platform.

B2 – Quality Control

Crosslines

Seven cross lines were planned and acquired over the survey area. The percentage of crossline nautical miles as compared to main scheme was 1.29%, which accounts for nautical miles over large land extensions due to the designed line plan. The crosslines locations produced close to 500 potential intersections with main scheme lines that provide a good comparison analysis rate, however, the number of analyses ended up being determined by the actual valid bottom detection on the intersections. A difference analysis between the crossline and the main scheme lines surface was performed using the QC Tool in CARIS HIPS 6.1.

The QC reports were generated based on the given accuracy specification of:

$$\pm\sqrt{[a^2 + (b*d)^2}$$

where, a = 0.5, b = 0.013 and d = depth.

However, since a variance of a difference, rather than a variance from a mean is being used, the a and b values within CARIS will use:

$$a = 0.5 * \sqrt{2} = 0.707$$
$$b = 0.013 * \sqrt{2} = 0.018$$

The majority of QC reports fell well within the required accuracy specifications. However, there was a case where the results fell below the 95% confidence level in the QC report (Table 2). This case is associated with specific areas with steep slopes. It should be noted that data at these locations are in agreement with the adjacent sidelaping lines and are considered well within the required specifications.

Topographic data beyond the MHW line were not included because any specification for vertical accuracy must assume relatively flat bottom (due to laser footprint size in relation to the irregularity of the seafloor) and topographic data beyond MHW line were typically over target rich or steep slope environments such as vegetation, steep slopes, and other topographic features

Table 2 – Summary of QC Results

X-LINE FLIGHT DATE	REFERENCE SURFACE	X-CHECK FLIGHT LINE	# OF SAMPLES	DIFFERENCE MEAN	DIFFERENCE STANDARD DEVIATION	% OF SAMPLES MEETING ORDER 1
22-Aug-07	H11727_BASE_Final	2106_A_01501	8996	-0.005	0.025	98.5
22-Aug-07	H11727_BASE_Final	2106_A_01511	5227	-0.040	0.200	98.8
22-Aug-07	H11728_BASE_Final	2106_A_01521	10056	0.102	0.214	98.6
22-Aug-07	H11728_BASE_Final	2106_A_01531	7366	0.023	0.208	99.6
22-Aug-07	H11729_BASE_Final	2106_A_01541	9809	0.085	0.236	98.7
22-Aug-07	H11729_BASE_Final	2106_A_01551	3914	0.111	0.342	94.3
25-Aug-07	H11729_BASE_Final	0002_B_02411	14743	0.112	0.396	99.5

Data Uncertainty

Each sounding was assigned with horizontal and vertical TPE values developed from an investigation carried out on survey data collected in Shilshole Bay, Washington immediately following Keku Strait field acquisition. The TPE model was developed from statistical analysis on the LIDAR measurement error as a function of water depth. In general terms, TPE values are lower than IHO Order 1 levels down to an estimated 20 m water depth (reduced). Deeper than 20 m the theoretical error grows higher than Order 1, however, LIDAR depth detection did not reach that water depth level.

On the final BASE surfaces the uncertainty values carried on were the greater from the *a priori* uncertainty (TPE) and the standard deviation adjusted for 95% C.I. (2σ). For a

complete discussion of the TPE model analysis refer to survey report document FP6128.021-RPT-01-00[1].

Data Quality

In general, the LiDAR data quality for H11727 was good along the coastline and around islets and rocky areas. Minimal surf conditions benefited data collection around rocks and shallow water that allowed continuous coverage from water to land. There were no unusual conditions encountered, but few common situations to note affected data acquisition effectiveness:

- Water quality (in terms of clarity and turbidity) affected bottom detection in charted waters within the general laser extinction depth level. It was apparent conditions were influenced by tidal currents flowing on narrow and shallow waters producing higher turbidity levels. The lack of bottom detection on these areas were tried to resolve flying infill lines at more favorable tidal cycle periods; in most cases coverage improved but in others bottom detection was not achieved.

- LIDAR bottom detection was also affected by kelp. In some areas canopy blocked completely the laser signal; in some others the laser was able to penetrate superficial kelp only to detect mid-water returns; due to the uncertainty of these returns they havd to be rejected. Kelp beds were identified and delineated using the orthophoto mosaic (provided as part of the deliverable products) and included as features in the S-57 file.

Survey Junctions

The registered survey H11727 makes no junction with other surveys.

Quality Control Checks

Ground truth lines planned within the survey area were flown every day of the survey to verify data consistency and repeatability. LIDAR-to-LIDAR comparisons offered a good quality check to validate calibration parameters and eliminate potential systematic errors.

Additionally, to confirm the agreement of the LiDAR system, the plane flew over the Shilshole Bay ground truth site in Puget Sound, Washington immediately after collecting data over the survey area. Multibeam data collected in 2005 were compared to LIDAR data and revealed that the system was operating to specifications.

[1] Fugro Pelagos Inc. 2007. SHOALS-1000T Hydrographic LIDAR TPE Estimation and Target Detection Test, Shilshole Bay, Puget Sound Washington. FP6128.021-RPT-01-00. December 2007.

Positioning system confidence checks were conducted using the POS/AV controller software. The controller software has numerous real time displays that were monitored throughout the survey to ensure the positional accuracies specified in the NOS Hydrographic Surveys Specifications and Deliverables (version June 25th, 2007) were achieved. These include, but are not limited to the following: GPS status, position accuracy, receiver status (which included HDOP) and satellite status. Note: Flights were planned to avoid periods of high PDOP/HDOP and/or low number of available satellites.

B3 – Corrections to Soundings

Detailed summary for the Correction to Soundings processing can be found in the Data Acquisition and Processing Report. No deviation from the stated in that report had to be undertaken.

B4 – Data Processing

Three CARIS BASE surfaces were created in a single resolution for Sheet A. The data were gridded at 3 m, using CUBE weighting method, adding survey lines with IHO S-44 Order 1criteria. The MHW and MLLW lines were created in CARIS Fieldsheet Editor v6.1 at the appropriate intervals. The MHW contour elevation was taken from the derived tidal datum plane at tide station 9451349 at The Summit Island (Table 3). The MHW was in most part uninterrupted, however, small segments were interpolated for shoreline continuity; these few short segments were attributed with a statement emphasizing this fact in the S-57 file. On the other hand, the MLLW line was not interpolated manually to rectify breaks in the MLLW line.

Table 3 – Computed Datum Planes at tide station 9451349, The Summit

Datum Plane (MLLW)	Height (m)
MHHW	4.631
MHW	4.366
MTL	2.429
MSL	2.450
MLW	0.492
MLLW	0.000

C – VERTICAL AND HORIZONTAL CONTROL

Refer to the OPR-O180-KR-07 Horizontal and Vertical Control Report for a detailed description of the horizontal and vertical control used on this Survey. A summary of the projects horizontal and vertical control follows. No deviations from the report occurred.

Horizontal Control

The horizontal control datum for this survey was the North American Datum of 1983 (NAD83), UTM Zone 8 (Central Meridian 135ºW). All real-time positions were also collected in NAD83 using Omnistar differential corrections.

It was necessary to acquire dual frequency GPS data at a known location on the ground so that a KGPS solution could be used for final horizontal positioning. Two ground control points were established in the project, one at Kake runway (KAK1) and the other at Petersburg runway (PAPG). Both stations were used during all flights whenever possible. Refer to the Horizontal and vertical Control report for more Horizontal Control results and procedures.

Vertical Control

All soundings data were reduced to MLLW from verified tidal data from the installed tide station located at Monte Carlo Island (ID#: 9451247) and The Summit Island (ID#: 9451349) In Keku Strait, AK (Table 4).

Table 4 – Tide Gauges

STATION	MODEL	GAUGE TYPE	LOCATION	LATITUDE	LONGITUDE
9451247	H350XL	Digital bubbler	Monte Carlo, AK	56º 32' 04"N	133º 46' 02" W
9451349	H350XL	Digital bubbler	The Summit, AK	56º 40' 54"N	133º 44' 12" W

The final tide zones height and time corrections were modified to use the Monte Carlo and Summit gauges. Time and height corrections are listed in the Table 5 below.

