

H11030

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.* B

*Registry No.* H-11030

### LOCALITY

*State* Alaska

*General Locality* Cook Inlet

*Sublocality* Woronzof Shoal to Anchorage

2001

CHIEF OF PARTY  
Frederick W. Iversen

### LIBRARY & ARCHIVES

DATE

**H-11030****HYDROGRAPHIC TITLE SHEET**INSTRUCTIONS - The hydrographic sheet should be accompanied by this form,  
filled in as completely as possible, when the sheet is forwarded to the office.

FIELD NO.

**B**State ALASKAGeneral Locality Cook InletSublocality Woronzof Shoal to AnchorageScale 1:10,000Date of Survey May 18 - September 8, 2001Instructions Date 3/1/2001Project No. OPR-P385-KR-01Vessel Sea Ducer (AK 0691 P), Jolly Pickle (AK 3472 M)Chief of Party Frederick W. IversenSurveyed by Iverson, Battan, Boulanger, Bergman, Dollard, Englebreck, Esposito,  
Farley, Gates, Hocker, Howland, Hussey, Kemp, McCrary, Parent, et allSoundings taken by echo sounder Reson 8101, Reson 8124Graphic record scaled by TERRA PERSONNELGraphic record checked by TERRA PERSONNELEvaluation by B. Mihailov Automated plot by HP Design Jet 1050CVerification by G. Nelson, B. MihailovSoundings in Feet at MLLWREMARKS: The purpose of this work is to provide NOAA with modernand accurate data for Woronzof Shoal to Anchorage.PHB Revision: Report has been evaluated. Comments, revisions,and corrections are entered as endnotes.ALL TIMES ARE RECORDED IN UTC. UTM Zone 5TERRA SURVEYS1930 South Whiting CirclePalmer, AK 99645

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**Separates<sup>1</sup>**

I	Acquisition and Processing Logs- <i>Delivered in Project Wide Format</i>
II	Side Scan Contact Listing and Images of Significant Contacts- <i>Not Applicable for this survey</i>
III	Sound Velocity Profile Data- <i>Delivered in same binder as Separate V Crossline Comparisons</i>
IV	Hydrographic Survey Letter Instructions/Statement of Work- <i>Not Applicable for this survey</i>
V	Crossline Comparisons- <i>Delivered in same binder as Separate III Sound Velocity Profile Data</i>

**Descriptive Report to Accompany Hydrographic Survey H-11030**

**Sheet B**

**Scale 1:10,000**

**May-September 2001**

**Terra Surveys, LLC**

**Chief of Party: Frederick W. Iversen**

**A. AREA SURVEYED**

This navigable area survey was conducted in accordance with Hydrographic Project Instructions OPR-P385-KR-2001<sup>2</sup>, Approaches to Anchorage, Northern Cook Inlet; Alaska dated March 1, 2001.

The purpose of this contract was to provide NOAA with modern, accurate hydrographic survey data with which to update the nautical charts of this area. Dramatic bottom changes, both shoaling and deepening have been reported. The survey area is approximately 12.3 square nautical miles with the southerly limits 0.4 nautical miles south of Woronzof Shoal and the northerly limits off the city of Anchorage. Cook Inlet is a major commercial shipping lane for the Port of Anchorage, which lies on the eastern edge of this project. It has been an established international Port since 1961. A new dock; Port Mackenzie is on the west shore, and north of this survey. Construction for the Port Mackenzie dock began in 1998 and there is a comprehensive plan of development in the near future. These Ports and the ships that use them rely heavily on the accuracy of the nautical chart that covers this area. Both Ports are detailed further in Section D. Additional Results.<sup>3</sup>

Two shallow water, multibeam sonar systems were used to locate and determine the least depths over the obstructions, wrecks and shoals as well as to determine the least depths over the entire project area. This survey has a maximum depth of 166 feet and a minimum depth of 9 feet above datum.<sup>4</sup>

**COVERAGE GRAPHIC**

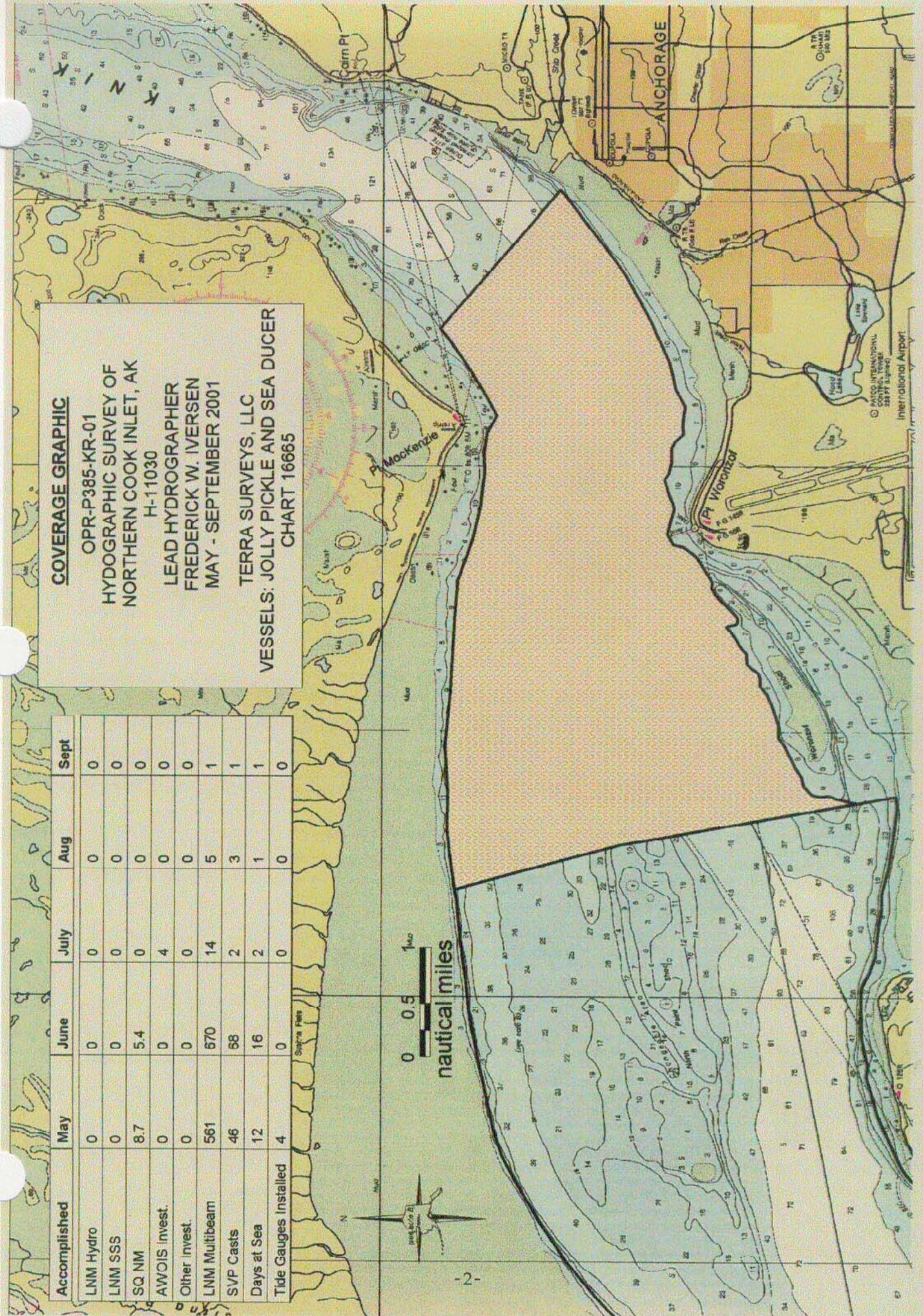
OPR-P385-KR-01  
 HYDROGRAPHIC SURVEY OF  
 NORTHERN COOK INLET, AK  
 H-11030

LEAD HYDROGRAPHER  
 FREDERICK W. IVERSEN  
 MAY - SEPTEMBER 2001

TERRA SURVEYS, LLC  
 VESSELS: JOLLY PICKLE AND SEA DUCER  
 CHART 16665

Accomplished	May	June	July	Aug	Sept
LNM Hydro	0	0	0	0	0
LNM SSS	0	0	0	0	0
SQ NM	8.7	5.4	0	0	0
AWOIS invest.	0	0	4	0	0
Other invest.	0	0	0	0	0
LNM Multibeam	561	670	14	5	1
SVP Casts	46	68	2	3	1
Days at Sea	12	16	2	1	1
Tide Gauges Installed	4	0	0	0	0

0 0.5 1  
 nautical miles



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 2437 (upside down)

International Airport

## B.1 Equipment

### *Seaducer*

Approximately 83 percent of the soundings for this survey were acquired from the motor vessel *SeaDucer*, with the remaining data collected from the jet boat *Jolly Pickle*. The *SeaDucer* is a custom built aluminum Uscola Offshore Pilot vessel. Its overall length is thirty-one feet, with a beam of 10 feet and a draft of 1-2 feet. Major systems used on the *SeaDucer* are listed on the following table.

<b>VESSEL <i>Seaducer</i></b>	
<b>LOA: 31 FT, BEAM 10.0 FT, DRAFT: 1-2 FT</b>	
<b>Equipment</b>	<b>Manufacturer &amp; Model</b>
Multibeam sonar	Reson SeaBat 8101
Positioning	Seatex Seapath 200
Sound velocity	Applied Microsystems 3317, 3279, 4427
Vessel attitude	Seatex Seapath 200

### *Jolly Pickle*

The *Jolly Pickle* is a twenty-four foot Almar aluminum jet boat with an 8-foot beam and a draft of 1 ft. Major systems used on the *Jolly Pickle* are listed on the following table.

<b>VESSEL <i>Jolly Pickle</i></b>	
<b>LOA: 24 FT, BEAM 8 FT, DRAFT: 1 FT</b>	
<b>Equipment</b>	<b>Manufacturer &amp; Model</b>
Multibeam sonar	Reson SeaBat 8124
Positioning	Seatex Seapath 200 RTK Trimble AG120 DGPS
Sound velocity	Applied Microsystems 3259, 4425
Vessel attitude	Seatex Seapath 200

Equipment performance details are provided in the Project-Wide Report, Sections A, Equipment and B, Quality Control.<sup>5</sup>

## B2. Quality Control

The internal consistency and integrity of the survey data was found to be good. All of the soundings that appear on the smooth sheet meet or exceed the accuracy requirements of the specifications.

Survey H-11030 (Sheet B) has 1150 Nautical Miles of main scheme lines and 55 NM of crosslines. This equates to 4.8 % of the mainscheme lines and is slightly less than the requirements of 5%. The difference is due to “fill in” lines ran, after the mainscheme were done, to collect data for any gaps in coverage.

There were 57 crosslines and 1040 mainscheme lines in Sheet B. This resulted in 3904 crossings. A total of 43 crossings were analyzed, each one from a different crossline, which complies with the requirements of the SOW.<sup>6</sup>

Statistical analysis of the crossline comparisons was accomplished using the Caris HIPS Quality control report tool. This tool is used to compare the sounding data from the crossline against a reference DTM surface. The reference DTM surface is constructed with soundings from a mainscheme survey line. In most cases the mainscheme line was selected to be close in time to the crossline in order to minimize any failed intersections due to bottom change as opposed to sounder error. The changing seafloor is very apparent in Cook Inlet and is detailed further in the Project Wide Data Acquisition and Processing report. The output from this tool is a text report containing statistical results of the differences between the crossline data and the mainscheme line data. The statistics are grouped by sonar beam number and can be found in Separate V<sup>7</sup> of this report. A spreadsheet is included which summarizes the range of beams within each crossline comparison which meet or exceed the 95% compliance standard.

The crossline reports generated with the Caris program use a class file that was developed from the NOAA specifications for this project. The table below shows the parameters for this class file.

<b>Min. Depth</b>	<b>Max. Depth</b>	<b>Allowable Error</b>
<b>0.0m</b>	<b>-10.00m</b>	<b>0.50m</b>
<b>-10.00m</b>	<b>-20.00m</b>	<b>0.54m</b>
<b>-20.00m</b>	<b>-30.00m</b>	<b>0.60m</b>
<b>-30.00m</b>	<b>-40.00m</b>	<b>0.68m</b>
<b>-40.00m</b>	<b>-50.00m</b>	<b>0.77m</b>
<b>-50.00m</b>	<b>-1000.00m</b>	<b>1.4%</b>

*Each error in the file is for a depth mid way between each group (ex. -10.00 to -20.00 uses -15 depth to compute an allowable error of .54). From -50m and deeper, a slope was computed. The computed allowable errors met NOAA specifications for this project.<sup>8</sup>*

Two histograms were made from the final smoothsheet soundings. The graphs show sounding distribution by beam number. Two multi-beam echo sounders were used on H-11029, Sheet A. One was a Reson 8101 with 101 beams and the other a Reson 8124 with 80 beams. The beams for the 8101 sounder are numbered from port to starboard, 1-101 with beam 51 representing the nadir beam. Likewise the 8124 sounder is numbered from port to starboard, 1-80.

