

H11147

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey **HYDROGRAPHIC**

Field No. **OPR-P183-KR-03**

Registry No. **H11147 (A-I, L-N)**

LOCALITY

State **Alaska**

General Locality **Shumagin Islands and Vicinity**

Sublocality **(Various - See Section A)**

.....
2003
.....

CHIEF OF PARTY

..... **Mark Sinclair and Darren Stephenson**

LIBRARY & ARCHIVES

DATE

NOAA FORM 77-28 (11-72)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NO. H11147 A – I & L - N
HYDROGRAPHIC TITLE SHEET		FIELD No. N/A
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: <u>Alaska</u>		
General Locality: <u>Shumagin Islands and Vicinity</u>		
Sub-Locality: <u>see Section A: Area Surveyed</u>		
Scale: <u>1:10,000</u> Date of Survey: <u>April 22 to July 20, 2003</u>		
Instructions dated: <u>April 8, 2003</u> Project No: <u>OPR-P183-KR-03</u>		
Vessel: <u>Tenix LADS Aircraft, VH – LCL</u>		
Hydrographer: <u>Mark Sinclair</u> Chief of Party: <u>Darren Stephenson</u>		
Surveyed by: <u>Rod Curtin, Tom Farrow, Michael Hawkins, Harry Newsham,</u>		
<u>Hugh Parker, Scott Ramsay, Garry Rowe, Graeme Stringfellow,</u>		
<u>Nigel Townsend, Greg Wyers</u>		
Soundings taken by echo sounder, hand lead, pole: <u>Laser Airborne Depth Sounder</u>		
Graphic record scaled by: <u>Luke Chamberlain, Chris Johnson</u>		
Graphic records checked by: <u>Neil Hewitt</u>		
Protracted by: <u>N/A</u> Automated plot: <u>HP Design Jet 800PS</u>		
Verification by: <u>G. Nelson</u>		
Soundings in: <u>Fathoms at MLLW</u>		
REMARKS: <u>Contract # DG 133 C-03-CQ-0011</u>		
<u>Contractor: Tenix LADS Incorporated, 2548 Beach Blvd, Suite 200 Biloxi, MS, 39531</u>		
<u>Sub contractor: John Oswald and Associates, 12001 Audubon Dr., Anchorage, AK 99516</u>		
<u>Times: All times are recorded in UTC</u>		
<u>Purpose: The purpose of this survey is to provide NOAA with modern, accurate</u>		
<u>hydrographic survey data with which to update the nautical charts of the assigned area. In</u>		
<u>addition, the data will be used by NOAA’s PMEL Tsunami Program to create Tsunami</u>		
<u>inundation maps. Endnote compiled during office processing.</u>		
<u>Projection is UTM Zone 4 Page numbers may be out of order or non-sequential.</u>		

**DESCRIPTIVE REPORT TO ACCOMPANY
HYDROGRAPHIC SURVEY H11147 A-I & L-N
SCALE 1:10000, SURVEYED 2003
TENIX LADS INC (TLI)
MARK SINCLAIR, HYDROGRAPHER**

PROJECT**Project Number:** OPR-P183-KR-03**Dates of Instructions:** April 8, 2003**Original:** DG 133 C-03-CQ-0011**Task Order:** 0001**Dates of Supplemental Instructions:** May 7, 2003 email regarding meeting with NOAA
July 25, 2003 first and second amendment to
Task Order 0001**Sheet Letter:** A-I & L-N**Registry Number:** H11147**PURPOSE ¹**

The purpose of this survey is to provide NOAA with modern, accurate hydrographic survey data with which to update the nautical charts of the assigned area. In addition, the data will be used by NOAA's PMEL Tsunami Program to create Tsunami inundation maps.

A. AREA SURVEYED

The LADS Mk II aircraft operated out of Cold Bay airport from April 19 to July 22, 2003. During this period 32 survey sorties were flown under Task Order 1 OPR-P183-KR-03 to the Shumagin Islands and vicinity, Alaska.

Environmental factors such as wind strength and direction, cloud cover, high ground and water clarity influenced the area of data acquisition on a day by day basis.

The planned and actual linear miles sounded for the areas are provided at Appendix III.

The sub-locality of the sheets are.

Sheet A	Popof Strait
Sheet B	Korovin Strait
Sheet C	Korovin Bay and Strait
Sheet D	Southeast of Popof Island
Sheet E	South of Popof Island
Sheet F	Popof Island to Kelly Rock
Sheet G	Delarof Harbor and Vicinity, Unga Cape
Sheet H	South of Unga Island
Sheet I	Acheredin Bay to Acheredin Point
Sheet L	Falmouth Harbor and Approaches
Sheet M	Southwest of Nagai Island
Sheet N	John Island to Mountain Point.

		NAD83 Position	
		Degrees Latitude (N)	Degrees Longitude (W)
<i>Sheet A</i>	NW corner	55°.39410000	160°.58168101
	SE corner	55°.28437800	160°.46172100
<i>Sheet B</i>	NW corner	55°.39870800	160°.47625000
	SE corner	55°.33035800	160°.28340600

Amended Sheet C limit to include topographic data on eastern side of Popof Island.

<i>Sheet C</i>	NW corner	55°.42402277	160°.33092122
<i>Amended Sheet D</i>	SE corner	55°.30081723	160°.20369676
<i>Sheet D</i>	NW corner	55°.30744100	160°.35467699
	SE corner	55°.19772100	160°.23476999
<i>Sheet E</i>	NW corner	55°.30218700	160°.46352100
	SE corner	55°.19246700	160°.34359300

Amended Sheet F limit to include western part of Baralof Bay and small bay 5 nm further north.

<i>Sheet F</i>	NW corner	55°.28515447	160°.58809747
<i>Amended</i>	SE corner	55°.17543839	160°.44497825

Amended Sheets G – I

<i>Sheet G</i>	NW corner	55°.08785117	160°.52943751
	SE corner	55°.06934328	160°.48979676
<i>Sheet Sea Lion</i>	NW corner	55°.21506605	160°.58785144
	SE corner	55°.10532222	160°.45161704
<i>Sheet H</i>	NW corner	55°.21496044	160°.70462448
	SE corner	55°.10522820	160°.58463705
<i>Sheet I</i>	NW corner	55°.21499874	160°.82761489
	SE corner	55°.10522902	160°.70247326

Amended Sheets L – N limits to fit in extra data at the southern end of the area.

<i>Sheet L</i>	NW corner	55°.11461288	160°.03543088
	SE corner	55°.04626605	160°.22832756
<i>Sheet M</i>	NW corner	55°.04762323	160°.03601823
	SE corner	54°.97927045	160°.22889082
<i>Sheet N</i>	NW corner	54°.97997789	160°.14917268
	SE corner	54°.85677407	160°.26911033

Table 1 – Shumagin Islands Smooth Sheet Layout

B. DATA ACQUISITION AND PROCESSING

Refer to the Data Acquisition and Processing Report for a detailed description of the equipment, processing and quality control procedures. A general description and items specific to this survey are discussed in the following sections.

B.1 EQUIPMENT

Data collection was conducted using the LADS Mk II Airborne System, data processing using the LADS Mk II Ground System and data visualization, quality control and final products using Caris HIPS 5.3, GMT/VTK, Terramodel and MicroStation version 8.

B.1.1 Airborne System

The LADS Mk II Airborne System (AS) consists of a Dash 8-200 series aircraft which has a transit speed of 250 knots at altitudes of up to 25,000 feet and an endurance of up to eight hours. Survey operations are conducted from heights between 1,200 and 1,800 feet at ground speeds between 140 and 175 knots. The aircraft is fitted with a Nd: YAG laser which is eye safe in accordance with ANSI Z136.1-2000, American National Standard for Safe Use of Lasers. The laser operates at 900 Hertz to provide 5x5 or 4x4 meter laser spot spacing in the main line sounding mode of operation, and is mounted on a stabilized platform. These modes require an aircraft speed of 175 or 140 knots over the ground, and operate across a laser swath width of 240 or 192 meters. The electro-mechanical scanner also provides examination modes of sounding with laser spot spacings of 3x3 and 2x2 meters and swath widths of 100 and 50 meters respectively.

Green laser pulses are scanned beneath the aircraft in a rectilinear pattern. The pulses are reflected from the land, sea surface, within the water column and from the seabed. The green returned laser energy is captured by the green receiver and then digitized and logged onto digital linear tape. An infra-red beam is also directed vertically beneath the aircraft. The height of the aircraft is determined by the infra-red laser return, which is supplemented by the inertial height from the Attitude and Heading Reference System and GPS height. The LADS Mk II system can operate by day and night, and operations at night are enhanced by removing a daylight filter from the receiving optics. Real-time positioning is obtained by either an Ashtech GG24 GPS receiver combined with Wide Area DGPS provided by Thales GeoSolutions or an Ashtech GG24 GPS receiver providing stand-alone GPS. Ashtech Z12 GPS receivers are also provided as part of the Airborne System and Ground Systems to log KGPS data on the aircraft and at a locally established base station.

B.1.2 Ground System

The LADS Mk II Ground System (GS) Gandalf was used to conduct data processing in the field. Gandalf consists of a three 833 MHz CPU HP (Compaq) ES40 Alpha server with 1 GB EEC RAM, 764 GB disk space, digital linear tape (DLT) drives, digital audio tape (DAT) drives and networked to up to six terminals (X-terms or PCs) to provide the user interface to the hydrographic surveyor.

Quality control checks and editing of the data were conducted on Ground System Frodo, comprising a three 833 MHz CPU HP (Compaq) ES40 Alpha Server with 1 GB RAM, 600 GB disk space, digital linear tape (DLT) drives, digital audio tape (DAT) drives and networked to a series of X-terms or personal computer operator consoles, HP plotter, printers and QC workstations.

The GS supports survey planning, data processing, quality control and data export. The GS component also includes a KGPS base station which provides independent post-processed position and height data. A comprehensive description of the GS is provided in the Data Acquisition and Processing Report.²

B.2 QUALITY

B.2.1 Data Density

The majority of the survey areas were sounded at 4x4 meter laser spot spacing with 80 meter line spacing which provided the required 200% coverage. Popof Strait was sounded using 3x3 meter spot spacing with a 40 meter line spacing to provide IHO target detection. A number of features were examined using either a 2x2 or 3x3 meter laser spot spacing.

At the sea surface the footprint of the laser beam is approximately 2.5 meters in diameter. As the beam passes through the water column it slowly diverges due to scattering. It should be noted that at 4x4 meter laser spot spacing there is a gap of between 1 to 1.5 meters between the illuminated area of adjacent soundings at the sea surface. There is a possibility that small objects in shallow water along the coastline may fall between consecutive 4x4 meter soundings and not be detected. To achieve IHO target detection, 3x3 meter laser spot spacing is used.³

B.2.2 Water Clarity

The water clarity south of the Alaska Peninsula was generally good for laser survey. The maximum lidar depths measured during the survey exceeded 35 meters, although 20 meters was the generally achieved depth.⁴

Some localized areas of turbidity were experienced in the survey area due to run off, mechanical wave action or plankton. A number of areas required several reflies in addition to the 200% planned coverage.

Popof Island: Both Popof Strait and the north and northeast coast of Popof Island suffered from intermittent turbidity. Along the east coast of Popof Island the water clarity improved towards Popof Head with depths to 30 meters. The water clarity along the south coast remained consistent with depths to 25 meters.

Unga Island: The northeast coast of Unga Island suffered from turbidity similar to Popof Strait. Further south along the east coast seemed to have clearer water. The south coast is very exposed to the swell and weather from the south and all the bays suffered from turbidity

due to surface run off and mechanical wave action. Despite six attempts to survey the area, sparse data was collected along the coast north of Acheredin Point.

Korovin Island: The southwest corner was steep to and the water clarity was good which provided depths to 25 meters. In Korovin Bay, depths to 25 meters were also collected along the western side but the eastern part of the bay suffered from intermittent turbidity.

Nagai Island: The water clarity along the west coast of Nagai Island was checked by reconnaissance. The area is exposed and is generally turbid, however satisfactory conditions existed during periods in July. The southeastern corner of Falmouth Bay remained turbid despite three attempts to obtain better data. Sparse data was collected along the headlands; the bay to the south of Falmouth Bay initially had a large turbid plume but it cleared to enable soundings to be measured all the way into the bay. John Island was turbid on occasions; the water clarity through Saddlers Mistake and around the exposed southern coast was good which allowed depths to 35 meters to be measured.

B.2.3 Data Management

Due to the size and complexity of the survey area the project was split into four databases to ease the management of data acquisition and processing. The databases are identified as follows:

Database Name	General Locality	Sheets
Shum 1	Popof Strait, south coast of Popof Island and east coast of Unga Island	A, E and F
Shum 2	North and east coast of Popof Island and the south coast of Korovin Island	B, C and D
Shum 3	South coast of Unga Island and Sea Lion Rocks	G, H and I
Shum 4	Southwest coast of Nagai Island	L, M and N

Table 2 – Databases

A detailed table of databases and line numbers is presented in the Data Acquisition and Processing Report.

B.2.4 Data Acquisition

Survey operations were planned when suitable weather conditions prevailed. The first survey sortie was flown on April 22, 2003. Survey sorties were conducted when there was minimal low cloud in the survey area and this generally occurred if the wind was below 20 knots from the west to the northeast. In general the aircraft departed at 0900 hours local time to take advantage of the better GPS satellite availability and geometry and returned at 1600 hours local time. Towards the end of the project fuel arrangements were made at Sand Point and when survey conditions were good the aircraft landed and refueled. This occurred for most of the survey of the west coast of Nagai Island.

The final survey sortie was conducted on July 20, 2003.

B.2.5 Sea Conditions - Sea State, Waves, Swell, White Water

The sea state ranged from 1 to 3-4 throughout the survey, and was generally between states 2 and 3. This did not adversely affect data quality except in a few areas where it increased turbidity close to the coast and where it created significant white water around rocks and exposed areas such as the southern coast of Unga Island and the southern coast of Nagai Island. White water creates saturated surface pulses, where this has occurred the soundings have been edited to No Bottom At (NBA) 0 meters.

Very calm seas were experienced on occasions in the sheltered areas through Popof Strait and through Korovin Strait. Under such very calm conditions the sea may become glassy which degrades the sea surface model. When such conditions existed, survey operations were diverted to the more suitable area.

Long period swell was not significant during the survey and an allowance has been made in the assessment of accuracy.

B.2.6 No Bottom At (NBA)

NBA depths have been assigned to noise pulses where the water was too dirty or too deep to detect the seabed. The NBA depth is assigned based on inspection of the raw laser waveforms. In the opinion of the hydrographic surveyor the NBA depth is a depth less than which seabed returns are not expected. Areas where NBA depths have been assigned can be seen from the gray areas on the coverage plots.

In general, NBA areas in deep water have been retained in the data set. In shallow water, NBA areas have been rejected from the data where better data was collected on a subsequent flight; in this case the NBA area is superseded.

In some shallow areas, data has been collected which is partly good but contains NBA depths. In some cases this data has been retained to improve the coverage of the seabed. Where this has occurred, the gray NBA areas can be seen overlaying the seabed on the coverage plot.

B.2.7 Kelp

Large areas of kelp exist in the survey area.

Kelp areas can be recognized in the data by the following indications:

- Mid water column pulses, frequently with low amplitude and poorly defined leading edges.
- Returns from the seabed are highly attenuated.
- Soundings in shallow water are very sparse.
- Soundings do not correlate with overlapping data from the adjacent line.

Kelp areas are shown on the smooth sheet. ⁵

B.2.8 Nature of the Seabed

In general, the seabed was very rugged in the survey areas. The coastline was very complex and frequently rose steeply out of the sea. Some of the bays in the vicinity of Popof Strait have a gentle gradient which can be seen in the data. Rocky kelp-covered ridges were common. The complexity increased the time required for operators to validate the data.

B.2.9 Datums

On completion of each flight the GPS data logged on the aircraft and at the base station was processed to determine the KGPS position and height of the aircraft. This data is used in the calculation of the sea surface datum.

B.2.10 Wind

Survey operations were conducted in wind strengths of up to 25 knots during the survey. In general the wind strength during the time of survey was around 10 knots from the west to northeast. The direction of the wind influenced the area for survey operations to be conducted due to high levels of turbulence under conditions where the wind was coming off high ground. The wind direction also influenced the formation of low cloud.

B.2.11 Cloud

Low cloud was a significant factor. The wind direction affected the cloud base in the survey area. For example, in southerly or easterly conditions a low cloud base was experienced. The effects of low cloud were managed as follows:

1. NOAA has a weather station at Cold Bay, which is manned 24 hours and provided 36, 48 and 96 hour forecasting, as well as predictions based on local knowledge.
2. Limited weather forecasts were available for Sand Point and the actual weather was confirmed by telephoning Sand Point prior to departure for each survey sortie
3. Two internet sites proved to be invaluable for forecasting the weather. An aviation site, <http://adds.aviationweather.gov/>, provided aviation weather which supplied METAR data, actual wind speed and direction, cloud base and satellite cloud data. The observations were updated every 20 minutes. A NOAA weather site, <http://pafc.arh.noaa.gov/>, provided aviation weather and general weather.
4. The alternative survey areas in Task Orders 2 and 3 were used during prolonged poor conditions on the Alaska Peninsula.

B.2.12 Effects of High Ground

At the time of survey the maximum operating height of the LADS Mk II aircraft was 1,800 feet. The proximity of high ground can therefore affect the planned direction of survey lines. For example, the southern coast of Unga Island, Nagai Island and the headland of Korovin Island have significant high ground. The location of the high ground also caused severe turbulence under certain conditions. For example, the south coast of Unga Island is very exposed and could only be flown on days of a northerly wind, however under these conditions, the high ground created turbulence; this limited operations to periods of light to

moderate wind strengths. Due to high ground at Nagai Island, all survey operations were conducted at 1,800 feet.

B.2.13 Drying Heights and Topographic Data

Topographic data has been collected up to a height of approximately 10 meters above the water level at the time of acquisition.

In the digital data, drying heights and topographic heights are above the MLLW datum in negative meters. On the hardcopy smooth sheet and MicroStation files, drying heights are expressed in negative decimal fathoms above MLLW and topographic heights above 2.3 feet above MHW are expressed in feet above MHW.

It should be noted that on islets which have a height above 10 meters, the maximum height of the island may not have been measured. An example of this situation in the Results and Recommendations section is annotated as 'Height of islet > 33 feet'.

The topographic height range of the LADS MkII system has since been extended to 50 meters.

B.2.14 Receiver Gain

Changes in gain levels in the Airborne System automatically accommodate for changes in the sea surface, water column and seabed conditions. In some areas after long over-land passages low gain levels were initially set on passing back over the water. Where this has been identified in the data these lines were re-flown from the opposite direction to improve the coverage.

B.2.15 Raw Laser Waveforms

The raw laser waveform returns from the areas which were covered with kelp are considerably attenuated. In order to detect the seabed in such areas, the threshold in the GS was lowered to detect pulses with low signal-to-noise ratios. This enabled the seabed to be detected but also resulted in increased operator data validation times. In some areas of kelp the seabed was completely obscured and either no signal was detected (NBD - No Bottom Determined) or noise was detected by the system, in which case an appropriate NBA (No Bottom At) depth was assigned by the hydrographic survey operators during data validation.

B.2.16 Data Processing

The data was processed at the operating site in Cold Bay on return from each sortie. Initial validation of the data was conducted at this site. Final validation, checking and approval by hydrographic surveyors were then conducted back at either the Tenix LADS depot in Biloxi, MS or Adelaide, South Australia.

B.2.17 Progress Sketches

Progress sketches were provided to NOAA on a bi-weekly basis from the commencement of operations.

B.2.18 Final Data

Final data for Task Order 1 is being delivered in four parts; the first sheets A, E and F (Shum 1), the second sheets B, C and D (Shum 2), the third sheets L, M and N (Shum 4) and the fourth sheets G, H and I (Shum 3).

On each separate delivery the section D, Results and Recommendations, of the report is being updated.

B.3 DIGITAL DATA FORMATS

Refer to the Data Acquisition and Processing Report Appendices I and II.

B.4 BENCHMARKS

Five depth benchmark areas were created from the LADS data. Two benchmarks lay along a line through Popof Straight and three more benchmarks on a line to the south of Korovin Island. These benchmarks were surveyed to check the system accuracy.

Center coordinates for the benchmark areas are as follows:

Sand Point Benchmark Line

Benchmark Name	Nominal Depth	Easting (WGS 84)	Northing (WGS 84)
BM_5	14 m	404 100	6 135 080
BM_6	5 m	404 087	6 135 080

Korovin Benchmark Line

Benchmark Name	Nominal Depth	Easting (WGS 84)	Northing (WGS 84)
BM_7	4 m	420 620	6 141 390
BM_8	12 m	420 330	6 140 820
BM_9	18 m	420 090	6 140 363

Table 3 – Benchmarks

Either one or both benchmark lines were flown during each sortie. The total number of benchmarks compared during the survey was 125. The tidal model in use for the comparison of benchmarks was the same as for main line sounding and benchmark comparisons were conducted after the application of verified tides. Comparison summaries are provided in the Separates.

The LADS data is compared against the gridded benchmark surface in the GS and statistics are generated which include the number of points compared, the mean depth difference (MDD) and the standard deviation (SD) between the data sets. The benchmark comparison

function compares the data against the benchmark surface, and as this data is unedited it may contain noise normally removed during the validation process which is flagged as the shoalest and deepest differences.

B.4.1 Mean Depth Differences (MDD) and Standard Deviation (SD)

The benchmarks were flown independently of the database being surveyed at the time. The averages of the mean depth differences and standard deviation for each benchmark run are as follows:

Sand Point Benchmarks

GS ID	BM Name	Nominal Depth	MDD	SD
1	BM_5	14 m	0.01 +/- 0.11	0.17 +/- 0.03
2	BM_6	5 m	-0.01 +/- 0.06	0.12 +/- 0.03

Korovin Benchmarks

GS ID	BM Name	Nominal Depth	Average MDD	SD
4	BM_7	5 – 7 m	0.06 +/- 0.14	0.10 +/- 0.05
5	BM_8	12 m	0.13 +/- 0.12	0.16 +/- 0.02
6	BM_9	32 m	0.18 +/- 0.14	0.18 +/- 0.05

Table 4 – Benchmark Results

These results are excellent and show the depth difference means and the standard deviation of all the benchmarks are very consistent. These results indicate that the LADS Mk II system operated correctly.

B.4.1.1 Crosslines

Crosslines were planned after the majority of main lines had been completed. Areas were selected where the seabed was reasonably flat. This minimizes the apparent differences in depths due to minor positional differences, which occurs in steeper areas of seabed.

Nine crosslines were sounded at 4x4 meter laser spot spacing as follows:

Line 704.0.1	64 crossline intersections.	Popof Strait
Line 6108.0.1	12 crossline intersections.	Red Cove, south coast of Popof Island.
Line 95.1.1	12 crossline intersections.	Korovin Bay
Line 6003.0.1	5 crossline intersections.	Northeast coast of Popof Island
Line 3418.0.1	5 crossline intersections.	South Unga Island, Acheredin Bay
Line 3407.0.1	9 crossline intersections.	South Unga Island, Acheredin Bay
Line 92.0.1	12 crossline intersections.	Saddlers Mistake, Nagai Island
Line 93.0.1	5 crossline intersections.	South coast of Nagai Island
Line 94.0.1	15 crossline intersections.	Saddlers Mistake, Nagai Island

B.4.2 Mean Depth Differences (MDD) and Standard Deviation (SD)

The averages of the mean depth differences and standard deviation for each crossline are as follows:

B.4.3 Crosslines

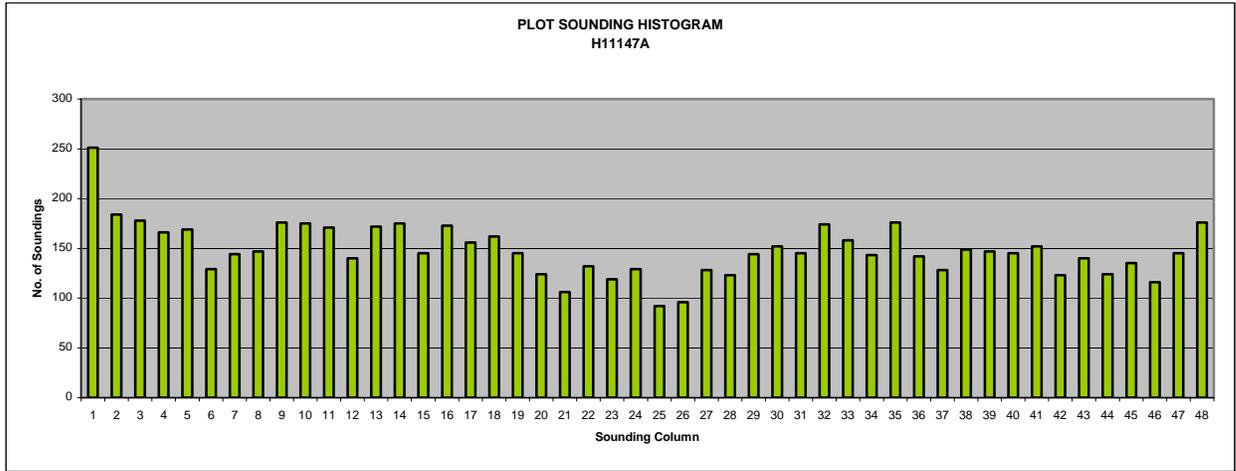
Run No.	Comparisons	Mean Confidence	Average MDD	Average SD
704.0.1	108 340	6.4	0.05 +/- 0.07	0.18 +/- 0.14
6108.0.1	25 208	6.3	-0.01 +/- 0.07	0.20 +/- 0.12
95.1.1	8 407	6.4	-0.01 +/- 0.19	0.27 +/- 0.12
6003.0.1	1 327	1.7	0.13 +/- 0.08	0.22 +/- 0.01
3418.0.1	9 050	6.9	-0.18 +/- 0.19	0.21 +/- 0.05
3407.0.1	18 210	7.6	-0.03 +/- 0.12	0.15 +/- 0.04
92.0.1	30 298	4.6	-0.02 +/- 0.05	0.15 +/- 0.09
93.0.1	8 566	2.9	-0.10 +/- 0.13	0.30 +/- 0.05
94.0.1	31 532	7.3	0.04 +/- 0.07	0.20 +/- 0.08
Total	242 848	Means	0.02 +/- 0.11	0.19 +/- 0.12

Table 5 – Crossline Comparison Results

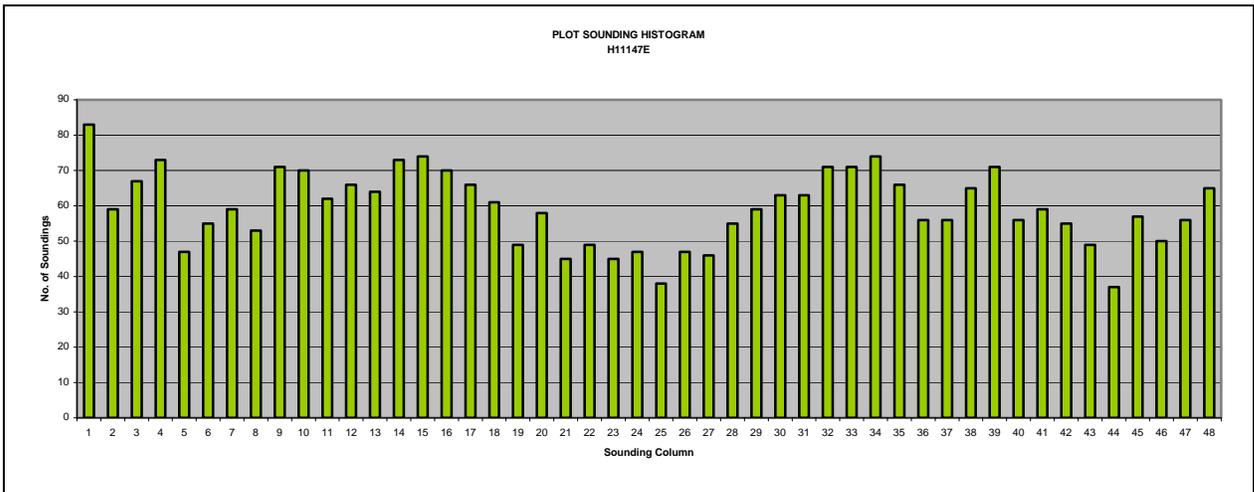
Crossline comparison details are provided in the Separates Report.

These results are consistent with IHO Order-1 depth accuracy for depths ≤ 20 meters, and IHO Order-2 depth accuracy for depths between 20 and 30 meters.