Table 5 – Final Tide Zones

ZONE	PRIMARY			
	SITE	NUMBER	TIME	RANGE
SA197	Monte Carlo	9451247	0 min	1.00
SA200	Monte Carlo	9451247	0 min	1.01
SA417	Monte Carlo	9451247	6 min	1.02
SA408	Summit	9451349	0 min	1.00
SA409	Summit	9451349	0 min	0.99
SA411	Summit	9451349	0 min	0.93
SA412	Summit	9451349	0 min	0.92
SA413	Summit	9451349	0 min	0.90
SA414	Summit	9451349	0 min	0.89
SA415	Summit	9451349	0 min	0.87
SA416	Summit	9451349	0 min	0.85
SA410	Summit	9451349	0 min	0.98
SA410A	Summit	9451349	0 min	0.96
SA410B	Summit	9451349	0 min	0.95

During Keku Strait Survey, there were no unusual conditions regarding tidal information to note. Refer to the Horizontal and Vertical Control Report OPR-O180-KRL-07 and to John Oswald and Associates LLC submitted reports for a more detailed description of the tidal data.

Additionally, it was required to know the elevations of tidal benchmarks in both the ellipsoidal datum and the final charting datum, in this case NAD83 and MLLW respectively (Table 6). The offset between these two datum planes was applied to the data on land (drying area) during post-processing to depict data in the final charting datum. It should be noted that only KGPS horizontal position was applied to bathymetric LIDAR data and that at no time LIDAR depths were corrected with KGPS height data.

Table 6 - MLLW to Ellipsoid (NAD 83) Offset

LOCATION	LATITUDE	LONGITUDE	ELLIPSOID HEIGHT	MLLW HEIGHT	DIFFERENCE
Monte Carlo, AK (Tidal 5 1973)	56º 32' 06"N	133º 46' 02" W	2.736 m	4.879 m	2.143 m
Summit, AK (Tidal 1 1929)	56º 40' 54"N	133º 44' 12" W	3.261 m	5.451 m	2.190 m

D – RESULTS AND RECOMMENDATIONS

D1 – Chart Comparison

H11727 survey was compared to charts listed in Table 7.

Table 7– NOAA Chart List

Chart Number	Scale	Edition	Edition Dates as of June 25, 2007
OPR-O180-KRL-07			
50	1:10,000,000	6th	June 2003
500	1:3,500,000	8th	June 2003
530	1:4,860,700	31st	June 2005
531	1:2,100,000	23rd	January 2006
16016	1:969,756	20th	November 2003
17360	1:217,828	34th	March 2006
17372	1:20,000	11th	September 2003

Comparisons were made to RNC and ENC. In few places it was found the survey data had better agreement with the ENC. Only in cases where differences were notable to both RNC and ENC corresponding comments were made.

Comparison to coastline

In general, survey coastline follows closely the charted one, but also confirmed variations and differences, particularly in extended tidal flats such as the example in Figure 2.

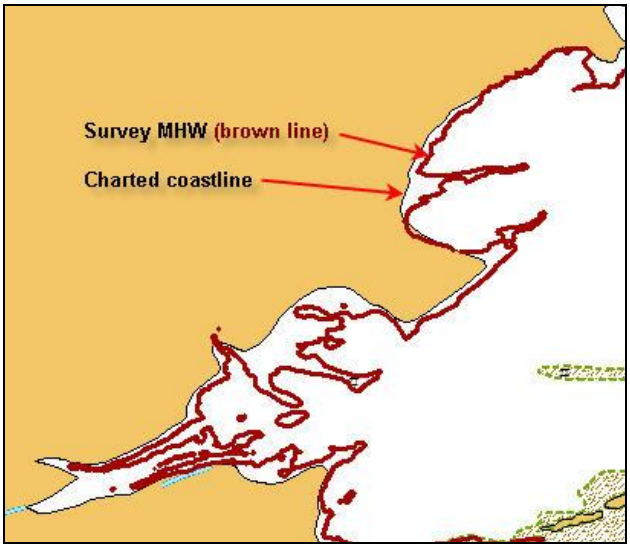


Figure 2 - Coastline comparison at 56°43'24.124"N 133°46'0.076"W

Major degree of variation between existing coastline and survey MHW line are noted as follow:

- Coastline in chart 17372 at 56°41'6.404"N 133°42'55.21"W is off 70 to 170 m from surveyed coastline. Digital imagery permits confirmation of changed configuration.

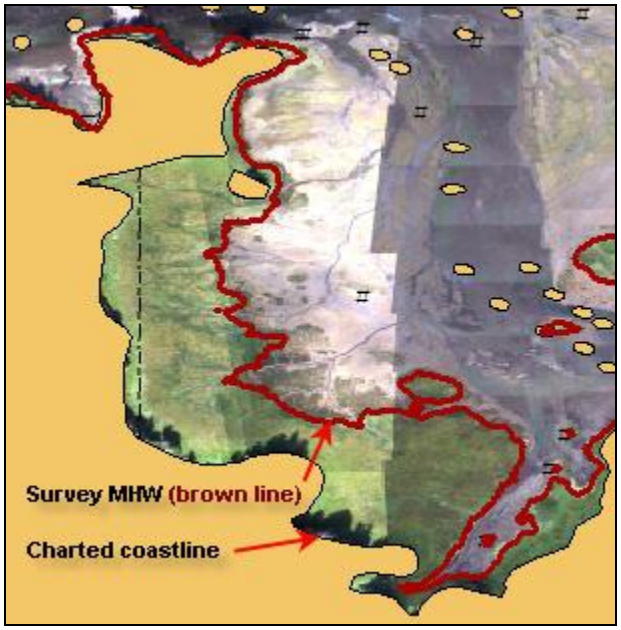


Figure 3 - Changed coastline; digital imagery overlaid.

- Coastline in chart 17372 at 56°39'42.178"N 133°44'22.709"W is off 70 to 170 m from surveyed coastline. Digital imagery permits confirmation of changed configuration.

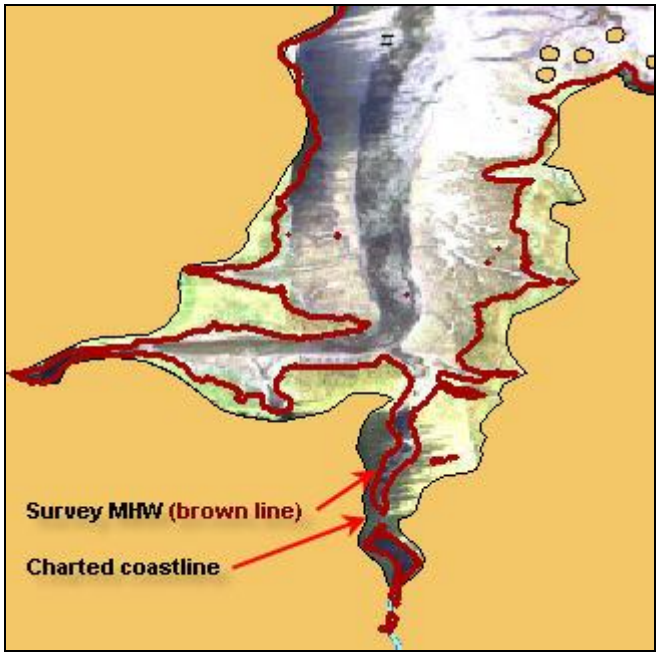


Figure 4 - Changed coastline; digital imagery overlaid

- Coastline in chart 17372 at location 56°37'53.382"N 133°43'46.779"W seems off 50 to 180 m from survey coastline. Digital imagery permits confirmation of changed configuration.

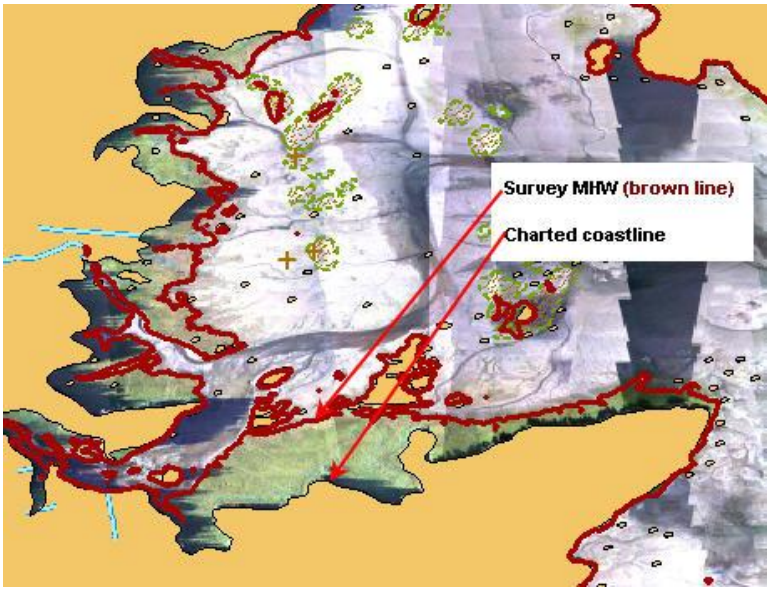


Figure 5 - Changed coastline; digital imagery overlaid.