### **8101 Histogram (*Seaducer*)**

There are two anomalies that are obvious in this chart. There are a large number of soundings used that come from the nadir area of the swath. The other irregularity observed in the data is that there is a definite bias favoring the midrange beams of the port side.

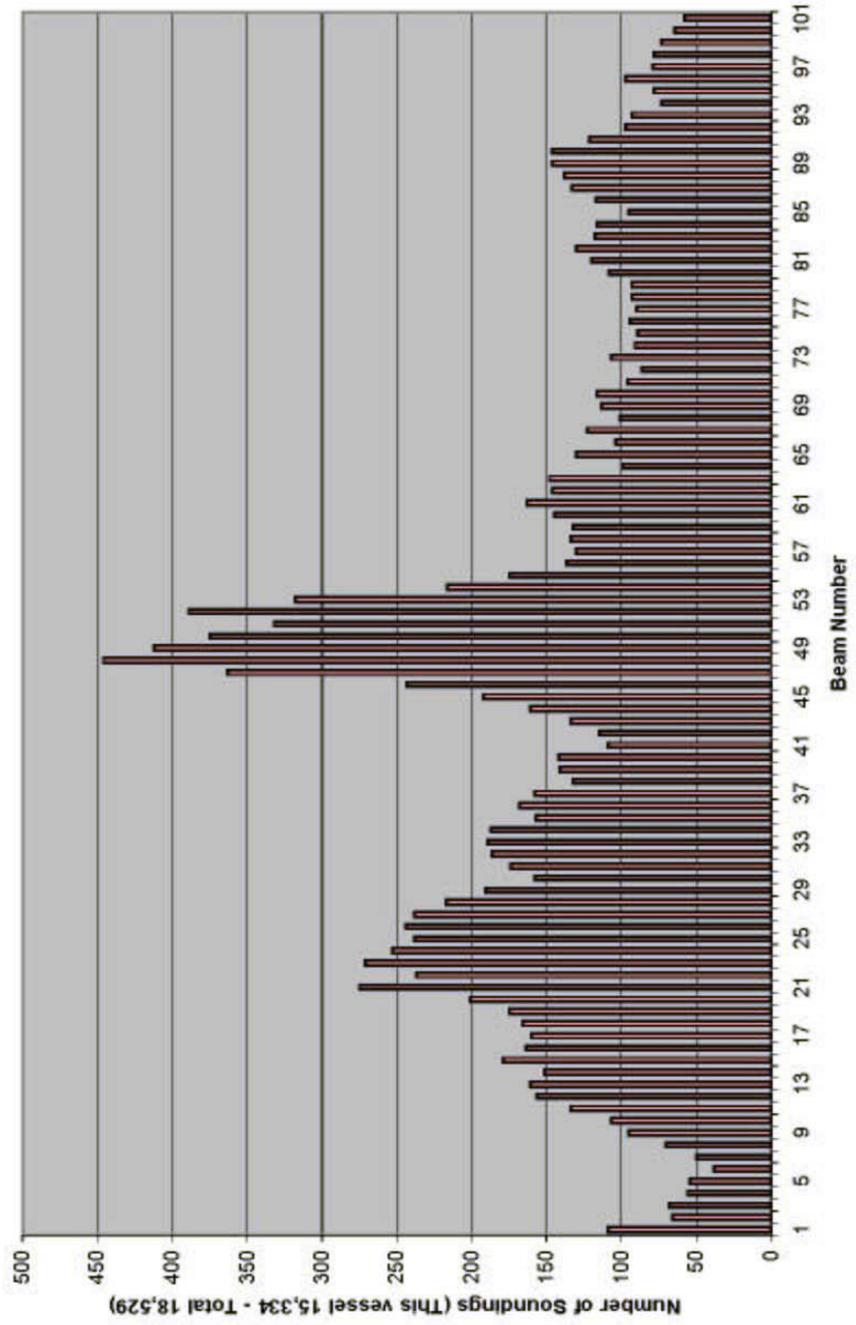
The above average nadir beam selections is something Terra Surveys, LLC has seen before and is systematic to this sounder. It is called the nadir spiking effect and it can be seen as an artifact in the sun illuminated DTM image. When two lines from this sounder are compared using the crossline analysis tool, the number of acceptable soundings of these beam numbers (48-53) is usually slightly less (less than 5%) than that of their neighbors but still within acceptable tolerance. The shoal biasing of all cells brings these slightly shoaler soundings into the final data set.

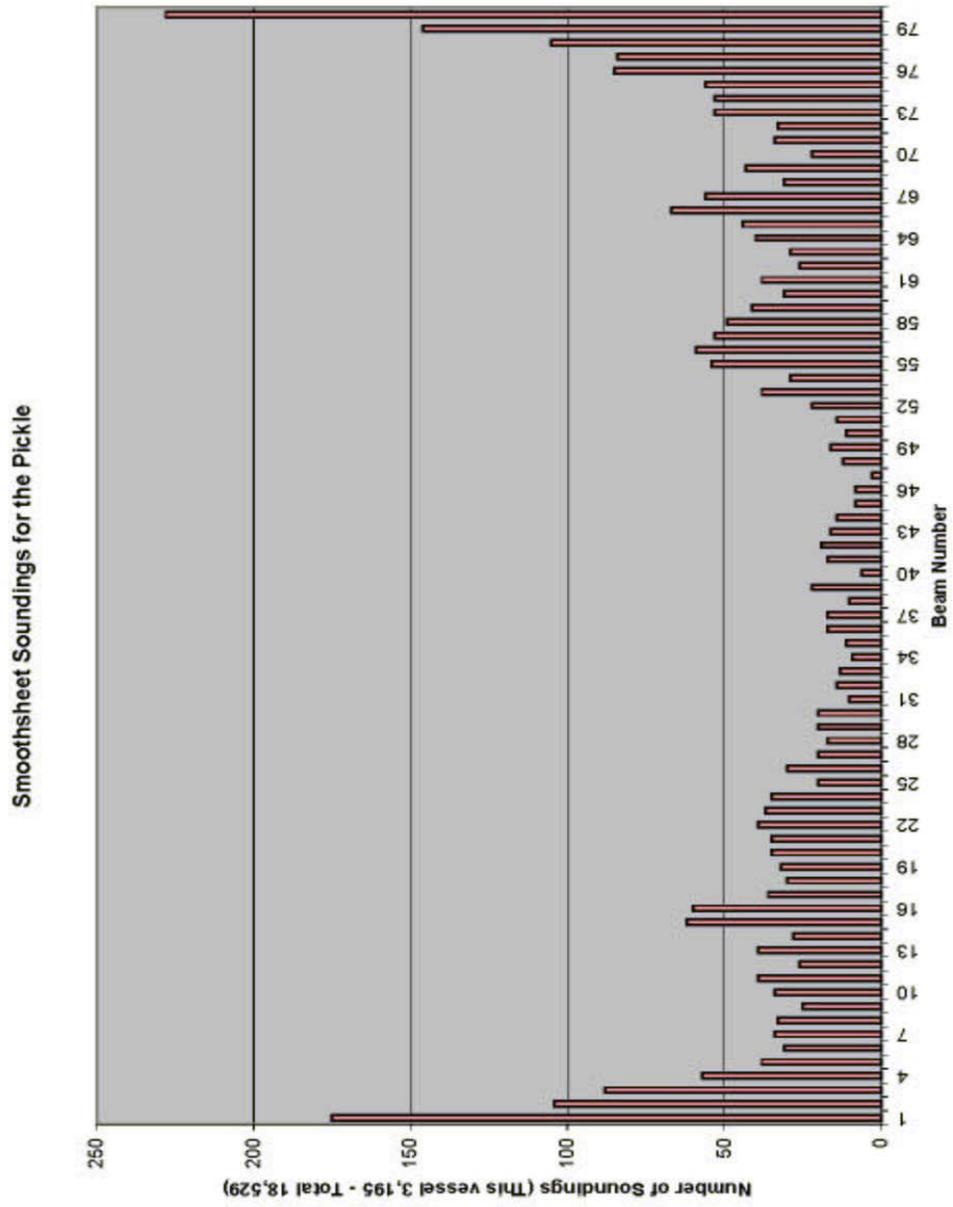
The port side bias is probably the result of these soundings being collected during the time when we had sonar noise producing outrides on the collection vessel. The port side data required an extra effort in cleaning and had a wider range of depths than the starboard. All soundings represented on the smooth sheet passed tolerances, but the wider range on the port side produced more smoothsheet soundings upon shoal biasing.<sup>9</sup>

### **8124 Histogram (*Jolly Pickle*)**

The chart shows large spikes in the outer beams. The Jolly Pickle was used for a large amount of the shoal surveying along the shore. A review of the smoothsheet verified that most shoreline soundings were from the 8124's outer beams. This is a result of surveying parallel to the shore with the Jolly Pickle, and generally caused the outer beams to collect the shoalest soundings.

Smoothsheet Soundings for the Sea Ducer





***Beam # v.s. # of Soundings on Smoothsheet by Vessel***

<u>Vessel</u>	<u>Beam</u>	<u>Count</u>	<u>Vessel</u>	<u>Beam</u>	<u>Count</u>
Pickle	1	175	Pickle	42	19
Pickle	2	104	Pickle	43	16
Pickle	3	88	Pickle	44	14
Pickle	4	57	Pickle	45	8
Pickle	5	38	Pickle	46	8
Pickle	6	31	Pickle	47	3
Pickle	7	34	Pickle	48	12
Pickle	8	33	Pickle	49	16
Pickle	9	25	Pickle	50	11
Pickle	10	34	Pickle	51	14
Pickle	11	39	Pickle	52	22
Pickle	12	26	Pickle	53	38
Pickle	13	39	Pickle	54	29
Pickle	14	28	Pickle	55	54
Pickle	15	62	Pickle	56	59
Pickle	16	60	Pickle	57	53
Pickle	17	36	Pickle	58	49
Pickle	18	30	Pickle	59	41
Pickle	19	32	Pickle	60	31
Pickle	20	35	Pickle	61	38
Pickle	21	35	Pickle	62	26
Pickle	22	39	Pickle	63	29
Pickle	23	37	Pickle	64	40
Pickle	24	35	Pickle	65	44
Pickle	25	20	Pickle	66	67
Pickle	26	30	Pickle	67	56
Pickle	27	20	Pickle	68	31
Pickle	28	17	Pickle	69	43
Pickle	29	20	Pickle	70	22
Pickle	30	20	Pickle	71	34
Pickle	31	10	Pickle	72	33
Pickle	32	14	Pickle	73	53
Pickle	33	13	Pickle	74	53
Pickle	34	9	Pickle	75	56
Pickle	35	11	Pickle	76	85
Pickle	36	17	Pickle	77	84
Pickle	37	17	Pickle	78	105
Pickle	38	10	Pickle	79	146
Pickle	39	22	Pickle	80	228
Pickle	40	6			
Pickle	41	17			
				<u>Total</u>	<u>3074</u>