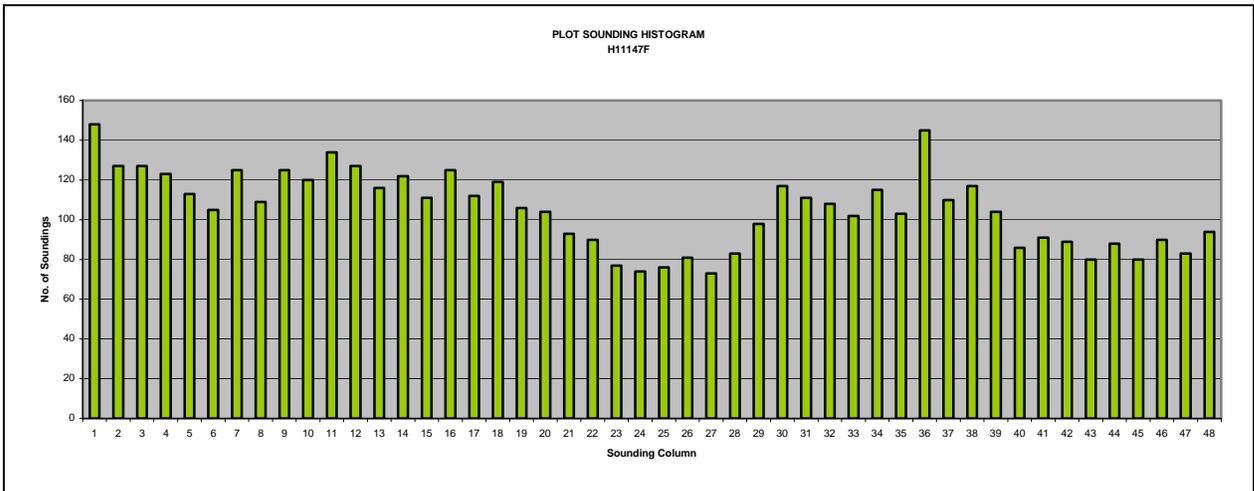
B.5 ANALYSIS OF RESULTS



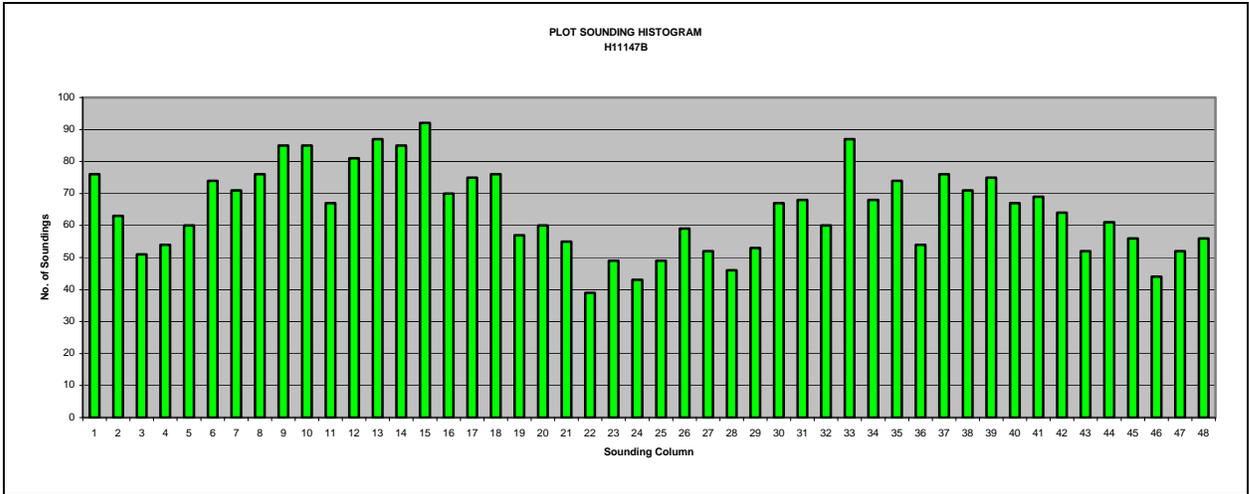
Graph 1 – Sounding Histogram Smooth Sheet H11147A



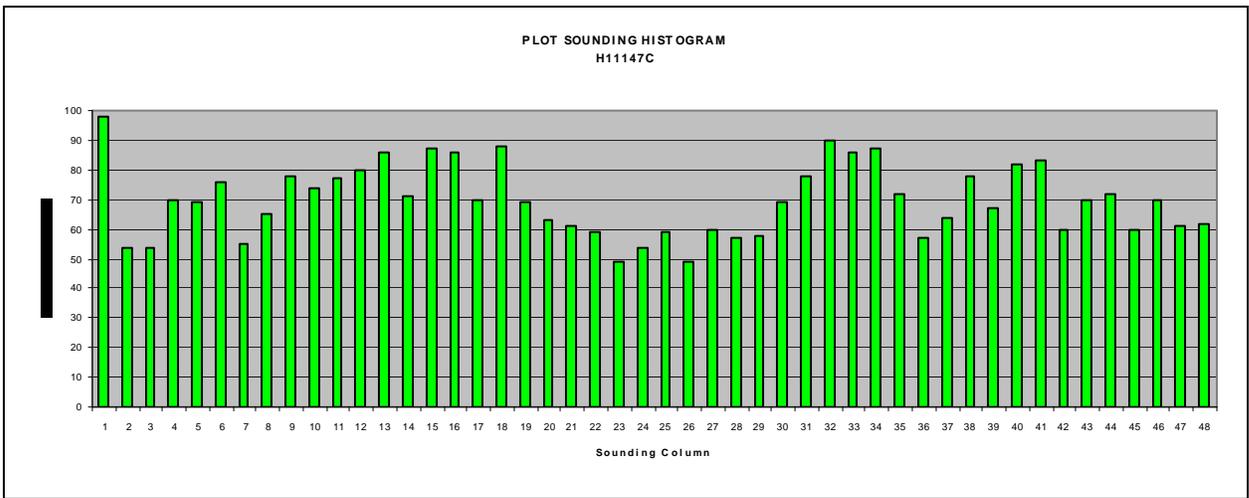
Graph 2 – Sounding Histogram Smooth Sheet H11147E



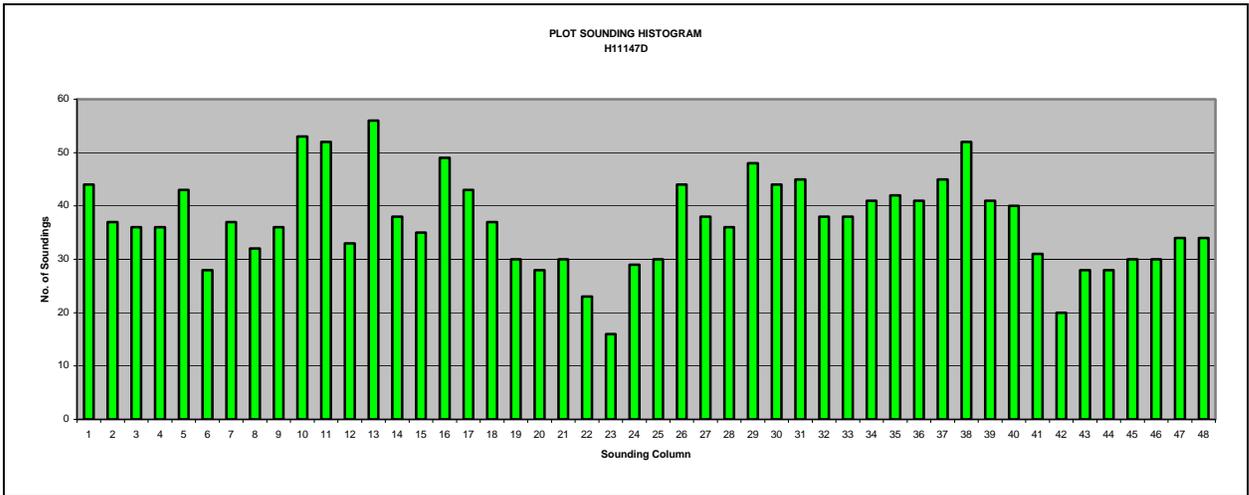
Graph 3 - Sounding Histogram Smooth Sheet H11147F



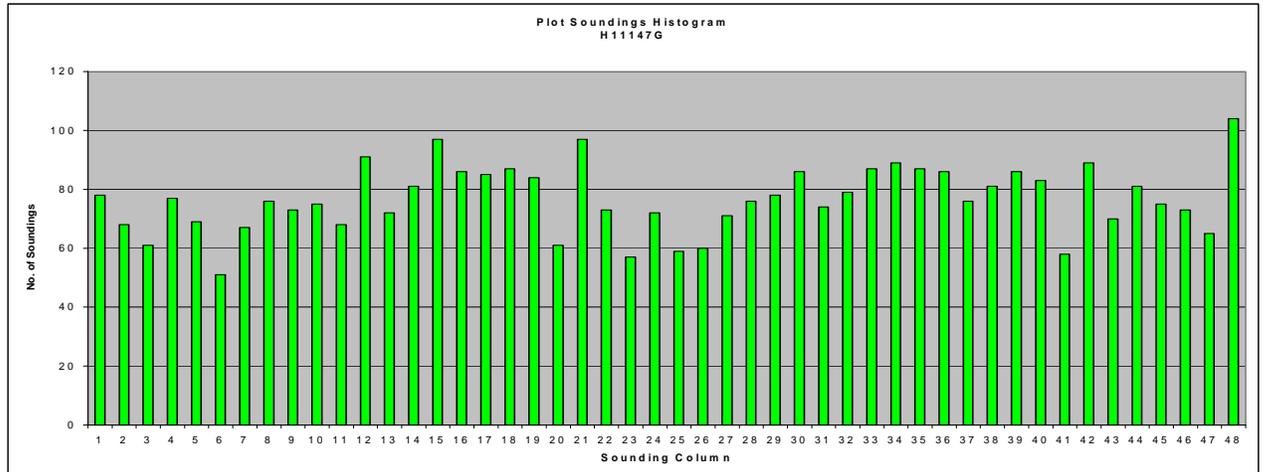
Graph 4 - Sounding Histogram Smooth Sheet H11147B



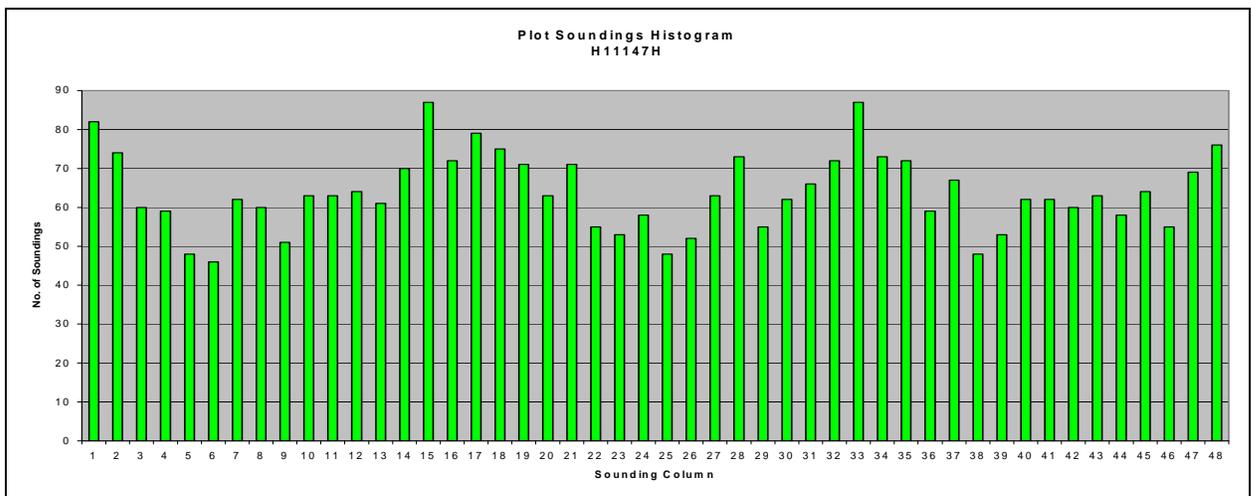
Graph 5 - Sounding Histogram Smooth Sheet H11147C



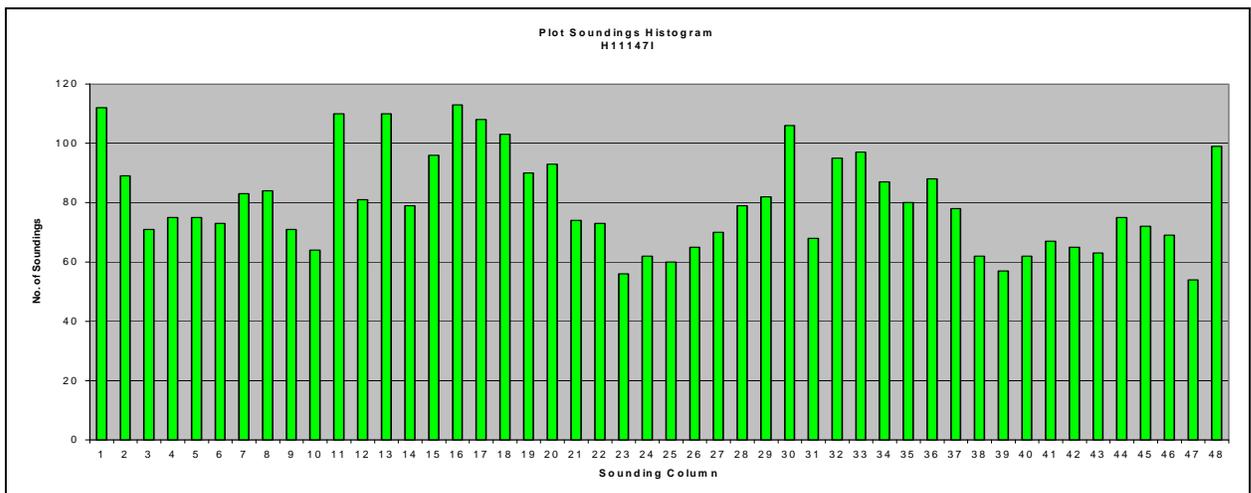
Graph 6 - Sounding Histogram Smooth Sheet H11147D



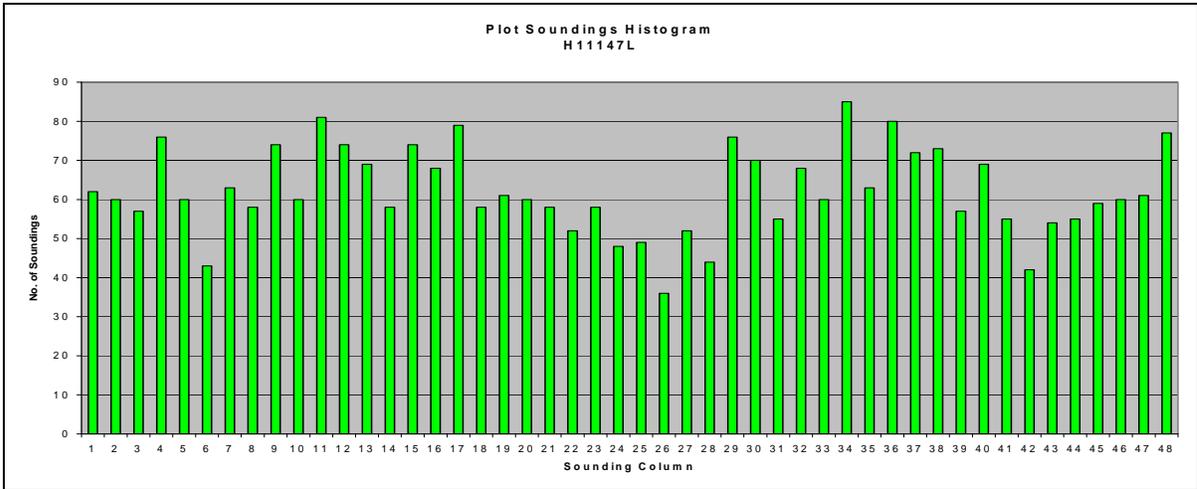
Graph 4 - Sounding Histogram Smooth Sheet H11147G



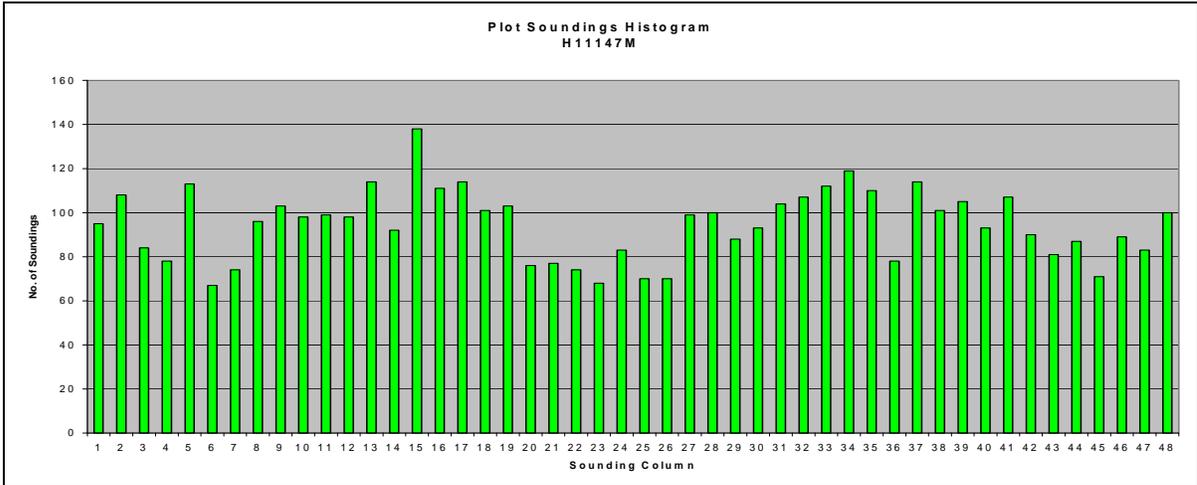
Graph 5 - Sounding Histogram Smooth Sheet H11147H



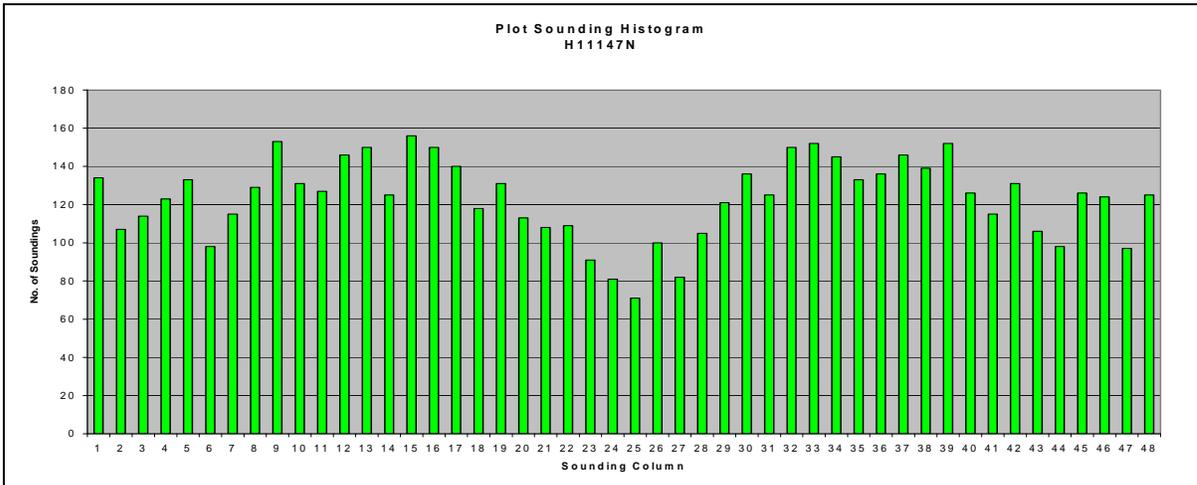
Graph 6 - Sounding Histogram Smooth Sheet H11147I



Graph 7 - Sounding Histogram Smooth Sheet H11147L



Graph 8 - Sounding Histogram Smooth Sheet H11147M



Graph 9 - Sounding Histogram Smooth Sheet H11147N

B.6 POSITION CHECKS

Two independent positioning systems were used during the survey. Real-time positions were determined by stand-alone GPS. A KGPS position was also determined relative to a local GPS base station which was established on the rooftop of the survey site office in Cold Bay. The KGPS position and height were applied to soundings during post-processing.

Position checks were conducted prior to, during and following data collection, as follows:

- a. DGPS Site Confirmation. A 24-hour certification was conducted of the local GPS base station established at the survey office site.
- b. Static Position Check. Prior to commencing data collection the coordinates of the aircraft GPS antenna were determined relative to three marks which were surveyed on the tarmac at Cold Bay Airport. Data was then logged by each LADS Mk II positioning system enabling the positions to be checked against the known surveyed points. The accuracy of the KGPS (PNAV C/A code + carrier phase) during the static position check was 0.17 meters (95% confidence). The results and details of the static position check are enclosed in Vertical and Horizontal Control Report.⁶
- c. Dynamic Position Check. During each sortie GPS data was logged on the aircraft and at the local GPS base station. This provided a check between the real-time GPS and post-processed positions. The mean difference between the real-time and post-processed position for each database ranged from 2.111 to 2.496 meters, with the mean standard deviation from 0.223 to 0.263 meters. Details are provided in the Vertical and Horizontal Control Report.
- d. Position Confidence. The position quality was also monitored by checking a post-processed position confidence (C3), which is determined from the AS platform error, GPS error and residual errors between the actual GPS positions and aircraft position as determined from the line of best fit. No position anomalies were detected.

The position checks provided results that were within the expected tolerances and showed that the positioning systems were functioning as expected.

B.7 CORRECTIONS TO SOUNDINGS

Refer to the Data Acquisition and Processing Report for a description of corrections to soundings, which demonstrates that corrections to the soundings were being applied correctly.

There were no deviations from the corrections described therein.

C. VERTICAL AND HORIZONTAL CONTROL

Refer to the Vertical and Horizontal Control Report for a detailed description of the vertical and horizontal control used during this survey. A summary of vertical and horizontal control for the survey follows.

C.1 VERTICAL CONTROL

Vertical control for the survey was based on the Mean Lower Low Water tidal datum (MLLW) from the NOAA station at Sand Point (9459450).

Station details are as follows:

Gauge	Location	GS No.	WGS84	
			Latitude	Longitude
9459450	Sand Point city dock	TS1	55° 20.2' N	160° 30.1' W

Table 6 – Sand Point Tide Gauge

C.2 ZONING

Tide zones that cover the extent of the survey were supplied by NOAA with time and range correctors relative to the Sand Point tide station. These are as follows:

Tide Zone	GS Identifier	Time Corrector	Range Corrector	Reference Station
SWA204A	TA1	0 minutes	x1.00	9459450
SWA193A	TA2	0 minutes	x1.02	9459450
SWA204	TA3	-6 minutes	x0.98	9459450

Table 7 – Tide Zones

Prior to the commencement of the survey, a tidal zoning analysis of the areas was conducted by surveying company 'John Oswald and Associates, LLC' in Anchorage, Alaska. The result of this analysis concluded that the zoning provided by NOAA should be adequate to meet the accuracy specifications for soundings and the datum jump between tide zones should be below 0.070 meters with the majority of the differences in the 2 – 3 centimeter range. A complete copy of this analysis can be found in Appendix IV.

The verified tides supplied by NOAA were independently checked by John Oswald and Associates. The tides were compared to predictions at the time of survey to ensure that there were no meteorological effects at the tide gauge. Once the data was checked a fifth degree polynomial was applied to the tidal data and this data was then supplied to Tenix LADS Inc.

For final processing, tidal correctors were applied to the tidal data provided by John Oswald and Associates. The time and height correctors listed above were used for processing the data for tides.

Data across zone boundaries showed no data steps, the crosslines also showed no data deviation across the tidal zones. The preliminary tidal zoning has been considered adequate and therefore the preliminary tide zoning correctors have been considered to be the final zoning correctors. ⁷

C.3 HORIZONTAL CONTROL

Data collection and processing were conducted on the Airborne and Ground Systems in World Geodetic System (WGS84) on Universal Transverse Mercator (Northern Hemisphere) projection UTM(N) in Zone 4, Central Meridian 159° West. All units are in meters. This data was post-processed and all soundings are relative to the North American Datum 1983 (NAD83).

C.3.1 LADS Local GPS Base Station – Cold Bay

A local GPS base station was established by Tenix LADS surveyors on the roof of the processing building at Cold Bay Lodge, Mitchell Road, Cold Bay, Alaska on April 17-19 2003. A 24 hour DGPS site certification was conducted on the local GPS base station prior to survey operations.

The derived NAD83 coordinates for the local GPS base station, are:

NAD83		UTM (N)		
Latitude (N)	Longitude (W)	Easting (m)	Northing (m)	Ellipsoidal Height (m)
55°12'17.80534"	162°42'36.73896"	263 932.424	6 123 878.296	39.7513

Table 8 – GPS Base Station

Real-time positions were determined using an Ashtech GG24 GPS receiver.

The DGPS positions were determined off-line using data logged at the base station and on the aircraft. This data was processed through Ashtech PNAV software to calculate both a DGPS and Coarse Acquisition (C/A) code + carrier phase smoothed position solution. The C/A code + carrier phase smoothed positions were then imported into the GS and were applied to all soundings. This provided increased sounding position accuracy and horizontal redundancy.

D. RESULTS AND RECOMMENDATIONS

D.1 CHART COMPARISON - SMOOTH SHEET H11147A ⁸

D.1.1 Chart 16553 (Inset)

H11147A was compared to:

- Chart 16553 3rd Edition 2 September 1989, at scale 1:80 000
- Chart 16553 3rd Edition 2 September 1989, inset of Popof Strait at scale 1:20 000

Note: Charted depths are in Fathoms and Feet and in format 2₄. Surveyed depths are in decimal Fathoms and in format 2⁴. For comparison, fathom and feet conversion is in brackets in format [2₂].

D.1.1.1 Charted Depths and Features

The following comparisons and AWOIS from Smooth Sheet H11147A relate to chart 16553 inset of Popof Strait at 1:20 000.

1. Charted 2₄ in posn: 55°21'43.78" N, 160°30'59.38" W NAD83 in 1-2 fms of water.
2. Recommend replacing charted 3₂ with surveyed 2⁹ [2₅] in position 55°21'37.28" N, 160°30'36.89" W NAD83 and amending contour to represent surveyed shoal. Area was surveyed with 200% lidar coverage. Kelp.
3. Charted rock awash on chart 16553 and rock awash (PD) on inset at 55°21'31"N 160°31'05"W, NAD83. Surveyed (0⁸) [0₅] in position 55°21'31.55"N 160°31'04.12"W, NAD83 was confirmed by independent hand held GPS. Recommend minor position update and (PD) be removed from inset. See AWOIS report 52982.
4. Charted 1₄ in posn: 55°21'08.18" N, 160°31'18.89" W NAD83 is in 2-3 fms of water. Area was surveyed at 4x4 meter spot spacing with 200% lidar coverage.
5. Depths of 2⁵ fms [2₃] were surveyed in posn: 55°20'21.71" N, 160°31'38.37" W NAD83 over Unga Reef between Islet and dangerous rock inside charted danger line. Area was surveyed at 4x4 meter spot spacing with 200% lidar coverage.
6. Charted 3 in posn: 55°20'16.10" N, 160°31'41.82" W NAD83 is in surveyed 2⁴ [2₂] fms of water. Area surveyed at 3x3 meter spot spacing with 200% lidar coverage.
7. Charted 2₃ in posn: 55°20'11.71" N, 160°31'37.38" W NAD83 is in surveyed 1² [1₁] fm of water. Kelp. Area surveyed at 3x3 meter spot spacing with 200% lidar coverage.
8. Dangerous wreck not found. Area surveyed at 3x3 meter spot spacing with 200% lidar coverage. Recommend removing wreck symbol from the chart. See AWOIS report 52985.
9. Surveyed 1³ [1₂] fm sounding with symbol Obstn in position 55°20'07.04" N, 160°32'24.44" W NAD83 and 1³ [1₂] fm sounding with symbol Obstn in position

-
- 55°20'08.32" N, 160°32'20.35" W NAD83. See AWOIS report 52986. Recommend investigate with boat.
10. Recommend extending 3 fm contour around Caton Shoal further south to match this survey and removing charted 3 fms in posn 55°19'49.40" N, 160°31'47.03" W NAD83.
 11. Charted 1₄ in posn: 55°20'04.58" N, 160°31'32.89" W NAD83 is in depths of 2-3 fms, area covered by 3x3 and 4x4 m spot spacing at 200%.
 12. Charted 1₅ in posn: 55°19'59.61" N, 160°31'33.01" W NAD83 is in depths of 3-4 fms, area covered by 3x3 and 4x4 m spot spacing at 200%.
 13. An uncharted jetty exists at Sand Point to the west of the main jetty and should be charted in the following positions: jetty starts at posn: 55°19'12.98" N, 160°31'11.65" W NAD83 and extends out to posn: 55°19'17.15" N, 160°31'12.90" W NAD83. The main jetty is also mischarted on the main chart and should be charted in the same position as the inset. A number of dolphins and pylons exist in this area, however not all were detected during this survey. The detected dolphins and pylons are depicted on the smooth sheet. A small charted jetty close east of main jetty was not detected. Recommend confirm position and number of dolphins with boat.
 14. Coastline extends approximately 30 meters further seaward than charted in position 55°19'41.83" N, 160°30'29.18" W NAD83.
 15. Recommend replacing charted 4₂ in posn: 55°20'03.26" N, 160°30'55.85" W NAD83 with surveyed 3⁹ [3₅] in posn: 55°20'04.12" N, 160°30'56.51" W NAD83 and amending contour to match this survey. Area surveyed with 3x3 meter spot spacing at 200% lidar coverage. Kelp.
 16. Recommend replacing charted 1₅ in posn: 55°20'11.63" N, 160°30'57.51" W NAD83 with surveyed 1⁷ [1₄] in posn: 55°20'12.34" N, 160°30'57.89" W NAD83. Area surveyed with 3x3 meter spot spacing at 200% lidar coverage.
 17. Recommend replacing charted 8₅ in posn: 55°19'37.63" N, 160°31'17.38" W NAD83 with surveyed 8⁴ [8₂] in posn: 55°19'37.20" N, 160°31'17.99" W NAD83 and amending contour to match this survey. Area covered by 4x4 m spot spacing at 200%.
 18. Recommend chart 1⁷ [1₄] RK in posn 55°20'03.68" N, 160°32'56.50" W NAD83 30 meters off 1 fm ridge and replace charted 2₅ with surveyed 1⁵ [1₃] in posn 55°20'02.27" N, 160°32'58.80" W NAD83. Area surveyed at 4x4 meter spot spacing at 400% lidar coverage. Kelp.
 19. Recommend replacing charted 5₅ in posn 55°19'52.09" N, 160°30'16.97" W NAD83 with surveyed 2⁴ [2₂] RK in position 55°19'51.82" N, 160°30'16.56" W NAD83 and amend 5 fm contour to match this survey. Area surveyed with 3x3 meter spot spacing at 200% lidar coverage. **See item 1**, Danger to Navigation Report H11147A in Appendix I.
 20. Recommend chart 4⁵ [4₃] RK in posn: 55°19'53.83" N, 160°30'23.94" W NAD83. Area surveyed with 3x3 meter spot spacing at 200% lidar coverage. **See item 2**, Danger to Navigation Report H11147A in Appendix I.
-

-
21. Recommend chart 5¹ [5₁] RK in posn: 55°19'56.62" N, 160°30'24.68" W NAD83. Area surveyed with 3x3 meter spot spacing at 200% lidar coverage. **See item 3**, Danger to Navigation Report H11147A in Appendix I.
 22. Recommend chart 3³ [3₂] RK in posn: 55°20'01.44" N, 160°30'10.06" W NAD83. Area surveyed with 3x3 and 4x4 meter spot spacing at 200% lidar coverage. **See item 4**, Danger to Navigation Report H11147A in Appendix I.
 23. Rock awash in posn: 55°20'19.81" N, 160°30'12.59" W NAD83, not detected during this survey however the rock is in an area of sparse data due to kelp. Recommend further investigation by boat.
 24. Recommend replacing charted 1₄ in posn: 55°20'21.65" N, 160°30'46.33" W NAD83 with surveyed 0⁸ [0₅] in posn: 55°20'23.20" N, 160°30'43.84" W NAD83. Area surveyed with 3x3 meter spot spacing at 200% lidar coverage.
 25. Recommend chart 0⁹ [0₅] in posn: 55°20'23.85" N, 160°30'36.84" W NAD83 in lieu of group of soundings over Popof Reef. Area surveyed with 3x3 meter spot spacing at 200% lidar coverage.
 26. Surveyed position of submerged sewer pipeline differs from chart in position and orientation. See AWOIS report 52983. Recommend removing charted pipeline and inserting surveyed pipeline.
 27. Recommend chart 1⁷ [1₄] RK in posn: 55°21'17.02" N, 160°30'24.88" W NAD83. Kelp.
 28. Recommend replacing charted 2 fms in posn: 55°21'24.16" N, 160°30'04.63" W NAD83 with surveyed 0⁹ [0₅] in posn 55°21'23.11" N, 160°30'04.31" W NAD83. Area surveyed with 3x3 meter spot spacing at 200% lidar coverage. Kelp.
 29. Charted 5₃ in posn 55°21'38.70" N, 160°29'50.77" W NAD83, surveyed 2⁸ [2₅] RK in posn 55°21'38.24" N, 160°29'49.58" W NAD83. Area surveyed with 3x3 and 4x4 meter spot spacing at 200% lidar coverage. **See item 5**, Danger to Navigation Report H11147A in Appendix I. Recommend investigate with boat. Low amplitude returns in kelp.
 30. Recommend replacing charted 9₂ in posn 55°21'47.51" N, 160°30'15.85" W NAD83 with surveyed 7⁹ [7₅] RK in posn 55°21'48.21" N, 160°30'13.58" W NAD83. Area surveyed with 3x3 and 4x4 meter spot spacing at 200% lidar coverage. **See item 12**, Danger to Navigation Report H11147A in Appendix I.
 31. Recommend replacing charted 4₃ in posn 55°21'35.77" N, 160°29'25.33" W NAD83 with surveyed 4 [4] RK in posn 55°21'36.07" N, 160°29'25.91" W NAD83. Area surveyed with 3x3 and 4x4 meter spot spacing at 200% lidar coverage.
 32. Recommend replacing charted 6₄ in posn 55°21'35.77" N, 160°29'19.23" W NAD83 with surveyed 4⁵ [4₃] RK in posn 55°21'31.16" N, 160°29'20.97" W NAD83. Area surveyed with 3x3 and 4x4 meter spot spacing at 200% lidar coverage.
 33. Coastline extends up to 80 meters further seaward than charted in posn 55°19'47.88" N, 160°30'01.06" W NAD83. Possible reclamation.
-

-
34. Surveyed 2⁶ [2₄] obstruction in posn 55°20'10.04" N, 160°30'25.95" W NAD83 on edge of 3⁸ [3₅] rock. Close north 4⁹ [4₅] RK and 3⁸ [3₅] RK. **See item 6**, Danger to Navigation Report H11147A in Appendix I. Recommend investigate obstruction with boat.
 35. Narrow channel between Range Island and East Head has charted depths of 3₅, this survey found depths as shoal as 2² [2₁] in this channel in posn 55°21'24.62" N, 160°29'59.00" W NAD83.
 36. Surveyed 2³ [2₂] shoal in 3-5 fms of water in posn 55°20'59.64" N, 160°30'32.32" W NAD83.
 37. Charted 2₅ shoal in posn 55°20'50.22" N, 160°30'46.36" W NAD83 extends further south, recommend amending 3 fm contour to match this survey.
 38. Recommend extending 3 fm contour further west to match this survey in posn 55°20'37.48" N, 160°30'28.62" W NAD83.
 39. Charted RK (6) in posn 55°21'32.28" N, 160°29'34.73" W NAD83 not located during this survey, however the area has sparse data, recommend further investigation.