- Survey coastline in cove at location 56°37'25.806"N 133°41'40.433"W reaches 200 m out from charted coastline in chart 17372.

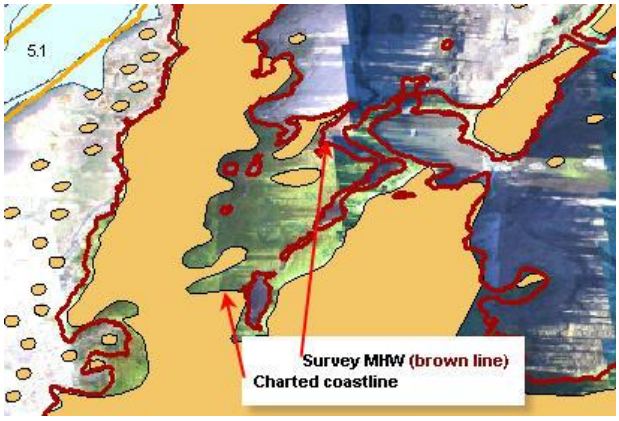


Figure 6 - Changed coastline; digital imagery overlaid

- Land area 65 m long by 45 m wide on chart 17372 located at 56°33'21.631"N 133°45'50.936"W was found below MHW line.

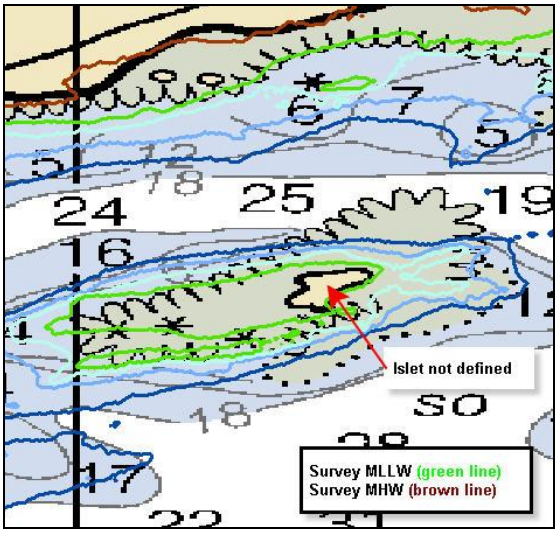


Figure 7 – Charted islet not found.

- Islet 165 m long and 120 m wide on Chart 17360 located at 56°30'46.789"N 133°45'23.276"W was found located 140 m off to the SW.

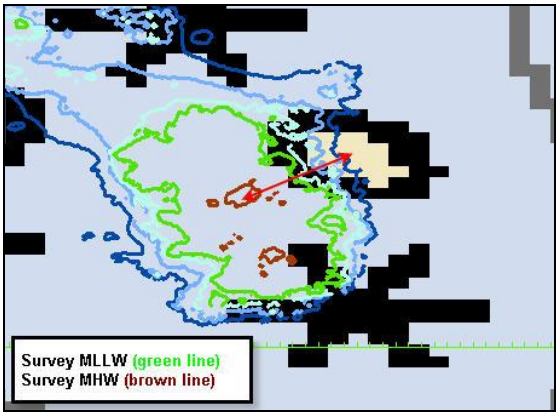


Figure 8 - Islet off charted position

- Islet 650 m long by 185 m wide on Chart 17360 located at 56°29'45.165"N 133°42'42.744"W was found located 90 m off to the WNW.

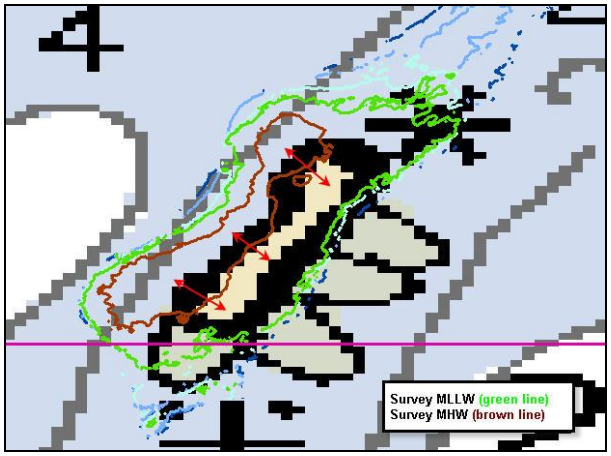


Figure 9 - Islet off charted position

- Islet 185 m long by 128 m wide on Chart 17360 located at 56°30'25.924"N 133°41"17.11"W was found located 131 m off to the W and under the MHW line.

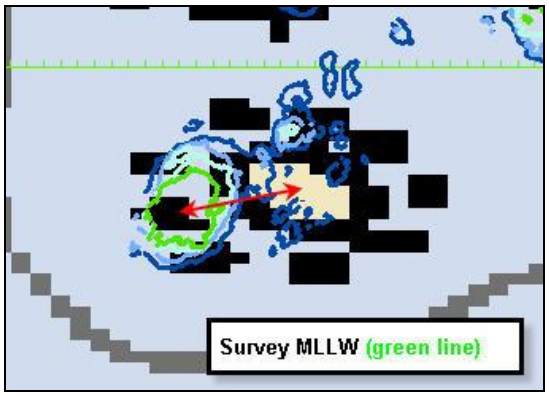


Figure 10 - Islet not found; fesature off charted position

Comparison of Soundings

The soundings and contours in general follow the trend found on the existing chart 17372, however subtle differences can be found all over the survey area. Those areas that do vary to a larger degree are noted as follows:

- Survey did not revealed the 0.9 m shoal on chart 17372 located at 56°43'17.402"N 133°44'25.626"W; instead depth is about 3.7 m.

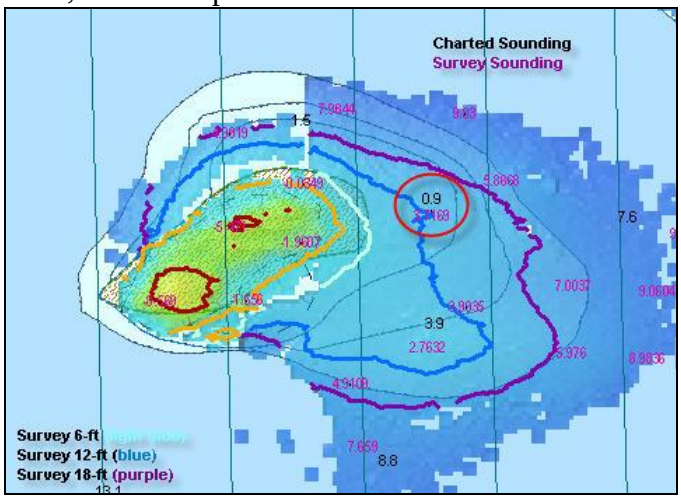


Figure 11 - Charted sounding 0.9 m not found.

- Charted sounding 3.6 m on Chart 17372 located at 56°41'55.941"N 133°44'8.57"W was not found.

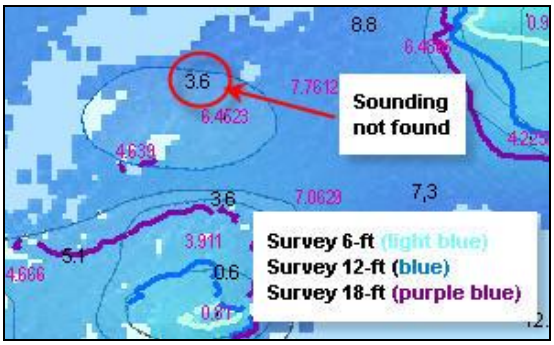


Figure 12 - Charted sounding 3.6 m not found.

- Survey revealed that charted sounding 2.7 m on chart 17372 located at 56°35'27.956"N 133°41'41.775"W is 80 m off to the SW and is about 1 m shallower.

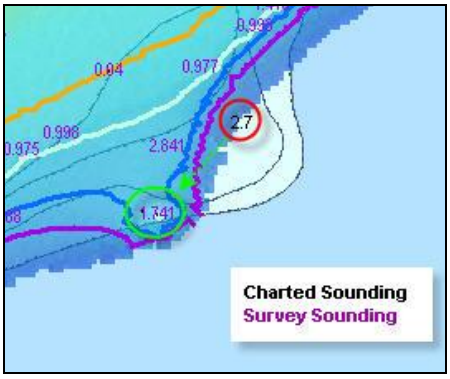


Figure 13 – Charted sounding 2.7 m located 80 m off charted position and 1 m shallower.