***Beam # v.s. # of Soundings on Smoothsheet by Vessel***

<u>Vessel</u>	<u>Beam Count</u>		<u>Vessel</u>	<u>Beam Count</u>	
Sea Ducer	1	109	Sea Ducer	41	109
Sea Ducer	2	66	Sea Ducer	42	115
Sea Ducer	3	68	Sea Ducer	43	134
Sea Ducer	4	56	Sea Ducer	44	161
Sea Ducer	5	54	Sea Ducer	45	192
Sea Ducer	6	38	Sea Ducer	46	243
Sea Ducer	7	50	Sea Ducer	47	363
Sea Ducer	8	70	Sea Ducer	48	446
Sea Ducer	9	95	Sea Ducer	49	412
Sea Ducer	10	107	Sea Ducer	50	375
Sea Ducer	11	134	Sea Ducer	51	332
Sea Ducer	12	156	Sea Ducer	52	389
Sea Ducer	13	161	Sea Ducer	53	318
Sea Ducer	14	151	Sea Ducer	54	216
Sea Ducer	15	179	Sea Ducer	55	175
Sea Ducer	16	164	Sea Ducer	56	137
Sea Ducer	17	160	Sea Ducer	57	130
Sea Ducer	18	166	Sea Ducer	58	134
Sea Ducer	19	175	Sea Ducer	59	132
Sea Ducer	20	201	Sea Ducer	60	145
Sea Ducer	21	275	Sea Ducer	61	163
Sea Ducer	22	237	Sea Ducer	62	146
Sea Ducer	23	271	Sea Ducer	63	148
Sea Ducer	24	253	Sea Ducer	64	99
Sea Ducer	25	238	Sea Ducer	65	130
Sea Ducer	26	244	Sea Ducer	66	104
Sea Ducer	27	238	Sea Ducer	67	123
Sea Ducer	28	217	Sea Ducer	68	101
Sea Ducer	29	191	Sea Ducer	69	113
Sea Ducer	30	158	Sea Ducer	70	116
Sea Ducer	31	174	Sea Ducer	71	96
Sea Ducer	32	186	Sea Ducer	72	86
Sea Ducer	33	189	Sea Ducer	73	107
Sea Ducer	34	187	Sea Ducer	74	91
Sea Ducer	35	157	Sea Ducer	75	89
Sea Ducer	36	168	Sea Ducer	76	94
Sea Ducer	37	158	Sea Ducer	77	90
Sea Ducer	38	132	Sea Ducer	78	93
Sea Ducer	39	141	Sea Ducer	79	93
Sea Ducer	40	142	Sea Ducer	80	108

***Beam # v.s. # of Soundings on Smoothsheet by Vessel***

**Vessel Beam Count**

Sea Ducer	81	120
Sea Ducer	82	130
Sea Ducer	83	118
Sea Ducer	84	116
Sea Ducer	85	95
Sea Ducer	86	117
Sea Ducer	87	133
Sea Ducer	88	138
Sea Ducer	89	146
Sea Ducer	90	146
Sea Ducer	91	121
Sea Ducer	92	97
Sea Ducer	93	93
Sea Ducer	94	73
Sea Ducer	95	78
Sea Ducer	96	97
Sea Ducer	97	79
Sea Ducer	98	78
Sea Ducer	99	73
Sea Ducer	100	64
Sea Ducer	101	58
<u>Total</u>		<u>14991</u>

**Summary By Vessel:**

Pickel	Total Number of Soundings =	3,074
Sea Ducer	Total Number of Soundings =	<u>14,991</u>
		<u>18,065</u> Soundings

### Contemporary Survey Junctions

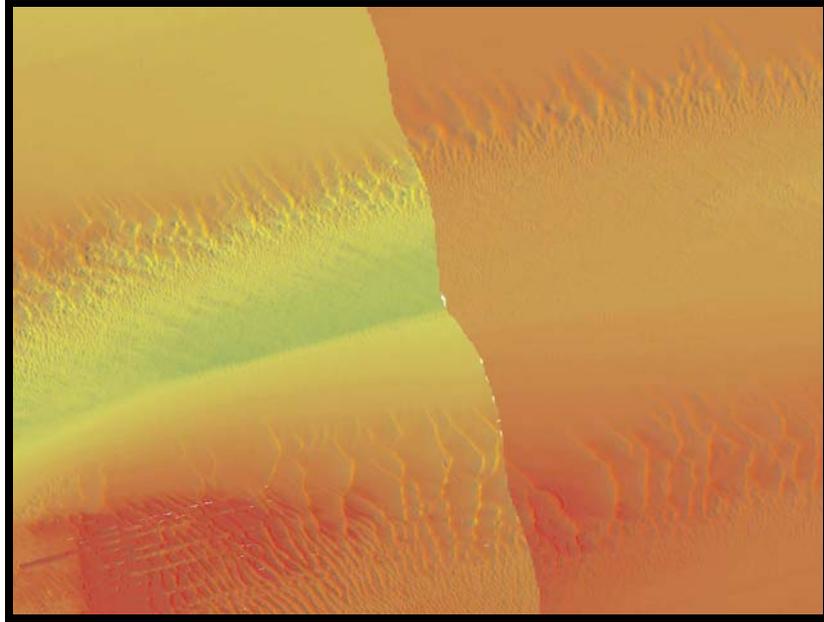
This survey was compared to H-11031 (2001, Scale 1:10,000) and H-11029 (2001, Scale 1:20,000). They adjoin this survey at the northern and southern limits respectfully. Generally the two surveys agreed. However for H-11031 (Sheet C), in the area of 61°14'08.07"N, 149°56'40.54"W, there are several soundings that differ by as much as 19 feet<sup>10</sup>. Further investigation shows that the data with discrepancies was collected 34 days apart and is an area of typical Cook Inlet bottom movement. In H-11029 (Sheet A) there are several areas that differ by as much as 8 feet.<sup>11</sup> This is also in area of bottom movement. The DTM shows significant sand wave action along this junction. The table below details the positions and days apart surveyed.

This phenomenon is discussed in detail in the Project Wide Data Acquisition Report and in Section D<sup>12</sup> of this report. It is recommended that contours and soundings be updated in the next chart edition.<sup>13</sup>

### Compare H-11030(B) to H-11029(A) Junction<sup>14</sup>

Latitude	Longitude	H-11030 (B) depth	H-11029 (A) depth	Days Apart Surveyed	Comment
61°13'39.67"	150°07'41.18"	20 feet	14 feet	49 days	Shoaling
61°13'13.62"	150°07'18.87"	19 feet	11 feet	72 days	Shoaling
61°12'53.15"	150°07'18.25"	11 feet	5 feet	67 days	Shoaling
61°12'43.57"	150°07'08.08"	16 feet	9 feet	67 days	Deepening

The DTM image below shows some of the sand wave action along the junction of H-11030 and H-11029.



*The DTM images from both surveys overlaid.*

### **Quality Control Checks**

All of the quality control methods and procedures are detailed in the Project Wide Data Acquisition and Processing Report. There were no unique problems that pertain to this survey. A table of Line Statistics is included in Separate V, Crossline Comparisons<sup>15</sup> that details all required aspects of quality control on each line.<sup>16</sup>

### **B3. Corrections To Echo Soundings**

Hydrographic Survey H-11030 was performed with two other surveys in Project OPR-P385-KR-2001<sup>17</sup>. Any changes affects all three surveys in the area and is described in the project wide Data Acquisition and Processing Report.<sup>18</sup> There are some unique tide corrections to this sheet. This is summarized below and detailed in Section C. of the Project Wide Data Acquisition and Processing Report.

Daily measurements from a Reference Point (RP) on the hull to the waterline derived static draft. The draft was recorded twice daily. The draft readings were incorporated into a database, which included the date and time, line name, and engine RPM. This static draft was used in conjunction with the settlement and squat data to create a delta-draft file used in Caris processing.<sup>19</sup>

#### **Tide Issues unique to H-11030**

The survey began on DN 138. Tide stations Fire Island (945-5912) and Port Mackenzie (945-5934) began collecting data on DN 148. Survey data collected before Fire Island (945-5912) data was available was processed using Anchorage (945-5920) and Nikiski (945-5760). The Discreet zone interpolation method was used. The time offset for Nikiski was determined using an average of the highs and lows published on NOAA's web server. Nikiski (945-5760) was used as the secondary gauge in the adjustment. The standard discreet zone with time offset and range corrector method left tidal artifacts approaching 1 meter. The Discreet zone interpolation method reduced the tidal artifacts to 0.3 meters or less. The data collected after the Fire Island (945-5912) gauge was operational was reduced using Anchorage (945-5920) and Fire Island (945-5912) and the discreet zone interpolation method.

### C. Vertical and Horizontal Control

Soundings for this survey were tide adjusted using data from NOAA Tide Station Anchorage 945-5920, Nikiski (945-5760), Fire Island 945-5912, and Port Mackenzie 945-5934. The Fire Island and Port Mackenzie gauges are subordinate stations installed by Terra Surveys, LLC and LCMF Inc for this project. Anchorage preliminary water level data was downloaded from the NOAA web site (<http://www.co-ops.nos.noaa.gov>) daily. The survey began on DN 138. Tide stations Fire Island (945-5912) and Port Mackenzie (945-5934) began collecting data on DN 148. Survey data collected before Fire Island (945-5912) data was available was processed using Anchorage (945-5920) and Nikiski (945-5760). The Discreet zone interpolation method was used. The time offset for Nikiski was determined using an average of the highs and lows published on NOAA's web server. Nikiski (945-5760) was used as the secondary gauge in the adjustment. The standard discreet zone with time offset and range corrector method left tidal artifacts approaching 1 meter. The Discreet zone interpolation method reduced the tidal artifacts to 0.3 meters or less. The data collected after the Fire Island (945-5912) gauge was operational was reduced using Anchorage (945-5920) and Fire Island (945-5912) and the discreet zone interpolation method. The final zoning methodology is described in further detail in the Project wide Vertical and Horizontal Control report.<sup>20</sup>

The horizontal control datum for this survey is North American Datum of 1983 (NAD 83). The projection used during collection was UTM, Zone 5. United States Coast Guard Stations (USCG) *TSEA* and *Kenai* were used to send correctors to the survey vessels. A 24-hour observation on Cooperative station *CMJV2* was used as a fixed point DGPS performance check on *TSEA*. The observation survey showed the position on *CMJV2* met the required accuracy standards. The 24-hour observation survey is detailed in the Project Wide Vertical and Horizontal Control report. A summary of the daily DGPS confidence checks can be found in the Project Wide Vertical and Horizontal Control report as well.

### D1. Chart Comparison

There were no Local Notice to Mariners that affected the survey area. Notice number 36(Monthly Edition-September 2001) was the last notice reviewed for this project.

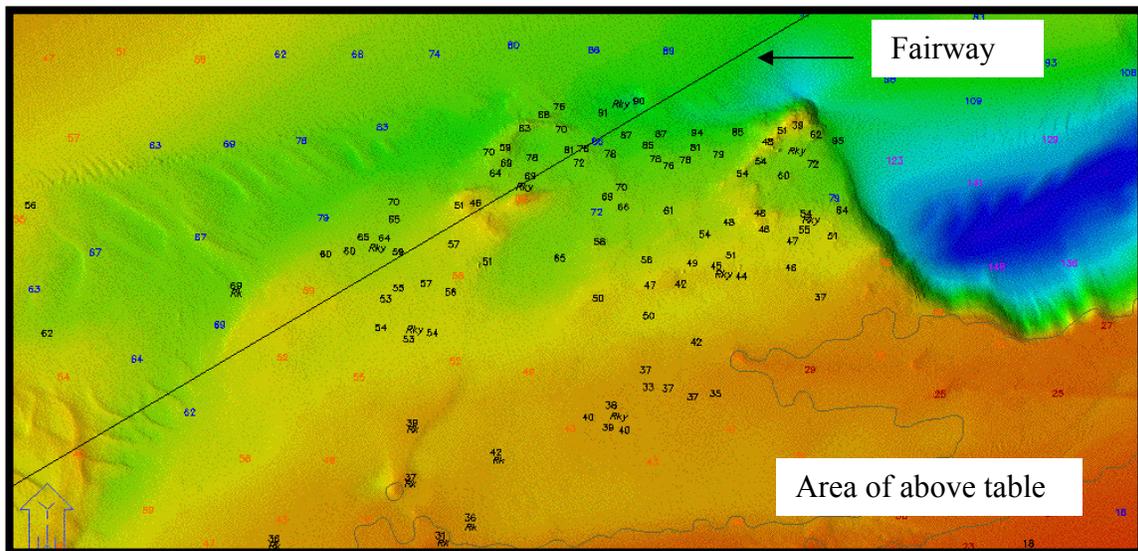
This survey was compared in AutoCAD Map and MicroStation to the following charts:<sup>21</sup>

Chart	Scale	Edition	Date
16660	1:194,154	27 <sup>th</sup>	April 19,1997
16663	1:100,000	5 <sup>th</sup>	July 12,1997
16665	1:50,000	7 <sup>th</sup>	March 31, 2001

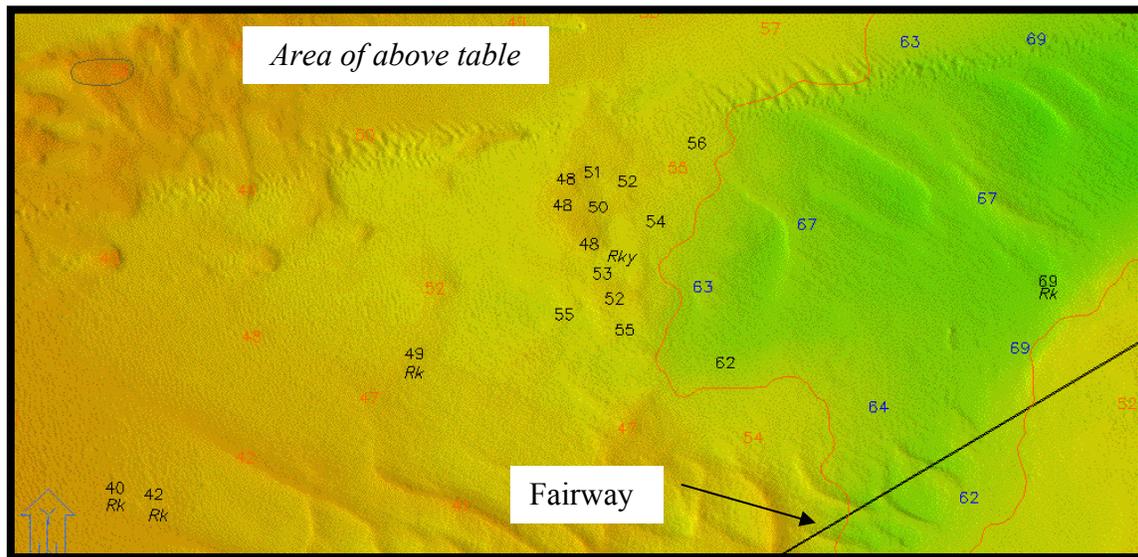
This chart comparison showed many changes within the survey. As a result, a Danger to Navigation report was generated and can be found in Appendix I of this report.<sup>22</sup>

The survey found two significant rock fields. They have been labeled as rocky (*rky*) and are described below.