D.1.1.2 AWOIS

52982: Charted as Rock Awash on chart 16553 and Rock Awash (PD) on inset at 55°21'31"N 160°31'05"W, NAD83. Surveyed position 55°21'31.55"N 160°31'04.12"W, NAD83 was confirmed by independent GPS. Recommend position be updated and (PD) be removed from inset.

52983: The sewer pipeline was surveyed at 2x2 meter spot spacing covering the area 50 meters on each side and seaward from its reported terminus. Two possible pipelines are visible in the data, which is consistent with reports that the first pipeline had moved because it was not anchored properly and a second pipeline was installed. However the reports also indicated that the first pipeline had been removed. The only conclusion is the first pipeline was only partially removed and a certain amount remains. A visual search of the area was also conducted but only one pipeline was observed. The AWOIS and charted position of the terminus, 55°20'29"N, 160°30'15"W NAD83 is incorrect. The pipeline enters the water at approximately 55°20'35.04"N, 160°30'02.75"W NAD83 and the terminus is at approximately 55°20'31.30"N, 160°30'17.31"W NAD83. The suspected remains of the first pipeline run from 55°20'32.32"N, 160°30'10.48"W NAD83 to 55°20'29.61"N, 160°30'17.93"W NAD83.

52985: The reported wreck in position 55°20'12.12"N, 160°31'27.84"W NAD83 was covered by main survey lines at 3x3 and 4x4 meter spot spacing, 400%, with a radius in excess of 600 meters, no indication of a wreck was found in the data. A visual search was also conducted for the mast with nothing sighted. A search by echo sounder was conducted over the AWOIS position with no significant change in depth noted in 16 feet of water. Local advice from the residents of Sand Point indicate no local knowledge of the wreck or visible mast in the area. Recommend removing wreck from chart.

52986: The reported wreck “Conquest” in position 55°20’12” N 160°32’24”W NAD83 was covered by main survey lines at 3x3 and 4x4 meter spot spacing, 400%, with a radius in excess of 600 meters. Two significant features approximately 82 meters apart were noted in the vicinity. Sand Point residents reported the existence of the wreck in the vicinity of the AWOIS position. Surveyed 1.3 fm sounding with symbol Obstn in position 55°20’07.04” N, 160°32’24.44” W NAD83 and 1.3 fm sounding with symbol Obstn in position 55°20’08.32” N, 160°32’20.35” W NAD83. Recommend investigate with boat.

D.1.1.3 Additional Boatwork inside Lidar Area (H11147A Inset)

It is recommended the following features as discussed in D.1.1.1 be investigated by boat:

- a. Item 9 – Obstructions northwest of Caton Shoal. (AWOIS 52986)
- b. Item 13 – Confirm jetties and dolphins.
- c. Item 23 – Piles and dolphins inside Humbolt Harbour.
- d. Item 24 – RK awash north of township of Sand Point.
- e. Item 30 – RK off East Head.
- f. Item 35 – RKs west of Sand Point.
- g. Item 40 – RK (6) on East Head.

D.1.2 Chart 16553

H11147A was compared to:

- Chart 16553 3rd Edition 2 September 1989, at scale 1:80 000.

D.1.2.1 Charted Depths and Features

The following comparisons and AWOIS from smooth sheet H11147A relate to chart 16553 (note inset covering Popof Strait is provided from page D.1-1) were conducted on the 1:80 000 scale chart.

1. Charted of 2₂ in posn. 55°24’32.41” N, 160°34’14.47” W NAD83 is adjacent to 18 ft islet approximately 200m from shoreline, recommend charting Islet in position 55°23’29.29” N, 160°34’10.83” W NAD83.
2. Charted drying rock in posn 55°23’25.36” N, 160°34’24.48” W NAD83 is in surveyed 2-3 fms of water in an area of sparse data, recommend further investigation to disprove.
3. Charted 4₅ fms in posn 55°23’37.36” N, 160°33’48.17” W NAD83 in 5¹ [5₁] fms of water. Area of sparse data, recommend retain 4₅ fms until further investigation.
4. Recommend chart 32 ft Islet in position 55°23’21.32” N, 160°33’25.53” W NAD83.
5. Chart 3⁴ [3₂] RK in position 55°23’26.00” N, 160°33’22.68” W NAD83. 3⁴ [3₂] RK close south.

6. Surveyed coastline extends up to 70 meters further seaward than the charted coastline in position 55°23'12.55" N, 160°32'53.78" W NAD83.
7. Recommend chart 1⁶ [1₄] RK in posn 55°23'11.64" N, 160°32'34.01" W NAD83.
8. Islet (5) in posn 55°23'04.59" N, 160°32'05.68" W NAD83 not located during this survey, 0⁶ [0₃] surveyed in posn 55°23'05.35" N, 160°32'00.82" W NAD83 and surveyed -1⁴ [-1₂] in posn 55°23'04.04" N, 160°32'03.02" W NAD83. Note 2⁶ [2₄] RK to seaward. Further investigation recommended.
9. 2 and 3 fathom contours extend further offshore than charted in position 55°22'52.80" N, 160°31'21.83" W NAD83.
10. Remove charted 4₂ in posn 55°22'37.69" N, 160°30'58.04" W NAD83. Recommend replace with surveyed 2⁷ [2₄] RK in posn 55°22'38.67" N, 160°31'00.03" W NAD83. Note surveyed 6⁵ [6₃] RK, 4² [4₁] RK and 3⁵ [3₃] RK close by. Kelp on rocks. **See item 7, Danger to Navigation Report H11147A in Appendix I.**
11. Two charted rocks in posn 55°17'27.25" N, 160°34'01.16" W NAD83 and 55°17'16.09" N, 160°34'00.06" W NAD83, not found in this survey however area of sparse data, recommend further investigation by boat to disprove.
12. Charted rock in posn 55°17'28.02" N, 160°34'19.00" W NAD83, relocate to (0⁴) [(0₂)] RK in posn 55°17'27.05" N, 160°34'23.10" W NAD83.
13. Surveyed 5⁴ [5₂] RK in posn 55°17'11.02" N, 160°33'51.78" W NAD83 in very sparse data recommend further investigation.
14. Surveyed 4³ [4₂] RK in posn 55°17'12.04" N, 160°27'52.65" W NAD83. Areas of sparse data in kelp. Recommend further investigation. **See item 8, Danger to Navigation Report H11147A in Appendix I.**
15. Recommend moving charted rock awash from posn 55°17'23.14" N, 160°27'53.71" W NAD83, to surveyed (1²) [(1₁)] RK in posn 55°17'23.43" N, 160°27'54.49" W NAD83.
16. Charted 4₂ in posn 55°17'13.85" N, 160°28'22.73" W NAD83, surveyed 0 RK in position 55°17'15.72" N, 160°28'17.74" W NAD83, area of sparse data, in kelp. Recommend further investigation.
17. Possible rock 3⁴ [3₂] RK in posn 55°17'09.38" N, 160°28'51.86" W NAD83. Area of sparse data in kelp. Recommend further investigation to confirm. **See item 11, Danger to Navigation Report H11147A in Appendix I.**
18. Possible rock 3 RK in posn 55°17'13.98" N, 160°28'49.80" W NAD83. Area of sparse data in kelp. Recommend further investigation to confirm.
19. Surveyed 3⁷ [3₄] RK in posn 55°17'29.54" N, 160°29'31.82" W NAD83. Area of sparse data, recommend further investigation. **See item 9, Danger to Navigation Report H11147A in Appendix I.**
20. Surveyed small islet with height of 3ft in posn 55°17'56.99" N, 160°29'44.75" W NAD83. Recommend further investigation.

-
21. Surveyed small islet with height of 4ft in posn 55°18'21.68" N, 160°30'31.77" W NAD83. Recommend further investigation.
 22. Surveyed coastline extends approximately 60 meters further seaward than charted coastline in posn: 55°18'32.38" N, 160°31'02.62" W NAD83.
 23. Surveyed coastline extends up to 120 meters further seaward than charted coastline in posn: 55°18'53.35" N, 160°31'25.58" W NAD83. This change in coastline is possibly due to the construction of an airport at Sand Point.
 24. Jetty at Sand Point mischarted on this chart but correct on the inset of Popof Strait. Recommend charting main jetty in same position as on inset of Popof Strait and chart new jetty to west in accordance with chart recommendation 13 of sheet H11147A, Popof Strait inset. Delete small jetty charted close east. Recommend confirm dolphins by boat.
 25. Two wharf like structures in posn 55°20'08.01" N, 160°30'07.83" W NAD83 not shown on this chart but shown on inset of Popof Strait. Recommend confirm by boat and check navigation aids and structures.
 26. Sewer pipeline in posn 55°21'22.37" N, 160°29'09.31" W NAD83 and buoy offshore not detected during this survey, pipeline is not shown on Popof Strait inset. Recommend further investigation.
 27. Recommend chart 2¹ [2₁] RK in posn 55°21'38.31" N, 160°28'18.86" W NAD83 and amend contours to match this survey. Kelp. **See item 10**, Danger to Navigation Report H11147A in Appendix I.
 28. Two charted islets in posn 55°21'20.63" N, 160°28'02.41" W NAD83 and 55°21'14.90" N, 160°27'55.26" W NAD83. Surveyed islet (3) and drying rock (1²) [(1₁)] in posn 55°21'13.37" N, 160°27'55.44" W NAD83. Area of sparse data, recommend further investigation.
 29. Rock Awash in posn 55°21'10.32" N, 160°27'50.78" W NAD83 not located during this survey. Area of sparse data, recommend further investigation.
 30. Wreck "Ray Mar" in posn 55°20'50.73" N, 160°27'42.85" W NAD83 mischarted, recommend moving to posn 55°21'25.99" N, 160°28'20.11" W NAD83. See AWOIS report no 52984.
 31. Area along coastline between 55°17'52.65" N, 160°29'29.86" W NAD83 and 55°17'26.66" N, 160°27'40.82" W NAD83 has numerous possible rocks in area of sparse data in kelp. Recommend further investigation to prove or disprove possible rocks. See chart recommendations 14 – 19.
 32. Surveyed * in posn: 55°21'41.27" N 160°28'10.11" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. There is doubt as to whether this rock exists, recommend further investigation by boat, area of kelp. **See item 13**, Danger to Navigation Report H11147A in Appendix I.

D.1.2.2 AWOIS

52984: The wreck of the “Ray Mar” (Houston) was investigated visually and found to have broken in two and separated by approximately 54 meters, the bow was observed to be in the tidal zone and the stern against the cliffs above the high water line. The AWOIS position of 55°20’51.29”N, 160°27’40.63”W NAD83 is incorrect. Positions of the two sections of the wreck were obtained using hand held GPS and are as follows:

- Bow: 55°21’26.01”N, 160°28’20.19”W NAD83, observed height approximately 6 meters.
- Stern: 55°21’25.65”N, 160°28’23.18”W NAD83 observed height approximately 6 meters.

D.1.2.3 Additional Boatwork Inside Lidar Area (H11147A)

It is recommended that the following features be investigated by boat:

- a. Item 2 – Charted drying rock off north coast Unga Island.
- b. Item 3 – Charted 4₅ in area of sparse data on edge of surveyed area off north coast of Unga Island.
- c. Item 8 – Islet and rocks.
- d. Item 11 – Two charted rocks off cape south of Green Bight.
- e. Item 13 – 5⁴ [5₂] RK southeast of Green Bight.
- f. Item 14 – 4³ [4₂] RK off south coast of Popof Island in kelp.
- g. Item 16 – Surveyed 0 RK off south coast of Popof Island in kelp.
- h. Item 17 – Possible RK 3⁴ [3₂] in kelp off south coast of Popof Island.
- i. Item 18 – Possible RK 3 in kelp off south coast of Popof Island.
- j. Item 19 – 3⁷ [3₄] RK in kelp off south coast of Popof Island
- k. Item 20 – Small Islet (3) off south coast of Popof Island.
- l. Item 21 – Small Islet (4) off south coast of Popof Island.
- m. Item 24 – Confirm jetties and dolphins at Sand Point.
- n. Item 25 – Confirm wharf and dolphins close north of township of Sand Point.
- o. Item 26 – Sewer pipeline and buoy east of East Head.
- p. Item 27 – Possible 2¹ [2₁] RK in kelp off north coast of Popof Island.
- q. Item 28 – Two charted islets surveyed as Islet (3) and (1²) [(1₁)] RK.
- r. Item 29 – Charted rock awash on north coast of Popof Island.
- s. Item 31 – Rocks off south coast of Popof Island in area of sparse coverage due to kelp.
- t. Areas of poor coverage due to variable turbidity around position 55°23’ .5” N 160°34’ .5” W (see coverage plot).

- u. Area of poor coverage due to persistent turbidity from 55°17'.2" N 160°29'.0" W to 55°17'.2" N 160°28'.2" W NAD83 (see coverage plot).
- v. Gap in the coverage plot in kelp area in Popof Strait in position 55°20'55.86" N 160°30'59.07" W NAD83. Recommend further investigation.
- w. Gap in the coverage plot in kelp area at northern end of Popof Strait in position 55°21'36.60" N 160°30'42.57" W NAD83. Recommend further investigation.
- x. Item 32 – Possible * north of Popof Island.

D.1.3 Navigational Aids

Lights/Beacons

The following lights were not detected by lidar and have not been included on the smooth sheet:

- 27080 Popof Strait Entrance – Light 1
- 27100 Sand Point Dock Light
- 27105 Humboldt Harbor Breakwater – Light 2
- 27110 Humboldt Harbor Breakwater – Light 3
- 27112 Caton Shoal – Buoy 6
- 27116 Sand Point Airport Warning – Buoys (4)

(Note: 27105 and 27110 may have been detected but were indistinguishable as they were located on the breakwater itself).

The following navigation aids were detected by lidar and the position adopted is as follows:

1. 27085 Popof Strait Light – Buoy 3
 - Charted position is 55°20'44"N , 160°31'05"W NAD83 (403 733E, 6 134 295N)
 - Two positions where detected by LADS at 403 707 E, 6 132 277 N and 403 715 E, 6 134 244 N. These are 34m apart.
 - The adopted position is the mean of the two detections above, being;

403 711 E, 6 134 261 N
 - This lies 40m from the charted position on a bearing of 212°.
2. 27090 Unga Reef Lighted – Buoy 4
 - Charted position is 55°20'15"N , 160°31'20"W NAD83 (403 449E, 6 133 404N)
 - One position was detected by LADS at **403 438E, 6 133 401N**. This is 12m away on a bearing of 254° from the charted position. This was used as the adopted position.

3. 27095 Popof Reef Lighted Gong – Buoy 5
- Charted position is 55°20'08"N , 160°31'02"W NAD83 (403 761E, 6 133 181N)
 - One position was detected by LADS at **403 760E, 6 133 189N**. This is 9m away on a bearing of 349° from the charted position. This was used as the adopted position.
4. In addition to the charted lights/beacons there are 5 pylons/buoys in a row, which lie on the eastern side of the north-south breakwater inside the Marina. These are approx 3.7m (2 fathoms) above MLLW.
5. Row of 5 pylons in Marina. Replaced contours with pile symbol and annotated only one making it plural. A number of hits were obtained for each pylon and the following positions were adopted for each, A being the most northerly and E the most southerly;

A	Two positions	404 829.5	6 132 950.6	(-2.2 fm)
		<u>404 830.8</u>	<u>6 132 948.3</u>	<u>(-2.2 fm)</u>
	Adopted Mean Position	404 830.1	6 132 949.5	(-2.2 fm)
B	One position	404 830.8	6 132 934.6	(-2.4 fm)
C	Two positions	404 828.9	6 132 920.4	(-2.4 fm)
		<u>404 831.5</u>	<u>6 132 919.9</u>	<u>(-2.2 fm)</u>
	Adopted Mean Position	404 830.2	6 132 920.2	(-2.4 fm)
D	Two positions	404 830.4	6 132 906.7	(-2.4 fm)
		<u>404 827.8</u>	<u>6 132 904.2</u>	<u>(-2.3 fm)</u>
	Adopted Mean Position	404 829.1	6 132 905.5	(-2.4 fm)
E	Three positions	404 828.2	6 132 891.1	(-2.2 fm)
		404 830.6	6 132 888.5	(-2.0 fm)
		<u>404 831.2</u>	<u>6 132 892.2</u>	<u>(-2.7 fm)</u>
	Adopted Mean Position	404 830.0	6 132 890.6	(-2.7 fm)

Summary of adopted positions of Marina pylons:

	<u>Latitude NAD83</u>	<u>Longitude NAD83</u>	<u>Ht (MLLW)</u>
A	55°20'01.27" N	160°30'01.07" W	-2.2 fm
B	55°20'00.78" N	160°30'01.01" W	-2.4 fm
C	55°20'00.32" N	160°30'01.03" W	-2.4 fm
D	55°19'59.84" N	160°30'01.07" W	-2.4 fm
E	55°19'59.36" N	160°30'01.00" W	-2.7 fm

D.1.4 Recommended Overlap with Lidar Data

In general, an overlap to the approximate position of the 15 meter isobath is recommended on sheet H11147A.

D.2 CHART COMPARISON – SMOOTH SHEET H11147B ⁹

D.2.1 H11147B

H11147B was compared to:

- Chart 16553 3rd Edition 2 September 1989, at scale 1:80 000. Nil corrections

The following discrepancies were noted during chart comparison:

D.2.1.1 Charted Depths and Features

Notes:

- Charted depths are in Fathoms and Feet and in format 2₄. Surveyed depths are in decimal Fathoms and in format 2⁴. For comparison, fathom and feet conversion is in brackets in format [2₂].
- A number of Charted Depths and Features fall in the overlap of data between sheets H11146B and H11147A (see D.1.2.1 Items 27 – 30 and 32).
- Sheets A, E and F (database Shum 1) and sheets B, C and D (database Shum 2) were conducted as two independent surveys and therefore minor differences in position and depth of soundings occur in the overlap area of sheets A and B. Minor differences between Smooth Sheets A and B are as follows:

Position (NAD 83)	Depth Sheet A	Depth Sheet B	Comment
55°21'27.27" N 160°28'05.57" W	Islet (29)	Islet (25)	Difference possibly due to vegetation or uneven ground, recommend chart Islet (29).
55°21'25.25" N 160°28'01.08" W	Drying RK (<u>I</u> ¹)	Drying RK (<u>I</u>)	Difference within error budget, recommend (<u>I</u> ¹).
55°21'24.54" N 160°27'59.06" W	Not Found	Drying RK (<u>0</u> ¹)	Possible rock in heavy kelp, recommend further investigation.
55°21'13.42" N 160°27'55.47" W	Drying RK (<u>I</u> ²)	Drying RK (<u>I</u> ¹)	Difference within error budget, recommend (<u>I</u> ²).
55°21'20.13" N 160°28'01.67" W	Islet (3)	Drying RK (<u>I</u> ⁴)	Soundings fall either side of the 2.3 ft above MHW datum change and therefore are related to different datums. Difference is within the error budget, recommend chart <i>Drying RK</i> (<u>I</u> ⁴).

1. Surveyed 1⁸ [1₅] RK in posn: 55°20'59.52" N 160°27'33.65" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. **See item 1**, Danger to Navigation Report H11147B in Appendix 1. Kelp, recommend further investigation.

-
2. Charted dangerous rocks in posn: 55°20'35.31" N 160°26'29.29" W NAD 83 not found during this survey. Areas of sparse coverage due to kelp. Recommend further investigation.
 3. Surveyed 1³ [1₂] RK in posn: 55°20'47.58" N 160°26'07.83" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Kelp, recommend further investigation by boat. Note: 1³ [1₂] RK 20m south west. **See item 2**, Danger to Navigation Report H11147B in Appendix 1.
 4. Recommend chart (I²) [1₁] * in posn: 55°20'27.82" N 160°24'52.46" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 5. Recommend chart (0⁶) [0₆] * in posn: 55°21'02.82" N 160°23'30.78" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 6. Surveyed 7⁸ [7₅] RK in posn: 55°21'41.78" N 160°22'24.22" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Sparse coverage, kelp, recommend further investigation by boat. Note: 8³ [8₂] RK and 8⁷ [8₄] RK close north.
 7. Recommend replace charted 9 in posn: 55°21'52.35" N 160°22'13.78" W NAD 83 with surveyed 8⁹ [8₅] RK in posn: 55°21'54.32" N 160°22'10.78" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 8. Recommend chart 2⁴ [2₂] RK in posn: 55°21'38.29" N 160°21'24.51" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 1 RK 40 meters south east.
 9. Charted dangerous rock in posn: 55°21'35.93" N 160°20'10.83" W NAD 83 not found this survey, recommend remove from chart. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: Steep seabed, surveyed depths of 6 – 10 fms.
 10. Dangerous rock charted in posn: 55°21'01.48" N 160°19'27.57" W NAD 83, surveyed 0¹ [0₁] RK in posn: 55°21'01.08" N 160°19'27.76" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Sparse coverage, kelp, recommend further investigation by boat. Note 0⁷ [0₄] RK and 1⁷ [1₄] RK close north. Also on sheet H11147C.
 11. Charted coastline differs from surveyed coastline by up to 90 meters in posn: 55°20'58.17" N 160°19'36.56" W NAD 83. Also on sheet H11147C.
 12. Recommend replacing charted 0₄ in posn: 55°20'26.95" N 160°20'39.26" W NAD 83 with surveyed (0⁴) [0₂] * in posn: 55°20'22.45" N 160°20'48.36" W NAD 83 and amend contours to match this survey. Area covered with 4x4 meter spot spacing at 200% lidar coverage.
 13. Recommend replace dangerous rock in posn: 55°20'32.21" N 160°19'43.70" W NAD 83 with surveyed (0⁵) [0₃] RK in posn: 55°20'31.77" N 160°19'43.83" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note 0⁵ [0₃] RK 30 meters south west and 2 RK 80 meters North East. Also on sheet H11147C.
 14. Recommend replace charted 9 in posn: 55°20'36.51" N 160°19'33.48" W NAD 83 with surveyed 9⁸ [9₅] RK in posn: 55°20'36.42" N 160°19'35.04" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Also on sheet H11147C.
-

-
15. Recommend chart (Q^1) [Q_1] * in posn: 55°19'54.86" N 160°19'17.20" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Also on sheet H11147C.
 16. Surveyed (Q^8) [Q_5] * in posn: 55°23'41.03" N 160°19'30.16" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (9) 140 meters South East. Sparse coverage, recommend further investigation by boat. Also on sheet H11147C.
 17. Recommend chart 4¹ [4_1] RK in posn: 55°23'32.75" N 160°19'14.92" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Also on sheet H11147C.
 18. Recommend replace dangerous rock in posn: 55°23'33.45" N 160°18'39.94" W NAD 83 with surveyed (3) islet in posn: 55°23'35.24" N 160°18'39.01" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Also on sheet H11147C.
 19. Charted dangerous rock in posn: 55°23'34.31" N 160°18'19.83" W NAD , surveyed 0² [0_1] RK in posn: 55°23'34.91" N 160°18'27.64" W NAD 83. Also on sheet H11147C.
 20. Recommend replace charted Islet in posn: 55°23'33.99" N 160°18'11.93" W NAD 83 with surveyed Islet (4) in posn: 55°23'35.63" N 160°18'12.00" W NAD 83. Surveyed coastline differs from charted coastline by up to 70 meters in posn: 55°23'35.86" W NAD 83. Recommend amend coastline to match this survey. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Also on sheet H11147C.
 21. Recommend replace charted dangerous rock in posn: 55°23'33.51" N 160°18'01.89" W NAD 83 with Islet (51) in posn: 55°23'34.54" N 160°18'03.53" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 2 RK 50 meters south. Also on sheet H11147C.
 22. Surveyed 1⁸ [1_5] RK in posn: 55°20'09.94" N 160°19'00.79" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data recommend further investigation.

D.2.1.2 Additional Boatwork inside Lidar Area

It is recommended the following features north of Popof Island as discussed in D.2.1.1 be investigated by boat.

- a. Item 1 - 1⁸ [1_5] RK in kelp area.
- b. Item 2 - Charted dangerous rock not found sparse kelp area.
- c. Item 3 - 1³ [1_2] RK in kelp area.
- d. Item 6 - 7⁸ [7_5] RK in kelp area.
- e. Item 10 - Charted dangerous rock in sparse kelp area.
- f. Item 16 - (Q^8) [Q_5] * in area of sparse coverage.
- g. Item 22 - 1⁸ [1_5] RK in area of sparse data.
- h. 1⁸ [1_5] in posn: 55°21'24.21" N 160°19'45.57" W NAD 83 possible rock.
- i. Possible RK in heavy kelp in overlap between Smooth Sheets A and B (see note C)

D.2.2 Recommended Overlap with Lidar Data

In general, the following overlaps are recommended:

- a. North coast of Popof Island, from 55° 21' 30" N 160° 28' 30" W to 55° 20' 50" N 160° 24' 45" W. An overlap to the 15 meter isobath.
- b. North coast of Popof Island, from 55° 20' 50" N 160° 24' 45" W to Pirate Cove. An overlap to the 20 meter isobath.
- c. North coast of Popof Island from Pirate Cove to 55° 21' 00" N 160° 19' 30" W. The coast is relatively steep to; an overlap to the 10 meter isobath.
- d. East Coast of Popof Island, from 55° 21' 00" N 160° 19' 30" W to Dark Cliffs. An overlap to the 20 meter isobath.
- e. High Island is generally steep to. Few lidar soundings were obtained. Boatwork close to the low water line in fair weather.
- f. Korovin Island. See recommendations for Smooth Sheet C.

D.3 CHART COMPARISON – SMOOTH SHEET H11147C ¹⁰

D.3.1 H11147C

H11147C was compared to:

- Chart 16553 3rd Edition 2 September 1989, at scale 1:80 000. Nil corrections

The following discrepancies were noted during chart comparison:

D.3.1.1 Charted Depths and Features

Notes:

- Charted depths are in Fathoms and Feet and in format 2₄. Surveyed depths are in decimal Fathoms and in format 2⁴. For comparison, fathom and feet conversion is in brackets in format [2₂].
- A number of Charted Depths and Features fall in the overlap of data between sheets H11147 C and H11147 B (see D.2.1.1 items 10-11 and 13-21).
 - Recommend chart 5⁸ [5₅] RK in posn: 55°23'37.78" N 160°16'51.46" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 - Recommend chart 7⁹ [7₅] RK in posn: 55°23'42.86" N 160°16'39.47" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note 4⁶ [4₄] RK 80 meters west.
 - Recommend chart 4⁹ [4₅] RK in posn: 55°24'00.78" N 160°16'24.92" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 - Recommend chart 1⁶ [1₄] RK in posn: 55°24'23.89" N 160°16'07.01" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 2² [2₁] 60 meters West and 1⁸ [1₅] 150 meters north.
 - Numerous rocky and reef areas in Korovin Bay recommend amending chart in this area to match this survey. Area covered with 4x4 meter spot spacing at 200% lidar coverage.
 - Complex area of rocks and islets off the headland at the eastern end of Korovin Bay, area of sparse data recommend further investigation by boat. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 2⁷ [2₄] RK in posn: 55°23'44.62" N 160°13'16.16" W NAD 83.
 - Surveyed 1⁸ [1₅] RK in posn: 55°20'09.93" N 160°19'00.79" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend confirm by boat.
 - Recommend chart (0¹) [0₁] * in posn: 55°19'54.86" N 160°19'17.20" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 - Recommend replace charted dangerous rock in posn: 55°19'36.49" N 160° 19'20.12" W NAD 83 with surveyed (0³) [0₃] * in posn: 55°19'34.73" N 160°19'21.25" W NAD 83. Islet (8) close west. Area covered with 4x4 meter spot spacing at 200% lidar coverage.

Note three dangerous rocks close south not found during this survey recommend remove from chart.

10. Surveyed 1⁴ [1₂] RK in posn: 55°18'57.45" N 160°19'01.30" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 1⁶ [1₄] RK 50 meters north in NBA area. Area of sparse data recommend further investigation .
11. Recommend chart 1⁷ [1₄] RK in posn: 55°18'26.26" N 160°18'37.15" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. **See item 4**, Danger to Navigation Report H11147C in Appendix 1. Also on sheet H11147D.
12. Recommend chart 0⁶ [0₄] RK in posn: 55°18'15.49" N 160°18'26.95" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Also on sheet H11147D.
13. Recommend replace charted dangerous rock in posn: 55°18'09.86" N 160°18'25.24" W NAD 83 with surveyed (0⁵) [0₃] RK in posn: 55°18'12.13" N 160°18'27.19" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Also on sheet H11147D.
14. Surveyed 1⁸ [1₅] RK in posn: 55°18'04.49" N 160°18'29.88" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data, recommend further investigation by boat. Also on sheet H11147D.
15. Surveyed 10³ [10₂] RK in posn: 55°18'24.23" N 160°16'53.15" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 11¹ [11₁] RK 150 meters west. Area of sparse data, recommend further investigation by boat. **See item 1**, Danger to Navigation Report H11147C. Also on sheet H11147D.
16. Surveyed 8⁷ [8₄] RK in posn: 55°19'01.97" N 160°17'55.99" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note 9¹ [9₁] RK 55 meters south east, area of sparse data recommend further investigation by boat. **See item 2**, Danger to Navigation Report H11147C.
17. Charted 8 in posn: 55°19'18.97" N 160°17'30.56" W NAD 83, Surveyed 7 RK in posn: 55°19'16.59" N 160°17'34.09" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 8⁴ [8₂] RK 70 meters north east and 9² [9₁] RK 150 meters south. Area of sparse data, recommend further investigation by boat. **See item 3**, Danger to Navigation Report H11147C.
18. Charted 9 with blue tint in posn: 55°18'18.83" N 160°17'19.89" W NAD 83 not found during this survey, area assigned NBA 10. Recommend further investigation by boat. Note: Chart Comparison No. 15. Also on sheet H11147D.

D.3.1.2 Additional Boatwork inside Lidar Area

It is recommended the following features South of Korovin Island and East of Popof Island as discussed in D.3.1.1 be investigated by boat.

- a. Item 6 - Complex area of rocks in sparse data.
- b. Item 7 - 1⁸ [1₅] RK Small isolated feature.

- c. Item 10 - 1⁴ [1₂] RK in area of sparse coverage
- d. Item 14 - 1⁸ [1₅] RK in area of sparse coverage.
- e. Item 15 - 10³ [10₂] RK in area of sparse coverage.
- f. Item 16 - 8⁷ [8₄] RK in area of sparse coverage.
- g. Item 17 - 7 RK in area of sparse coverage.
- h. Item 18 - Charted 9 not found.

D.3.2 Recommended Overlap with Lidar Data

In general, the following overlaps are recommended:

- a. South Coast of Korovin Island. An overlap to the 20 meter isobath is recommended with the following exceptions:
 - West of the headland at 55° 23' 35" N 160° 19' 15" W the coast is steep to; an overlap to the 10 meter isobath.
 - Off the reef at the eastern end of Korovin Bay at 55° 23' 50" N 160° 13' 10" W; an overlap to the 10 meter isobath.
- b. East side of Popof Island, south of Dark Cliffs. An overlap to the 20 meter isobath is recommended.