- Survey revealed that charted sounding 2.4 m on chart 17372 located at 56°37'25.831"N 133°40'44.673"W is about 1 m shallower.

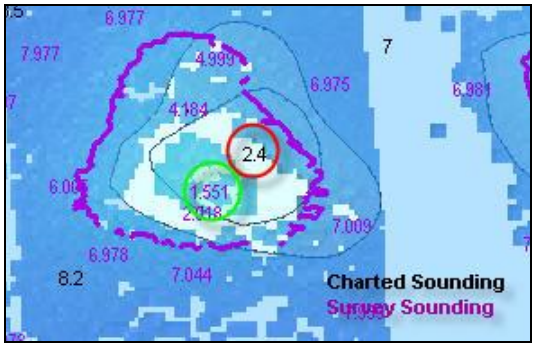


Figure 14 - Charted sounding 2.4 m is about 1 m shallower.

- Survey data did not revealed 1.8 m charted sounding on Chart 17372 located at 56°32'51.315"N 133°43'40.688"W.

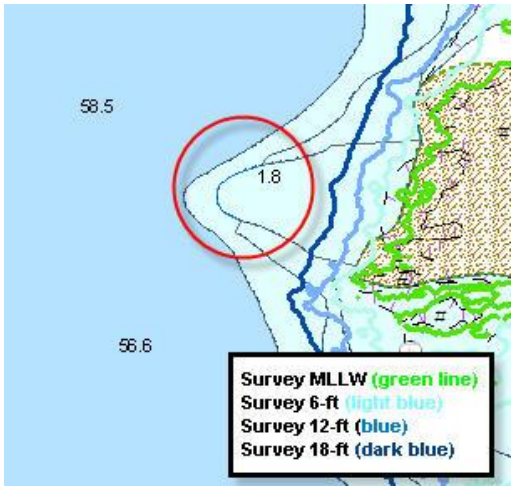


Figure 15 – Charted sounding 1.8 m not found.

The contours from H11727 take on the same general shape. Contours seem to be a little closer to the coastline up to the MLLW line, where the survey MLLW follows very closely the charted contour. Significant variations are noted as follows:

- Survey data revealed contours change slope that on Chart 17372 located at 56°43'30.76"N 133°45'9.494"W.

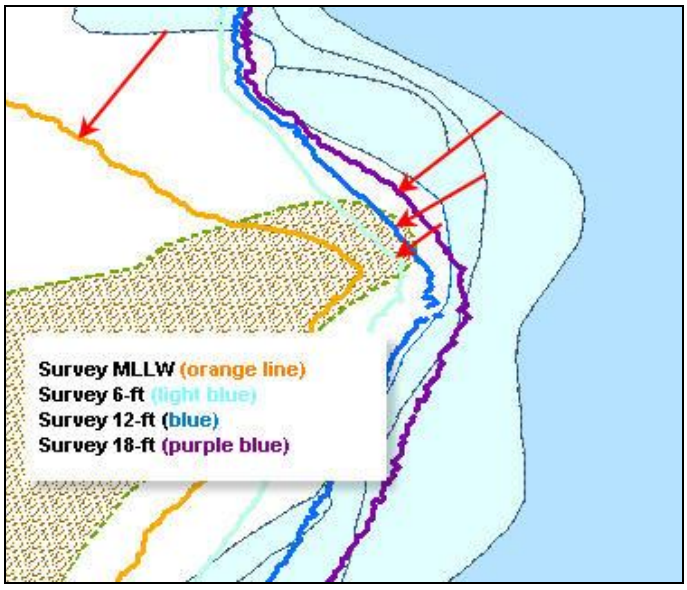


Figure 16 – Contours; change depicted by survey.

- Survey data revealed MLLW line displaced 200 m East that on Chart 17372 located at 56°36'1.504"N 133°40'6.702"W.

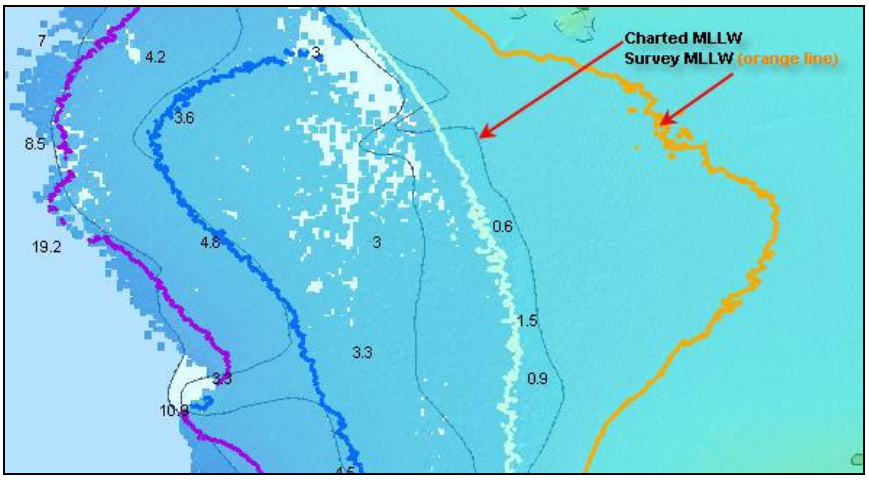


Figure 17 – Contours; MLLW line off from charted location.

- Charted sounding 0.9 m and contours depiction on Chart 17372 located at 56°36'13.473"N 133°40'59.313"W were not found.

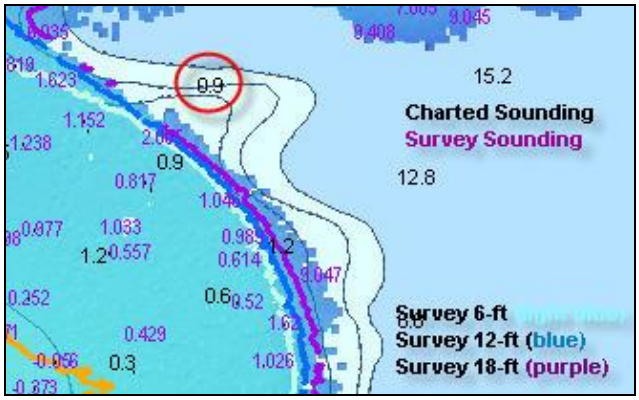


Figure 18 – Contours; charted sounding and contour depiction not found.

Automated Wreck and Obstruction Information System

There were no AWOIS items assigned to OPR-O180-KRL-07.

Charted Features

There were no charted features labeled PA, ED, PD, or Rep within the limits of H11727.

Dangers to Navigation

No dangers to navigation were submitted during the hydrographic survey of H11727.

D2 – Additional Results

Additional Item Investigations

No additional item investigations were performed on this contract.

Orthophoto Mosaics

ERDAS Image v9.0 software was utilized to create orthophoto mosaics from the SHOALS-1000T system digital images. Mosaics were used for the shoreline comparison and identification of other features. The accuracy of the mosaics is apparent when viewing photo images from reciprocal lines overlapping in the mosaic, the horizontal alignment of distinct features are within IHO Order 1 (+5m). The positional accuracy of the mosaic was verified by ground truth methods.

Recommendations

In general, achieved water depths (reduced) were in average 15 m particularly in the South entrance to the strait; maximum depth validated was around 17 m in isolated areas. Existing water quality is regarded as the main cause of this result. However there are areas were bottom detection achieved was much shallower and patchy.

The following features require further investigation. These features were either not found with the LiDAR system or are additional features that were found and are of question. These areas described are recommended to be visited with a multibeam echo-sounder system or other techniques to verity no navigation hazards exist.

- Charted sounding 2.7 m on chart 17372 located at 56°35'27.956"N 133°41'41.775"W is 80 m off to the SW and is about 1 m shallower (Figure 13).
- Charted sounding 2.4 m on chart 17372 located at 56°37'25.831"N 133°40'44.673"W is about 1 m shallower (Figure 14).
- Charted sounding 3.6 m on Chart 17372 located at 56°41'55.941"N 133°44'08.570"W was not found (Figure 12).
- Charted sounding 1.8 m on Chart 17372 located at 56°32'51.315"N 133°43'40.688"W was not found (Figure 15).

The areas below are also recommended for further investigation due to limitation on laser's water penetration and lack of confident in bottom detection.

- Laser extinction around vicinity at 56°43'19.641"N 133°44'42.762"W.