Vicinity	Comment
61°13'15"N and 150°00'39" W	An area of approximately 100 notable rocks. Least depths range from 33 to 95 feet. They surround AWOIS Item 52650. The Fire Island Fairway passes through this rock field. See following screen capture. <sup>23</sup>



Vicinity	Comment
61°13'07" N and 150°02'35" W	A smaller field is centered approximately at this location with least depths ranging from 48 feet to 62 feet. This area is approximately 580 meters North of the Fire Island Fairway line. See following screen capture. <sup>24</sup>

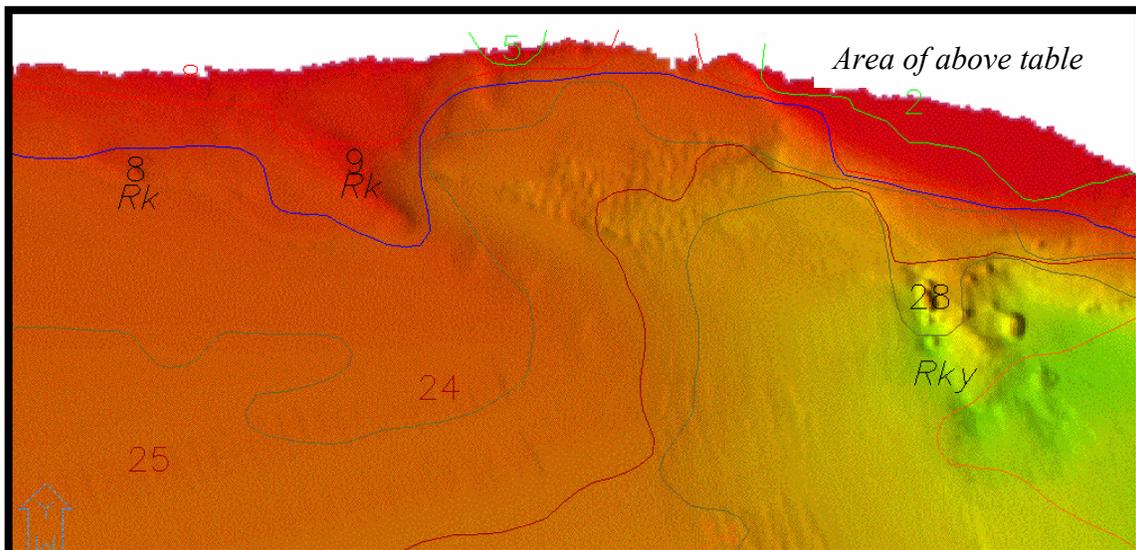


**Additional rocks not found on chart<sup>25</sup>**

Chart Depth	H-11030 Feet	Latitude				Longitude				Comment On Agreement With Chart
N/A	37	61°	13'	28.18"	N	149°	55'	23.63"	W	Rock not noted on chart
N/A	20	61°	12'	54.05"	N	149°	57'	52.70"	W	Rock not noted on chart
N/A	27	61°	12'	51.37"	N	149°	58'	46.73"	W	Rock not noted on chart
N/A	86	61°	13'	04.90"	N	149°	58'	49.31"	W	Rock not noted on chart

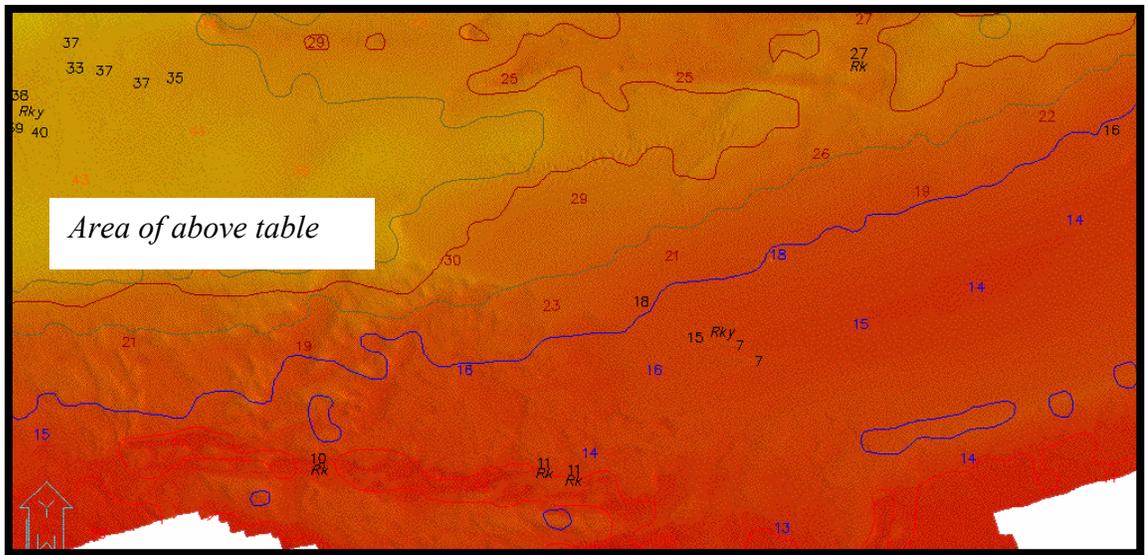
**Additional rocky areas<sup>26</sup>**

Chart Depth	H-11030 Feet	Latitude				Longitude				Comment On Agreement With Chart
N/A	11 <sup>27</sup>	61°	14'	15.49"	N	150°	01'	50.98"	W	Rock not noted on chart
N/A	8	61°	14'	04.27"	N	150°	00'	07.06"	W	Rock not noted on chart
N/A	9	61°	14'	04.20"	N	149°	59'	55.83"	W	Rock not noted on chart
N/A	Varies	61°	14'	00.20"	N	149°	59'	26.72"	W	Rocky Area not noted on chart



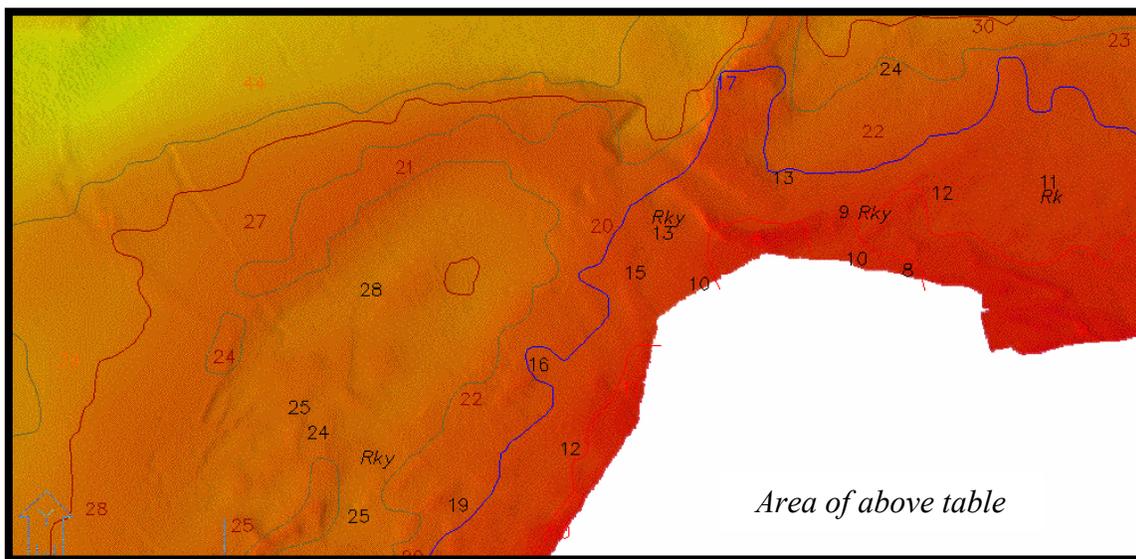
**Additional rocky areas<sup>28</sup>**

Chart Depth	H-11030 Feet	Latitude				Longitude				Comment On Agreement With Chart
N/A	Varies	61°	12'	34.67"	N	149°	59'	06.10"	W	Rocky Area not noted on chart
N/A	10	61°	12'	27.63"	N	149°	59'	59.29"	W	Rock not noted on chart



**Additional rocky areas<sup>29</sup>**

Chart Depth	H-11030 Feet	Latitude				Longitude				Comment On Agreement With Chart
N/A	Varies	61°	12'	24.93"	N	150°	01'	38.15"	W	Rocky Area not noted on chart



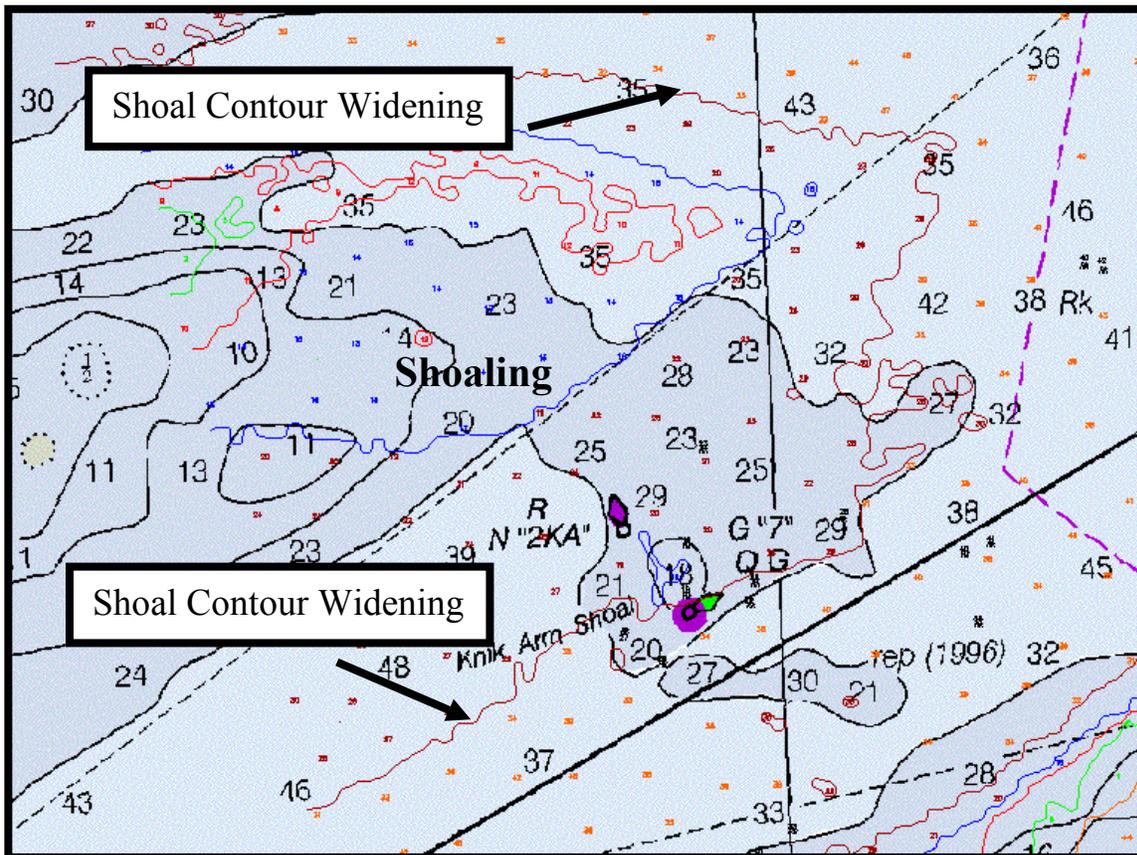
The follow is a table of soundings and positions that disagree with the chart.<sup>30</sup>