D.4 CHART COMPARISON – SMOOTH SHEET H11147D ¹¹

D.4.1 H11147D

H11147D was compared to:

- Chart 16553 3rd Edition 2 September 1989, at scale 1:80 000. Nil Corrections

The following discrepancies were noted during chart comparison:

D.4.1.1 Charted Depths and Features

Notes:

- a. Charted depths are in Fathoms and Feet and in format 2₄. Surveyed depths are in decimal Fathoms and in format 2⁴. For comparison, fathom and feet conversion is in brackets in format [2₂].
 - b. A number of Charted Depths and Features fall in the overlap of data between sheets H11147 D and H11147 C (see D.3.1.1 items 11 – 15 and 18).
1. Charted dangerous rock in posn: 55°17'42.94" N 160°18'50.72" W NAD 83, surveyed (12) [11] * in posn: 55°17'42.23" N 160°18'52.29" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (01) [01] * 41 meters south east. Area of sparse data, recommend further investigation.
 2. Surveyed 3¹ [3₁] RK in posn: 55°17'37.45" N 160°18'40.07" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: numerous rocks in the vicinity. Kelp on rocks recommend further investigation.
 3. Surveyed coastline differs from charted coastline by up to 90 meters in posn: 55°17'28.68" N 160°18'49.54" W NAD 83, recommend amending contours to match this survey.
 4. Surveyed (0²) [0₁] * in posn: 55°17'30.02" N 160°18'49.70" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data, recommend further investigation by boat. Note: 3⁵ [3₃] RK 100 meters east.
 5. Charted dangerous rock in posn: 55°17'19.91" N 160°18'50.46" W NAD 83, surveyed 1⁵ [1₃] RK in posn: 55°17'15.56" N 160°18'46.89" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data, recommend further investigation by boat. Note: numerous rocks in the vicinity.
 6. Recommend replace charted dangerous rock in posn: 55°16'51.70" N 160°19'22.40" W NAD 83, with (0) * in posn: 55°16'50.13" N 160°19'25.87" W NAD 83 and amend contours to match this survey in this area.
 7. Recommend replace dangerous rock in posn: 55°16'52.88" N 160°19'09.65" W NAD 83 with surveyed 0¹ [0₁] RK in posn: 55°16'51.57" N 160°19'08.58" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 7⁸ [7₅] RK 200 meters north east.

-
8. Recommend replace dangerous rock in posn: 55°16'33.96" N 160°19'09.61" W NAD 83 with surveyed 0⁸ [0₅] RK in posn: 55°16'31.22" N 160°19'10.17" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: group of rocks 200 meters north.
 9. Charted dangerous rock in posn: 55°16'30.39" N 160°19'20.74" W NAD 83, surveyed 0⁵ [0₃] RK in posn: 55°16'27.01" N 160°19'24.14" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data, recommend further investigation by boat.
 10. Recommend replace dangerous rock in posn: 55°16'08.02" N 160°19'38.69" W NAD 83 with surveyed islet (17) in posn: 55°16'07.83" N 160°19'36.78" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage.
 11. Recommend chart 1⁷ [1₄] RK in posn: 55°16'01.35" N 160°19'30.14" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 12. Surveyed coastline differs from charted coastline between 55°15'59.15" N 160°19'45.74" W NAD 83 and 55°15'36.35" N 160°19'54.29" W NAD 83. Note: numerous rock along this area of coastline, area of sparse data recommend further investigation by boat.
 13. Recommend chart 3 RK in posn: 55°15'52.15" N 160°19'30.84" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 2⁷ [2₄] RK 55 meters west. **See item 1**, Dangers to Navigation H11147D in Appendix I.
 14. Recommend chart 4⁷ [4₄] RK in posn: 55°15'43.62" N 160°19'36.78" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 1⁶ [1₄] RK 45 meters West. **See item 2**, Dangers to Navigation H11147D in Appendix I.
 15. Surveyed 4 Obstn in posn: 55°15'32.85" N 160°19'40.86" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Small isolated seabed feature, possibly wreckage. Recommend confirm / identify by boat.
 16. Surveyed coastline differs from charted coastline by up to 100 meters in posn: 55°15'14.01" N 160°19'45.87" W NAD 83, recommend amending contours to match this survey.
 17. Recommend replace charted dangerous rock in posn: 55°15'15.27" N 160°19'30.89" W NAD 83 with surveyed islet (4) in posn: 55°15'14.89" N 160°19'30.20" W NAD 83.
 18. Recommend chart 3 RKS in posn: 55°15'10.71" N 160°19'34.91" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Detached rocks close south west and east of feature.
 19. Recommend chart 2² [2₁] RKS in posn: 55°15'04.70" N 160°19'37.69" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: numerous rocks in the vicinity.
 20. Surveyed coastline differs from charted coastline by up to 70 meters in posn: 55°14'47.05" N 160°19'57.78" W NAD 83, recommend amending contours to match this survey.
-

-
21. Charted 4³ [4₂] in posn: 55°14'30.01" N 160°20'21.11" W NAD 83, surveyed 6² [6₁] RK in posn: 55°14'30.84" N 160°20'16.40" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data, recommend further investigation by boat. Kelp on rock.
 22. Replace charted 14 in posn: 55°14'17.80" N 160°19'58.23" W NAD 83 with surveyed 11² [11₁] in posn: 55°14'19.65" N 160°19'59.97" W NAD 83. Note 11⁶ [11₄] and 13 further south east, recommend break 20 fathom contour.

D.4.1.2 Additional Boatwork inside Lidar Area

It is recommended the following features on the south eastern side of Popof Island as discussed in D.4.1.1 be investigated by boat.

- a. Item 1 - Charted dangerous rock, area of sparse coverage.
- b. Item 2 - 3¹ [3₁] RK in Kelp.
- c. Item 4 - (0²) [0₁] ✱, area of sparse coverage.
- d. Item 5 - Charted dangerous rock, area of sparse coverage.
- e. Item 9 - Charted dangerous rock, area of sparse coverage.
- f. Item 12 - Numerous rocks in sparse data along mischarted section of coastline.
- g. Item 15 - 4 Obstn, possible debris or wreckage.
- h. Item 21 - 4³ [4₂] in area of sparse data, kelp on rock.
- i. Turbid area north west of Popof Head at 55° 15' 00" N 160° 20' 36" W.

D.4.2 Recommended Overlap with Lidar Data

In general, the following overlaps are recommended:

- a. East coast of Popof Island, north of 55° 17' 00" N. An overlap to the 20 meter isobath.
- b. South east coast of Popof Island, from 55° 17' 00" to Popof Head. An overlap to the 25 meter isobath.

D.5 CHART COMPARISON – SMOOTH SHEET H11147E ¹²

D.5.1 H11147E

H11147E was compared to:

- Chart 16553 3rd Edition 2 September 1989, at scale 1:80 000

D.5.1.1 Charted Depths and Features

Note: Charted depths are in Fathoms and Feet and in format 2₄. Surveyed depths are in decimal Fathoms and in format 2⁴. For comparison, fathom and feet conversion is in brackets in format [2₂].

1. Surveyed (Q^3) [0₂] * in posn: 55°17'47.88" N 160°26'47.58" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data, recommend further investigation by boat.
2. Surveyed (Q^6) [0₄] * in posn: 55°17'48.24" N 160°26'46.37" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data, recommend further investigation by boat.
3. Surveyed (Q^4) [0₂] * in posn: 55°17'48.93" N 160°26'39.63" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend further investigation by boat.
4. Recommend moving charted islet in posn 55°17'41.00" N 160°26'09.42" W NAD83 to surveyed posn 55°17'39.63" N 160°26'02.24" W NAD83. Height of islet > 33 feet.
5. Surveyed 1⁹ [1₅] RK in posn: 55°17'38.77" N 160°26'07.27" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Low amplitude pulse, recommend further investigation by boat.
6. Surveyed (Q^5) [0₃] * in posn: 55°17'32.74" N 160°26'01.56" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data inshore kelp. **See item 1**, Danger to Navigation Report H11147E in Appendix I.
7. Recommend chart 5³ [5₂] RK in posn: 55°17'30.71" N 160°26'12.87" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
8. Surveyed 2³ [2₂] RK in posn: 55°17'09.36" N 160°26'02.53" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Low amplitude pulse – kelp, recommend further investigation by boat.
9. Charted dangerous rock in posn: 55°17'14.67" N 160°26'01.39" W NAD83; Surveyed 1⁹ [1₅] RK in posn: 55°17'14.46" N 160°26'01.33" W NAD83. Sparse coverage due to kelp, recommend further investigation by boat.
10. Replace charted dangerous rock and danger line in posn: 55°17'09.66" N 160°26'11.03" W NAD83 with 5⁶ [5₄] RK in posn: 55°17'09.86" N 160°26'13.41" W NAD83.
11. Recommend chart (Q^4) [0₂] * in posn: 55°17'14.06" N 160°25'53.82" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data - kelp.

-
12. Recommend remove charted dangerous rock symbol in posn: 55°17'06.06" N 160°25'49.74" W NAD83. Surveyed ($\underline{0}^4$) [$\underline{0}_2$] * in posn: 55°17'09.99" N 160°25'44.42" W NAD83.
 13. Recommend extending charted coastline to match this survey in posn: 55°17'13.14" N 160°25'45.13" W NAD83.
 14. Surveyed 3 RK in posn: 55°17'03.30" N 160°25'38.89" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend further investigation by boat.
 15. Surveyed 3² [3₁] RK in posn: 55°16'58.38" N 160°25'46.38" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data, recommend further investigation by boat.
 16. Surveyed 3² [3₁] RK in posn: 55°16'59.73" N 160°25'41.86" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data, recommend further investigation by boat.
 17. Surveyed ($\underline{0}$)* in posn: 55°17'01.61" N 160°25'32.34" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data recommend, further investigation by boat. Rocks close North.
 18. Islet surveyed in posn: 55°17'05.32" N 160°25'32.04" W NAD83. Height of islet > 33 feet.
 19. Recommend chart 1⁶ [1₄] RK in posn: 55°16'57.96" N 160°25'29.89" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 20. Charted dangerous rock symbol, danger curve and blue tint in posn: 55°16'55.76" N 160°25'50.58" W NAD83, surveyed ($\underline{1}$) * in posn: 55°16'54.93" N 160°25'44.93" W NAD83. Area of sparse data recommend, further investigation by boat.
 21. Surveyed 1⁹ [1₅] RK in posn: 55°16'56.38" N 160°25'32.92" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend further investigation by boat.
 22. Surveyed 7³ [7₂] RK in posn: 55°16'50.50" N 160°25'35.99" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data – kelp. Recommend further investigation by boat.
 23. Recommend replacing charted 5₃ in posn: 55°16'54.39" N 160°25'58.64" W NAD83 with surveyed 2⁵ [2₃] RK in posn: 55°16'53.97" N 160°25'26.74" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. **See item 2**, Danger to Navigation Report H11147E in Appendix I.
 24. Recommend inserting surveyed 0⁹ [0₅] RK in posn: 55°16'52.59" N 160°25'20.07" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. **See item 3**, Danger to Navigation Report H11147E in Appendix I.
 25. Surveyed 9⁶ [9₄] RK in posn: 55°16'32.39" N 160°25'23.78" W NAD83. Recommend further investigation by boat. **See item 4**, Danger to Navigation Report H11147E in Appendix I.
-

-
26. Recommend amending coastline and contours around the headland at the western end of Simeon Bight to match this survey.
 27. In the vicinity of 55°16'40" N 160°25'02" W NAD83 a number of surveyed rocks in sparse data and kelp were surveyed. Recommend further investigation by boat.
 28. Surveyed 1⁵ [1₃] RK in posn: 55°17'01.08" N 160°25'04.58" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data, recommend further investigation by boat.
 29. Surveyed (0⁵) [0₃]* in posn: 55°17'07.48" N 160°25'00.90" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Sparse coverage on edge of kelp area. Recommend further investigation by boat.
 30. Charted dangerous rock in posn: 55°16'50.38" N 160°24'57.72" W NAD83 not found this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend removing charted dangerous rock.
 31. Recommend replacing charted dangerous rock symbol in posn: 55°17'18.59" N 160°24'35.80" W NAD83 with surveyed (0⁶) [0₄]* in posn: 55°17'17.42" N 160°24'31.65" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. *Note: (0) * 90 meters West South West.*
 32. Surveyed 1⁴ [1₂] RK in posn: 55°17'03.73" N 160°23'36.89" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note other surveyed rocks in the vicinity, area of sparse data recommend further investigation by boat.
 33. Surveyed 1⁴ [1₂] RK in posn: 55°16'53.97" N 160°23'19.30" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 2⁵ [2₃] RK 70 meters North West. Sparse data due to kelp. Recommend further investigation by boat.
 34. Recommend replacing charted 7₁ in posn: 55°16'41.42" N 160°24'01.78" W NAD83 with surveyed 4² [4₁] RK in posn: 55°16'37.42" N 160°23'54.83" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Also recommend amending 10 fathom contour to match this survey. **See item 5**, Danger to Navigation Report H11147E in Appendix I.
 35. Surveyed 1⁷ [1₄] RK in posn: 55°16'33.02" N 160°23'46.89" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage, kelp. Recommend further investigation by boat. **See item 6**, Danger to Navigation Report H11147E in Appendix I.
 36. Charted coastline differs from the surveyed coastline by up to 140 meters in posn: 55°16'51.50" N 160°23'11.58" W NAD83.
 37. Recommend chart 4⁵ [4₃] RK in posn: 55°16'45.25" N 160°23'43.50" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. **See item 7**, Danger to Navigation Report H11147E in Appendix I.
 38. Surveyed 3⁹ [3₅] RK in posn: 55°16'39.87" N 160°23'21.41" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend investigate with boat.
 39. Surveyed 1⁹ [1₅] RK in posn: 55°16'33.83" N 160°23'06.26" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Sparse coverage due to kelp. Recommend further investigation by boat.
-

-
40. Recommend chart 6⁶ [6₄] RK in posn: 55°16'22.83" N 160°23'44.41" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. **See item 8**, Danger to Navigation Report H11147E in Appendix I.
 41. Surveyed 5³ [5₂] RK in posn: 55°16'20.72" N 160°22'58.78" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Kelp. Recommend check with boat.
 42. Recommend chart 9⁶ [9₄] RK in posn: 55°16'07.51" N 160°23'03.38" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 43. Recommend chart 5 RK in posn: 55°16'06.27" N 160°22'56.72" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 44. Surveyed (0⁴) [0₂]* in posn: 55°16'04.02" N 160°22'45.69" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage, area of sparse data recommend further investigation by boat.
 45. Surveyed 5¹ [5₁] RK in posn: 55°15'52.46" N 160°23'11.11" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Kelp on shoal. Recommend confirm with boat.
 46. Recommend remove dangerous rock symbol in posn: 55°15'20.44" N 160°22'43.39" W NAD83 and chart islet (5) in posn: 55°15'19.97" N 160°22'44.44" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 47. Recommend chart (1)* in posn: 55°15'24.25" N 160°22'36.93" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Other rocks surveyed in area.
 48. Recommend chart 8⁷ [8₄] RK in posn: 55°15'16.68" N 160°22'33.67" W NAD83 and remove *rky* annotation. Area covered with 4x4 meter spot spacing at 200% lidar coverage.
 49. Charted dangerous rock in posn: 55°15'27.93" N 160°21'34.06" W NAD83, surveyed (0²) [0₁]* in posn: 55°15'25.17" N 160°21'32.41" W NAD83, area of sparse data. Also 0⁹ [0₅] RK in posn: 55°15'24.00" N 160°21'31.84" W NAD83 on edge of kelp area, recommend further investigation by boat. Note: Turbid area close southwest in posn: 55°15'22.63" N 160°21'38.21" W NAD83 has poor coverage, recommend further investigation by boat.
 50. Surveyed (0⁴) [0₂]* in posn: 55°15'17.70" N 160°20'59.22" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage, area of sparse data, recommend further investigation by boat.
 51. Recommend chart Islet in posn: 55°15'11.85" N 160°20'55.27" W NAD83 with a height of 11 feet as on smooth sheet. Group of rocks in area.
 52. Surveyed 1⁶ [1₄] RK in posn: 55°15'10.40" N 160°20'47.29" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Low amplitude pulses. Recommend further investigation by boat.
 53. Replace charted 1₂ in posn: 55°15'51.53" N 160°26'01.24" W NAD83 with 1² [1₁] RK in posn: 55°15'51.23" N 160°25'59.03" W NAD83. Note: 1⁷ [1₄] RK and 2³ [2₂] RK close by.

54. Kelly Rock in posn: 55°11'35.87" N 160°27'27.08" W NAD83 is mischarted. Recommend charting as per smooth sheet.

D.5.1.2 AWOIS

Nil

D.5.1.3 Additional Boatwork Inside Lidar Area (H11147E)

It is recommended that the following features as discussed in D.5.1.1 be investigated by boat:

- a. Surveyed (Q^3) [Q_2] * in posn: 55°17'47.88" N 160°26'47.58" W NAD83. Area of sparse data.
- b. Surveyed (Q^6) [Q_4] * in posn: 55°17'48.24" N 160°26'46.37" W NAD83. Area of sparse data.
- c. Surveyed (Q^4) [Q_2] * in posn: 55°17'48.93" N 160°26'39.63" W NAD83.
- d. Surveyed 1^9 [1_5] RK in posn: 55°17'38.77" N 160°26'07.27" W NAD83. Low amplitude pulse.
- e. Surveyed 2^3 [2_2] RK in posn: 55°17'09.36" N 160°26'02.53" W NAD83. Low amplitude pulse – kelp.
- f. Charted dangerous rock in posn: 55°17'14.67" N 160°26'01.39" W NAD83; Surveyed 1^9 [1_5] RK in posn: 55°17'14.46" N 160°26'01.33" W NAD83. Sparse coverage due to kelp.
- g. Surveyed 3 RK in posn: 55°17'03.30" N 160°25'38.89" W NAD83.
- h. Surveyed 3^2 [3_1] RK in posn: 55°16'58.38" N 160°25'46.38" W NAD83. Area of sparse data.
- i. Surveyed 3^2 [3_1] RK in posn: 55°16'59.73" N 160°25'41.86" W NAD83. Area of sparse data.
- j. Surveyed (Q) * in posn: 55°17'01.61" N 160°25'32.34" W NAD83. Rocks close North. Area of sparse data.
- k. Charted dangerous rock symbol, danger curve and blue tint in posn: 55°16'55.76" N 160°25'50.58" W NAD83, surveyed (L) * in posn: 55°16'54.93" N 160°25'44.93" W NAD83. Area of sparse data.
- l. Surveyed 1^9 [1_5] RK in posn: 55°16'56.38" N 160°25'32.92" W NAD83.
- m. Surveyed 7^3 [7_2] RK in posn: 55°16'50.50" N 160°25'35.99" W NAD83. Area of sparse data – kelp.
- n. Surveyed 9^6 [9_4] RK in posn: 55°16'32.39" N 160°25'23.78" W NAD83.
- o. In the vicinity of 55°16'40" N 160°25'02" W NAD83 a number of surveyed rocks in sparse data and kelp were surveyed.
- p. Surveyed 1^5 [1_3] RK in posn: 55°17'01.08" N 160°25'04.58" W NAD83. Area of sparse data.

-
- q. Surveyed (Q^5) [Q_3]* in posn: 55°17'07.48" N 160°25'00.90" W NAD83. Sparse coverage on edge of kelp area.
 - r. Surveyed 1^4 [1_2] RK in posn: 55°17'03.73" N 160°23'36.89" W NAD83. Note other surveyed rocks in the vicinity, area of sparse data.
 - s. Surveyed 1^4 [1_2] RK in posn: 55°16'53.97" N 160°23'19.30" W NAD83. Note: 2^5 [2_3] RK 70 meters North West. Sparse data due to kelp.
 - t. Surveyed 1^7 [1_4] RK in posn: 55°16'33.02" N 160°23'46.89" W NAD83. Kelp.
 - u. Surveyed 3^9 [3_5] RK in posn: 55°16'39.87" N 160°23'21.41" W NAD83.
 - v. Surveyed 1^9 [1_5] RK in posn: 55°16'33.83" N 160°23'06.26" W NAD83. Sparse coverage due to kelp.
 - w. Surveyed 5^3 [5_2] RK in posn: 55°16'20.72" N 160°22'58.78" W NAD83. Kelp.
 - x. Surveyed (Q^4) [Q_2]* in posn: 55°16'04.02" N 160°22'45.69" W NAD83. Area of sparse data.
 - y. Surveyed 5^1 [5_1] RK in posn: 55°15'52.46" N 160°23'11.11" W NAD83. Kelp on shoal.
 - z. Charted dangerous rock in posn: 55°15'27.93" N 160°21'34.06" W NAD83, surveyed (Q^2) [Q_1]* in posn: 55°15'25.17" N 160°21'32.41" W NAD83, area of sparse data. Also 0^9 [0_5] RK in posn: 55°15'24.00" N 160°21'31.84" W NAD83 on edge of kelp area. Note: Turbid area close southwest in posn: 55°15'22.63" N 160°21'38.21" W NAD83 has poor coverage.
 - aa. Surveyed (Q^4) [Q_2]* in posn: 55°15'17.70" N 160°20'59.22" W NAD83. Area of sparse data.

D.5.2 Recommended Overlap with Lidar Data (H11147E)

In general, it is recommended that boatwork overlap the lidar survey data to the 20 meter isobath.

D.6 CHART COMPARISON – SMOOTH SHEET H11147F¹³**D.6.1 H11147F**

H11147F was compared to:

- Chart 16553 3rd Edition 2 September 1989, at scale 1:80 000

D.6.1.1 Charted Depths and Features

Note: Charted depths are in Fathoms and Feet and in format 2₄. Surveyed depths are in decimal Fathoms and in format 2⁴. For comparison, fathom and feet conversion is in brackets in format [2₂].

1. Charted coastline differs from surveyed coastline by up to 100 meters in posn: 55°16'55.12" N 160°33'50.50" W NAD83.
2. A number of rocks surveyed from shore to surveyed 4 RK in posn: 55°16'36.96" N 160°33'50.82" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data recommend further investigation of rocks by boat. Also recommend extending contours in this area to match this survey. **See item 1**, Danger to Navigation H11147F in Appendix I.
3. Recommend replacing charted 4₃ in posn: 55°16'29.52" N 160°33'26.29" W NAD83 with surveyed 4¹ [4₁] in posn: 55°16'27.67" N 160°33'22.72" W NAD83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Kelp.
4. Recommend chart (0) * in posn: 55°16'24.56" N 160°33'58.07" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Kelp.
5. Recommend chart 1⁵ [1₃] RK in posn: 55°16'17.68" N 160°33'51.24" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
6. Charted coastline differs from surveyed coastline by up to 80 meters in posn: 55°16'21.99" N 160°33'40.37" W NAD83.
7. Recommend chart 4⁷ [4₄] RK in posn: 55°16'05.08" N 160°33'10.02" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Kelp.
8. Recommend replacing charted 1₅ in posn: 55°15'47.00" N 160°32'57.31" W NAD83 with surveyed 1⁴ [1₂] RK in posn: 55°15'48.91" N 160°32'58.61" W NAD83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Kelp.
9. Recommend chart 9⁷ [9₄] RK in posn: 55°15'54.09" N 160°32'33.70" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
10. Charted coastline differs from surveyed coastline by up to 80 meters around Hardscratch Point in posn: 55°15'44.10" N 160°32'22.62" W NAD83.
11. Possible 1 RK in kelp in posn: 55°15'53.45" N 160°32'00.14" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend further investigation by boat. **See item 2**, Danger to Navigation Report H11147F in Appendix I.

-
12. Surveyed 0³ [0₂] RK in posn: 55°15'42.45" N 160°32'02.23" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data, recommend further investigation by boat.
 13. Recommend chart Islet (6) in posn: 55°15'11.79" N 160°31'35.21" W NAD83.
 14. Surveyed 3⁵ [3₃] RK in posn: 55°15'11.85" N 160°31'29.65" W NAD83, on charted dangerous rock symbol in posn: 55°15'10.39" N 160°31'31.69" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data recommend further investigation by boat.
 15. Recommend chart (1¹) [1₁] * in posn: 55°15'05.30" N 160°31'35.23" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 16. Surveyed 6⁷ [6₄] RK in posn: 55°15'00.64" N 160°31'19.79" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data recommend further investigation by boat. **See item 3**, Danger to Navigation Report H11147F in Appendix I.
 17. Charted coastline differs from surveyed coastline by up to 120 meters between 55°15'07.07" N 160°31'38.74" W NAD83 and 55°14'33.03" N 160°31'52.62" W NAD83 and at 55°15'25.84" N 160°31'48.98" W NAD83.
 18. Recommend chart wharf in position 55°14'27.88" N 160°33'05.50" W NAD83 in Squaw Harbor.
 19. Recommend replacing charted 3 in posn: 55°14'06.32" N 160°33'22.13" W NAD83 with surveyed 2⁸ [2₅] in posn: 55°14'08.65" N 160°33'25.58" W NAD83 and amend contours to match this survey. Area covered with 4x4 meter spot spacing at 200% lidar coverage.
 20. Recommend chart 2⁸ [2₅] RK in posn: 55°13'50.66" N 160°33'39.16" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 21. Recommend chart piles in posn: 55°13'46.95" N 160°33'05.96" W NAD83.
 22. Recommend chart 3² [3₁] RK in posn: 55°13'41.81" N 160°31'11.80" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 23. Recommend chart 1⁸ [1₅] RK in posn: 55°13'42.49" N 160°30'59.59" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 24. Surveyed (0) * in posn: 55°13'29.79" N 160°29'38.90" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data, kelp, recommend further investigation by boat. **See item 4**, Danger to Navigation Report H11147F in Appendix I.
 25. Recommend replace charted dangerous Rock Symbol in posn: 55°13'22.56" N 160°29'25.39" W NAD83 with surveyed (0¹) [0₁] * in posn: 55°13'23.67" N 160°29'29.28" W NAD83.
 26. Recommend replace charted dangerous Rock Symbol in posn: 55°13'07.71" N 160°29'20.00" W NAD83 with surveyed (0⁴) [0₂] * in posn: 55°13'09.59" N 160°29'23.81" W NAD83.
-

-
27. Surveyed 8⁷ [8₄] RK in posn: 55°13'28.46" N 160°29'09.48" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. **See item 5**, Danger to Navigation Report H11147F in Appendix I. Note: 6³ [6₂] RK 125 meters southwest, recommend charting rocks and depth curves as to match this survey.
 28. Recommend chart 7⁸ [7₅] RK in posn: 55°13'06.19" N 160°29'14.93" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 29. Surveyed 5⁵ [5₃] RK in posn: 55°13'00.27" N 160°28'47.39" W NAD83 found on charted 5 in posn: 55°12'59.88" N 160°28'47.04" W NAD83, recommend further investigation by boat. Note: numerous rocks close by.
 30. Recommend chart (0⁹) [0₅]* in posn: 55°13'01.06" N 160°29'41.17" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 31. Recommend chart (0⁵) [0₃]* in posn: 55°12'43.15" N 160°29'46.24" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 32. Recommend chart 5⁹ [5₅] RK in posn: 55°12'40.75" N 160°29'28.98" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 33. Recommend chart 5⁷ [5₄] RK in posn: 55°12'33.70" N 160°29'30.21" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 34. Charted 1 in posn: 55°12'32.74" N 160°29'18.25" W NAD83 not found this survey recommend further investigation by boat. Note: 5⁷ [5₄] RK 200 meters west.
 35. Charted dangerous Rock Symbol in posn: 55°11'44.78" N 160°29'13.88" W NAD83, surveyed small Islet (14) in posn: 55°11'44.06" N 160°29'10.37" W NAD83. Note: rocks in the vicinity, sparse data, kelp, recommend further investigation by boat.
 36. Recommend chart 9⁴ [9₂] RK in posn: 55°11'53.41" N 160°28'56.15" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 37. Recommend chart 5⁸ [5₅] RK in posn: 55°11'50.48" N 160°29'03.55" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 38. Recommend chart Islet in posn: 55°11'33.26" N 160°28'50.41" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Islet surveyed close west. Height of islets > 33 feet and 34 feet respectively.
 39. Recommend chart 1⁶ [1₄] RK in posn: 55°11'34.16" N 160°27'37.25" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 40. Kelly Rock in posn: 55°11'35.87" N 160°27'27.08" W NAD83 is mischarted. (also reported on chart comparison 54 on sheet H11147E).
 41. Recommend chart 1³ [1₂] RK in posn: 55°11'32.58" N 160°27'35.06" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. In kelp. Investigation by boat recommended.
 42. Recommend chart 6⁶ [6₄] RK in posn: 55°11'20.76" N 160°27'22.42" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 43. Recommend chart 8⁹ [8₅] RK in posn: 55°10'54.21" N 160°27'22.54" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
-

-
44. Halfway Rock in posn: 55°10'49.92" N 160°27'42.04" W NAD83 is mischarted.
 45. Charted Islet in posn: 55°10'56.74" N 160°27'46.26" W NAD83 not found during this survey. Recommend remove from chart.
 46. Recommend chart 6⁶ [6₃] RK in posn: 55°10'48.04" N 160°27'39.05" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 8³ [8₂] close south.
 47. Charted coastline differs from surveyed coastline by up to 120 meters between 55°13'42.49" N 160°30'59.59" W NAD83 and 55°10'50.62" N 160°30'12.48" W NAD83. Note: numerous rocks found along this coastline.
 48. Charted dangerous rock in posn: 55°10'51.30" N 160°27'58.82" W NAD83, surveyed (0¹) [0₁]* in posn: 55°10'49.33" N 160°27'59.77" W NAD83.
 49. Recommend chart small islet (11) in posn: 55°10'43.49" N 160°29'45.98" W NAD83.
 50. Charted Islet in posn: 55°10'50.61" N 160°30'30.84" W NAD83 is mischarted.
 51. Recommend chart 3⁶ [3₄] RK in posn: 55°16'58.16" N 160°31'44.86" W NAD83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 3⁶ [3₄] 100 meters east and 5⁹ [5₆] 140 meters southwest.
 52. Recommend replace charted 6₃ in posn: 55°17'04.85" N 160°31'26.29" W NAD83 with surveyed 5¹ [5₁] in posn: 55°17'02.65" N 160°31'23.41" W NAD83.
 53. Egg Island and Little Egg Island mischarted.
 54. Charted dangerous rock in posn: 55°16'34.49" N 160°30'57.17" W NAD83, Surveyed (0⁹) [0₅] * in posn: 55°16'33.69" N 160°30'56.39" W NAD83. Note: 1⁴ [1₂] RK 35 meters southeast and 2⁵ [2₃] 100 meters northeast.
 55. Recommend chart small islet (17) in posn: 55°16'37.01" N 160°31'01.18" W NAD83.

D.6.1.2 AWOIS

Nil.

D.6.1.3 Additional Boatwork Inside Lidar Area (H11147F)

It is recommended that the following features as discussed in D.6.1.1. be investigated by boat.:

- a. A number of rocks surveyed from shore to surveyed 4 RK in posn: 55°16'36.96" N 160°33'50.82" W NAD83. Area of sparse data.
- b. Possible 1 RK in kelp in posn: 55°15'53.45" N 160°32'00.14" W NAD83.
- c. Surveyed 0³ [0₂] RK in posn: 55°15'42.45" N 160°32'02.23" W NAD83. Area of sparse data.
- d. Surveyed 3⁵ [3₃] RK in posn: 55°15'11.85" N 160°31'29.65" W NAD83, on charted dangerous rock symbol in posn: 55°15'10.39" N 160°31'31.69" W NAD83. Area of sparse data.

-
- e. Surveyed 6⁷ [6₄] RK in posn: 55°15'00.64" N 160°31'19.79" W NAD83. Area of sparse data.
 - f. Surveyed (0) * in posn: 55°13'29.79" N 160°29'38.90" W NAD83. Area of sparse data, kelp.
 - g. Surveyed 5⁵ [5₃] RK in posn: 55°13'00.27" N 160°28'47.39" W NAD83 found on charted 5 in posn: 55°12'59.88" N 160°28'47.04" W NAD83. Note: numerous rocks close by.
 - h. Charted 1 in posn: 55°12'32.74" N 160°29'18.25" W NAD83 not found this survey. Note: 5⁷ [5₄] RK 200 meters west.
 - i. Charted dangerous Rock Symbol in posn: 55°11'44.78" N 160°29'13.88" W NAD83, surveyed small Islet (14) in posn: 55°11'44.06" N 160°29'10.37" W NAD83. Note: rocks in the vicinity, sparse data, kelp.

D.6.2 Recommended Overlap with Lidar Data (H11147F)

In general, it is recommended that the Boatwork overlap the lidar survey to the 20 meter isobath, south of 55°13'30"N. North of this latitude, it is recommended an overlap to the 10 meter isobath is provided.