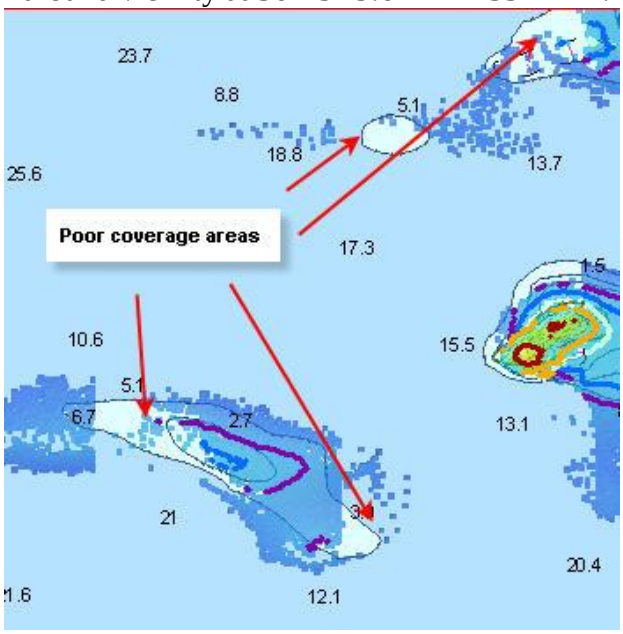


Figure 19 - Laser extinction; water quality.

- Laser extinction around vicinity at 56°42'35.704"N 133°44'7.616"W.

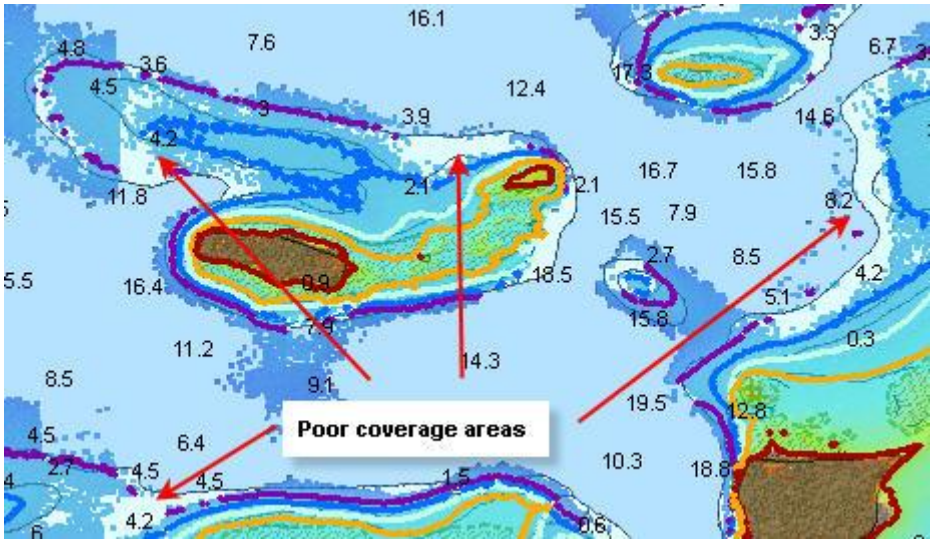


Figure 20 - Laser extinction; water quality.

- Laser extinction around vicinity at 56°42'22.297"N 133°45'21.482"W.

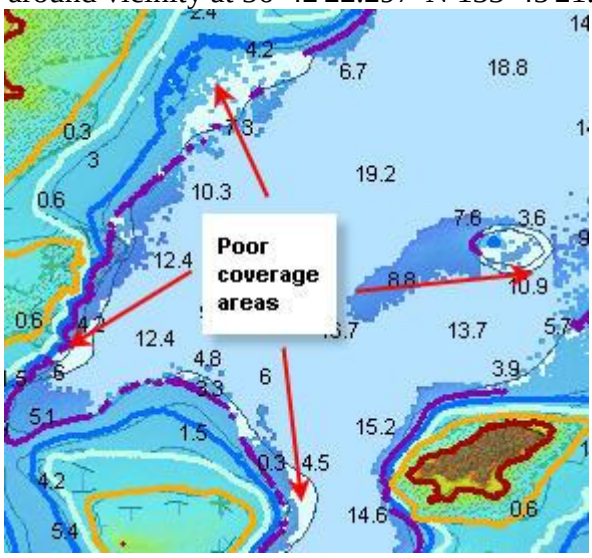


Figure 21 - Laser extinction; water quality.

- Laser extinction around vicinity at 56°41'37.143"N 133°44'52.644"W.

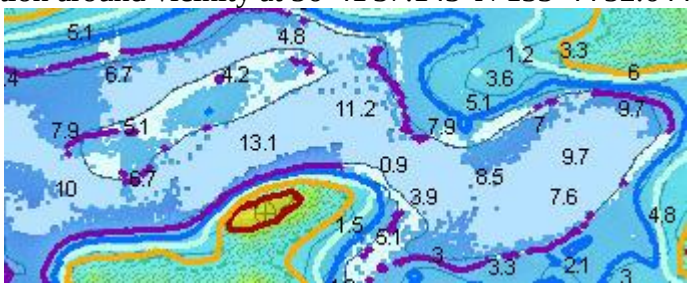


Figure 22 - Laser extinction; water quality.

- Laser extinction around vicinity at 56°41'14.677" N 133°44'28.122"W.

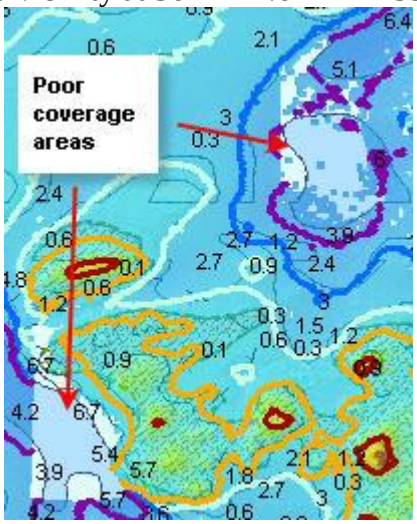


Figure 23 - Laser extinction; water quality.

- Laser extinction around vicinity at 56°40'51.898"N 133°44'22.205"W .

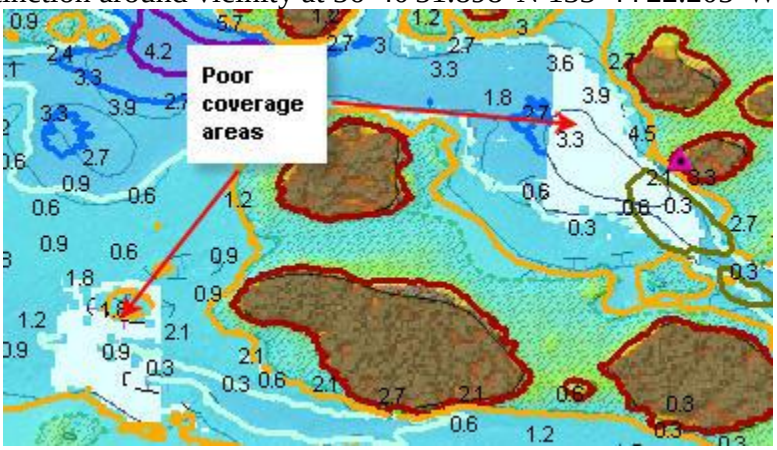


Figure 24 - Laser extinction; water quality.

- Laser extinction around vicinity at 56°39'46.669"N 133°43'17.6"W.

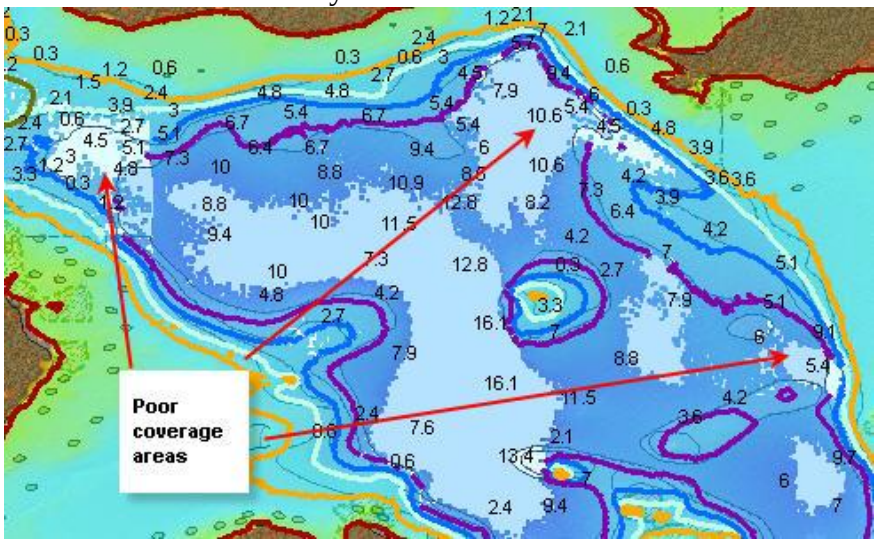


Figure 25 - Laser extinction; water quality.