Chart Depth	H-11030 Feet	Latitude				Longitude				Comment
15	24	61°	14'	26.69"	N	150°	05'	08.69"	W	
46	28	61°	11'	57.91"	N	150°	06'	53.67"	W	
27	8	61°	11'	32.44"	N	150°	05'	11.82"	W	See Danger To Navigation Report
21	30	61°	12'	01.93"	N	150°	04'	38.71"	W	
53	40	61°	12'	49.79"	N	150°	02'	39.07"	W	See Danger To Navigation Report
56	72	61°	13'	41.56"	N	149°	56'	48.35"	W	
76	57	61°	13'	38.96"	N	149°	56'	48.35"	W	
26	19	61°	14'	22.10"	N	149°	55'	15.90"	W	
35	9	61°	13'	07.06"	N	149°	57'	09.10"	W	
35	20	61°	12'	54.28"	N	150°	06'	43.36"	W	
23	13	61°	12'	52.02"	N	150°	05'	02.84"	W	

The following images address the bottom changes discovered during this survey. Soundings were suppressed with a radius of 200 meters and all the smoothsheet contours have been superimposed on top.

### North Point and Knik Arm Shoal

The north end of North Point Shoal lies in the Southerly part of H-11030. The survey encompasses all of Knik Arm Shoal. There is significant widening and increased shoaling of this geographical area. The image below compares the survey to the chart. This is typical of the dynamics of the Cook Inlet bottom and is further described in the Project Wide Data Acquisition and Processing Report and in Section D2 of this report. This area has been addressed in the Danger to Navigation Report, Appendix I.<sup>31</sup>



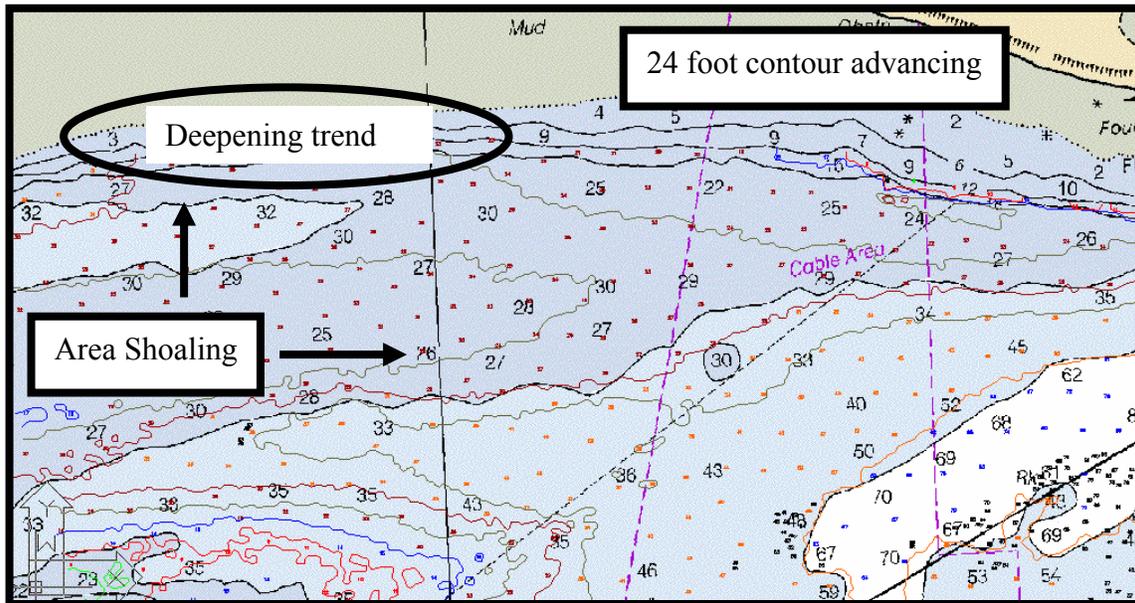
*Chart 16665 with new survey contours overlaid*

### Recommendations

The newest editions of affected charts should reflect this change. This area will require continuous surveys<sup>32</sup>

### New Channel along the North Shore

There is a deepening trend on the north side of the survey. The chart shows a channel that slopes up towards the mud, whereas the survey reveals the bottom to be shoaler in the charted channel and then slopes off into new channel where it used to be shoal. Essentially, the channel has migrated North.



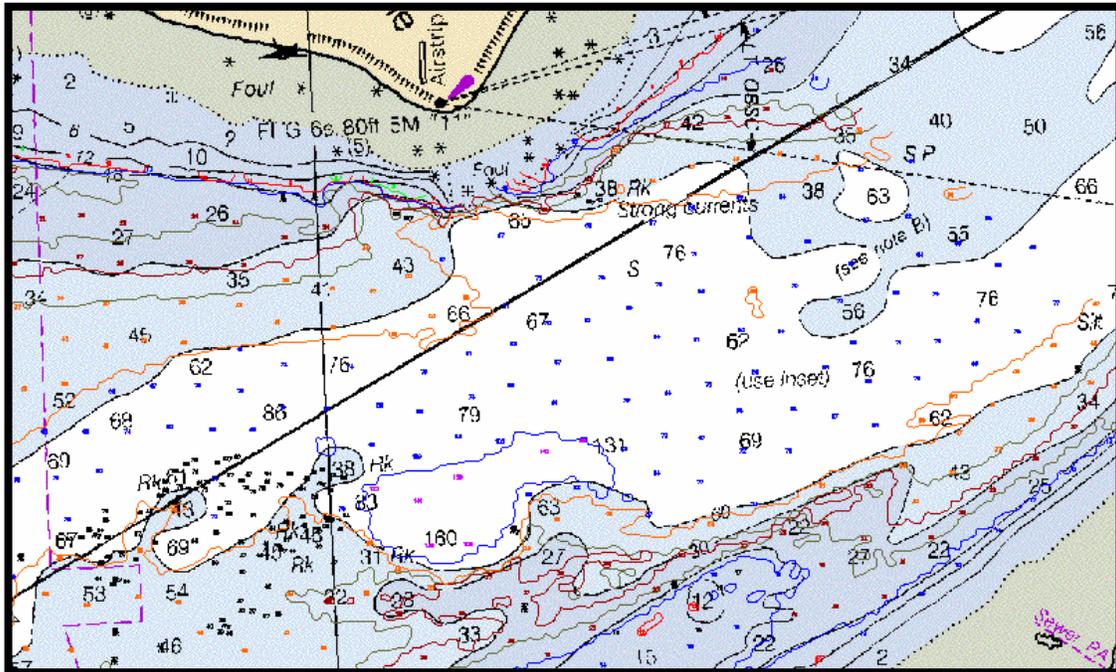
*Chart 16665 with new survey contours overlaid*

### Recommendations

The newest editions of affected charts should reflect this change. This area will require continuous surveys.<sup>33</sup>

### Bottom Changes at the North End of the Survey

There are both deepening and shoaling trends at the north end of this survey. As noted on the chart, it is an area of strong currents, therefore it is likely in a constant state of flux. This area is critical for mariners needing safe passage to the Port MacKenzie dock.



*Chart 16665 with new survey contours overlaid*

### Recommendations

The newest editions of affected charts should reflect this change. This area will require continuous surveys.<sup>34</sup>

### Woronzof Shoal

As seen below, the Woronzof Shoal is receding somewhat to the West and advancing to the North. An area just North of the Shoal has silted in above datum. This area has been addressed in the Danger to Navigation Report, Appendix I.<sup>35</sup>

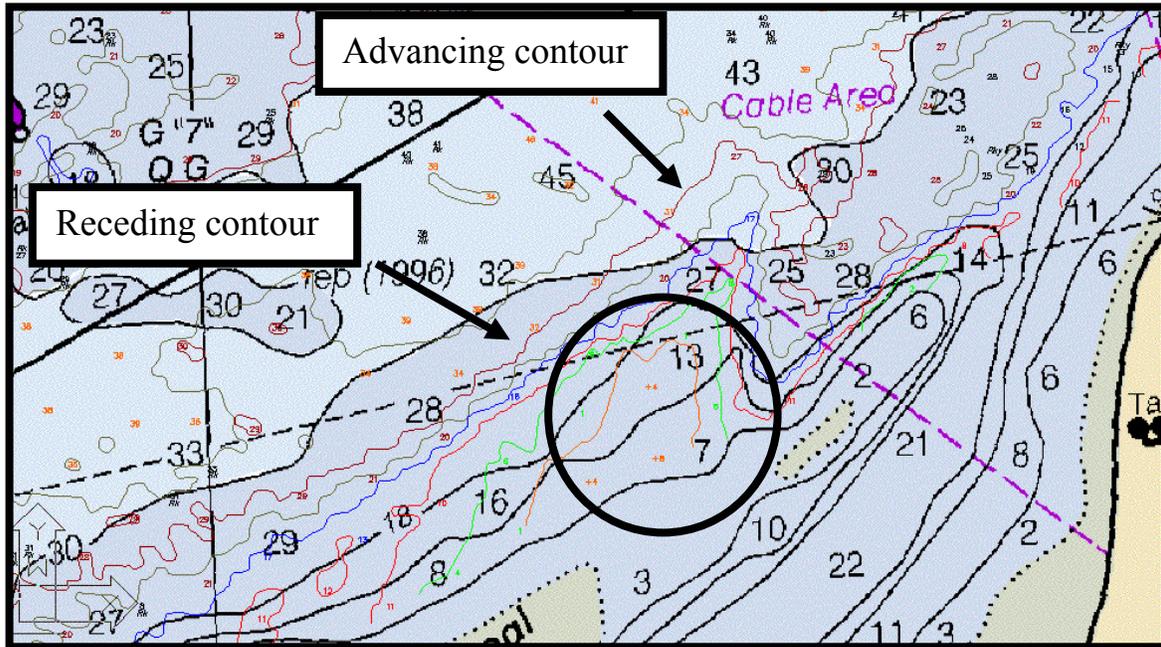
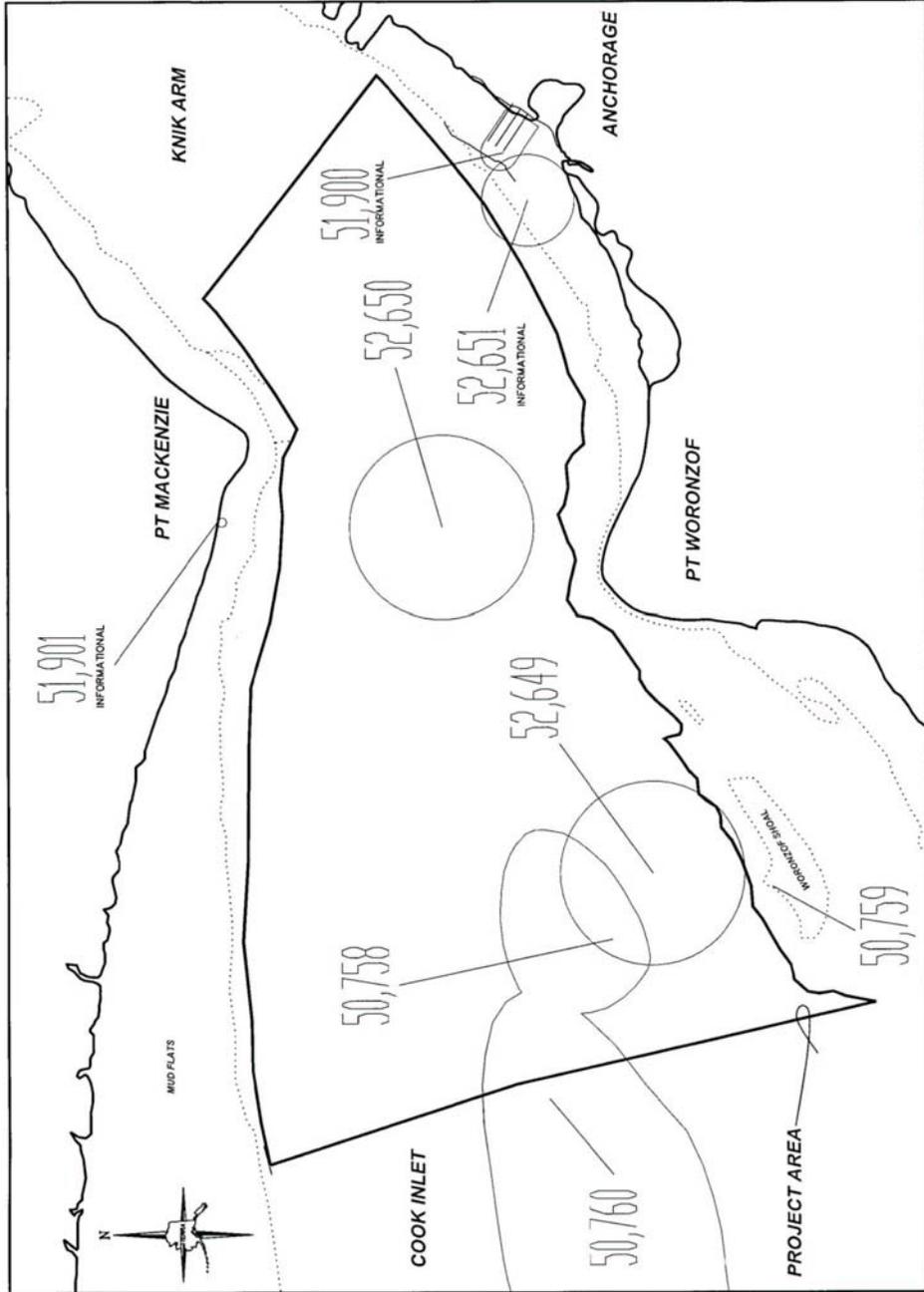