D.7 CHART COMPARISON – SMOOTH SHEET H11147G ¹⁴**D.7.1 H11147G**

H11147G was compared to:

- Chart 16553 3rd Edition 2 September 1989, at scale 1:80 000 Nil corrections.
- Chart 16553 3rd Edition 2 September 1989, inset of Delarof Harbor at scale 1:20 000. Nil corrections.

The following discrepancies were noted during chart comparison:

D.7.1.1 Charted Depths and Features

Note: Charted depths are in Fathoms and Feet and in format 2₄. Surveyed depths are in decimal Fathoms and in format 2⁴. For comparison, fathom and feet conversion is in brackets in format [2₂].

The following comparisons from Smooth Sheet H11147G relate to chart 16553 inset of Delarof Harbor at 1:20 000. Nil corrections.

1. Charted Coastline differs from surveyed by up to 70 meters between 55°10'34.53" N 160°30'33.19" W NAD 83 and 55°09'51.24" N 160°29'55.53" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
2. Recommend chart (32) islet in posn: 55°10'34.31" N 160°30'30.48" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note (14) islet 40 meters northeast.
3. Charted 5 fathom contour in posn: 55°10'20.01" N 160°30'09.41" W NAD 83 differs from surveyed by up to 180 meters, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart in this area to match this survey.
4. Recommend chart (8) islet in posn: 55°10'21.38" N 160°30'28.66" W NAD 83 and (5) islet in posn: 55°10'22.45" N 160°30'30.31" W NAD 83 area covered with 4x4 meter spot spacing at 200% lidar coverage.
5. Recommend chart (23) islet in posn: 55°10'12.79" N 160°30'10.15" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
6. Recommend chart (I²) [1₁] * in posn: 55°10'04.87" N 160°29'59.32" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (1) * 40 meters north.
7. Recommend replace charted danger area in posn: 55°10'03.95" N 160°29'51.57" W NAD 83 with (0⁶) [0₄] * in posn: 55°10'04.96" N 160°29'51.61" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp.
8. Recommend replace charted danger area in posn: 55°10'08.84" N 160°29'34.01" W NAD 83 with (1³) [1₂] * in posn: 55°10'07.95" N 160°29'35.50" W NAD 83, area covered

- with 4x4 meter spot spacing at 200% lidar coverage. Note: 1² [1₁] RK 85 meters southwest and 7¹ [7₁] 110 meters northeast.
9. Possible 4⁷ [4₄] RK in kelp in posn: 55°10'05.62" N 160°29'34.55" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 8 RK on rock ridge extending 100 meters east. Recommend further investigation by boat.
 10. Recommend replace charted danger area in posn: 55°10'02.83" N 160°29'38.24" W NAD 83 with (L) * in posn: 55°10'01.85" N 160°29'38.38" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (Q²) [Q₁] * in kelp 50 meters southeast, (Q²) [Q₁] * in kelp 65 meters southwest and 3⁶ [3₄] RK in kelp 100 meters east.
 11. Recommend amend position of Elephant Rock from 55°09'59.86" N 160°29'43.01" W NAD 83 to 55°09'59.11" N 160°29'44.15" W NAD 83 and annotate with height of (*I7*). Area covered with 4x4 meter spot spacing at 200% lidar coverage.
 12. Recommend replace charted 10 in posn: 55°10'13.88" N 160°29'00.54" W NAD 83 with 7⁹ [7₅] RK in posn: 55°10'12.78" N 160°29'01.69" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 8⁴ [8₂] RK 50 meters southeast.
 13. Charted dangerous rock "Blind Breaker" in posn: 55°10'09.50" N 160°29'05.31" W NAD 83, surveyed 2 RK in posn: 55°10'09.19" N 160°29'06.50" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation by boat. Note: 7³ [7₂] RK 230 meters southwest and 9⁸ [9₅] RK 100 meters west on rocky ridge.

The following comparisons from Smooth Sheet H11147G relate to Chart 16553 3rd Edition 2 September 1989, at scale 1:80 000. Nil corrections. Chart recommendations 1 to 10 and 13 above for chart 16553 inset (1:20 000) also apply to chart 16553 (1:80 000).

14. Recommend replace charted dangerous rock in posn: 55°09'49.66" N 160°29'50.57" W NAD 83 with (*22*) islet in posn: 55°09'49.99" N 160°29'53.13" W and (*I9*) islet in posn: 55°09'50.92" N 160°29'52.29" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note 0⁵ [0₃] Rk close east, 0⁵ [0₃] Rk and 0³ [0₂] Rk 90 meters northeast.
15. Recommend replace charted dangerous rock in posn: 55°09'45.23" N 160°29'45.13" W NAD 83 with (Q⁹) [Q₅] * in posn: 55°09'43.70" N 160°29'51.82" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note (*0*) * 60 meters east.
16. Recommend chart (*5*) islet in posn: 55°09'41.33" N 160°29'56.59" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note charted coastline differs from surveyed in this area, recommend amend to match this survey.
17. Recommend chart (*8*) islet in posn: 55°09'36.01" N 160°29'47.89" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
18. Recommend chart (*11*) islet in posn: 55°09'32.37" N 160°29'52.60" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.

-
19. Charted 8 in posn: 55°09'30.80" N 160°29'45.24" W NAD 83, surveyed depths in area 3 - 5 fathoms, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
 20. Recommend chart 8⁵ [8₃] RK in posn: 55°09'28.68" N 160°29'37.62" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 8⁸ [8₅] RK 40 meters south and 10³ [10₂] RK 70 meters northeast.
 21. Numerous surveyed islets and rocks off small headland in posn: 55°09'25.58" N 160°29'52.92" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart in this area to match this survey.
 22. Charted dangerous rock in posn: 55°09'18.56" N 160°29'59.40" W NAD 83 not found this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of heavy kelp. Note: 1² [1₁] RK, 1⁶ [1₄] RK 120 meters northeast and 1³ [1₂] RK 110 meters southeast. Recommend further investigation by boat.
 23. Surveyed 0³ [0₂] RK in kelp in posn: 55°09'08.14" N 160°30'04.28" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 1¹ [1₁] RK and 1⁶ [1₄] RK 70 meters northeast. Recommend further investigation by boat.
 24. Charted dangerous rock in posn: 55°09'03.40" N 160°30'15.20" W NAD 83, surveyed (0⁶) [0₄] * in posn: 55°09'03.50" N 160°30'08.13" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of heavy kelp, recommend further investigation by boat.
 25. Surveyed 0⁵ [0₃] RK in posn: 55°08'56.96" N 160°30'23.52" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation by boat.
 26. Charted coastline in pos: 55°09'18.35" N 160°30'14.74" W NAD 83 differs from surveyed by up to 70 meters in this area, recommend amend chart to match this survey.
 27. Recommend chart 1¹ [1₁] RK in posn: 55°08'31.67" N 160°30'37.42" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 2¹ [2₁] RK 190 meters southwest.
 28. Charted coastline in pos: 55°08'29.09" N 160°31'07.00" W NAD 83 differs from surveyed by up to 70 meters in this area, recommend amend chart to match this survey.
 29. Recommend chart 1⁵ [1₃] RK in posn: 55°08'21.38" N 160°30'52.88" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 3⁹ [3₅] RK 140 meters northeast.
 30. Numerous surveyed islets and rocks along coast between 55°08'18.22" N 160°31'14.41" W NAD 83 and 55°08'10.91" N 160°32'20.67" W NAD 83 (Unga Cape), area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey. Of particular note is 5 RK in posn: 55°07'56.10" N 160°31'07.30" W NAD 83 in area of kelp. **See item 1** Danger to Navigation Report H11147G. Also 5³ [5₂] RK in posn: 55°07'37.30" N 160°31'46.55" W NAD 83. **See item 2** Danger to Navigation Report H11147G.
-

-
31. Charted coastline differs from surveyed coastline by up to 120 meters between 55°08'13.63" N 160°31'16.40" W NAD 83 and 55°09'31.34" N 160°32'27.50" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
 32. Charted dangerous rock in posn: 55°08'21.12" N 160°32'09.42" W NAD 83 not found this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of heavy kelp, recommend further investigation by boat.
 33. Recommend replace charted dangerous rock in posn: 55°08'30.45" N 160°32'06.21" W NAD 83 with (0⁸) [0₅] * in posn: 55°08'29.10" N 160°32'02.37" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of heavy kelp.
 34. Charted dangerous rock in posn: 55°08'40.56" N 160°32'04.84" W NAD 83 not found this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of heavy kelp, recommend further investigation.
 35. Recommend replace charted dangerous rock in posn: 55°08'50.82" N 160°32'09.61" W NAD 83 with (1⁴) [1₂] * in posn: 55°08'53.75" N 160°32'06.37" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of heavy kelp.
 36. Two charted dangerous rocks in posn: 55°09'00.76" N 160°32'15.24" W NAD 83 and 55°09'07.74" N 160°32'20.54" W NAD 83 not found this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of heavy kelp, recommend further investigation by boat.
 37. Surveyed 1⁴ [1₂] RK in posn: 55°09'14.38" N 160°32'32.28" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of heavy kelp, recommend further investigation by boat.
 38. Charted dangerous rock in posn: 55°09'32.10" N 160°32'45.75" W NAD 83 not found this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. On edge of kelp area recommend further investigation by boat.
 39. Charted dangerous rock in posn: 55°09'32.26" N 160°32'55.17" W NAD 83, surveyed (1²) [1₁] * in posn: 55°09'32.50" N 160°32'57.07" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation.
 40. Charted coastline differs from surveyed coastline by up to 120 meters between 55°09'34.64" N 160°33'00.43" W NAD 83 and 55°09'22.47" N 160°35'00.96" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
 41. Recommend chart (5) islet in posn: 55°09'29.12" N 160°33'08.75" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 42. Surveyed 3¹ [3₁] RK in posn: 55°09'07.57" N 160°33'21.50" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 3⁸ [3₅] RK 140 meters south. Small area of kelp, recommend further investigation by boat.
 43. Recommend chart (0) * in posn: 55°09'21.74" N 160°33'17.56" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp.

-
44. Recommend chart (24) islet in posn: 55°09'24.03"N 160°33'37.35" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (3) islet 50 meters southeast and (1⁵) [1₃] * 140 meters southeast.
 45. Recommend chart (6) islet in posn: 55°09'21.63" N 160°33'44.48" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (0⁵) [0₃] * 30 meters northeast.
 46. Charted 5 fathom contour differs from surveyed by up to 210 meters in posn: 55°09'13.31" N 160°33'48.93" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart in this area to match this survey.
 47. Recommend replace charted dangerous rock in posn: 55°09'00.98" N 160°34'12.17" W NAD 83 with (3) islet in posn: 55°09'02.29"-160°34'14.28" NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (0⁵) [0₃] * 60 meters southwest.
 48. Numerous charted and surveyed rocks and islets along coast between 55°08'54.01" N 160°34'13.96" W NAD 83 and 55°08'44.42" N 160°35'12.04" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. 10 fathom contour also differs in this area. Recommend amend chart in this area to match this survey. (Also see item 40).
 49. Possible (0⁷) [0₄] * in posn: 55°08'54.51" N 160°35'09.78"W NAD 83 area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation.
 50. Recommend chart 5⁴ [5₂] RK in posn: 55°08'58.95" N 160°35'13.95" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 6⁶ [6₄] RK 60 meters south.
 51. Charted dangerous rock in posn: 55°09'06.59" N 160°35'09.27" W NAD 83 not found this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation. Note: 0² [0₁] RK 140 meters south and 4⁸ [4₅] RK 100 meters west.
 52. Charted depths and 3 fathom contour differ from surveyed in posn: 55°09'25.53" N 160°32'50.54" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart in this area to match this survey.
 53. Recommend amend islets in posn: 55°04'38.23" N 160°31'02.76" W NAD 83 (Lion Rocks) to match this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 54. Recommend replace charted dangerous rock in posn: 55°04'30.22" N 160°31'10.86" W NAD 83 with (0⁷) [0₄] * in white water in posn: 55°04'27.57" N 160°31'12.29" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 55. Recommend chart 2⁶ [2₄] RK in posn: 55°04'31.53" N 160°31'01.41" W, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note 8⁷ [8₄] RK 60 meters east.
 56. Recommend chart 0⁶ [0₄] RK in posn: 55°04'45.36" N 160°30'55.05" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note 1 RK 45 meters southwest and 6⁷ [6₄] RK 90 meters southeast.
-

-
57. Charted dangerous rock with blue tint in posn: 55°04'49.37" N 160°30'19.85" W NAD 83, not found this survey. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend further investigation by boat.
58. Possible 5 RK in posn: 55°04'39.75" N 160°31'11.10" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data, recommend further investigation by boat.

D.7.1.2 Additional Boat Work Inside Lidar Area

It is recommended the following features southeast of Unga Island as discussed D7.1.1 be investigated by boat.

- a. Item 9 – Possible rock in kelp.
- b. Item 13 – Charted rock in kelp. (Blind Breaker)
- c. Item 22 – Charted rock not found in kelp area.
- d. Item 23 - Rock in kelp.
- e. Item 24 – Rock in kelp.
- f. Item 25 – Rock in kelp.
- g. Item 32 - Charted rock not found.
- h. Item 34 - Charted rock not found.
- i. Item 36 - Two Charted rocks not found.
- j. Item 37 – Rock in kelp.
- k. Item 38 - Charted rock not found.
- l. Item 39 – Charted rock not found.
- m. Item 42 – Rock in kelp.
- n. Item 49 - Possible rock in kelp.
- o. Item 51 - Charted rock not found.
- p. Item 57 - Charted rock not found.
- q. Item 58 - Possible rock in sparse data.

The following additional features were also queried during data processing and it is recommended they be investigated by boat.

- a. 4¹ [4₁] RK in posn: 55°08'00.61" N 160°32'42.84" W NAD 83, doubtful sounding.
- b. 5⁹ [5₅] RK in posn: 55°07'43.58" N 160°32'00.77" W NAD 83, doubtful sounding.
- c. 3 RK in posn: 55°07'42.95" N 160°31'39.21" W NAD 83, doubtful sounding.

D.7.1.3 Recommended Overlap with Lidar Data

South of Delarof Harbor, from 55°10'30" N 160°30'30" W NAD 83 to 55°09'45" N 160°29'50" W NAD 83 the coast is rocky close inshore and generally sedimentary offshore with the occasional rock outcrop. An overlap from seaward up to the approximate position of the 14-fathom isobath is recommended by ship.

South of 55°09'45" N 160°29'50" W NAD 83 to Unga Cape the coast is steep to with numerous rocks and kelp inshore. An overlap to the 10-fathom isobath is recommended by boat or ship.

On the east, south and west sides of Unga Cape, from 55°08'00" N 160°31'20" W NAD 83 to 55°08'10" N 160°32'30" W NAD 83 there are many islets and rocks. This area is very exposed. An overlap by boat from 0.5 miles offshore up to the approximate position of the 5-fathom isobath is recommended in fair weather. Beyond 0.5 miles offshore, an overlap by ship is recommended.

There is a large bay on the west side of Unga Cape from 55°08'00" N 160°32'30" W NAD 83 to 55°08'45" N 160°35'00" W NAD 83. An overlap by boat or ship to the approximate position of the 14-fathom isobath is recommended.

D.8 CHART COMPARISON – SMOOTH SHEET H11147H ¹⁵

D.8.1 H11147H

H11147H was compared to:

- Chart 16553 3rd Edition 2 September 1989, at scale 1:80 000. Nil corrections.

The following discrepancies were noted during chart comparison:

D.8.1.1 Charted Depths and Features

Notes:

- Charted depths are in Fathoms and Feet and in format 2₄. Surveyed depths are in decimal Fathoms and in format 2⁴. For comparison, fathom and feet conversion is in brackets in format [2₂].
- A number of Charted Depths and Features fall in the overlap of data between sheets H11147 G and H11147 H (see D.7.1.1 items 40, 48 - 51).
 - Charted coastline in posn: 55°09'22.34" N 160°35'47.17" W NAD 83 differs from surveyed by up to 100 meters in this area, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey. Note rocks along this area of coastline.
 - Three charted islets in posn: 55°08'54.49" N 160°35'20.32" W NAD 83 not found during this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend remove from chart.
 - Recommend chart 6² [6₁] RK in posn: 55°08'43.16" N 160°35'17.20" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note 5⁸ [5₅] RK 110 meters south east.
 - Recommend move charted dangerous rock in posn: 55°08'59.65" N 160°36'04.20" W NAD 83 to surveyed (0⁶) [0₄] * in posn: 55°08'59.50" N 160°36'08.81" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp. Note numerous rocks in vicinity.
 - Recommend move charted dangerous rock in posn: 55°08'52.52" N 160°35'57.15" W NAD 83 to surveyed (0) * in posn: 55°08'55.05" N 160°36'03.46" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp. Note numerous rocks in vicinity.
 - Charted dangerous rock in posn: 55°08'24.81" N 160°36'25.72" W NAD 83 not found this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp recommend further investigation by boat. Note: 4⁵ [4₃] RK and 4⁷ [4₄] RK 400 meters northwest.
 - Surveyed 4 RK in posn: 55°08'33.35" N 160°37'01.02" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp recommend further investigation by boat. Note: 4³ [4₂] RK and 4⁷ [4₄] RK 90 meters northwest.

8. Recommend move charted islet in posn: 55°08'47.08" N 160°36'59.24" W NAD 83 to surveyed (3) islet in posn: 55°08'44.52" N 160°36'59.07" W NAD 83 area covered with 4x4 meter spot spacing at 200% lidar coverage. Note numerous rocks in vicinity, area of kelp.
9. Recommend replace charted dangerous rock in posn: 55°08'56.23" N 160°37'13.35" W NAD 83 with ($\underline{0}^2$) [$\underline{0}_1$] * in posn: 55°08'56.10" N 160°37'17.42" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note ($\underline{0}^1$) [$\underline{0}_1$] * 150 meters east and 0^7 [$\underline{0}_4$] RK 180 meters southeast.
10. Charted dangerous rock in posn: 55°08'58.05" N 160°37'20.60" W NAD 83, surveyed (3) islet in posn: 55°08'59.74" N 160°37'20.55" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Possible islet in white water, recommend confirm height by boat. Note: ($\underline{1}$) * 60 meters west.
11. Recommend replace charted dangerous rock in posn: 55°09'03.13" N 160°37'22.24" W NAD 83 with ($\underline{0}^2$) [$\underline{0}_1$] * in posn: 55°09'02.75" N 160°37'18.93" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: ($\underline{0}^7$) [$\underline{0}_4$] * 75 meters west.
12. Recommend chart 1^7 [$\underline{1}_4$] RK in posn: 55°09'07.98" N 160°37'44.22" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: numerous rocks in the vicinity this being the most navigationally significant. **See item 1** Danger to Navigation Report H11147H.
13. Recommend replace charted dangerous rock in posn: 55°09'17.01" N 160°37'33.18" W NAD 83 with ($\underline{0}^2$) [$\underline{0}_1$] * in posn: 55°09'16.75" N 160°37'35.38" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
14. Recommend replace charted dangerous rock in posn: 55°09'19.82" N 160°37'37.79" W NAD 83 with ($\underline{1}^4$) [$\underline{1}_2$] * in posn: 55°09'23.54" N 160°37'38.47" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
15. Possible 1^4 [$\underline{1}_2$] RK in kelp in posn: 55°09'33.77" N 160°37'52.43" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation. Note: numerous rocks in vicinity.
16. Possible 4 RK in kelp in posn: 55°09'27.58" N 160°38'32.58" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation. Note: numerous rocks in vicinity.
17. Complex area of rocks and coastline between 55°09'53.55" N 160°38'00.83" W NAD 83 and 55°09'59.95" N 160°39'19.57" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart in this area to match this survey.
18. Recommend amend charted islet in posn: 55°09'45.74" N 160°39'55.74" W NAD 83 to ($\underline{13}$) islet in posn: 55°09'45.12" N 160°39'58.63" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: ($\underline{0}^2$) [$\underline{0}_1$] * 50 meters east and ($\underline{1}^2$) [$\underline{1}_1$] * 30 meters northwest.
19. Complex area of rocks and coastline between 55°10'00.92" N 160°39'45.09" W NAD 83 and 55°10'45.31" N 160°40'43.41" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart in this area to match this survey.

-
20. Group of charted dangerous rocks in posn: 55°11'06.65" N 160°40'56.63" W NAD 83 not found this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation by boat.
 21. Group of four charted dangerous rocks in posn: 55°11'23.48" N 160°41'08.15" W NAD 83, surveyed ($\underline{0}^5$) [$\underline{0}_3$] * in posn 55°11'24.06" N 160°41'11.77" W NAD 83 and ($\underline{0}^1$) [$\underline{0}_1$] * in posn 55°11'21.45" N 160°41'09.89" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation by boat.
 22. Charted dangerous rock in posn: 55°11'18.46" N 160°41'33.86" W NAD 83, surveyed 1 RK on edge of kelp area in posn: 55°11'21.01" N 160°41'25.44" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. On edge of kelp area recommend further investigation by boat.
 23. Recommend chart 1⁵ [$\underline{1}_3$] RK in posn: 55°10'09.11" N 160°40'55.14" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: possible 3⁷ [$\underline{3}_4$] RK in kelp 150 meters northeast and possible 2⁸ [$\underline{2}_5$] RK in kelp 260 meters east. **See item 2** Danger to Navigation Report H11147H. Recommend further investigation by boat of 3⁷ and 2⁸.
 24. Recommend moving charted islet in posn: 55°09'27.06" N 160°39'59.35" W NAD 83 to surveyed posn: 55°09'27.72" N 160°39'57.89" W NAD 83 and annotate with height of (29). Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 2⁷ [$\underline{2}_4$] RK 90 meters east.

D.8.1.2 Additional Boat Work Inside Lidar Area

It is recommended the following features southwest of Nagai Island as discussed in D.8.1.1 be investigated by boat.

- a. Item 6 – Charted rock not found.
- b. Item 7 - Rock in kelp.
- c. Item 10 - Confirm height of islet by boat.
- d. Item 15 – Possible rock in kelp.
- e. Item 16 – Possible rock in kelp.
- f. Item 20 – Group of charted rocks not found.
- g. Item 21 – Group of charted rocks not found.
- h. Item 22 – Charted rock not found.
- i. Item 23 – Possible 3⁷ and 2⁸ rocks in kelp.

The following additional features were also queried during data processing and it is recommended they be investigated by boat.

- a. Small area of kelp with doubtful sounding of 5² [$\underline{5}_1$] in posn: 55°09'33.01" N 160°39'42.17" W NAD 83 (not shown on smooth sheet).

-
- b. Area of kelp with doubtful sounding of 0⁹ [0₅] in posn: 55°09'37.83" N 160°39'29.99" W NAD 83 (not shown on smooth sheet).
 - c. Area of kelp with doubtful sounding of 3⁹ [3₅] in posn: 55°10'04.84" N 160°40'44.03" W NAD 83 (not shown on smooth sheet).
 - d. Area of kelp with doubtful sounding of 6⁵ [6₃] in posn: 55°10'32.59" N 160°41'15.10" W NAD 83 (not shown on smooth sheet).

D.8.1.3 Recommended Overlap with Lidar Data

This part of the south coast of Unga Island is very exposed. The following overlap with the lidar data is recommended in fair weather.

From 55°08'40" N 160°35'00" W NAD 83 to 55°08'40" N 160°36'00" W NAD 83 there is a bay – an overlap from seaward up to the 10-fathom isobath is recommended.

From 55°08'40" N 160°36'00" W NAD 83 to 55°09'10" N 160°37'45" W NAD 83 the coast is littered with rocks. It is recommended an overlap by boat from seaward up to the approximate position of the 3-fathom isobath be conducted.

From 55°09'10" N 160°37'45" W NAD 83 to 55°10'30" N 160°41'00" W NAD 83, a general overlap from seaward up to the 10-fathom isobath is recommended.

In the vicinity of 55°09'20" N 160°38'40" W NAD 83, 55°09'35" N 160°39'35" W NAD 83 and 55°09'40" N 160°40'30" W NAD 83 the 10 fathom contour is only approximately defined on the smooth sheet and additional boat work up to the 8 fathom isobath is recommended in these areas.

It is considered possible that inshore of the islet (29) in position 55°09'30" N 160°40'00" W NAD 83 and rocks in position 55°09'40" N 160°40'30" W NAD 83, dangerous seas may form during conditions of large swells from the south east through south west. This may need to be considered during any additional survey by boat in these areas.

North west of 55°10'30" N 160°41'00" W NAD 83 is Acheredin Bay. An overlap to the approximate position of the 12-fathom isobath is recommended.

D.9 CHART COMPARISON – SMOOTH SHEET H11147I ¹⁶**D.9.1 H11147I**

H11147I was compared to:

- Chart 16553 3rd Edition 2 September 1989, at scale 1:80 000. Nil corrections

The following discrepancies were noted during chart comparison:

D.9.1.1 Charted Depths and Features

Note: Charted depths are in Fathoms and Feet and in format 2₄. Surveyed depths are in decimal Fathoms and in format 2⁴. For comparison, fathom and feet conversion is in brackets in format [2₂].

1. Recommend replace dangerous rock in posn: 55°11'51.44" N 160°42'31.82" W NAD 83 with (6) islet in posn: 55°11'53.53" N 160°42'27.40" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (3) islet 55 meters west and (1⁴) [1₂] * 70 meters southwest.
2. Recommend replace dangerous rock in posn: 55°11'51.47" N 160°42'40.53" W NAD 83 with (24) islet in posn: 55°11'54.09" N 160°42'40.71" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (21) islet 30 meters south, (1) * and (0⁸) [0₅] * 60 meters southeast.
3. Recommend replace dangerous rock in posn: 55°11'52.89" N 160°42'48.27" W NAD 83 with (4) islet in posn: 55°11'53.54" N 160°42'46.58" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (4) islet 15 meters north and (1²) [1₁] * 20 meters south.
4. Recommend replace dangerous rock in posn: 55°11'52.72" N 160°42'59.55" W NAD 83 with (3) islet in posn: 55°11'52.16" N 160°42'59.78" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (3) islet 20 meters northeast.
5. Two charted dangerous rocks in posn: 55°11'42.00" N 160°44'18.57" W NAD 83 not found this survey. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (0⁶) [0₄] * and (1²) [1₁] * close southeast, recommend further investigation by boat.
6. Complex area of islets and rocks in posn: 55°11'37.70" N 160°45'18.22" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart in this area to match this survey.
7. Complex area of islets and rocks in posn: 55°11'20.20" N 160°45'40.81" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart in this area to match this survey.
8. Two charted dangerous rocks in posn: 55°10'58.04" N 160°45'59.17" W NAD 83 not found this survey. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of heavy kelp, recommend further investigation by boat.
9. Charted coastline between 55°11'23.29" N 160°45'51.44" W NAD 83 and 55°10'01.74" N 160°46'34.17" W NAD 83 differs from surveyed by up to 60 meters. Area covered

- with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
10. Charted dangerous rock in posn: 55°10'40.23" N 160°45'44.18" W NAD 83, surveyed (\underline{Q}^1) [\underline{Q}_1] * in posn: 55°10'40.73" N 160°45'46.47" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp. Recommend amend chart to match this survey. Note: 0² [$\underline{0}_1$] RK 68 meters southeast and numerous rocks inshore.
 11. Recommend chart 1⁴ [$\underline{1}_2$] RK in posn: 55°10'25.03" N 160°45'57.26" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage.
 12. Recommend replace charted islet in posn: 55°10'21.05" N 160°46'06.66" W NAD 83 with group of surveyed islets, the most seaward being (3) islet in posn: 55°10'20.92" N 160°46'07.44" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: four other islets and two rocks inshore.
 13. Charted dangerous rock in posn: 55°10'18.25" N 160°46'02.36" W NAD 83, surveyed (\underline{I}^3) [\underline{I}_2] * in posn: 55°10'17.54" N 160°46'02.88" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation by boat. Note: 0⁶ [$\underline{0}_4$] RK 95 meters north and 60 meters northwest.
 14. Charted dangerous rock in posn: 55°10'02.84" N 160°46'35.60" W NAD 83 not found this survey. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend further investigation by boat.
 15. Charted dangerous rock in posn: 55°09'47.55" N 160°46'15.52" W NAD 83, surveyed (\underline{I}^2) [\underline{I}_1] * in posn: 55°09'45.96" N 160°46'17.77" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation by boat. Note: 0⁶ [$\underline{0}_4$] RK 135 meters north and 2⁶ [$\underline{2}_4$] 65 meters northeast.
 16. Charted dangerous rock in posn: 55°09'42.56" N 160°46'13.75" W NAD 83 not found this survey. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of heavy kelp, recommend further investigation by boat. Note: surveyed (\underline{I}^4) [\underline{I}_2] * 150 meters west.
 17. Complex area of coastline, islets and rocks between 55°09'41.63" N 160°46'24.05" W NAD 83 and 55°09'23.79" N 160°47'17.76" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp. Recommend amend chart to match this survey.
 18. Charted coastline between 55°09'20.47" N 160°47'18.98" W NAD 83 and 55°08'16.32" N 160°47'40.47" W NAD 83 differs from surveyed by up to 120 meters. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
 19. Recommend chart 7⁹ [$\underline{7}_5$] RK in posn: 55°09'02.78" N 160°46'34.33" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: Numerous rocks in vicinity, the most seaward being 8 RK 80 meters southeast.
 20. Complex area of islets and rocks off small headland in posn: 55°08'55.34" N 160°47'10.38" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.

-
21. Recommend replace charted dangerous rock in posn: 55°08'35.58" N 160°47'20.54" W NAD 83 with (0) * in posn: 55°08'35.52" N 160°47'18.99" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp. Note 7⁵ [7₃] RK 85 meters southwest and 8⁵ [8₃] RK 95 meters north.
 22. Recommend replace charted dangerous rock in posn: 55°08'11.06" N 160°47'34.81" W NAD 83 with (1⁴) [1₂] * in posn: 55°08'12.57" N 160°47'37.56" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp Note: (0²) [0₁] * 40 meters southeast, (0¹) [0₁] * 90 meters south and numerous rocks in the vicinity.
 23. Recommend replace charted islet in posn: 55°07'58.32" N 160°47'41.53"W NAD 83 with (60) islet in posn: 55°07'57.53" N 160°47'41.64"W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: group of surveyed islets in the vicinity, the most seaward being (8) islet in posn: 55°07'56.83" N 160°47'41.10" W NAD 83.
 24. Recommend replace charted dangerous rock in posn: 55°07'53.82" N 160°47'46.70" W NAD 83 with (1²) [1₁] * in posn: 55°07'56.85" N 160°47'50.20" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp. Note: (0³) [0₂] * 110 meters south, (0⁰) [0₅] * 200 meters southwest and 0⁴ [0₂] RK 170 meters south.
 25. Recommend chart (4) islet in posn 55°07'43.34" N 160°48'04.75" W NAD 83 and (9) islet in posn: 55°07'44.21" N 160°48'05.06" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note (1³) [1₂] * 55 meters north and (0) * 100 meters northeast. Possible 0¹ [0₁] RK in kelp 100 meters southeast. Further investigation of 0¹ RK recommended.
 26. Complex area of coastline, islets and rocks between 55°07'39.17" N 160°48'11.04" W NAD 83 and 55°07'16.69" N 160°49'22.37" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend coastline in this area to match this survey.
 27. Recommend amend charted islet in posn: 55°07'24.76" N 160°48'06.02" W NAD 83 to (62) islet in posn: 55°07'24.56" N 160°48'08.21" W NAD 83 and (22) islet in posn: 55°07'23.66" N 160°48'05.57" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage.
 28. Recommend replace charted islet in posn: 55°07'22.73" N 160°48'00.23" W NAD 83 with (1³) [1₂] * in posn: 55°07'21.94" N 160°47'58.64" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp.
 29. Charted dangerous rock in posn: 55°07'30.39" N 160°48'14.99" W NAD 83, possible (0⁵) [0₃] * 55°07'29.60" N 160°48'10.37" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation by boat. Note: 0³ [0₂] RK 50 meters northwest and 5⁹ [5₅] RK 100 meters east.
 30. Charted [4₅] in posn: 55°06'59.60" N 160°49'17.78" W NAD 83, surveyed 4⁹ [4₅] RK in posn: 55°06'57.89" N 160°49'18.12" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation by boat.
 31. Charted dangerous rock in posn: 55°07'36.81" N 160°49'05.86" W NAD 83 not found this survey. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp on edge of surveyed area, recommend further investigation by boat.
-

-
32. Charted dangerous rock in posn: 55°07'42.16" N 160°49'05.58" W NAD 83, surveyed (3) islet in white water in posn: 55°07'42.67" N 160°49'03.88" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note rocks 140 meters northeast along coast. Recommend confirm height of islet by boat.