- Laser extinction around vicinity at 56°38'28.341"N 133°42'20.403"W.

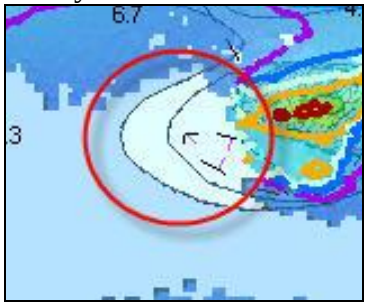


Figure 26 - Laser extinction; water quality.

- Laser extinction around vicinity at 56°38'15.408"N 133°41'59.71"W.

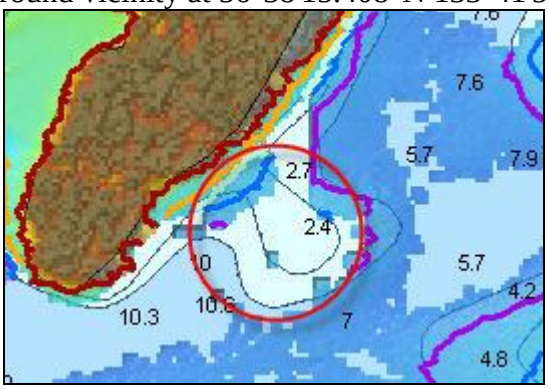


Figure 27 - Laser extinction; water quality.

- Laser extinction around vicinity at 56°34'1.31"N 133°42'54.099"W.

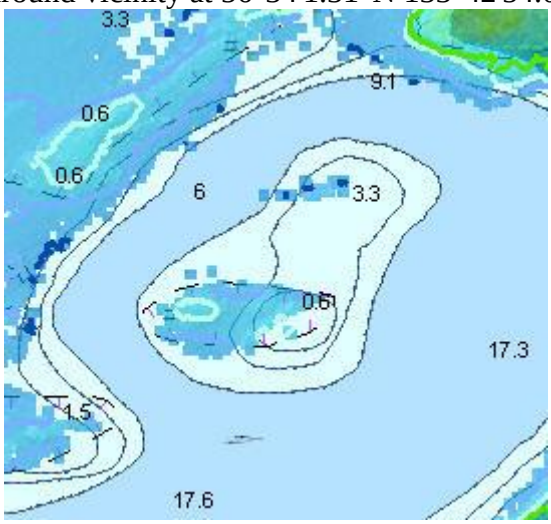


Figure 28– Laser extinction; water quality.

- Laser extinction at 56°33'39.44"N 133°41'7.155"W.

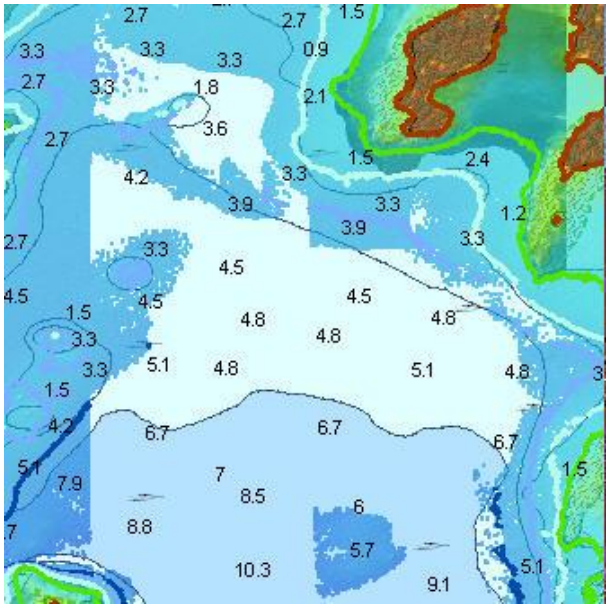


Figure 29 – Laser extinction; water quality.

- Laser extinction around area at 56°32'57.295"N 133°40'41.936"W.

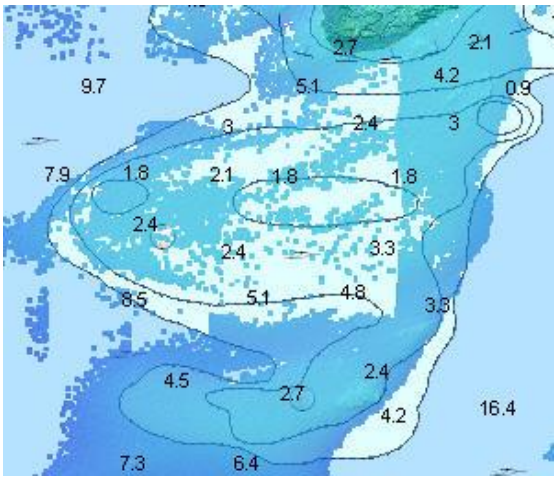


Figure 30 - Laser extinction; water quality.

- Laser extinction around area at 56°32'4.234"N 133°43'22.485"W.

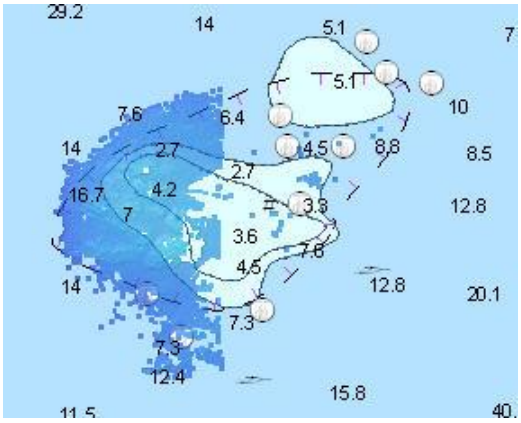


Figure 31 - Laser extinction; water quality.

- Laser extinction around area at 56°32'16.77"N 133°42'44.987"W.

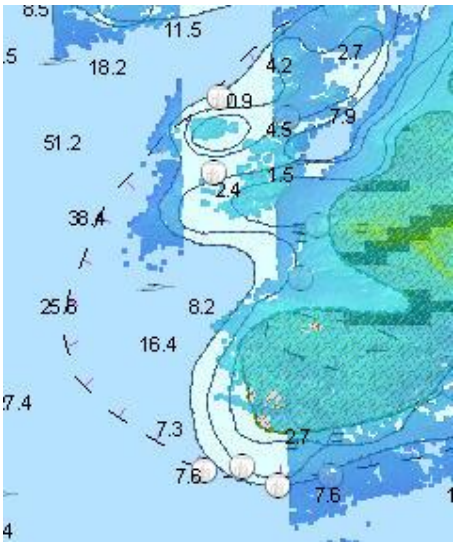


Figure 32 - Laser extinction; water quality.

Other reasons for questionable bottom detection include presence of dense kelp beds. In some instances, coverage is sparse on these areas where rocky bottom is presumed. It is also recommended to visit these areas to verify no navigation hazards exist.

- Questionable bottom detection around vicinity at 56°38'14.951"N 133°42'17.411"W.

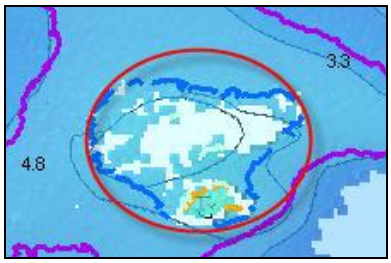


Figure 33 - Questionable bottom detection; kelp.

- Questionable bottom detection around vicinity at 56°38'11.807"N 133°41'30.649"W.

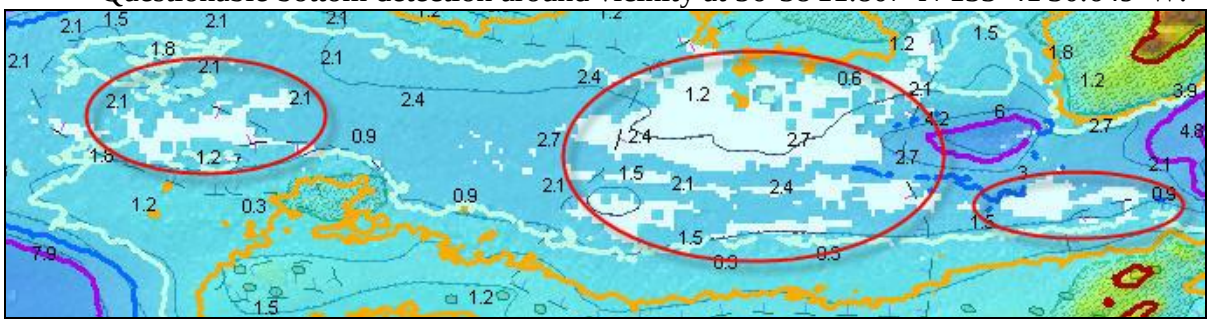


Figure 34 - Questionable bottom detection; kelp.