Chart 16665 with new survey contours overlaid

### Recommendations

The newest editions of affected charts should reflect this change. This area will require continuous surveys.<sup>36</sup>

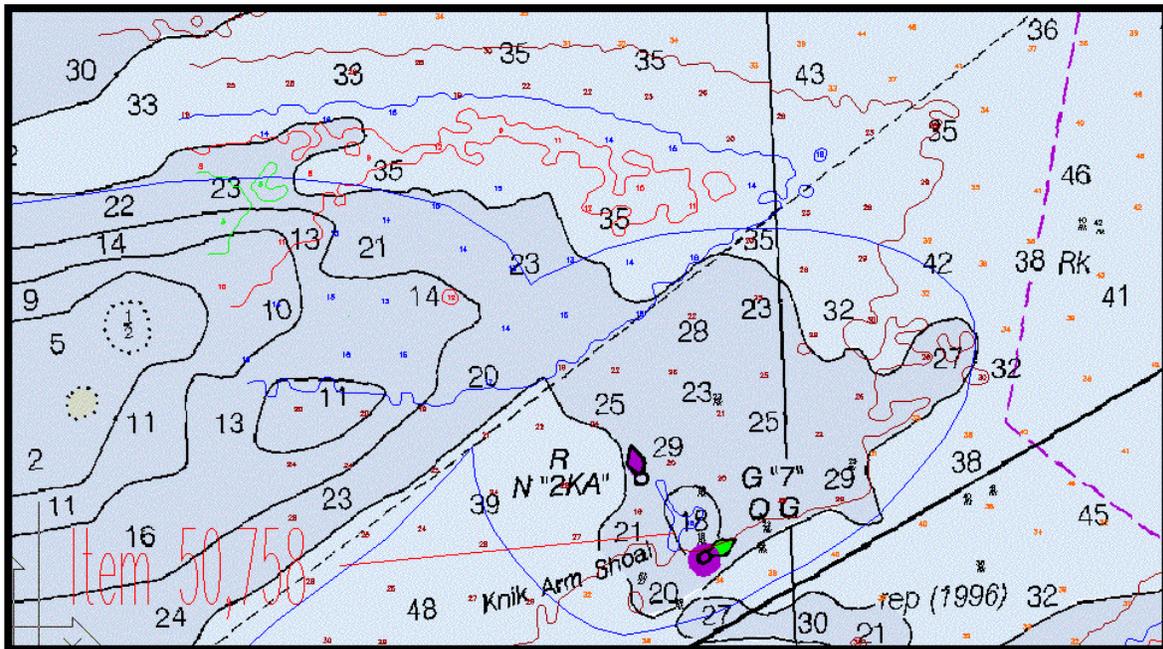
OPR-P385-KR-01  
**H 11030 - SHEET B - AWOIS**



### AWOIS Items

This contract required full investigations of four AWOIS items<sup>37</sup>. Reports and chart comparisons for each item are given on the following pages.

Record	Description	Comment
50758	Knik Arm Shoal	Feature's depth range is 16-29 feet (AWOIS History range is 18-23 feet). Shoal is advancing to the North. See screen capture. See Section D1 of this report for more on shoal definition. See AWOIS Figure 1.



AWOIS Item 50758 with contours and weeded soundings overlaid on Chart 16555

*AWOIS Figure 1*

## Item Investigation Report

Item Description (as charted): Knik Arm Shoal

Source: AWOIS 50758

Charted Position: Lat 61°12'17.01'' Long 150°05'25.99''

Charts Affected: 16665 7<sup>th</sup> edition March 2001

### Investigation

Date(s)/Day Number(s): 162

Survey Vessel Name: SeaDucer

Position Numbers/Time: 370752/ 17:22:12

Investigation Method: Shallow Water Multibeam Sonar

Surveyed Position (NAD83): Lat 61°12'18.19'' Long 150°05'21.86''

Position Determined By: Differential GPS

Investigation Summary:

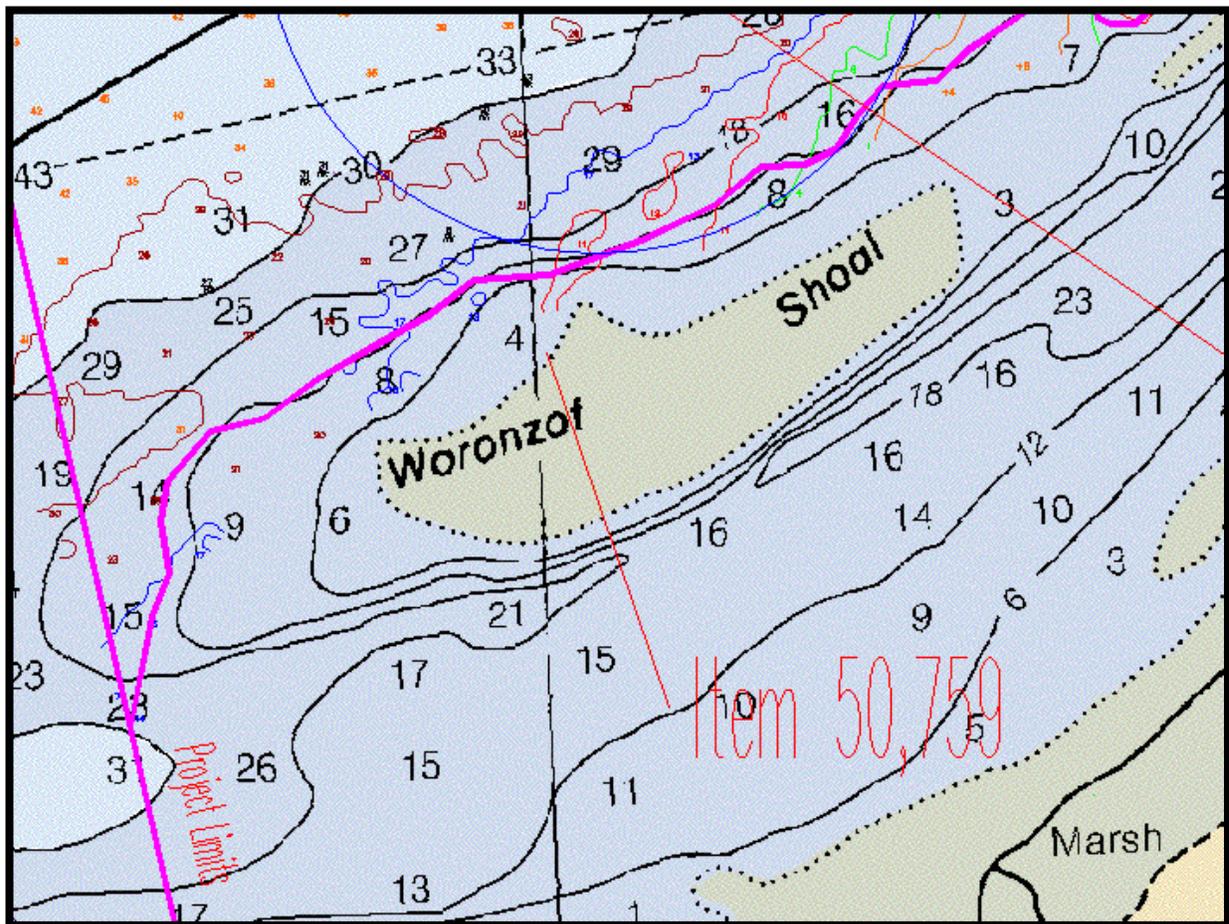
The area has full coverage. The Northeast edge as shown on the chart has migrated Northward. A dredged and maintained channel runs in a North Easterly direction on the South side of Buoy "7". Buoy "2KA" no longer exists. The least depth for the site is 16 feet located just North of Buoy "7".

### Charting Recommendation

Remove Buoy "2KA" from the chart. Adjust the contour line to the North to note the migration of the shoal.

Recommended Least Depth: 16 feet<sup>38</sup>

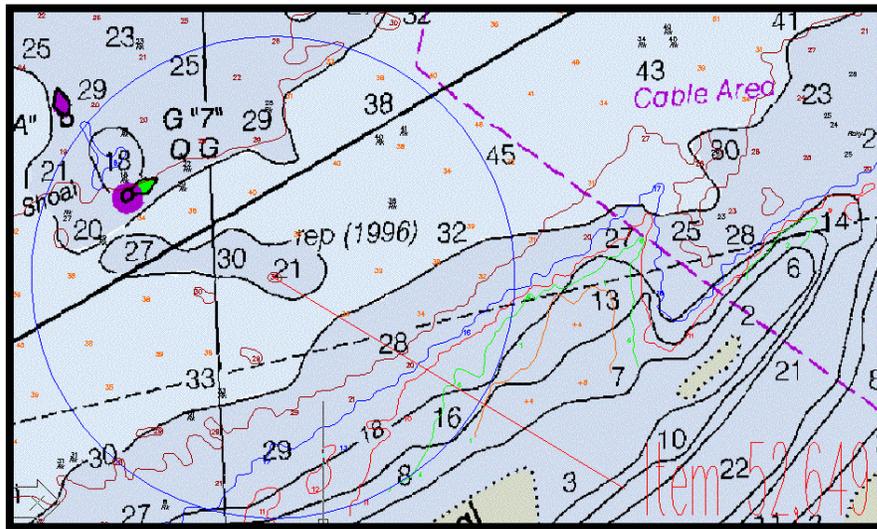
Record	Description	Comment
50759	Woronzof Shoal	Outside Area of Hydrography See AWOIS Figure 2.



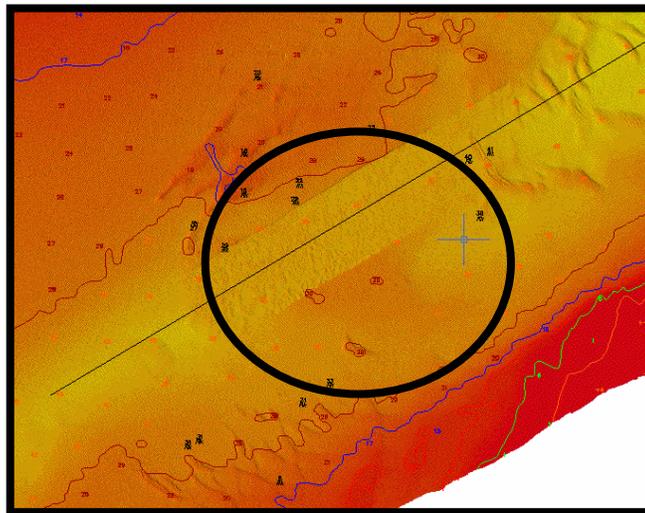
AWOIS Item 50759 with contours and weeded soundings overlaid on Chart 16555

*AWOIS Figure 2*

Record	Description	Comment
52649	Shoal	Area still has some depths of 29 to 30 feet. Area is currently a dredged and maintained channel. The shoal is marked on the smoothsheet. See screen capture below. The definition of the shoal is further described in Section D1 of this report. See AWOIS figures 3 and 4.