D.9.1.2 Additional Boat Work Inside Lidar Area

It is recommended the following features south of Unga Island as discussed D9.1.1 be investigated by boat.

- a. Item 5 – Two charted rocks not found.
- b. Item 8 - Two charted rocks not found.
- c. Item 13 – Rock in kelp.
- d. Item 14 – Charted rock not found.
- e. Item 15 – Rock in kelp.
- f. Item 16 – Rock in kelp.
- g. Item 29 – Possible rock in kelp.
- h. Item 30 – Rock in kelp.
- i. Item 31 – Charted rock not found.
- j. Item 32 – Confirm islet height

The following additional feature was also queried during data processing and it is recommended it be investigated by boat.

- a. Small area of kelp in posn: 55°11'29.12" N 160°45'19.83" W NAD 83, doubtful sounding not shown on smooth sheet.

D.9.1.3 Recommended Overlap with Lidar Data

In Acheredin Bay and south west to 55°09'40" N 160°46'00" W NAD 83 an overlap from seaward up to the 12-fathom isobath is recommended, with the exception of in the vicinity of 55°11'00" N 160°44'30" W NAD 83, where an overlap to the 10-fathom isobath is recommended.

Off the east and southeast sides of the large island in position of 55°09'30" N 160°46'15" W NAD 83 the seabed is poorly defined and an overlap by boat from seaward up to the position of the 3-fathom contour is recommended.

Across the mouth of the bay, from 55°09'15" N 160°46'20" W NAD 83 to 55°08'45" N 160°47'00" W NAD 83 an overlap from seaward up to the 10-fathom isobath is recommended.

South of 55°08'45" N 160°47'00" W NAD 83 to Acheredin Point there are many islets, rocks and kelp and generally poor coverage was achieved. An overlap by boat from seaward to the most offshore danger or seaward limit of the areas 'Foul with Kelp' is recommended. It is recommended that this should occur in fair weather.

D.10 CHART COMPARISON – SMOOTH SHEET H11147L ¹⁷**D.10.1 H11147L**

H11147L was compared to:

- Chart 16553 3rd Edition 2 September 1989, at scale 1:80 000. Nil corrections
- Chart 16540 11th Edition 4 March 1989 at scale 1:300 000. Nil corrections

D.10.1.1 Charted Depths and Features

Notes:

- a. Charted depths are in Fathoms and Feet and in format 2₄. Surveyed depths are in decimal Fathoms and in format 2⁴. For comparison, fathom and feet conversion is in brackets in format [2₂].

The following comparisons from smooth sheet H11147L relate to chart 16553 at scale 1:80 000. Nil corrections.

1. Recommend replace charted rocks and islets in posn: 55°06'34.67" N 160°11'52.94" W NAD 83 with surveyed rocks and islets in very complex area, many unable to be represented at the scale of the Smooth Sheet. Area covered with 4x4 meter spot spacing at 200% lidar coverage.
2. Recommend replace charted dangerous rock in posn: 55°06'25.49" N 160°11'31.34" W NAD 83 with surveyed (16) islet in posn: 55°06'23.44" N 160°11'29.81" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse coverage.
3. Recommend replace charted dangerous rock in posn: 55°06'21.52" N 160°11'28.35" W NAD 83 with surveyed (12) islet in posn: 55°06'21.71" N 160°11'27.75" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse coverage. Note (24) islet 140 meters southeast (inshore).
4. Recommend replace charted dangerous rock in posn: 55°06'14.73" N 160°11'33.03" W NAD 83 with surveyed (5) islet in posn: 55°06'14.94" N 160°11'31.94" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse coverage. Note: (3) islet 65 meters southwest.
5. Recommend replace charted dangerous rock in posn: 55°06'06.96" N 160°11'30.79" W NAD 83 with surveyed (7) islet in posn: 55°06'07.51" N 160°11'30.58" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse coverage. Note: (14) islet 65 meters north east (inshore) and (0⁹) [0₅] * 90 meters northwest, numerous rocks and islets in the vicinity around small headland.
6. Charted coastline differs from surveyed coastline by up to 80 meters between 55°06'37.09" N 160°11'42.71" W NAD 83 and 55°06'02.946" N 160°11'02.40" W NAD 83, recommend amend chart to match this survey.

7. Recommend replace charted dangerous rock in posn: 55°06'08.34" N 160°11'18.46" W NAD 83 with surveyed (15) islet in posn: 55°06'08.09" N 160°11'17.73" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse coverage. Note (1³) [1₂] * 30 meters south and (12) islet 140 meters east.
8. Recommend replace charted dangerous rock in posn: 55°06'01.41" N 160°11'05.88" W NAD 83 with surveyed (12) islet in posn: 55°06'03.54" N 160°11'08.10" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse coverage. Note: (6) islet 30 meters north east and (4) islet 100 meters south east, numerous rocks in the vicinity.
9. Recommend replace charted dangerous rock in posn: 55°06'00.19" N 160°10'57.10" W NAD 83 with surveyed (4) islet in posn: 55°06'00.25" N 160°10'56.08" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse coverage. Note: (0⁷) [0₄] * 40 meters northwest and (0²) [0₁] * 60 meters east.
10. Recommend replace charted dangerous rock in posn: 55°05'59.23" N 160°10'40.26" W NAD 83 with surveyed (18) islet in posn: 55°05'59.17" N 160°10'37.17" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse coverage. Note: numerous rocks and islets in the vicinity.
11. Surveyed (1) * in posn: 55°05'57.25" N 160°10'45.62" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of white water recommend further investigation by boat. Note: numerous rocks and islets in the vicinity.
12. Recommend chart (7) islet in posn: 55°05'56.71" N 160°10'21.62" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse coverage. Note (1²) [1₁] * 65 meters west, surveyed coastline differs from charted coastline by up to 50 meters in this area.
13. Possible (1) * in white water, in posn: 55°05'48.96" N 160°10'17.27" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of white water recommend confirm by boat. Note: 2¹ [2₁] RK 120 meters northwest and 1⁵ [1₃] RK 50 meters northwest.
14. Recommend chart (3) islet in posn: 55°05'38.92" N 160°10'24.71" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data. **See item 1** Danger to Navigation Report H11147L.
15. Recommend replace charted islet in posn: 55°05'38.81" N 160°09'55.08" W NAD 83, with surveyed (64) islet in posn: 55°05'38.95" N 160°09'51.86" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data. Note: numerous rocks and islets closer inshore, i.e. (5) islet 20 meters east and (9) islet 60 meters east.
16. Recommend chart (1¹) [1₁] * in posn: 55°05'36.60" N 160°09'39.62" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Sparse data in unsurveyed area of chart. Kelp.
17. Recommend chart (8) islet in posn: 55°05'33.94" N 160°09'16.83" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Sparse data in unsurveyed area of chart. Note: (0) * 70 meters southeast and (0⁷) [0₄] * 130 meters southeast.

-
18. Recommend chart (I^2) [1_1] * in posn: 55°05'06.89" N 160°07'31.00" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Sparse data in unsurveyed area of chart. Kelp.
 19. Charted dangerous rock in posn: 55°04'22.90" N 160°08'01.18" W NAD 83, not found during this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Close to area of sparse data due to turbidity, recommend further investigation by boat.
 20. Recommend replace charted dangerous rock in posn: 55°04'30.52" N 160°08'17.90" W NAD 83, with surveyed (8) islet in posn: 55°04'29.66" N 160°08'20.28" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage.
 21. Charted coastline differs from surveyed coastline by up to 40 meters between 55°04'28.55" N 160°08'22.75" W NAD 83 and 55°04'11.33" N 160°08'58.00" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
 22. Recommend chart (4) islet in posn: 55°04'25.14" N 160°08'26.41" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 23. Charted coastline differs from surveyed coastline by up to 70 meters between 55°04'23.70" N 160°10'02.82" W NAD 83 and 55°03'25.87" N 160°10'37.37" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
 24. Recommend chart (I^1) [1_1] * in posn: 55°03'56.35" N 160°11'00.45" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of white water. Note: 1⁸ [1_5] RK and 2⁹ [2_5] RK close north. **See item 2** Danger to Navigation Report H11147L.
 25. Recommend chart (Q^2) [Q_1] * in posn: 55°03'25.23" N 160°10'40.31" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data. Note: (24) islet 65 meters east (inshore).
 26. Recommend replace charted dangerous rock in posn: 55°03'22.12" N 160°10'37.73" W NAD 83 with surveyed (8) islet in posn: 55°03'23.10" N 160°10'35.87" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data. Note: (I^3) [1_2] close south and (I^1) [1_1] 100 meters southwest.
 27. Recommend replace charted dangerous rock in posn: 55°03'16.56" N 160°10'34.29" W NAD 83 with surveyed (4) islet in posn: 55°03'15.80" N 160°10'32.34" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data. Note: (4) islet close south and southeast and numerous rocks inshore.
 28. Recommend chart 0³ [0_2] RK in posn: 55°03'08.37" N 160°10'41.50" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data. Note: numerous rocks and islets off small headland, this rock being the most seaward, survey differs considerably from chart in this area, recommend amend chart to match this survey.
 29. Complex area of rocks and coastline between 55°03'07.82" N 160°10'39.04" W NAD 83 and 55°02'54.62" N 160°09'48.02" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
-

-
30. Recommend replace charted dangerous rock in posn: 55°02'52.64" N 160°09'43.19" W NAD 83 with surveyed (3) islet in white water in posn: 55°02'53.10" N 160°09'44.07" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data. Note: (3) islet 85 meters northeast, (0) * 40 meters southwest.
 31. Recommend chart (9) islet in posn: 55°02'56.91" N 160°09'29.14" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse coverage. Note: difference between surveyed and charted coastline in this area.
 32. Recommend replace charted dangerous rock in posn: 55°02'49.62" N 160°09'22.35" W NAD 83 with surveyed (10) islet in posn: 55°02'49.94" N 160°09'21.34" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse coverage.
 33. Charted coastline differs from surveyed coastline by up to 70 meters around 55°02'50.78" N 160°08'34.28" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
 34. Charted dangerous rocks in the vicinity of 55°02'56.12" N 160°06'26.62" W NAD 83, not found during this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation by boat.
 35. Charted rock awash on chart 16540 (not on chart 16553) in posn: 55°04'14.05" N 160°10'54.19" W NAD 83, not found during this survey, in area of turbidity recommend further investigation. Note: shoal No. 24 0.3 nautical miles south.
 36. Recommend replace charted dangerous rock in posn: 55°03'02.24" N 160°10'34.71" W NAD 83 with surveyed 0⁵ [0₃] RK in posn: 55°03'00.64" N 160°10'37.41" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data. Note: numerous rocks in vicinity, this rock being the most navigationally significant and seaward.
 37. Recommend chart (43) islet in posn: 55°03'03.92" N 160°06'01.93" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 38. Charted lagoon and sand spit in posn 55°04'02.64" N 160°06'29.91" W NAD 83, differs from surveyed. Recommend amend chart to match this survey.

D.10.1.2 Additional Boatwork inside Lidar Area

It is recommended the following features southwest of Nagai Island as discussed in D.10.1.1 be investigated by boat.

- a. Item 11 – Confirm possible rocks in white water.
- b. Item 13 - Confirm possible rocks in white water.
- c. Item 19 – Charted rock not found.
- d. Item 34 - Charted rock not found.
- e. Item 35 – Charted rock not found.

D.10.2 Recommended Overlap with Lidar Data

Smooth sheet L covers parts of the west coast of Nagai Island and Falmouth Harbor.

In general the west coast of Nagai Island is very exposed which reduced water clarity through turbulence in the water column. Kelp beds also limited laser coverage. However the coastline, islets and many below water rocks were surveyed. As a result of the reduced lidar coverage due to water quality and kelp, it is recommended that boat work be conducted along the coast from the seaward limit of the rocks and islets surveyed by lidar. It is recommended that this should be conducted in fair weather and extended out to the approximate position of the 10-fathom contour. Seaward of the 10 fathom contour, it is recommended that the survey be extended further offshore by ship.

In Falmouth Harbor good coverage was achieved with the exception of some small areas of turbidity. Boat work is recommended to seaward of the 5-fathom contour. At the head of Falmouth Harbor in posn: 55°04'15" N 160°07'01.30" W NAD 83, laser penetration was limited by water clarity to 5 fathoms and additional boat work is recommended. A deep hole also exists in posn: 55°04'06" N 160°06'15" W NAD 83, however this basin is land locked at low water.

D.11 CHART COMPARISON – SMOOTH SHEET H11147M¹⁸*D.11.1 H11147M*

H11147M was compared to:

- Chart 16553 3rd Edition 2 September 1989, at scale 1:80 000. Nil corrections
- Chart 16540 11th Edition 4 March 1989 at scale 1:300 000. Nil corrections

D.11.1.1 Charted Depths and Features

Notes:

- a. Charted depths are in Fathoms and Feet and in format 2₄. Surveyed depths are in decimal Fathoms and in format 2⁴. For comparison, fathom and feet conversion is in brackets in format [2₂].
- b. A number of Charted Depths and Features fall in the overlap of data between sheets H11147 M and H11147 L (see D.10.1.1 items 31 – 33, 36).

The following comparisons from smooth sheet H11147M relate to chart 16553 at scale 1:80 000. Nil corrections

1. Recommend chart 4⁹ [4₅] RK in posn: 55°02'37.09" N 160°08'59.59" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 6² [6₁] RK close southwest. **See item 1** Danger to Navigation Report H11147M.
2. Recommend chart 2⁷ [2₄] RK in posn: 55°02'42.92" N 160°08'32.63" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 1⁶ [1₄] RK 100 meters east (inshore) and 5 RK 150 meters southeast.
3. Recommend replace charted dangerous rock in posn: 55°02'38.50" N 160°08'11.18" W NAD 83 with surveyed (3) islet in posn: 55°02'37.28" N 160°08'08.99" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (1²) [1₁] * 100 meters west (seaward) and 2 RK 200 meters northwest.
4. Recommend replace charted dangerous rock in posn: 55°02'33.88" N 160°08'04.24" W NAD 83 with surveyed (7) islet in posn: 55°02'33.96" N 160°08'06.82" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (3) Islet 40 meters east.
5. Recommend replace charted dangerous rock in posn: 55°02'41.78" N 160°07'36.85" W NAD 83 with surveyed (4) islet in posn: 55°02'42.16" N 160°07'38.15" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (3) Islet 40 meters west.
6. Recommend replace charted dangerous rock in posn: 55°02'41.93" N 160°07'28.96" W NAD 83 with surveyed (0⁹) [0₅] * in posn 55°02'40.67" N 160°07'30.11" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note (0⁷) [0₄] * 50 meters north and (0⁷) [0₄] * 50 meters northwest.

7. Charted islets and rocks in posn: 55°02'38.70" N 160°05'27.61" W NAD 83, surveyed (I) in posn: 55°02'39.83" N 160°05'27.15" W NAD 83 and posn: 55°02'43.24" N 160°05'22.11" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Islets not observed in data or on downward looking video. Recommend remove from chart. Area foul with kelp.
8. Recommend replace charted dangerous rocks in posn: 55°02'34.64" N 160°05'12.64" W NAD 83 with surveyed (I³) [I₂] in posn: 55°02'34.16" N 160°05'09.36" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. On edge of area foul with kelp. Note: 2⁷ [2₄] RK 270 meters west and 180 meters southwest.
9. Charted rock in posn: 55°02'26.50" N 160°04'57.93" W NAD 83 not found this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Close to area of white water against coast, recommend further investigation by boat.
10. Recommend replace charted dangerous rock in posn: 55°02'04.60" N 160°05'58.40" W NAD 83 with surveyed (I¹) islet in posn: 55°02'02.61" N 160°05'58.68" W NAD 83 and (65) islet in posn: 55°02'01.32" N 160°05'57.76" W NAD 83.
11. Surveyed coastline differs from charted by up to 50 meters in posn: 55°02'00.80" N 160°05'57.17" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend to match this survey.
12. Charted dangerous rock in posn: 55°02'00.84" N 160°06'03.89" W NAD 83, surveyed (I⁴) [I₂] * in posn: 55°02'01.62" N 160°06'02.27" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation. Note (I⁵) [I₃] * 60 meters southeast.
13. Recommend chart (30) islet in posn: 55°01'49.82" N 160°06'27.59" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (Q²) [Q₁] * 40 meters northwest.
14. Charted islets and rocks in posn: 55°01'46.54" N 160°07'04.10" W NAD 83, Numerous drying rocks found in the vicinity during this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Islets not observed in data or on downward looking video recommend remove from chart. Area of heavy kelp.
15. Recommend replace two charted islets in posn: 55°01'43.23" N 160°06'51.36" W NAD 83 with surveyed (I²) [I₁] * in posn: 55°01'42.68" N 160°06'51.32" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 2⁵ [2₃] RK 60 meters west. (3) islet exists in data, upon review found to be white water and replaced by (I²) [I₁] * on smooth sheet.
16. Recommend chart (8) islet in posn: 55°01'37.30" N 160°06'35.50" W NAD 83 and (14) Islet in posn: 55°01'36.98" N 160°06'34.04" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
17. Recommend chart (17) islet in posn: 55°01'34.85" N 160°06'31.02" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note (3) islet 40 meters west.

18. Surveyed coastline differs from charted by up to 100 meters in posn: 55°01'37.59" N 160°06'36.81" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend to match this survey.
19. Charted dangerous rock in posn: 55°01'32.92" N 160°06'23.61" W NAD 83, surveyed ($\underline{0}^8$) [$\underline{0}_5$] * in posn: 55°01'33.90" N 160°06'22.15" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp.
20. Recommend move charted islet in posn: 55°01'15.26" N 160°07'00.66" W NAD 83 to 55°01'14.82" N 160°06'58.88" W NAD 83 and annotate with height (9), area covered with 4x4 meter spot spacing at 200% lidar coverage.
21. Charted islet in posn: 55°01'17.71" N 160°06'48.82" W NAD 83, surveyed ($\underline{0}^9$) [$\underline{0}_5$] * in posn: 55°01'17.12" N 160°06'48.38" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp, recommend further investigation. Note ($\underline{0}^9$) [$\underline{0}_5$] * 75 meters west and ($\underline{0}^7$) [$\underline{0}_2$] * 80 meters northeast.
22. Recommend replace charted dangerous rock in posn: 55°01'00.10" N 160°07'14.69" W NAD 83 with surveyed (13) islet in posn: 55°00'58.48" N 160°07'15.56" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage.
23. Charted dangerous rock in posn: 55°01'01.61" N 160°07'32.28" W NAD 83 not found this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Areas of sparse data in vicinity recommend further investigation.
24. Charted dangerous rock in posn: 55°01'07.29" N 160°07'55.02" W NAD 83 not found this survey, area covered with 4x4 meter spot spacing at 200% lidar coverage. Areas of sparse data in vicinity recommend further investigation.

The following comparisons relate to Chart 16540 11th Edition 4 March 1989 at scale 1:300 000. Nil corrections.

25. Recommend replace charted rock in posn: 55°00'39.67" N 160°08'13.09" W NAD 83 with surveyed (4) islet in posn: 55°00'43.08" N 160°08'19.04" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage, Note: ($\underline{1}^3$) [$\underline{1}_2$] * 80 meters east. **See item 2** Danger to Navigation Report H11147M.
26. Recommend chart 4⁸ [$\underline{4}_5$] RK in posn: 55°00'33.80" N 160°08'30.12" W NAD 83 area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp.
27. Recommend chart (10) islet in posn: 55°00'17.52" N 160°08'33.64" W NAD 83 and (5) islet in posn: 55°00'16.50" N 160°08'35.14" W NAD 83. Area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: ($\underline{0}^2$) [$\underline{0}_1$] * 60 meters northwest and ($\underline{1}^4$) [$\underline{1}_2$] * 50 meters northeast. In area 'foul with kelp'.
28. Recommend replace charted rock in posn: 55°00'08.89" N 160°08'44.03" W NAD 83 with surveyed (3) islet in posn: 55°00'10.56" N 160°08'39.92" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note ($\underline{1}^4$) [$\underline{1}_2$] * close south. In area 'foul with kelp'
29. Recommend chart ($\underline{1}^3$) [$\underline{1}_2$] * in posn: 55°00'05.46" N 160°08'43.43" W NAD 83 and ($\underline{1}^4$) [$\underline{1}_2$] * in posn: 55°00'05.70" N 160°08'49.46" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. In area 'foul with kelp'.

30. Recommend chart (10) islet in posn: 54°59'59.66" N 160°08'44.00" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
31. Recommend chart (0⁴) [0₂] * in posn: 54°58'56.40" N 160°09'30.99" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of heavy kelp.
32. Recommend replace charted dangerous rock in posn: 54°59'07.69" N 160°11'39.53" W NAD 83, with surveyed (1⁵) [1₃] * in posn: 54°59'03.61" N 160°11'34.47" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note two (1³) [1₂] close northwest and 2⁸ [2₅] RK 230 meters northwest.
33. Surveyed 8⁹ [8₅] RK in posn: 54°59'11.42" N 160°12'04.54" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 9⁸ [9₅] RK 50 meters southwest, 8² [8₁] RK 50 meters northeast and 7² [7₁] RK 90 meters east. Kelp on rocks, recommend further investigation.
34. Surveyed 4² [4₁] RK in posn: 54°58'47.53" N 160°12'39.50" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 4⁶ [4₄] RK 120 meters east. Area of kelp, recommend further investigation.

D.11.1.2 Additional Boatwork inside Lidar Area

It is recommended the following features southwest of Nagai Island as discussed in D.10.1.1 be investigated by boat.

- a. Item 9 - Charted rock not found near white water.
- b. Item 12 - Rock in kelp.
- c. Item 21 - Rock in kelp.
- d. Item 23 - Charted rock not found in sparse data.
- e. Item 24 - Charted rock not found in sparse data.
- f. Item 33 - Rocks in kelp.
- g. Item 34 - Rocks in kelp.

D.11.2 Recommended Overlap with Lidar Data

Smooth sheet M covers parts of the west coast of Nagai Island.

This part of Nagai Island is less exposed than on adjacent smooth sheets L and N; as a result the water was clearer and lidar coverage was better.

To the northwest of the headland in posn: 55°02'38" N 160°08'06" W NAD 83 the coast is more similar to smooth sheet L, and along this part it is recommended that boat work be conducted along the coast from the seaward limit of the rocks and islets surveyed by lidar. It is recommended that this be conducted in fair weather and extended out to the approximate

10-fathom contour, and the survey be extended offshore beyond the 10-fathom contour by ship.

In the large bay east of 55°02'30" N 160°08'00" W NAD 83 and 55°01'00" N 160°08'00" W NAD 83 very good lidar coverage was achieved and an overlap by ship to the 10 fathom contour is recommended.

Along the coast from 55°01'15" N 160°07'00" W NAD 83 to 55°02'38" N 160°08'06" W NAD 83 the coastline is generally foul with kelp inshore of the 5 fathom contour. In general boat work is recommended between the 5 and 10-fathom contours and ship work in greater than 10 fathoms.

In the large bay centered on 54°59'00" N 160°10'00" W NAD 83 boat work is recommended in two small areas of reduced lidar coverage as follows

- 54°59'23" N 160°09'24" W NAD 83 - within 100 meters
- 54°59'23" N 160°09'36" W NAD 83 - within 100 meters

Offshore, an overlap to the 10-fathom contour is recommended.

Along the north coast of John Island poor coverage was achieved due to kelp and the exposed nature of the area. East of 54°59'01" N 160°11'35" W NAD 83 additional boat work between the coast and the 5-fathom contour is recommended.

West and south of 54°59'01" N 160°11'35" W NAD 83 there are a large number of rocks and boat work between the 3 and 10 fathom contour is recommended in fair weather. Seaward of the 10-fathom contour it is recommended the area be surveyed by ship.

D.12 CHART COMPARISON – SMOOTH SHEET H11147N¹⁹**D.12.1 H11147N**

H11147N was compared to:

- Chart 16540 11th Edition 4 March 1989 at scale 1:300 000. Nil corrections.

D.12.1.1 Charted Depths and Features

Notes:

- Charted depths are in Fathoms and Feet and in format 2₄. Surveyed depths are in decimal Fathoms and in format 2⁴. For comparison, fathom and feet conversion is in brackets in format [2₂].
- A number of Charted Depths and Features fall in the overlap of data between sheets H11147 N and H11147 M (see D.11.1.1 item 34).
 - Possible 1 RK in kelp in posn 54°58'45.44" N 160°12'26.84" W NAD 83 area covered with 4x4 meter spot spacing at 200% lidar coverage. Doubtful sounding possible kelp recommend further investigation by boat. Note numerous rocks in vicinity.
 - Recommend replace charted islet in posn: 54°58'37.81" N 160°12'26.21" W NAD 83 with surveyed (4) islet in posn: 54°58'36.65" N 160°12'23.04" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: numerous rock in the vicinity, area of kelp.
 - Recommend chart (22) islet in posn: 54°58'38.65" N 160°12'17.51" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (17) islet 35 meters southeast.
 - Possible 1¹ [1₁] RK in posn: 54°58'30.62" N 160°12'26.47" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp recommend further investigation by boat. Note: 4⁷ [4₄] RK 80 meters northeast.
 - Charted islet in posn: 54°58'31.40" N 160°12'08.56" W NAD 83, surveyed (4) islet in posn: 54°58'32.10" N 160°12'07.93" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (3) islet in area of white water 110 meters west (seaward) and numerous rock in the vicinity, area of kelp. Recommend investigation by boat to confirm if feature is an islet and not a drying rock.
 - Surveyed 6⁸ [6₅] RK in posn: 54°58'23.55" N 160°12'19.94" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data recommend further investigation by boat. Note: three rocks further southwest (seaward).
 - Recommend replace charted dangerous rock in posn: 54°58'28.62" N 160°11'15.95" W NAD 83 with surveyed (1¹) [1₁] * in area of white water in posn: 54°58'31.43" N 160°11'14.32" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 1⁴ [1₂] RK 125 meters southwest.
 - Recommend replace charted dangerous rock in posn: 54°58'32.85" N 160°10'37.13" W NAD 83 with surveyed (1¹) [1₁] * in area of white water in posn: 54°58'36.73" N

- 160°10'43.64" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp.
9. Recommend replace charted dangerous rock in posn: 54°58'22.53" N 160°10'23.36" W NAD 83 with surveyed (\underline{Q}^2) [\underline{Q}_1] * in posn: 54°58'22.01" N 160°10'21.53" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp. Note: (\underline{Q}^3) [\underline{Q}_2] * 160 meters southwest.
 10. Recommend replace charted dangerous rock in posn: 54°58'14.82" N 160°10'51.88" W NAD 83 with surveyed (\underline{Q}^2) [\underline{Q}_1] * in posn: 54°58'09.63" N 160°10'43.39" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp. Note: (\underline{Q}^3) [\underline{Q}_2] * 220 meters northeast.
 11. Recommend replace charted dangerous rock in posn: 54°58'06.04" N 160°11'18.23" W NAD 83 with surveyed (3) islet in posn: 54°58'00.22" N 160°11'13.24" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (\underline{I}^1) [\underline{I}_1] * in area of white water 45 meters northwest.
 12. Surveyed (\underline{Q}^6) [\underline{Q}_4] * in posn: 54°57'52.07" N 160°11'31.29" W NAD 83 area covered with 4x4 meter spot spacing at 200% lidar coverage. Numerous rocks and islets surveyed off headland north of Saddlers Mistake, area of kelp. Recommend further investigation by boat.
 13. Surveyed 1^4 [\underline{I}_2] RK in posn: 54°57'41.73" N 160°11'22.91" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Single shoal sounding in area of kelp, recommend further investigation by boat. Note single shoal sounding 3^9 [\underline{I}_5] RK 140 meters northwest.
 14. Recommend chart (5) islet in posn: 54°57'14.96" N 160°10'58.24" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: (9) islet 45 meters east (close inshore).
 15. Recommend chart (3) islet in posn: 54°56'57.25" N 160°10'42.83" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 16. Numerous rocks in kelp surveyed along coast between 54°57'21.79" N 160°10'52.36" W NAD 83 and 54°56'57.11" N 160°10'32.58" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
 17. Recommend chart 7^8 [\underline{I}_5] RK in posn: 54°56'39.37" N 160°12'07.31" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
 18. Numerous surveyed rocks and islets close in shore along coast between 54°56'07.45" N 160°12'11.83" W NAD 83 and 54°55'56.00" N 160°14'15.78" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
 19. Recommend replace charted dangerous rock in posn: 54°56'18.90" N 160°14'04.10" W NAD 83 with Surveyed (\underline{I}^4) [\underline{I}_2] * in area of white water in posn: 54°56'22.56" N 160°14'03.52" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp. Note: 4^6 [\underline{I}_4] RK 145 meters east and 7^5 [\underline{I}_3] RK 145 meters northeast.

20. Recommend replace charted dangerous rock in posn: 54°56'10.36" N 160°14'17.70" W NAD 83 with Surveyed (I^4) [1_2] *in area of white water in posn: 54°56'09.02" N 160°14'15.40" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp. Note: 7⁶ [7_4] RK and 8² [8_1] RK 190 meters north.
21. Recommend chart group of islets in posn: 54°56'09.72" N 160°15'00.02" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage.
22. Numerous surveyed rocks and islets close inshore along coast between 54°56'00.45" N 160°14'51.17" W NAD 83 and 54°54'20.38" N 160°14'56.22" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
23. Surveyed 0¹ [0_1] RK in posn: 54°55'16.16" N 160°15'32.51" W NAD 83 area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp recommend further investigation. Note: numerous rocks in the vicinity.
24. Surveyed 0⁷ [0_4] RK in posn: 54°54'34.11" N 160°15'18.38" W NAD 83 area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of kelp recommend further investigation. Note: (0^6) [0_4] * 40 meters southeast and numerous rocks in the vicinity.
25. Numerous surveyed rocks and islets off small headland in posn: 54°54'08.40" N 160°15'17.94" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
26. Numerous surveyed rocks and islets close in shore along coast between 54°54'08.40" N 160°15'17.94" W NAD 83 and 54°53'30.53" N 160°14'27.97" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
27. Recommend replace charted dangerous rock in posn: 54°53'24.90" N 160°14'49.89" W NAD 83 with (32) islet in posn: 54°53'26.53" N 160°14'51.61" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: numerous other rocks and islets in vicinity.
28. Possible 4² [4_1] RK in kelp in posn: 54°53'10.14" N 160°14'59.93" W NAD 83 area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data recommend further investigation by boat.
29. Possible 3⁶ [3_4] RK in kelp in posn: 54°53'04.47" N 160°14'58.99" W NAD 83 area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data recommend further investigation by boat. Note: 7⁶ [7_4] RK 55 meters southeast and 7⁹ [7_5] RK 55 meters northeast. **See item 1** Danger to Navigation Report H11147N.
30. Recommend chart (6) islet in posn: 54°52'22.33" N 160°14'10.93" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: numerous other rocks and islets in vicinity. **See item 2** Danger to Navigation Report H11147N.
31. Possible (0^7) [0_4] * in white water in posn: 54°52'04.48" N 160°13'47.68" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data recommend further investigation by boat. Note: numerous other rocks and islets in vicinity.