- Questionable bottom detection around vicinity at 56°38'2.475"N 133°41'4.225"W.

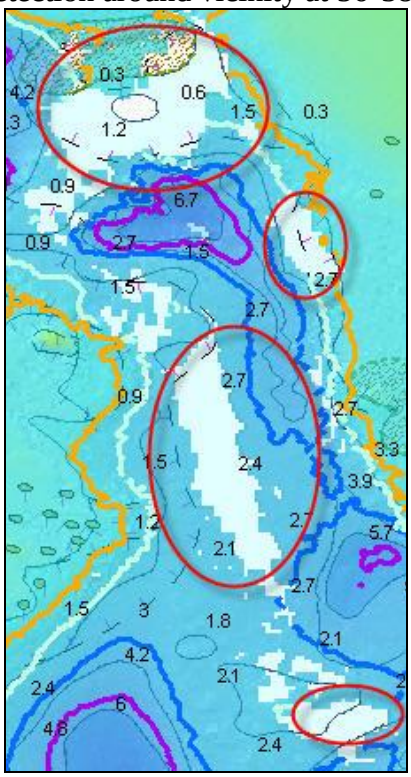


Figure 35 - Questionable bottom detection; kelp.

- Questionable bottom detection around vicinity at 56°36'57.98"N 133°41'9.049"W.

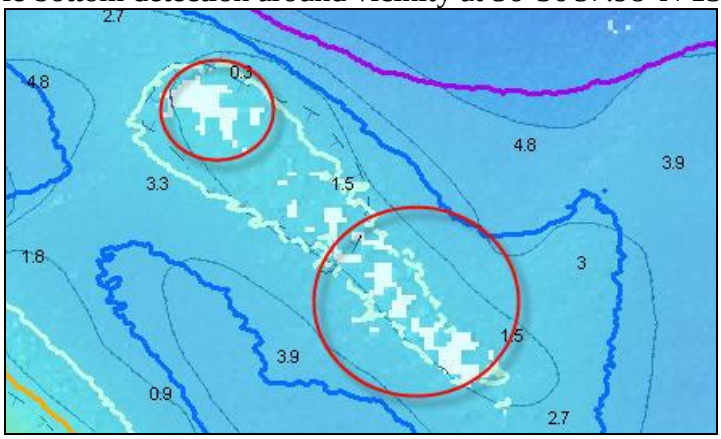


Figure 36 - Questionable bottom detection; kelp.

- Questionable bottom detection around vicinity at 56°36'31.499"N 133°40'59.66"W.

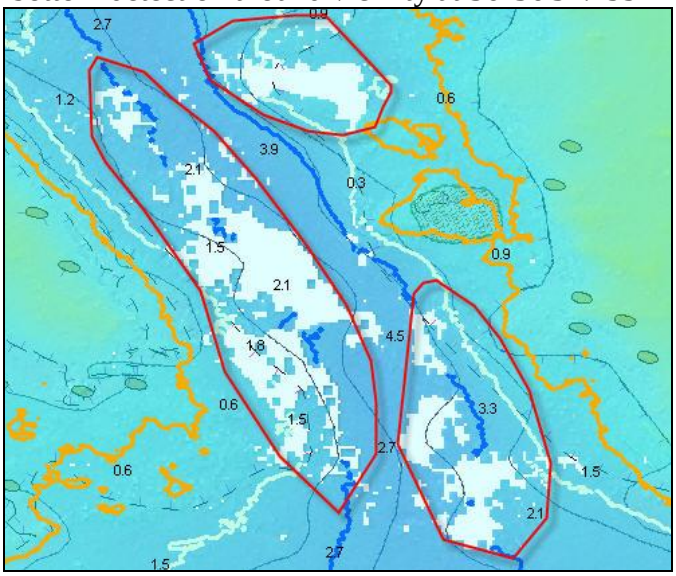


Figure 37 - Questionable bottom detection; kelp.

- Questionable bottom detection around vicinity at 56°36'21.792"N 133°41'27.71"W.

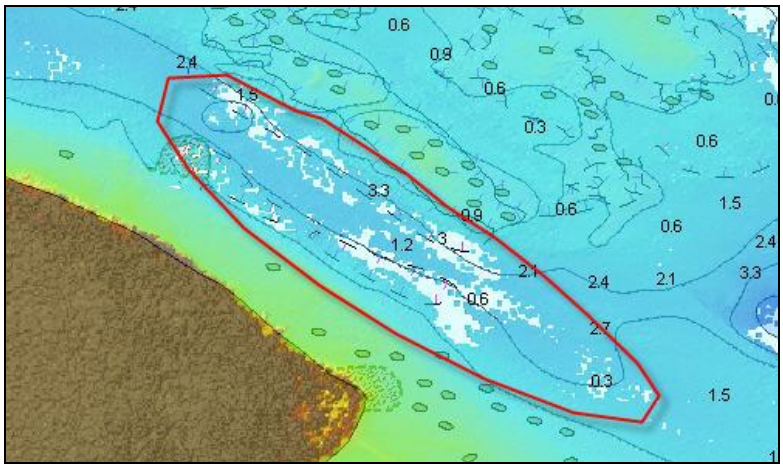


Figure 38 - Questionable bottom detection; kelp.

- Questionable bottom detection around vicinity at 56°37'1.826"N 133°42'16.58"W.

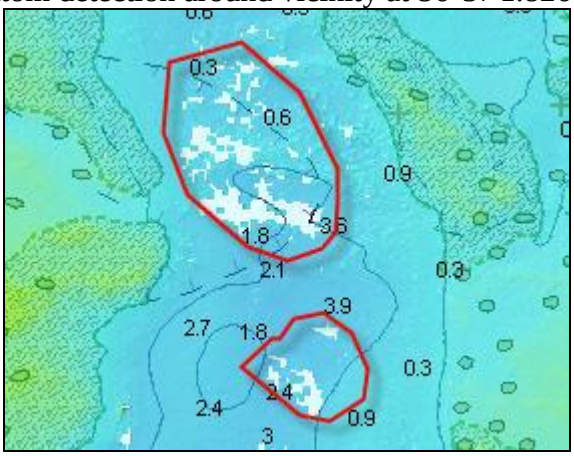


Figure 39 - Questionable bottom detection; kelp.

- Questionable bottom detection around vicinity at 56°36'32.432"N 133°42'3.325"W.

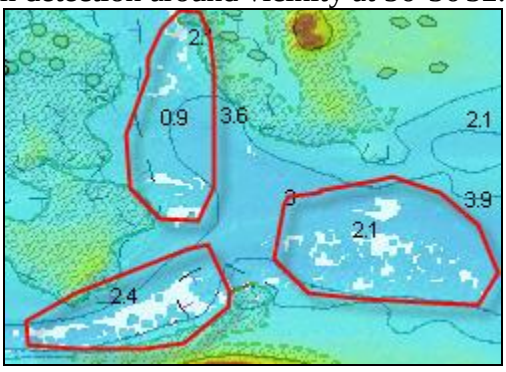


Figure 40 - Questionable bottom detection; kelp.

- Questionable bottom detection around vicinity at 56°35'4.07"N 133°42'11.62"W.

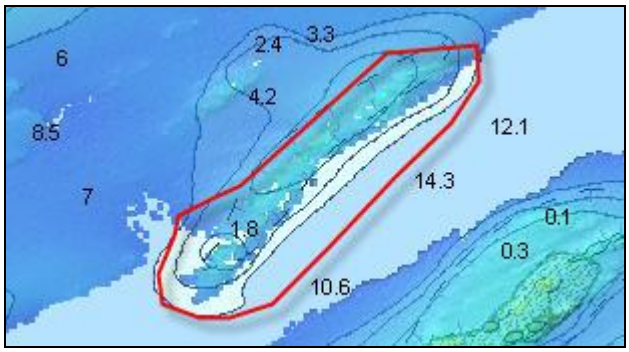


Figure 41 - Questionable bottom detection; kelp.

Bottom Samples

Bottom Samples were not required under this contract.

Aids to Navigation

None were positioned, however, if required these could be picked off the mosaics.