*AWOIS Item 52649 with contours and weeded soundings overlaid on Chart 16555*



*DTM showing dredged channel*

*AWOIS Figure 4*

## Item Investigation Report

Item Description (as charted): Shoal

Source: AWOIS 52649

Charted Position: Lat 61°12'01.87'' Long 150°04'39.07''

Charts Affected: 16665 7<sup>th</sup> edition March 2001

### Investigation

Date(s)/Day Number(s): 155

Survey Vessel Name: SeaDucer

Position Numbers(ID)/Time: 241166/ 22:41:44

Investigation Method: Shallow Water Multibeam Sonar

Surveyed Position (NAD83): N 6,788,635.04 E 657,036.23 (m) UTM Zone 5

Position Determined By: Differential GPS

Investigation Summary:

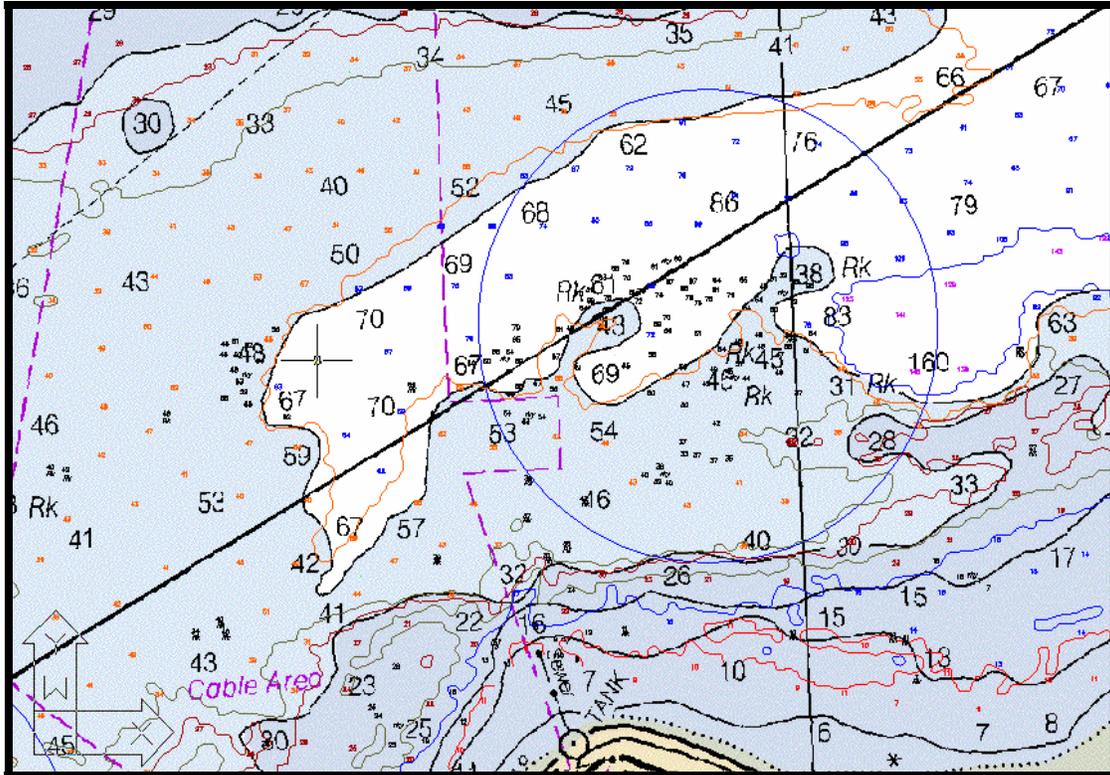
The area has full coverage. The least depth for the site is 29 feet, and can be found at the South edge of the site. The charted depth for this area is 21 feet. Compared to the chart this area has changed due to dredging and maintenance.

### Charting Recommendation

Adjust the contour line to the reduction of the shoal.

Recommended Least Depth: 29 feet<sup>39</sup>

Record	Description	Comment
52650	Charted Rocks	Rocky area. Feature's least depth is 33 feet (AWOIS History is 31 feet). Found and marked as <i>rky</i> on the final smoothsheet. See AWOIS figure 5.



AWOIS Item 52650 with contours and weeded soundings overlaid on Chart 16555

AWOIS Figure 5

## Item Investigation Report

Item Description (as charted): Charted Rocks

Source: AWOIS 52650

Charted Position: Lat 61°13'10.00" Long 150°00'20.00"

Charts Affected: 16665 7<sup>th</sup> edition March 2001

### Investigation

Date(s)/Day Number(s): 166

Survey Vessel Name: SeaDucer

Position Numbers/Time: 98436/ 16:13:50

Investigation Method: Shallow Water Multibeam Sonar

Surveyed Position (NAD83): N 6,790,374.56 E 660,695.93 (m) UTN Zone 5

Position Determined By: Differential GPS

Investigation Summary:

The area has full coverage. A large number of rocks exists in this area. They range in depth from 33 feet to 91 feet.

### Charting Recommendation

Change the noted individual rocks on the chart to several rocky symbols.

Recommended Least Depth: 33 ft<sup>40</sup>

An additional list of three AWOIS items was provided for information only. A review of the three informational items compared to the chart and a digital terrain model produced from the survey is summarized below.

<b>Record</b>	<b>Description</b>	<b>Comment</b>
51900	Sewer Terminus	Outside Area of Hydrography
51901	Barge	Outside Area of Hydrography
52651	Obstruction or Wreck	Outside Area of Hydrography

## D2. Additional Results

Shoreline verification was not required for this survey.<sup>41</sup>

There were two Aids to Navigation in this survey to report on.

<u>Name on chart</u>	<u>USCG Light list name</u>
G "7"	Knik Arm Shoal Lighted Buoy 7 (Volume VI 2001)
R N"2KA"	Knik Arm Shoal North Side Buoy 2KA (last listed in Volume VI 1999)

### **Found: Knik Arm Shoal Lighted Buoy 7 (Volume VI 2001)**<sup>42</sup>

Terra Surveys, LLC hydrographers identified and obtained a position on G"7". It appears to serve it's intended purpose and is at its record position.

Published 2001 Light list Position: 61° 12' 12" N, 150° 05' 24" W<sup>43</sup>



*Knik Arm Shoal Lighted Buoy 7*

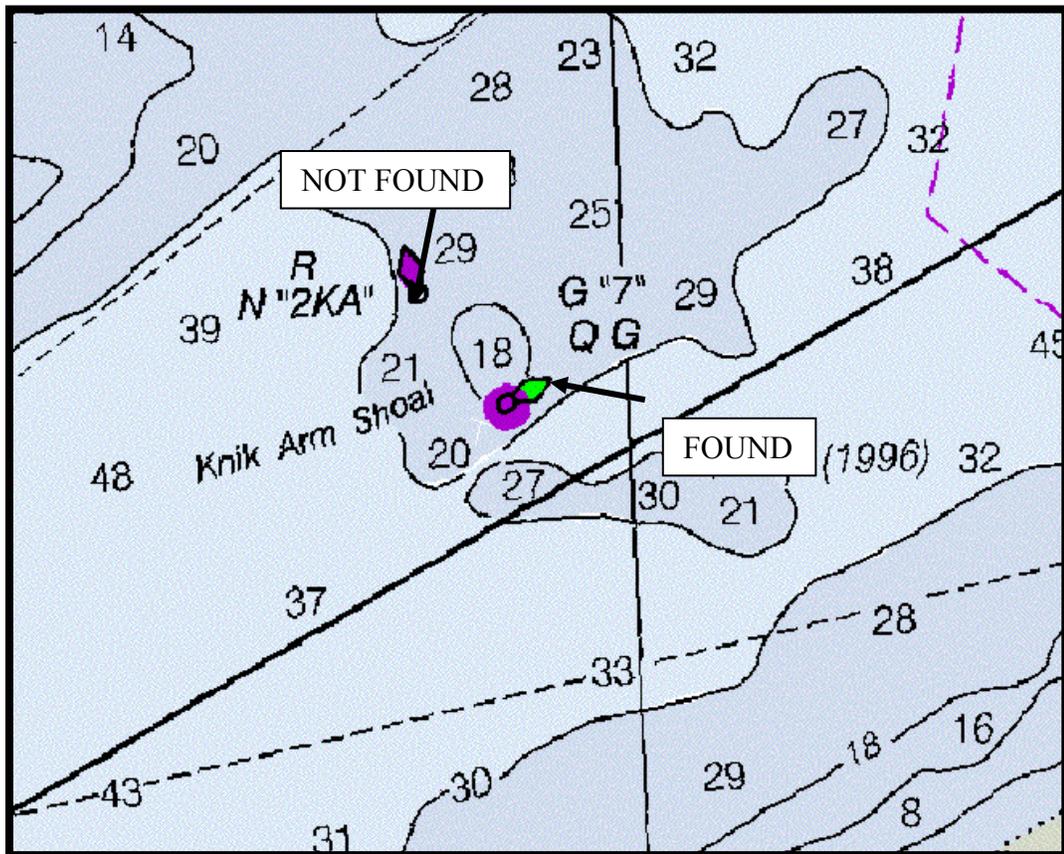
**Not Found: Knik Arm Shoal North Side Buoy 2KA (last listed in Volume VI 1999)**

Light list position Volume VI 1999: 61 12.4 N 150 05.6 W

This light was searched for at it's Light list position and not found. A review of past Light list editions lists shows the light was dis-established in notice number 17/99

**Recommendations**<sup>44</sup>

Remove this light from the next edition of affected charts.

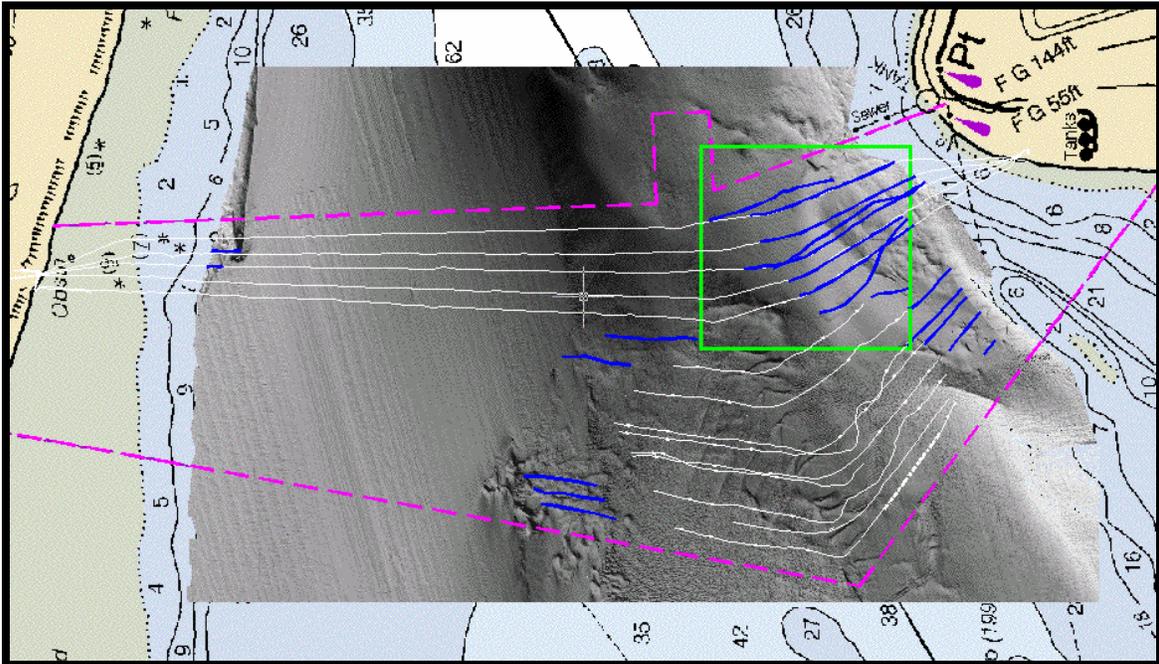


*Aids to navigation in H-11030, Chart 16665*

### Cable and Pipeline Crossings

A 1.5m bin size, sun-illuminated DTM was made over the designated cable-crossing corridor in the vicinity of Point Woronzof. Cables detected using this DTM image were found to be completely within the corridor. The location of the cables detected from this survey agreed well with as-built drawings supplied by the United States Army Corp of Engineers (USACE). No other cables were found on the sheet.