32. Charted dangerous rock in posn: 54°51'43.21" N 160°13'39.32" W NAD 83, surveyed (5) islet in white water in posn: 54°51'42.06" N 160°13'44.05" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Note: 0⁴ [0₂] RK 160 meters southeast and numerous other rocks and islets in vicinity. Recommend confirm height of feature by boat.
33. Surveyed (1¹) [1₁] * in white water in posn: 54°51'57.68" N 160°12'55.89" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data recommend further investigation by boat. Note: (0⁷) [0₄] * 140 meters northwest and numerous other rocks and islets in vicinity.
34. Surveyed (1) * in white water in posn: 54°52'05.38" N 160°12'50.90" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data recommend further investigation by boat. Note: (0⁵) [0₃] * 30 meters northeast, (0⁶) [0₄] * 90 meters southwest and numerous other rocks and islets in vicinity.
35. Numerous surveyed rocks and islets close in shore along coast between 54°53'22.76" N 160°14'04.66" W NAD 83 and 54°52'15.32" N 160°12'50.47" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Recommend amend chart to match this survey.
36. Possible 0⁶ [0₄] RK in kelp in posn: 54°51'40.30" N 160°13'45.77" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data in kelp recommend further investigation by boat.
37. Possible 3² [3₁] RK in kelp in posn: 54°51'36.06" N 160°13'52.25" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data in kelp recommend further investigation by boat to confirm / disprove. Note 2² [2₁] RK 80 meters northeast.
38. Possible 0⁴ [0₂] RK in kelp in posn: 54°58'35.47" N 160°12'32.46" W NAD 83, area covered with 4x4 meter spot spacing at 200% lidar coverage. Area of sparse data in kelp recommend further investigation by boat to confirm / disprove. Note 1⁹ [1₅] RK 45 meters northeast.
39. Recommend replace charted 40 in posn: 54°57'26.13" N 160°11'30.19" W NAD 83, with surveyed 7⁹ [7₅] in posn: 54°57'25.05" N 160°11'30.34" W. **See item 3** Danger to Navigation Report H11147N.
40. Recommend replace charted 20 in posn: 54°55'35.96" N 160°10'16.09 W NAD 83, with surveyed 6⁷ [6₄] in posn: 54°55'40.75" N 160°10'30.74" W. **See item 4** Danger to Navigation Report H11147N.

D.12.1.2 Additional Boat work inside Lidar Area

It is recommended the following features southwest of Nagai Island as discussed in D.12.1.1 be investigated by boat.

- a. Item 1 - Possible rock in kelp
- b. Item 4 - Possible rock in kelp.
- c. Item 5 - Islet or drying rock in white water.

- d. Item 6 - Rock in kelp.
- e. Item 12 - Rock in kelp.
- f. Item 13 - Rock in kelp.
- g. Item 23 - Rock in kelp.
- h. Item 24 - Rock in kelp.
- i. Item 28 - Possible rock in kelp.
- j. Item 29 - Possible rock in kelp.
- k. Item 31 - Possible rock in white water.
- l. Item 32 - Islet in white water - confirm height of feature.
- m. Item 33 - Drying rock in white water.
- n. Item 34 - Drying rock in white water.
- o. Item 36 - Rocks in kelp.
- p. Item 37 - Possible rocks in kelp.
- q. Item 38 – Possible rock in kelp.
- r. Small area of kelp with doubtful sounding in posn: 54°56'13.94" N 160°11'31.56" W NAD 83, (not shown on smooth sheet).
- s. 3² [3₁] RK in posn: 54°54'12.71" N 160°15'36.75" W NAD 83, doubtful sounding possibly kelp.

D.12.2 Recommended Overlap with Lidar Data

Smooth sheet N covers the southwest part of the coast of Nagai Island.

This part of the island is much more exposed than on smooth sheet M. In particular, south of 54°51'36.06" N, the coastline is very exposed, highly eroded and littered with many small islets and rocks.

On the southwest coast of John Island there are many rocks inshore of the 5 fathom contour. Boat work is recommended between the 5 and 10 fathom contour.

In the bay on the southeast side of John Island in posn: 54°58'30" N 160°10'30" W NAD 83 poor lidar coverage was obtained inside the 5-fathom contour due to water clarity. Additional boat work in this bay between the 1 and 5 fathom contours is recommended.

South of 54°58'00" N 160°11'00" W NAD 83 to 54°56'00" N 160°15'24" W NAD 83 excellent coverage was achieved and an overlap by ship to the 12 fathom contour is recommended.

South of 54°56'00" N 160°15'24" W NAD 83 to 54°53'00" N 160°14'00" W NAD 83, the coast is rugged with many islets and rocks. An overlap by ship to the 12-fathom contour is

recommended. There is one area along this section where boat work is recommended, where a rocky ridge extends offshore at 54°55'15" N 160°15'50" W NAD 83.

The far south coast of Nagai Island, south of 54°53'00" N 160°14'00" W NAD 83, is extremely eroded with many islets and rocks. Along this southern section of coast boat work is recommended from the seaward limit of the rocks and islets surveyed by lidar to approximately 0.5 nautical miles from the coastline. This should be conducted in fair weather, as this part of Nagai Island is very exposed. Seaward of 0.5 nautical miles offshore it is recommended the survey be extended further offshore by ship.

E. APPROVAL SHEET**LETTER OF APPROVAL – OPR-P183-KR-03**

This report and the accompanying smooth sheets are respectfully submitted.

Field operations contributing to the accomplishment of this survey were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report and the accompanying smooth sheets have been closely reviewed and are considered complete and adequate as per the Statement of Work.

Report

Data Acquisition and Processing
Vertical and Horizontal Control

Submission Date

December 19, 2003
December 19, 2003



Mark Sinclair
Hydrographer
Tenix LADS Incorporated

Date 19 December 2003

Revisions Compiled During Office Processing

¹ All LIDAR surveys referenced in this Descriptive Report have been applied to the HCell or Hdrawing of the multibeam survey or surveys they junctioned with. No stand-alone LIDAR information was compiled to either and HCell or Hdrawing. For information concerning the compilation of LIDAR features and soundings see the Descriptive Report for the multibeam survey or surveys the LIDAR survey was compiled to. LIDAR does not meet IHO object detection requirements. LIDAR was not used to supersede shoaler charted soundings or to disprove charted features. See Section D. "Results and Recommendations" endnotes for junction information.

² Filed with the project records.

³ See endnote 1.

⁴ Concur.

⁵ Concur.

⁶ Filed with the project records.

⁷ Concur.

⁸ H11147A was compiled with H11330.

⁹ H11147B was compiled with H11278.

¹⁰ H11147C was compiled with H11279.

¹¹ H11147D was compiled with H11280.

¹² H11147E was compiled with H11280 and H11331.

¹³ H11147F was compiled with H11332 and H11326.

¹⁴ H11147G was compiled with H11326.

¹⁵ H11147H was compiled with H11327.

¹⁶ H11147I was compiled with H11328.

¹⁷ H11147L was compiled with H11474 and H11482.

¹⁸ H11147M was compiled with H11473 and H11474.

¹⁹ H11147N was compiled with H11473.

Danger to Navigation Report

Hydrographic Survey Registry Number: H11147N

Survey Title: State: Alaska Locality: Shumagin Islands & Vicinity Sub-locality: John
Head to Mountain Point

Project Number: OPR-P183-KR-03

Survey Dates: April to July 2003

Depths are reduced to Mean Lower Low Water using verified tides. Positions are based on the NAD83 horizontal datum.

CHARTS AFFECTED:

<u>Chart</u>	<u>Scale</u>	<u>Edition</u>	<u>Date</u>
16540	1:300,000	11 th	03/04/89

DANGERS:

<u>Feature</u>	<u>Depth(ft or fms)</u>	<u>Latitude (N)</u>	<u>Longitude (W)</u>
Islet	6 ft at MHW	54° 52' 22.3"	160° 14' 10.9"

COMMENTS:

Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch at (206) 526-6835.

Danger to Navigation Report

Hydrographic Survey Registry Number: H11147M

Survey Title: State: Alaska Locality: Shumagin Islands & Vicinity Sub-locality:
Southwest of Nagai Island

Project Number: OPR-P183-KR-03

Survey Dates: April to July 2003

Depths are reduced to Mean Lower Low Water using verified tides. Positions are based on the NAD83 horizontal datum.

CHARTS AFFECTED:

<u>Chart</u>	<u>Scale</u>	<u>Edition</u>	<u>Date</u>
16553	1:80,000	3rd	09/02/89
16540	1:300,000	11 th	03/04/89

DANGERS:

<u>Feature</u>	<u>Depth(ft or fms)</u>	<u>Latitude (N)</u>	<u>Longitude (W)</u>
Islet	4 ft at MHW	55° 00' 43.1"	160° 08' 19.0"
Rock	4 fms 5 ft	55° 02' 37.1"	160° 08' 59.6"

COMMENTS:

Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch at (206) 526-6835.

Danger to Navigation Report

Hydrographic Survey Registry Number: H11147L

Survey Title: State: Alaska Locality: Shumagin Islands & Vicinity Sub-locality: Falmouth Harbor and Approaches

Project Number: OPR-P183-KR-03

Survey Dates: April to July 2003

Depths are reduced to Mean Lower Low Water using verified tides. Positions are based on the NAD83 horizontal datum.

CHARTS AFFECTED:

<u>Chart</u>	<u>Scale</u>	<u>Edition</u>	<u>Date</u>
16553	1:80,000	3rd	09/02/89
16540	1:300,000	11 th	03/04/89

DANGERS:

<u>Feature</u>	<u>Depth(ft or fms)</u>	<u>Latitude (N)</u>	<u>Longitude (W)</u>
Islet	3 ft at MHW	55° 05' 38.9"	160° 10' 24.7"
Rock	uncovers 1 ft	55° 03' 56.4"	160° 11' 00.5"

COMMENTS:

Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch at (206) 526-6835.

Danger to Navigation Report

Hydrographic Survey Registry Number: H11147G

Survey Title: State: Alaska Locality: Shumagin Islands & Vicinity Sub-locality: Delarof Harbor & Vicinity of Unga Cape

Project Number: OPR-P183-KR-03

Survey Dates: April to July 2003

Depths are reduced to Mean Lower Low Water using verified tides. Positions are based on the NAD83 horizontal datum.

CHARTS AFFECTED:

<u>Chart</u>	<u>Scale</u>	<u>Edition</u>	<u>Date</u>
16553	1:80,000	3rd	09/02/89
16540	1:300,000	11 th	03/04/89

DANGERS:

<u>Feature</u>	<u>Depth(ft or fms)</u>	<u>Latitude (N)</u>	<u>Longitude (W)</u>
Rock	5 fm	55° 07' 56.1"	160° 31' 07.3"
Rock	5 fms 2 ft	55° 07' 37.3"	160° 31' 46.6"

COMMENTS:

Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch at (206) 526-6840 or edward.j.vandenameele@noaa.gov.

Danger to Navigation Report

Hydrographic Survey Registry Number: H11147C

Survey Title: State: Alaska Locality: Shumagin Islands & Vicinity Sub-locality: Korovin Bay & Strait

Project Number: OPR-P183-KR-03

Survey Dates: April to July 2003

Depths are reduced to Mean Lower Low Water using predicted tides. Positions are based on the NAD83 horizontal datum.

CHARTS AFFECTED:

<u>Chart</u>	<u>Scale</u>	<u>Edition</u>	<u>Date</u>
16553	1:80,000	3rd	09/02/89
16540	1:300,000	11 th	03/04/89

DANGERS:

<u>Feature</u>	<u>Depth(ft or fms)</u>	<u>Latitude (N)</u>	<u>Longitude (W)</u>
Rock	10 fms 2 ft	55° 18' 24.2"	160° 16' 53.2"
Rock	8 fms 4 ft	55° 19' 02.0"	160° 17' 56.0"
Rock	7 fms	55° 19' 16.6"	160° 17' 34.1"

COMMENTS:

Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch at (206) 526-6835.

Danger to Navigation Report

Hydrographic Survey Registry Number: H11147

Survey Title: State: Alaska Locality: Shumagin Islands and Vicinity Sub-locality:
Popov Strait

Project Number: OPR-P183-KR-03

Survey Dates: April - July 2003

Depths are reduced to Mean Lower Low Water using verified tides. Positions are based on the NAD83 horizontal datum.

CHARTS AFFECTED:

<u>Chart</u>	<u>Scale</u>	<u>Edition</u>	<u>Date</u>
16553	1:80,000	3rd	09/02/89
16540	1:300,000	10th	03/04/89

DANGERS:

<u>Feature</u>	<u>Depth(ft or fms)</u>	<u>Latitude (N)</u>	<u>Longitude (W)</u>
Rock	2 fms 2 ft	55° 19' 51.8"	160° 30' 16.6"
Rock	4 fms 3 ft	55° 19' 53.8"	160° 30' 23.9"
Rock	5 fms 1 ft	55° 19' 56.6"	160° 30' 24.7"
Rock	2 fms 5 ft	55° 21' 38.2"	160° 29' 49.6"
Obstn	2 fms 4 ft	55° 20' 10.0"	160° 30' 26.0"
Rock	2 fms 4 ft	55° 22' 38.7"	160° 31' 00.0"
Rock	4 fms 2 ft	55° 17' 12.0"	160° 27' 52.7"
Rock	3 fms 4 ft	55° 17' 29.5"	160° 29' 31.8"
Rock	2 fms 1 ft	55° 21' 38.3"	160° 28' 18.9"
Rock	3 fms 2 ft	55° 17' 09.4"	160° 28' 51.9"
Rock	7 fms 5 ft	55° 21' 48.2"	160° 30' 13.5"
Rock	4 fms	55° 16' 37.0"	160° 33' 50.8"
Rock	1 fm	55° 15' 53.4"	160° 32' 00.1"
Rock	6 fms 4 ft	55° 15' 00.6"	160° 31' 19.8"
Rock	awash	55° 13' 29.8"	160° 29' 38.9"
Rock	uncovers 3 ft	55° 17' 32.7"	160° 26' 01.6"
Rock	5 ft	55° 16' 52.6"	160° 25' 20.1"
Rock	9 fms 4 ft	55° 16' 32.4"	160° 25' 23.8"
Rock	1 fm 4 ft	55° 16' 33.0"	160° 23' 46.9"
Rock	4 fms 3 ft	55° 16' 45.3"	160° 23' 43.5"
Rock	6 fms 4 ft	55° 16' 22.8"	160° 23' 44.4"
Rock	2 fms	55° 21' 41.3"	160° 28' 10.1"

COMMENTS: The first five features listed are on the Popof Strait inset for Chart 16553.

All features listed were found using LIDAR.

Danger to Navigation Report

Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch at (206) 526-6835

Danger to Navigation Report

Hydrographic Survey Registry Number: H11147N

Survey Title: State: Alaska Locality: Shumagin Islands & Vicinity Sub-locality: John
Head to Mountain Point

Project Number: OPR-P183-KR-03

Survey Dates: April to July 2003

Depths are reduced to Mean Lower Low Water using verified tides. Positions are based on the NAD83 horizontal datum.

CHARTS AFFECTED:

<u>Chart</u>	<u>Scale</u>	<u>Edition</u>	<u>Date</u>
16540	1:300,000	11 th	03/04/89

DANGERS:

<u>Feature</u>	<u>Depth(ft or fms)</u>	<u>Latitude (N)</u>	<u>Longitude (W)</u>
Rock	3 fms 4 ft *	54° 53' 04.5"	160° 14' 59.0"
Sounding	7 fms 5 ft	54° 57' 25.1"	160° 11' 30.3"
Sounding	6 fms 4 ft	54° 55' 40.8"	160° 10' 30.7"

COMMENTS:

All features detected with LIDAR.

* Recommend charting with "reported" label. The contractor recommended investigating this item by boat.

Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch at (206) 526-6840.

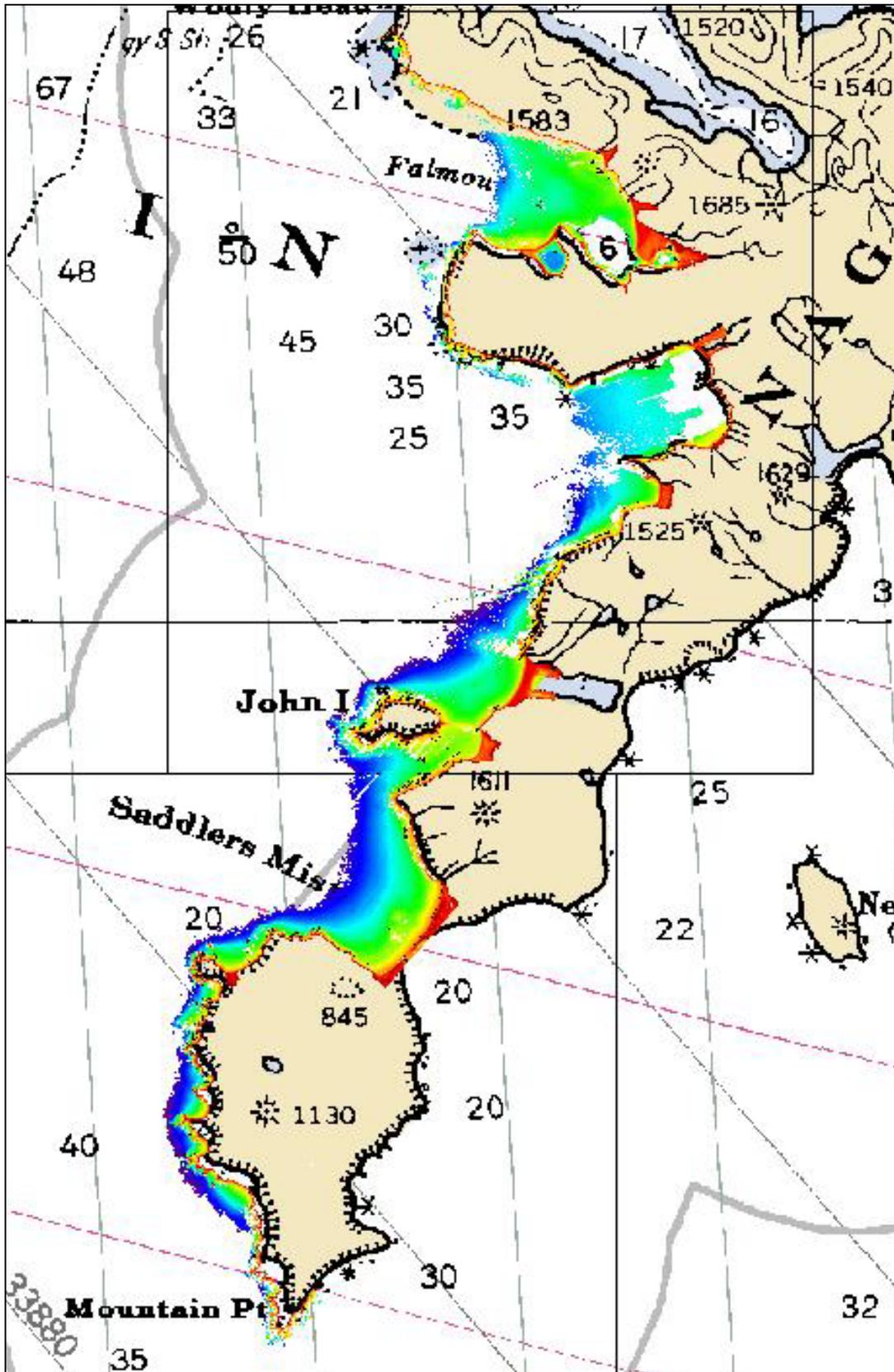
APPENDIX III – PROGRESS SHEET

This is the status upon completion of data acquisition for Task Order 1.

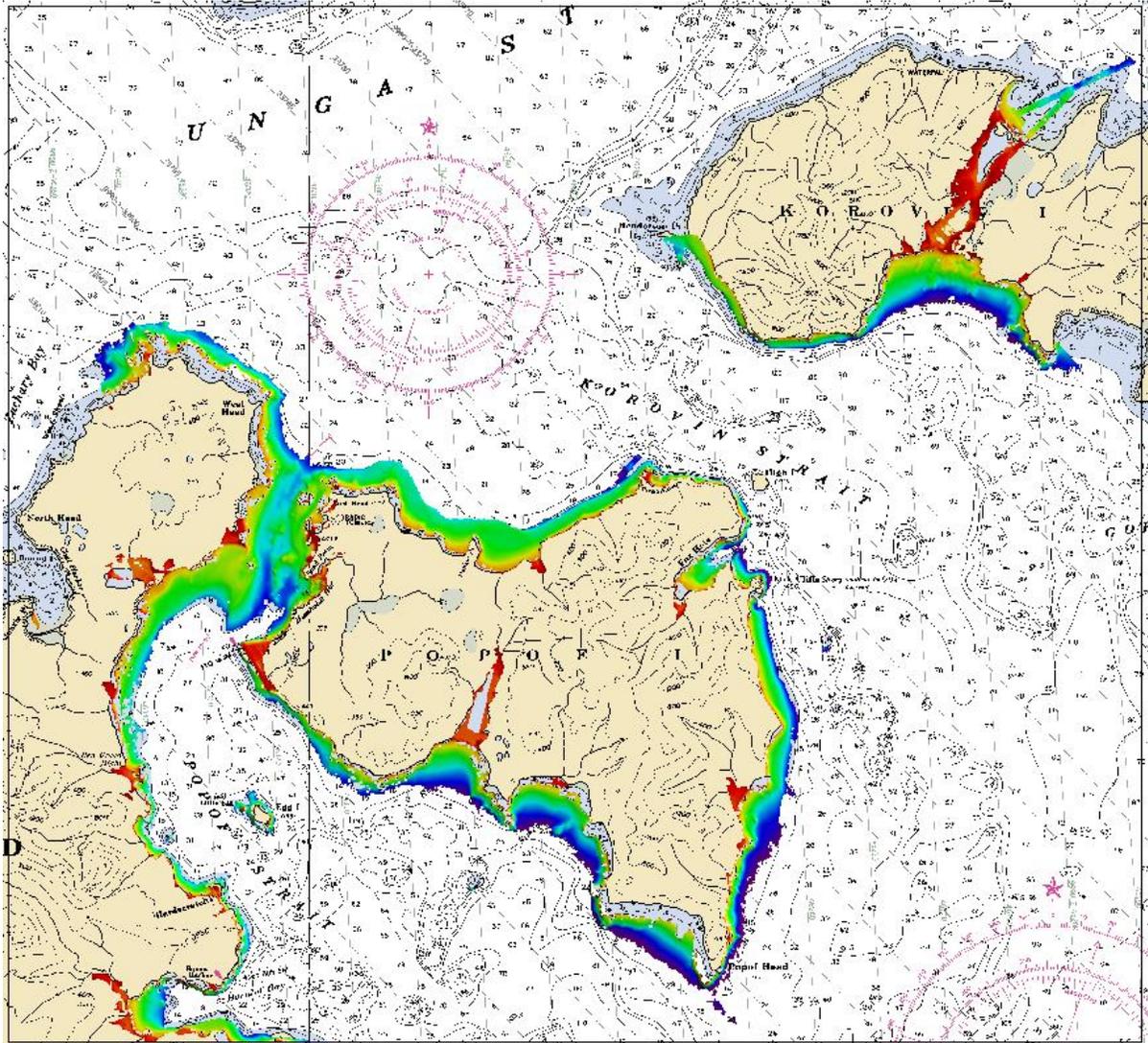
The total line nautical miles flown has increased because additional areas were created to obtain better coverage.

Line – nm - flown	April	May	June	July	Total	% Complete
CLIN 02	1160	1877	2979	3070	2337	131
CLIN 03	240	882	1593	0	1032	154
CLIN 05	0	772	1572	1661	1079	154
CLIN 04	0	0	0	1487	1190	125
Aircraft flown hours	49.64	70.97	31.9	55.76	208.27	-
Aircraft on task hours	36.4	60.79	24.3	42.69	164.18	-
Days with flight	8	11	5	9	34.4	96
Hours lost to weather	3.71	0	0	4	-	
Hours lost to system	0	21	14			

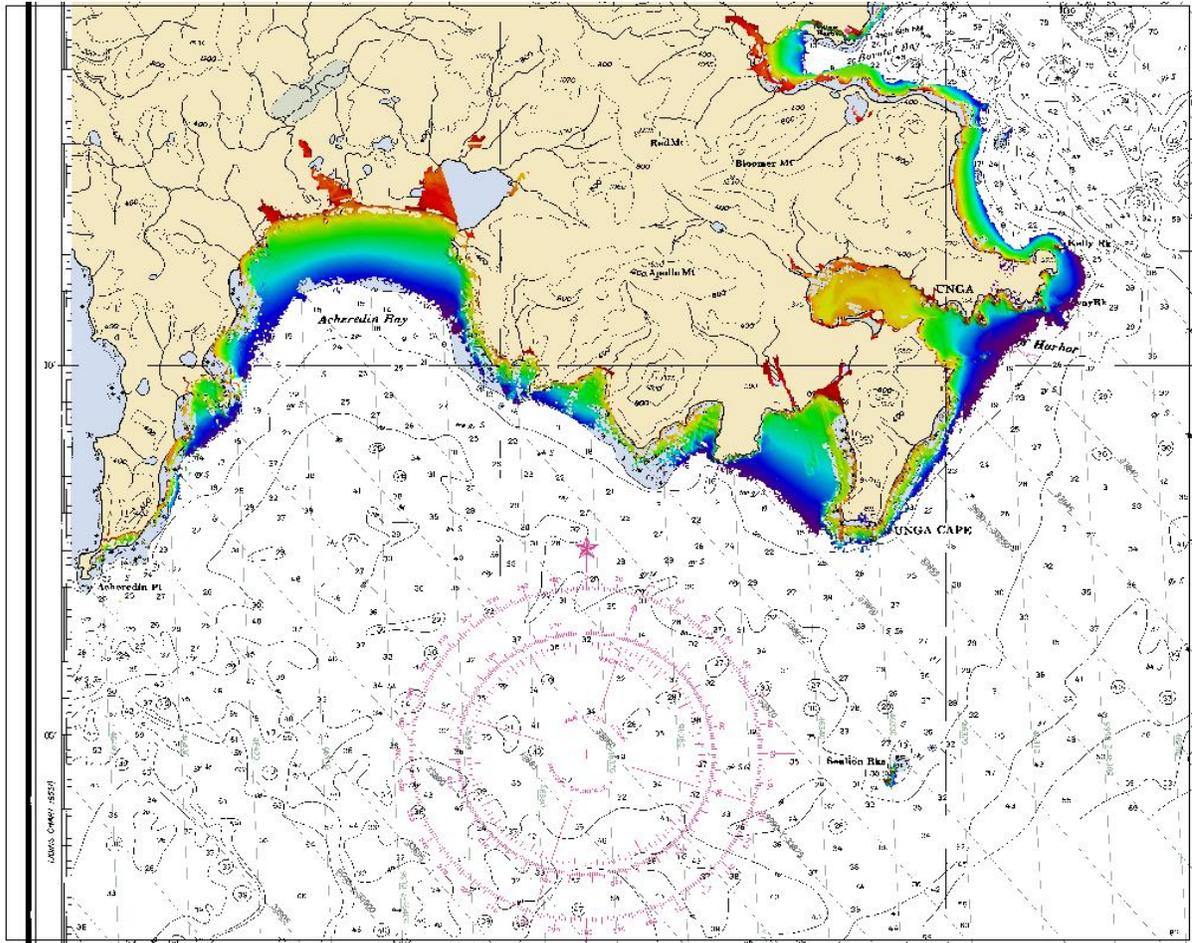
FINAL PROGRESS SKETCH 1



FINAL PROGRESS SKETCH 2



FINAL PROGRESS SKETCH 3



APPENDIX IV – TIDES AND WATER LEVELS

Abstract of Times of Hydrography

Date Flown	JD	Sortie No	Database	On Task (UTC)	Off Task (UTC)	Time On Task
22-Apr-03	112	1	Shum 1	17:50	22:40	4:50
23-Apr-03	113	3	Shum 1	17:15	22:45	5:30
24-Apr-03	114	4	Shum 1	17:36	22:45	5:09
25-Apr-03	115	5	Shum 1	17:35	22:25	4:50
26-Apr-03	116	6	Shum 1	17:30	23:10	5:40
27-Apr-03	117	2	Shum 2	17:35	23:15	5:40
28-Apr-03	118	7	Shum 1	18:26	20:30	2:04
28-Apr-03	118	3	Shum 2	20:30	23:15	2:45
4-May-03	124	1	Shum 3	17:50	19:00	1:10
4-May-03	124	8	Shum 1	19:00	1:30	5:30
5-May-03	125	9	Shum 1	21:00	22:20	1:20
5-May-03	125	4	Shum 2	22:20	0:30	2:10
9-May-03	129	10	Shum 1	17:30	0:00	6:30
9-May-03	129	5	Shum 2	0:00	2:55	2:55
10-May-03	130	2	Shum 3	18:45	1:00	6:15
11-May-03	131	6	Shum 2	17:50	23:35	5:45
12-May-03	132	7	Shum 2	18:00	20:55	2:55
14-May-03	134	9	Shum 2	18:10	21:20	3:10
14-May-03	134	3	Shum 3	21:20	23:10	1:50
14-May-03	134	11	Shum 1	23:00	23:30	0:30
21-May-03	141	4	Shum 3	17:50	21:50	4:00
21-May-03	141	10	Shum 2	0:05	1:50	1:45
21-May-03	141	12	Shum 1	1:50	2:30	0:40
22-May-03	142	5	Shum 3	17:20	20:30	3:10
22-May-03	142	13	Shum 1	20:30	22:40	2:10
23-May-03	143	6	Shum 3	15:30	17:00	1:30
23-May-03	143	14	Shum 1	17:00	19:25	2:25
23-May-03	143	12	Shum 2	20:40	23:50	3:10
25-May-03	145	7	Shum 3	1:30	3:40	2:10
25-May-03	145	14	Shum 2	3:40	4:30	0:50
5-Jun-03	156	15	Shum 1	0:18	2:55	2:37
5-Jun-03	156	15	Shum 2	3:20	4:35	1:15
6-Jun-03	157	16	Shum 2	18:00	19:30	1:30
6-Jun-03	157	9	Shum 3	19:45	21:55	2:10
11-Jun-03	162	11	Shum 3	19:55	22:55	3:00
11-Jun-03	162	17	Shum 2	23:28	0:15	0:47
13-Jun-03	164	12	Shum 3	19:55	22:20	2:25

Date Flown	JD	Sortie No	Database	On Task (UTC)	Off Task (UTC)	Time On Task
13-Jun-03	164	13	Shum 3	22:50	23:20	0:30
14-Jun-03	165	17	Shum 1	0:30	2:00	1:30
14-Jun-03	165	14	Shum 3	20:15	22:35	2:20
16-Jun-03	167	18	Shum 1	22:47	1:03	2:16
17-Jun-03	168	18	Shum 2	1:19	2:30	1:11
17-Jun-03	168	15	Shum 3	2:36	3:01	0:25
2-Jul-03	183	1	Shum 4	22:30	5:48	7:18
3-Jul-03	184	3	Shum 4	22:30	4:54	6:24
4-Jul-03	185	19	Shum 2	4:00	7:00	3:00
5-Jul-03	186	5	Shum 4	22:00	2:48	4:48
6-Jul-03	187	19	Shum 1	1:00	4:00	3:00
7-Jul-03	188	6	Shum 4	22:30	6:54	8:24
8-Jul-03	189	7	Shum 4	22:30	2:48	4:18
10-Jul-03	191	8	Shum 4	0:00	7:30	7:30
13-Jul-03	194	17	Shum 3	21:30	3:00	5:30
13-Jul-03	194	10	Shum 4	0:30	2:00	1:30
15-Jul-03	196	21	Shum 1	0:30	5:54	5:24
15-Jul-03	196	11	Shum 4	0:00	5:54	5:54
20-Jul-03	201	12	Shum 4	22:23	2:37	4:14

Station Information for Sand Point, AK

Water Level Station Information:

Station Name: **Sand Point, AK**
Station Identification Number: **9459450**
Latitude: **55° 20.2' N**
Longitude: **160° 30.1' W**
Date Established: **Sep 10 1972**
Maximum Water Level: **4.35 ft. above [MHHW](#)**
1 (12/31/1986)
Minimum Water Level: **-3.68 ft. below [MLLW](#)**
(11/15/1993)
[Mean Range](#): 5.19 ft.
[Diurnal Range](#): 7.23 ft.
Bench Mark Data Sheet: **Click [HERE](#)**

Mean Lower Low Water (MLLW): A tidal datum. The average of the lower low water height of each tidal day observed over the National Tidal Datum Epoch. For stations with shorter series, simultaneous observational comparisons are made with a control tide station in order to derive the equivalent datum of the National Tidal Datum Epoch.