E – APPROVAL SHEET

APPROVAL SHEET

H11727

Standard field surveying and processing procedures were followed in producing this survey in accordance with the following documents:

OPR-O180-KRL-07 Statement Of Work (SOW) and Hydrographic Manual;
Fugro Pelagos, Inc. LiDAR Acquisition Procedures;
Fugro Pelagos, Inc. LiDAR Processing Procedures;

The data were reviewed daily during acquisition and processing.

This report has been reviewed and approved. All records are forwarded for final review and processing to the Chief, Pacific Hydrographic Branch.

Approved and forwarded,

Dushan Arumugam

Digitally signed by Dushan Arumugam
DN: CN = Dushan Arumugam, C = US, O = Fugro Pelagos Inc.
Reason: I am approving this document
Date: 2008.05.29 17:51:40 -07'00'

Dushan Arumugam
Lead Hydrographer
Fugro Pelagos, Inc. Survey Party

Revisions and Corrections During Office Processing and Certification

[1] The LIDAR survey referenced in this Descriptive Report has been applied to the multibeam survey it junctions with. No stand-alone LIDAR information was compiled to the HCell. For information concerning the compilation of LIDAR features and soundings see the Descriptive Reports for multibeam surveys H12034 and H12035. LIDAR does not meet IHO object detection requirements. LIDAR was not used to supersede shoaler charted soundings or to disprove charted features.

The Data Acquisition and Processing Report and Horizontal and Vertical Control Report have been filed with the project records.

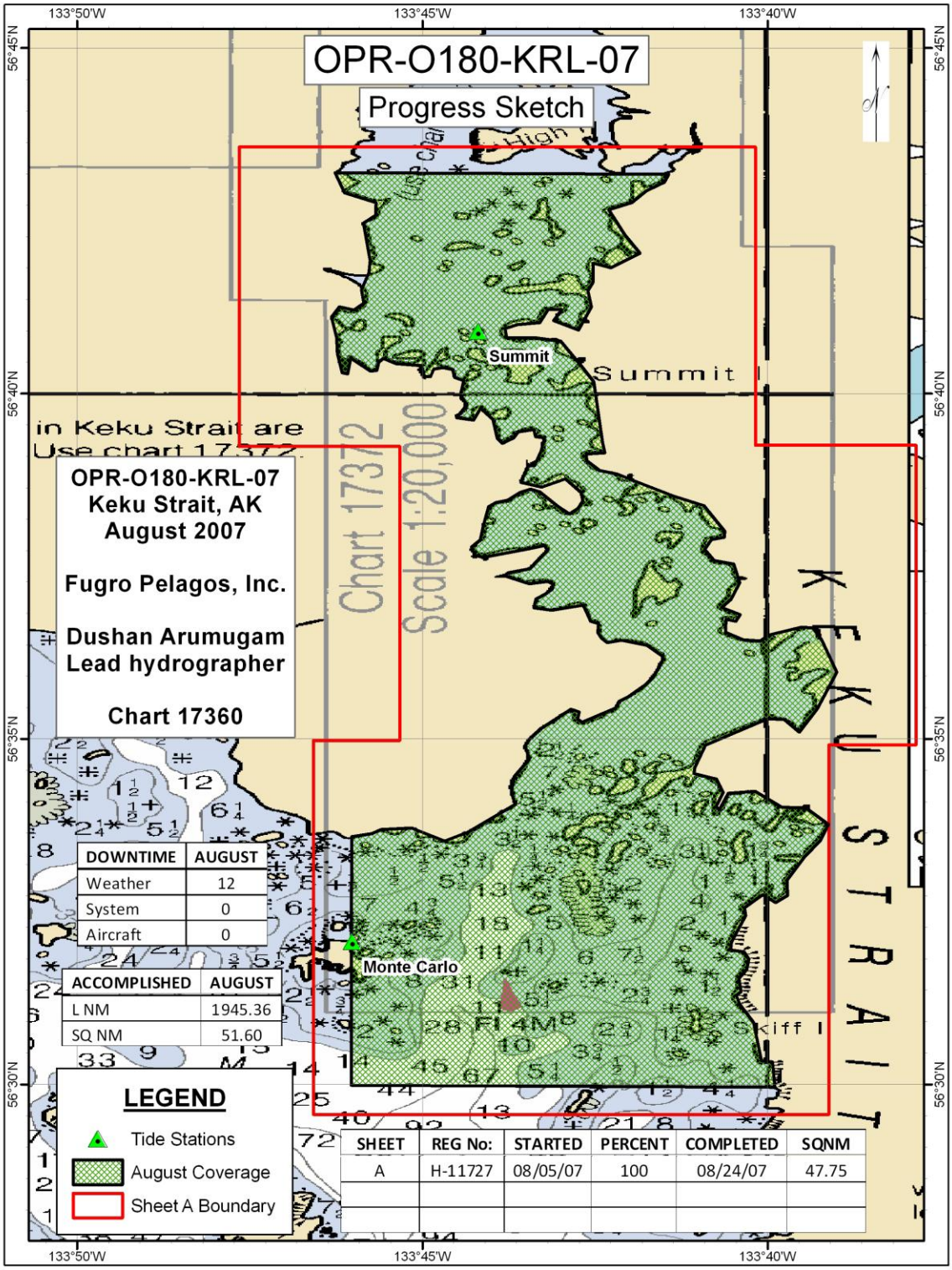
APPENDIX A – DANGER TO NAVIGATION REPORTS

No dangers to navigation were submitted during the hydrographic survey of H11727.

APPENDIX B – SURVEY FEATURE REPORT

No AWOIS item investigations were required in this survey.

APPENDIX C – FINAL PROGRESS SKETCH



APPENDIX D – TIDES AND WATER LEVELS

Abstract of Times of Hydrography for Smooth Tides

Project Number: OPR-O180-KRL-07 Registry Number: H11727

Contractor Name: Fugro Pelagos Inc. Date: August 25th, 2007

Sheet Letter: A

Inclusive Dates: August 5th, 2007 to August 25th, 2007

Fieldwork is complete and verified tides were applied for the production of the smooth sheet.

Table 8 – Abstract of Times of Hydrography for LiDAR

YEAR	DAY	START TIME (UTC)	END TIME (UTC)	COMMENTS
2007	217	20:05	22:00	
2007	218	01:42	03:39	
2007	221	17:45	20:46	
2007	222	00:25	02:56	
2007	224	02:48	04:17	
2007	224	14:17	17:18	
2007	224	20:43	21:43	
2007	225	14:26	17:52	
2007	225	20:49	00:18	Day roll over
2007	228	16:03	18:57	
2007	228	22:24	01:14	Day roll over
2007	234	19:59	23:18	
2007	235	00:01	03:29	
2007	237	00:02	01:16	

APPENDIX E – SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE

Re: S-57 features

David.Scharff [David.Scharff@noaa.gov]

Sent: Monday, November 26, 2007 1:00 PM

To: Jose Martinez

Attachments: David_Scharff.vcf (314 B)

Jose,

The reason for the individual sheets is to make the datasets more manageable however, I do see the
problem in this case. I think the easiest solution would be to have you submit this as a single sheet. This
will end up being somewhat larger than we prefer but we also can't submit the same data with three
registry numbers without creating a certain degree of confusion for our users. Please submit the Keku Strait
project under the following registry number and let me know if this creates any problems. If so we can
discuss an alternate approach.
Regards, Dave

Registry Number: *H11727*
Locality: Keku Strait
Sub locality: High Island to the Southern Entrance of Keku Strait
Scale: 1:10,000
Sheet: A

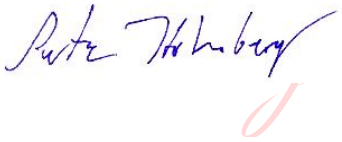
APPROVAL SHEET
H11727

Initial Approvals:

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

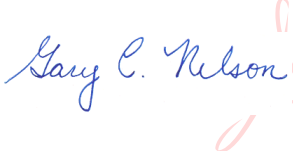
Digitally signed by
Kurt Brown
Date: 2010.12.22
11:34:53 -08'00'

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



Digitally signed by Pete Holmberg
DN: cn=Pete Holmberg, o=NOAA,
ou=PHB,
email=peter.holmberg@noaa.gov,
c=US
Date: 2010.12.22 12:50:27 -08'00'

I have reviewed the HCell, accompanying data, and reports. This survey and accompanying digital data meet or exceed OCS requirements and standards for products in support of nautical charting except where noted in the Descriptive Report.



Digitally signed by Gary C. Nelson
DN: cn=Gary C. Nelson, o=NOAA,
ou=Pacific Hydrographic Branch,
email=gary.nelson@noaa.gov,
c=US
Date: 2010.12.22 11:42:13 -08'00'

David Scharff
AWOIS and Surf Check
2011.01.05 08:41:10
-05'00'