Mean Higher High Water (MHHW): A tidal datum. The average of the higher high water height of each tidal day observed over the National Tidal Datum Epoch. For stations with shorter series, simultaneous observational comparisons are made with a control tide station in order to derive the equivalent datum of the National Tidal Datum Epoch.

Location: To reach the tidal benchmarks from the Airport, proceed on the only road that leads to town. Make the first left as you proceed towards town, veer left at the small boat harbor and follow down until you reach the causeway that leads to the City Dock. The gauge is located on the south side of the storage building on the City Dock. The benchmarks were in the vicinity.

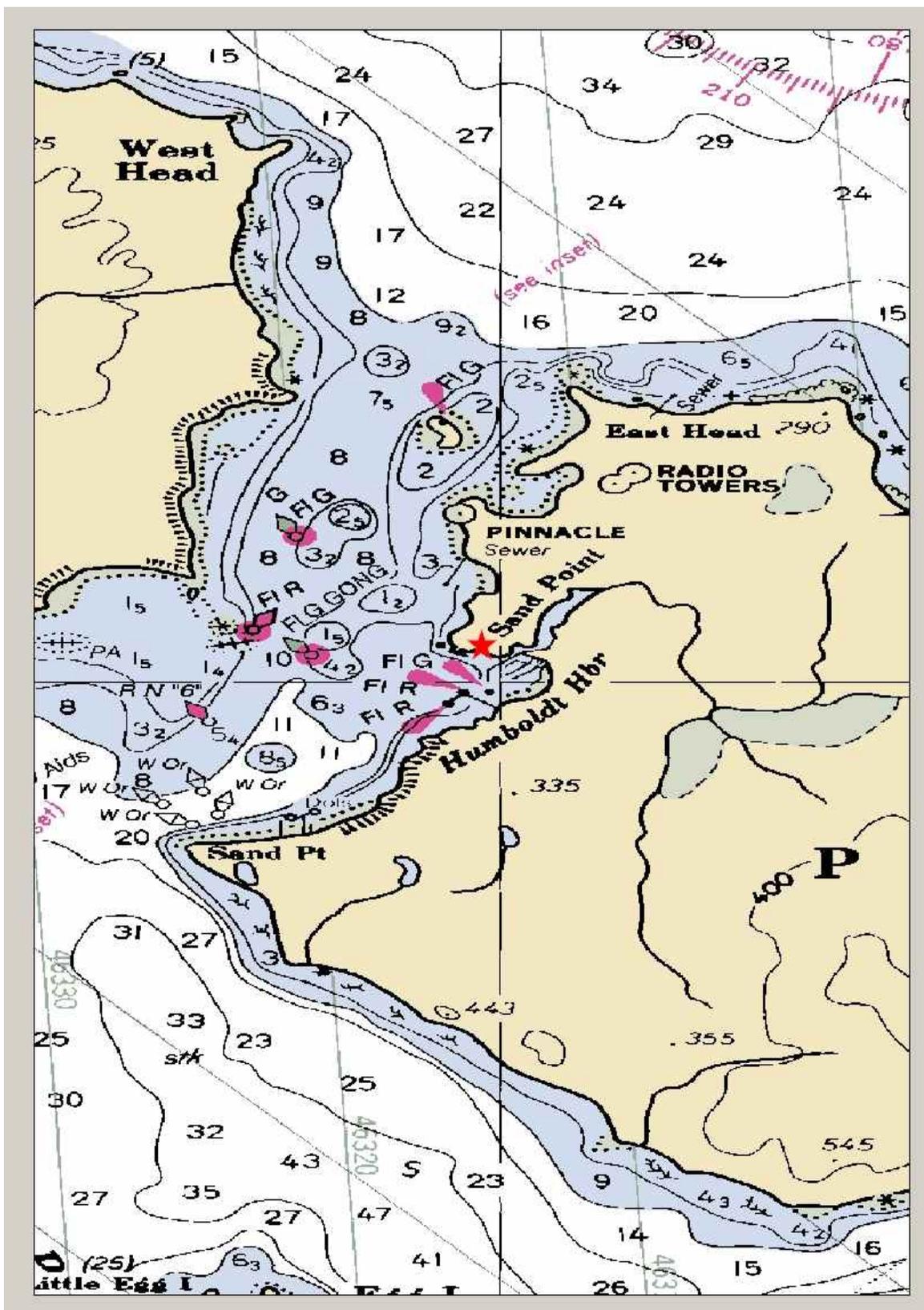
TIDAL DATUMS

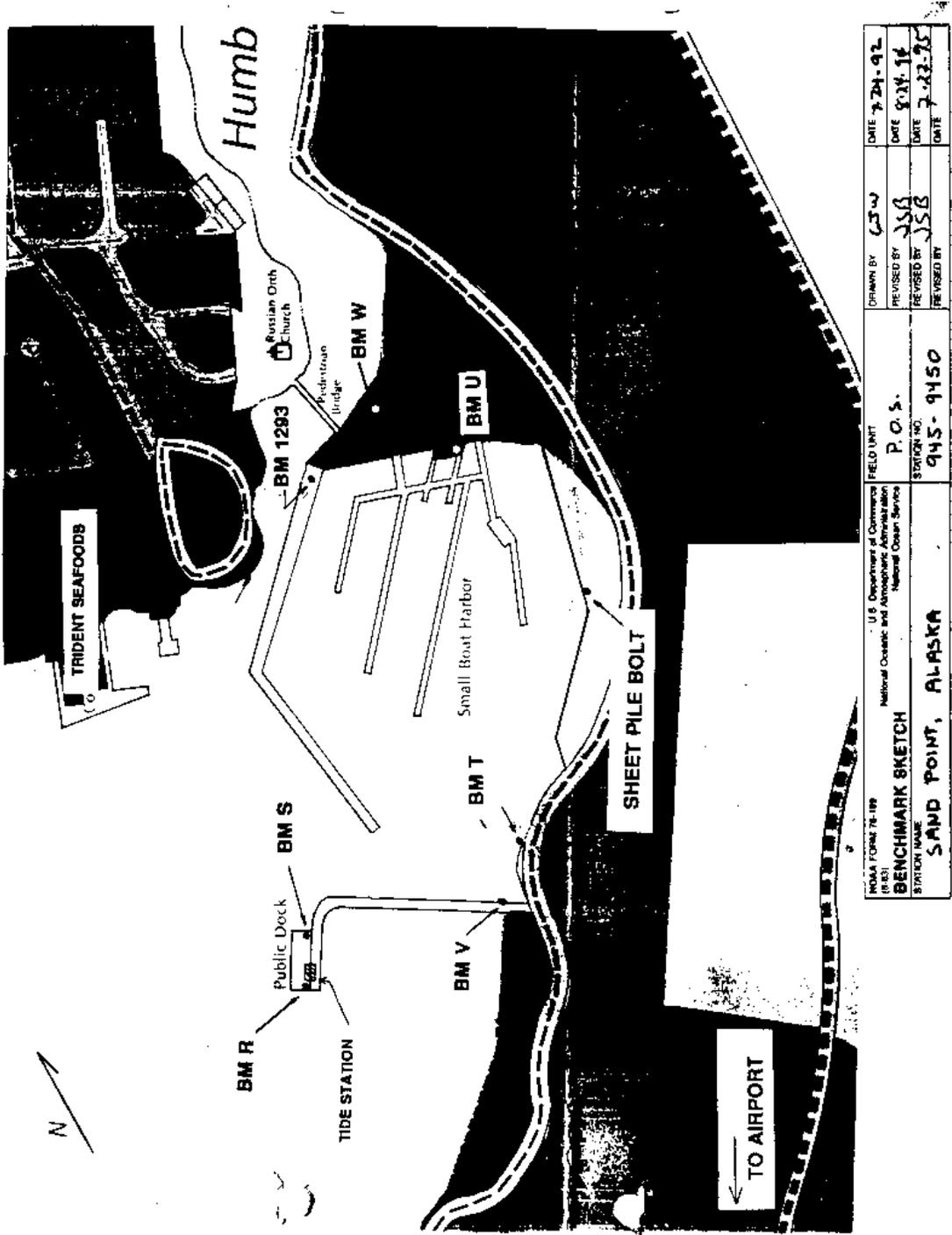
Tidal datums at SAND POINT, POPOF ISLAND based on:

LENGTH OF SERIES: 19 Years
TIME PERIOD: January 1983 - December 2001
TIDAL EPOCH: 1983-2001
CONTROL TIDE STATION:

Elevations of tidal datums referred to Mean Lower Low Water (MLLW), in METERS:

HIGHEST OBSERVED WATER LEVEL (12/31/1986)	3.531
MEAN HIGHER HIGH WATER (MHHW)	2.204
MEAN HIGH WATER (MHW)	1.988
MEAN TIDE LEVEL (MTL)	1.197
MEAN SEA LEVEL (MSL)	1.181
MEAN LOW WATER (MLW)	0.406
MEAN LOWER LOW WATER (MLLW)	0.000
LOWEST OBSERVED WATER LEVEL (11/15/1993)	-1.120





Tidal Zone Analysis Compiled By John Oswald and Associates, LLC***John Oswald and Associates, LLC***12001 Audubon Drive
Anchorage, Alaska 99516

Date: April 16, 2003

To: Darren Stephenson
Tenix/LADSFm: John Oswald
John Oswald and Assoc.

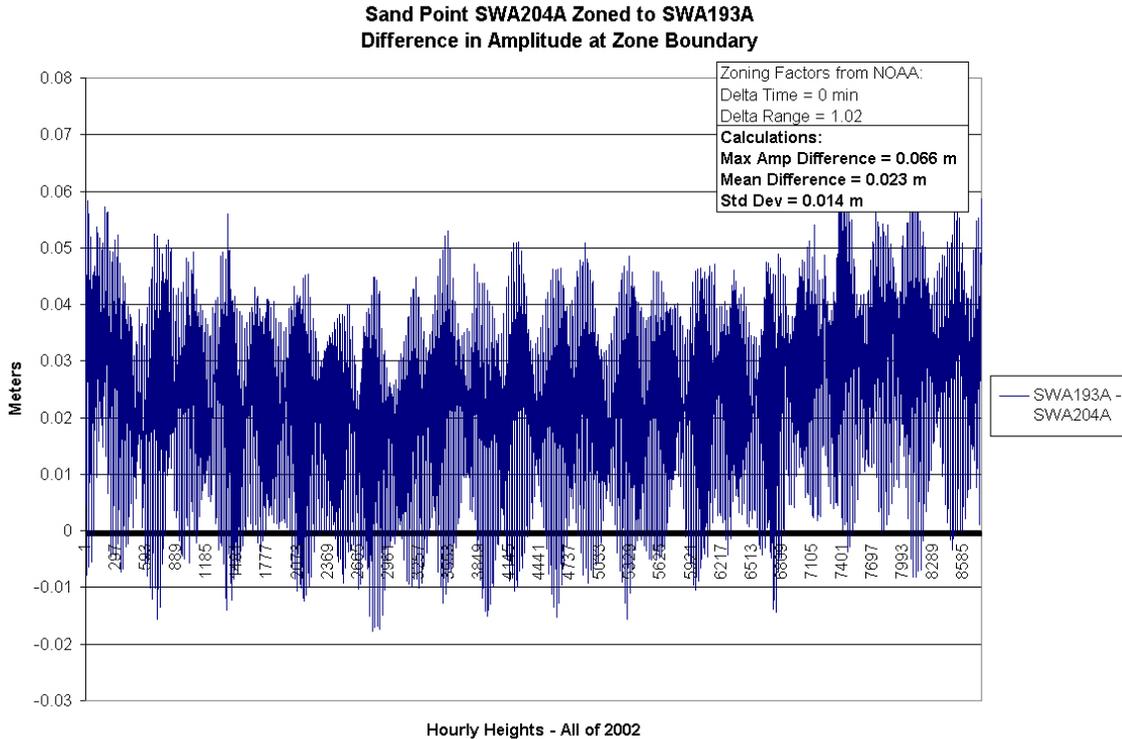
Re: Tidal Zoning for Shumagin Lidar Project

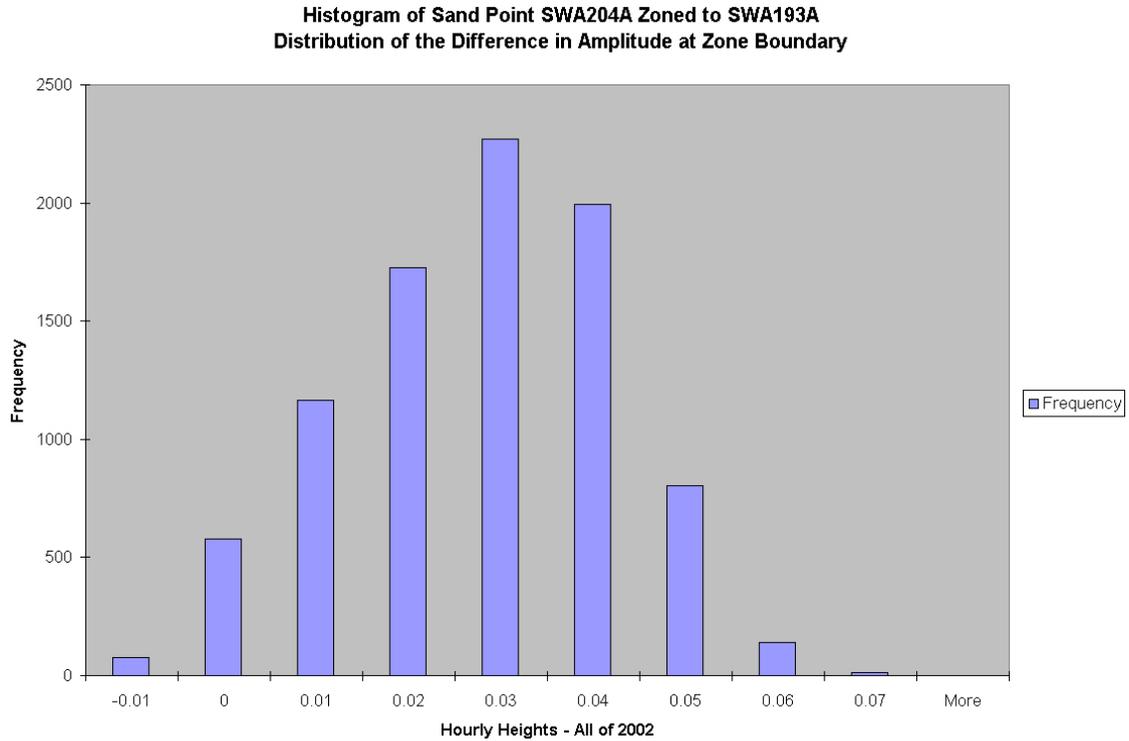
Here is the zoning analysis we were asked to provide regarding the Shumagin Island bathymetric lidar project you are mobilizing this week. Erik Oppedard did this analysis the past several days. Based on 2002 data at Sand Point and the zoning that NOAA provided in the SOW, Attachment #7, dated Jan 14, 2003, the zoning for this project should be adequate to meet the specifications. One note of caution needs to be mentioned. Since you plan to use predicted tides (initially) coupled with the NOAA zoning for the first reduction/QC of your bathymetric data, beware that weather effects will not be modeled. Only by using the NOAA verified data at Sand Point will these effects be removed. Weather effects could approach several feet.

Analysis of the Amplitude Change along the Shumagin Islands Zone Boundary

- 2 There are two tidal zones that make up the majority of the 2003 Shumagin Islands bathymetric lidar project area. The zones are SWA204A and SWA193A, the former containing the Sand Point control station with a zero minute time shift and 1.00-range corrector. The second zone is adjacent and to the north and has a zero minute time shift and a 1.02 range corrector from Sand Point. All data is on the NTDE of 1960-1978. Note this NTDE is expected to be updated by NOAA on April 21, 2003.
- 3 The Sand Point control station run by NOAA has a published mean range (MHW – MLW) of 1.585 meters and a published Great Diurnal (GT) Range (MHHW – MLLW) of 2.198 meters. Using the Great Diurnal Range for zone SWA204A and scaling it by 1.02 to form the predicted tide found in zone SWA193A yields a GT of 2.242, or a difference of 0.044 meters. This should be roughly the typical jump between the two zone boundaries.

- 4 To test this, one year of verified Hourly Height data at MLLW from NOAA was downloaded. This file was scaled by 1.02 and differenced with the original file. The largest magnitude of difference between the two zones for 2002 is 0.066 m with a mean of 0.023 m and a standard deviation of 0.014 m. There is a 50% increase between the predicted range difference and the computed range difference for the two zones in 2002. Several factors play a role in this jump. One, the predicted is based on 19-year means; there is still some tide above and below the GT. Secondly, storms have been somewhat removed from the predicted amplitudes yielding a dampened range.





Summary:

For a hydrographic survey, the zoning provided by NOAA should be adequate to meet the accuracy specifications for soundings. The datum jump should be below 0.070 meters with the majority of differences in the 2 – 3 cm category.

APPENDIX V – SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE

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

From: Edward J Van Den Ameele [mailto:Edward.J.Vandenameele@noaa.gov]
Sent: Tuesday, May 20, 2003 1:10 AM
To: 'John K Longenecker'; 'Gary Nelson'
Cc: 'John Lowell'
Subject: RE: PHB_visit_7_May_03

[See my two comments below; I'm sure John and Gary will have additional comments](#)
-EJ

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

From: John K Longenecker [mailto:John.K.Longenecker@noaa.gov]
Sent: Monday, May 19, 2003 7:55 AM
To: Gary Nelson
Cc: John Lowell; Edward J Van Den Ameele
Subject: PHB_visit_7_May_03

Could you please review and comment or give concurrence to the following statements or assumptions from the recent meeting at PHB? I will compile the response to Mark. Thanks.

John

Lidar Anywhere Task Order 1 OPR-P183-KR-03

Attendees:

Gary Nelson
Bob Mihailov
Bruce Olmstead
John Lowell
John Longenecker
Edward J Van den Ameele
Mark Sinclair

A meeting was held at Pacific Hydro Branch on 7 May, 2003 at the request of Tenix LADS Inc. The purpose of the meeting was to outline the TLI LADS Mk II survey plan and clarify items in the Statement of Work for Lidar Survey Services.

Summary of items raised:

- The SOW states certain versions of software are to be used. It is acceptable for delivered data to be compatible with the latest versions of Caris and Microstation.

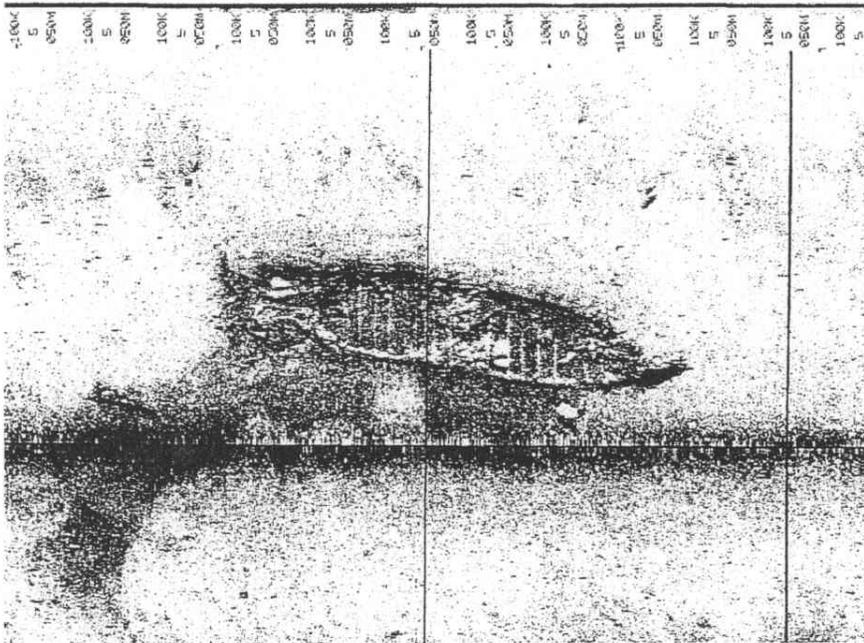
-
- The requirements for reporting were discussed. 1 HVCR and 1 DAPR are to be provided per Task Order, however each smoothsheet is to have a separate DR which will facilitate standard archiving practices.
 - Soundings in kelp were discussed. Sparse soundings in kelp are to be retained in the data set as they provide useful data, even if the coverage in these areas is incomplete. **EJ: I believe it was also decided to delineate and denote the extents of kelp areas on the smooth sheet (i.e. with dashed line and "kelp" annotation)**
 - Automatically generated contours on smooth sheets which are close to gaps in the data, due to kelp or white water, may be placed in the wrong position if they are interpolated from the nearest soundings. In such cases, contours are to be manually edited to reflect the best estimate of the true position of the feature. **EJ: This discussion mainly was in reference to the MLLW and MHW lines; and incorrect interpolation of the shoreline from irregularly spaced soundings.**
 - The requirement to bin the final data set was discussed. A 3 meter bin may be used for the sounding data set in lieu of the 5 meter bin.
 - The depiction of drying soundings on the smoothsheet was discussed. Drying soundings shall be at the same density as depths. The datum and units stated in the SOW are to be used.
 - 2D Microstation seed files shall be provided to PHB. It was noted that AHB specifies 3D seed files.
 - The importance of the correct production of smoothsheets was discussed. Gary Nelson offered to review early drafts and provide feedback. He will also provide an example of a smoothsheet and microstation files.
 - EJ advised that for the 2001 survey work, the list of doubtful soundings provided in the DR was very helpful. Such a list shall be provided in the event that doubtful depths are retained in the dataset.
 - More information on the interpretation of raw laser waveforms was requested. MJS will plan to visit PHB on his next trip to Alaska and provide a presentation on waveform interpretation.

Prepared by Mark Sinclair
Project Director
Tenix LADS Inc
14 May 03

APPENDIX VI – AWOIS

**AUTOMATED WRECK AND OBSTRUCTION SYSTEM
(AWOIS)**

**OPR-P183-KR-03
Shumagin Islands & Vicinity, AK
1/14/03**



Example of Side Scan Sonar Image

SURVEY REQUIREMENTS KEY

TYPE:

FULL -- VERIFY OR DISPROVE THE ASSIGNED ITEM. IF FOUND, LEAST DEPTH OR ELEVATION AND ACCURATE POSITION REQUIRED. DISPROVAL REQUIRES AN INVESTIGATION TO THE FULL EXTENT OF THE SPECIFIED SEARCH AREA. IF FEATURE IS LOCATED AND VERIFIED AS THE ITEM BEING SOUGHT, WITH NO SURROUNDING WRECKAGE, THEN NO ADDITIONAL SEARCH IS REQUIRED.

LIMITED -- REDUCED LINE SPACING TO A MINIMUM OF ONE-HALF OF THE MAIN SCHEME HYDRO, ANY INDICATION OF THE ASSIGNED ITEM MUST BE FURTHER DEVELOPED AS A FULL INVESTIGATION (SEE ABOVE).

INFORMATION -- ANY INDICATION BY MAIN SCHEME HYDRO MUST BE FURTHER DEVELOPED AS A FULL INVESTIGATION (SEE ABOVE).

WD/SSS -- WIRE DRAG OR SIDE SCAN SONAR

TECHNIQUES:

S2 -- 200% SIDE SCAN SONAR COVERAGE
S4 -- 400% SIDE SCAN SONAR COVERAGE
MB -- 100% MULTIBEAM COVERAGE
ES -- ECHO SOUNDER
DLS -- DIVER LOCATOR SONAR
WD -- WIRE DRAG (CLEARED DEPTH)
CT -- CONSTANT TENSION WIRE DRAG (CLEARED DEPTH)
BD -- BOTTOM DRAG
DI -- DIVER OR WADER INVESTIGATION (PNEUMATIC DEPTH GAUGE OR LEAD LINE LEAST DEPTH)
VS -- VISUAL SEARCH (BOTTOM VISIBLE IN CLEAR WATER OR AREA UNCOVERED AT CHART DATUM)
SD -- DISPROVAL MAY BE ACQUIRED BY SALVAGE DOCUMENTATION
-- SEE SURVEY REQUIREMENT COMMENTS IN HISTORY FIELD. NEW RECORDS USE "TECHNIQNOTE" FIELD (## NOT REQUIRED)

SEARCH RADIUS: METERS

THE GP CONTAINED IN THESE RECORDS WILL REFERENCE THE 1983 DATUM WHEN POSSIBLE. IF THE GP WAS CONVERTED FROM A 1927 REFERENCED DATUM TO A 1983 DATUM A CODE "6" WILL APPEAR IN THE VDATUM" FIELD.

THESE DATA WERE GENERATED FROM DATA FILES WITHIN THE NATIONAL OCEAN SERVICE. INFORMATION IN AWOIS IS INTENDED TO SATISFY THE NEEDS OF HYDROGRAPHIC SURVEY PLANNERS AND IS NOT CONSIDERED TO BE A COMPLETE RECORD OF WRECK AND OBSTRUCTION INFORMATION WITHIN ANY GEOGRAPHIC AREA. FOR ADDITIONAL INFORMATION OR ASSISTANCE IN INTERPRETING THE DATA PLEASE CONTACT THE GRAPHIC SURVEYS DIVISION (N/CS31), PHONE 301-713-2702.

RECRD VESSLTERMS CHART AREA
 CARTOCODE SNDINGCODE DEPTH

NATIVLAT NATIVLON NATIVDATUM
 LAT83 LONG83 GPQUALITY
 GPSOURCE
 LATDEC LONDEC

PROJECT ITEMSTATUS SEARCHTYPE
 RADIUS INIT ASSIGNED
 TECNIQ
 Techniqnot

History

Fieldnot
 Proprietar
 YEARSUNK NIMANUM SYSTEMNUM

RECRD VESSLTERMS CHART AREA
 CARTOCODE SNDINGCODE DEPTH

NATIVLAT NATIVLON NATIVDATUM
 LAT83 LONG83 GPQUALITY
 GPSOURCE
 LATDEC LONDEC

PROJECT ITEMSTATUS SEARCHTYPE
 RADIUS INIT ASSIGNED
 TECNIQ
 Techniqnot

History

Fieldnot
 Proprietar
 YEARSUNK NIMANUM SYSTEMNUM

RECD	<input type="text" value="52984"/>	VESLTERMS	<input type="text" value="UNKNOWN"/>	CHART	<input type="text" value="16553"/>	AREA	<input type="text" value="P"/>
		CARTOCODE	<input type="text" value="098"/>	SNDINGCODE	<input type="text" value=""/>	DEPTH	<input type="text" value=""/>

NATIVLAT	<input type="text" value="55/20/51.29"/>	NATIVLON	<input type="text" value="160/27/40.63"/>	<input type="button" value="convert"/>	NATIVDATUM	<input type="text" value="31"/>
LAT83	<input type="text" value="55/20/51.29"/>	LONG83	<input type="text" value="160/27/40.63"/>	<input type="button" value="Update"/>	GPQUALITY	<input type="text" value="Med"/>
	<input type="text" value="55"/> <input type="text" value="20"/> <input type="text" value="51.29"/>		<input type="text" value="160"/> <input type="text" value="27"/> <input type="text" value="40.63"/>		GPSOURCE	<input type="text" value="Scaled"/>
LATDEC	<input type="text" value="55.347580555556"/>	LONDEC	<input type="text" value="160.46128611111"/>			

PROJECT	<input type="text" value="OPR-P183"/>	ITEMSTATUS	<input type="text" value="Assigned"/>	SEARCHTYPE	<input type="text" value="Full"/>
RADIUS	<input type="text" value="500"/>	INIT	<input type="text" value="MBH"/>	ASSIGNED	<input type="text" value="6/4/2002"/>
TECNIQ	<input type="text" value="VS,DI,SD,LIDAR"/>				

Techniqnot

History

Fieldnot

Proprietar

YEARSUNK	<input type="text" value=""/>	NIMANUM	<input type="text" value=""/>	SYSTEMNUM	<input type="text" value="14193"/>	<input type="button" value="Print Record"/>
----------	-------------------------------	---------	-------------------------------	-----------	------------------------------------	---

RECD	<input type="text" value="52985"/>	VESLTERMS	<input type="text" value="UNKNOWN"/>	CHART	<input type="text" value="16553"/>	AREA	<input type="text" value="P"/>
		CARTOCODE	<input type="text" value="100"/>	SNDINGCODE	<input type="text" value=""/>	DEPTH	<input type="text" value=""/>

NATIVLAT	<input type="text" value="55/20/12.12"/>	NATIVLON	<input type="text" value="160/31/27.84"/>	<input type="button" value="convert"/>	NATIVDATUM	<input type="text" value="31"/>
LAT83	<input type="text" value="55/20/12.12"/>	LONG83	<input type="text" value="160/31/27.84"/>	<input type="button" value="Update"/>	GPQUALITY	<input type="text" value="Poor"/>
	<input type="text" value="55"/> <input type="text" value="20"/> <input type="text" value="12.12"/>		<input type="text" value="160"/> <input type="text" value="31"/> <input type="text" value="27.84"/>		GPSOURCE	<input type="text" value="Scaled"/>
LATDEC	<input type="text" value="55.3367"/>	LONDEC	<input type="text" value="160.5244"/>			

PROJECT	<input type="text" value="OPR-P183"/>	ITEMSTATUS	<input type="text" value="Assigned"/>	SEARCHTYPE	<input type="text" value="Full"/>
RADIUS	<input type="text" value="600"/>	INIT	<input type="text" value="MBH"/>	ASSIGNED	<input type="text" value="6/4/2002"/>
TECNIQ	<input type="text" value="S2,MB,ES,DI,SD,LIDAR"/>				

Techniqnot

History

Fieldnot

Proprietar

YEARSUNK	<input type="text" value=""/>	NIMANUM	<input type="text" value=""/>	SYSTEMNUM	<input type="text" value="14194"/>	<input type="button" value="Print Record"/>
----------	-------------------------------	---------	-------------------------------	-----------	------------------------------------	---

RECD	<input type="text" value="52988"/>	VESLTERMS	<input type="text" value="CONQUEST"/>	CHART	<input type="text" value="16553"/>	AREA	<input type="text" value="P"/>
		CARTOCODE	<input type="text" value="100"/>	SNDINGCODE	<input type="text" value=""/>	DEPTH	<input type="text" value=""/>

NATIVLAT	<input type="text" value="55/20/12.00"/>	NATIVLON	<input type="text" value="160/32/24.00"/>	<input type="button" value="convert"/>	NATIVDATUM	<input type="text" value="31"/>
LAT83	<input type="text" value="55/20/12.00"/>	LONG83	<input type="text" value="160/32/24.00"/>	<input type="button" value="update"/>	GPQUALITY	<input type="text" value="Low"/>
	<input type="text" value="55"/> <input type="text" value="20"/> <input type="text" value="12"/>		<input type="text" value="160"/> <input type="text" value="32"/> <input type="text" value="24"/>		GPSOURCE	<input type="text" value="Direct"/>
LATDEC	<input type="text" value="55.336666666667"/>	LONDEC	<input type="text" value="160.54"/>			

PROJECT	<input type="text" value="OPR-P183"/>	ITEMSTATUS	<input type="text" value="Assigned"/>	SEARCHTYPE	<input type="text" value="Full"/>
RADIUS	<input type="text" value="600"/>	INIT	<input type="text" value="MBH"/>	ASSIGNED	<input type="text" value="6/4/2002"/>
TECHNIQ	<input type="text" value="S2,MB,ES,DI,SD,LIDAR"/>				

Techniqnot

History

Fieldnot

Proprietar

YEARSUNK	<input type="text" value=""/>	NIMANUM	<input type="text" value=""/>	SYSTEMNUM	<input type="text" value="14195"/>	<input type="button" value="Print Record"/>
----------	-------------------------------	---------	-------------------------------	-----------	------------------------------------	---

APPROVAL SHEET
H11147 (A-I, L-N)

Initial Approvals:

The survey and associated records have been inspected with regard to survey coverage, delineation of the depth curves, development of critical depths, cartographic symbolization, and verification or disproval of charted data. The survey records and digital data comply with NOS requirements except where noted in the Descriptive Report and are adequate to supersede prior surveys and nautical charts in the common area.

_____ Date: _____

Gary C. Nelson
Cartographic Team Leader
Pacific Hydrographic Branch

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

_____ Date: _____

David O. Neander
Captain, NOAA
Chief, Pacific Hydrographic Branch