The image below is a plan view of the cable-crossing corridor from Pt. Woronzof to Pt. MacKenzie. Darker lines represent cables detected this survey. Lighter lines are cable locations from prior as-built surveys (supplied by the USACE).<sup>45</sup>



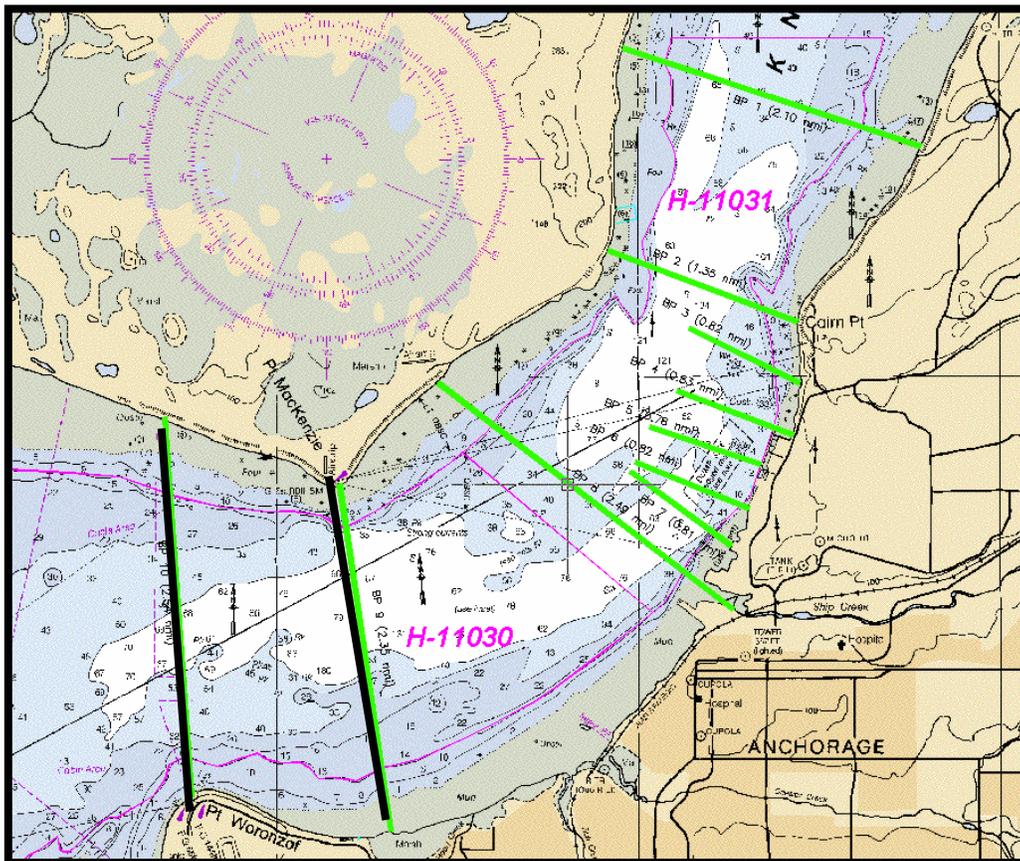
*Enlarged view of the DTM image used to locate cables from this survey, Chart 16665*

## Information of Significant Value

### The Dynamics of Cook Inlet

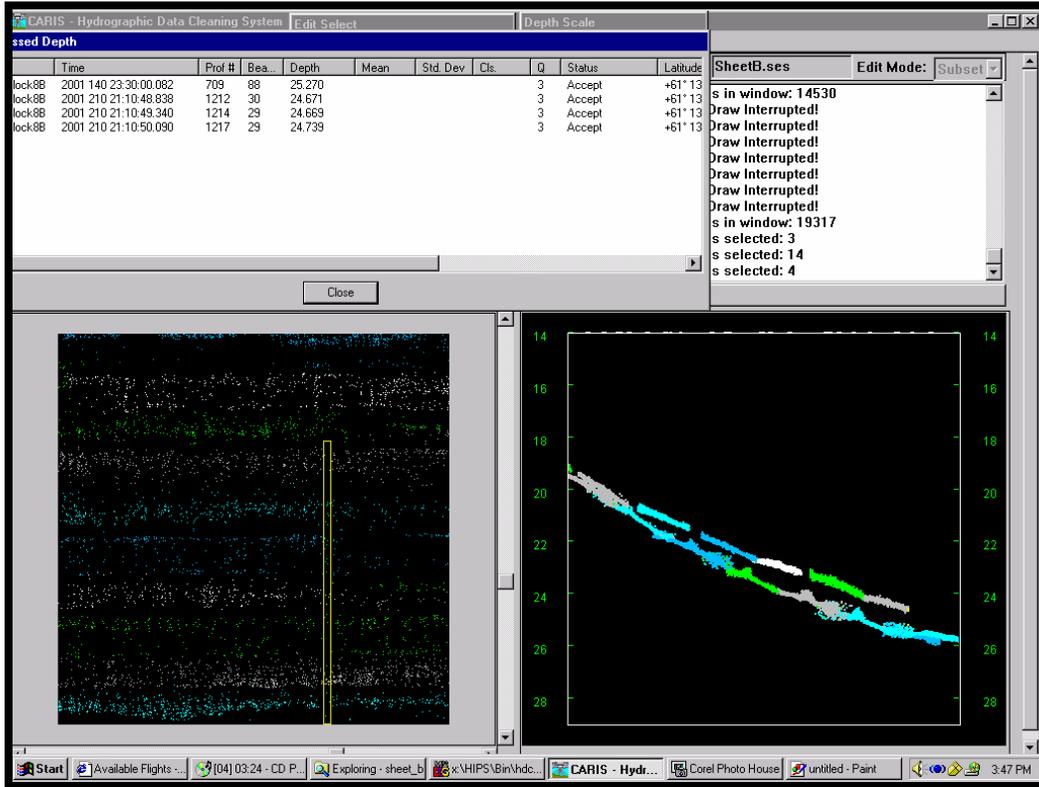
Terra Surveys, LLC is quite intimate with Cook Inlet and have been performing USACE condition surveys near Anchorage since 1994. This year, an extensive analysis was done of three sets of ten profile surveys of the same areas. The surveys clearly show that there is shoaling, deepening, sand waves and conversely, areas of little change. The time frame of these three surveys spans less than a year. The last two were done during the times of hydrography for this NOAA project; OPR-P385-KR-2001. The most likely assumption one can make about Cook Inlet is that the bottom is in a constant state of flux due to tides, currents and bottom type.

The USACE surveys are detailed in the Project Wide Data and Acquisition report<sup>46</sup>, Section A. Equipment. The following page shows an example of the bottom changes observed in this survey, H-11030, Sheet B.



*Two of the USACE Profile Surveys fall in H-11030, Chart 16665*

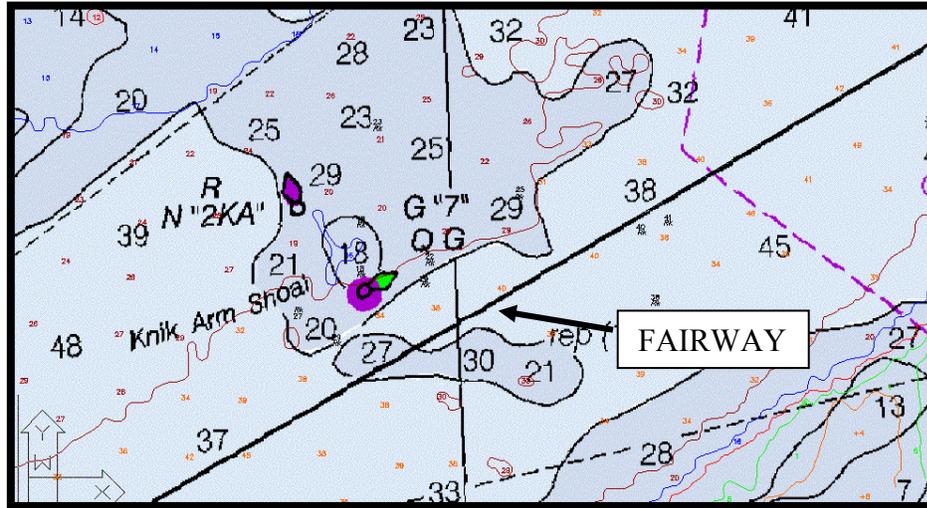
The image below is an example of bottom change over a period of 70 days. There is no definitive trend that is bias towards deepening or shoaling over the entire survey. The currents and tides are moving a lot of material around in relatively short periods of time. This particular area has changed by a half meter from DN 140 to DN 210. More deepening and shoaling trends in H-11030 are detailed in Section D1. Compare<sup>47</sup> Comparison.



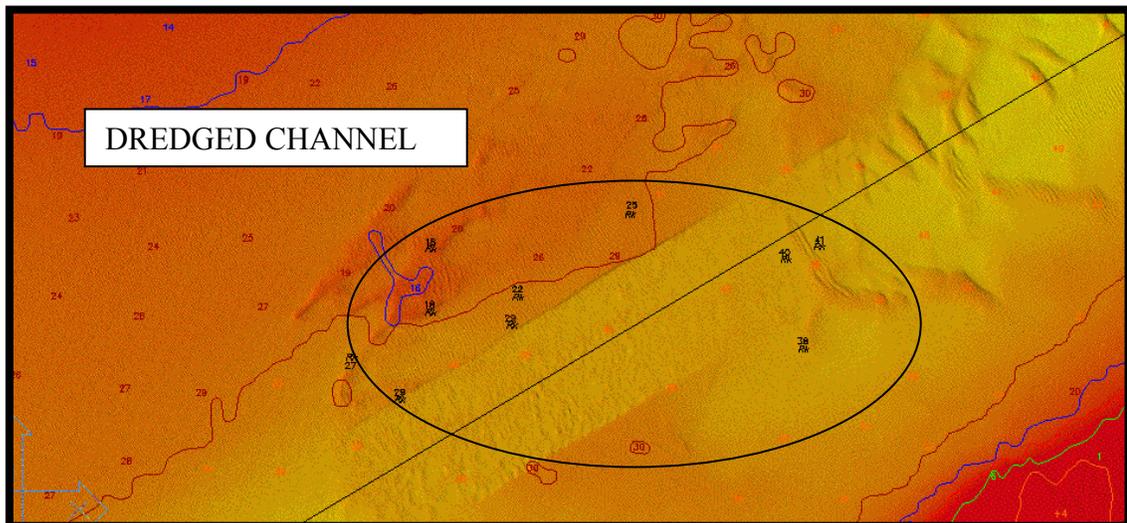
*A typical change in bottom over 70 days as seen in CARIS HDCS*

### Knik Arm Shoal Dredging

In the vicinity of  $61^{\circ}12'10''$  N and  $150^{\circ}04'53''$  W there is a dredged channel approximately 310 meters wide along the fairway. The area is maintained by the USACE and no longer has the charted depths of 21 and 27 feet. The area has an approximate minimum depth of 30 feet.<sup>48</sup>



*Charted fairway where dredging occurs*



*The dredged channel as seen in the DTM*

## Commerce in H-11030

Marine vessels traveling through H-11030 are headed towards two main ports of call to the north located in survey H-11031. They are the Port of Anchorage and Port Mackenzie. The Port of Anchorage is an established international port that was constructed in 1961. The construction at Port Mackenzie began in 1998 and is developing quickly as a potential economical boom for the communities on the west shore of Cook Inlet. The safety of Cook Inlet, Anchorage and the surrounding communities rely heavily on the accuracy of the charts in this area.

### **Port of Anchorage**

The port serves 80% of Alaska's populated area, from Homer to the North Slope by means of rail, road and air cargo connections. It handles over 90% of all consumer goods sold in the railbelt, stages 100% of the exports of refined petroleum products from the state's largest refinery in Fairbanks and a share of exports from refineries on the Kenai Peninsula and in Valdez. Anchorage is served regularly by two major carriers, which bring four to five ships weekly from the Pacific Northwest. Petroleum tankers supply jet fuel for airport operations, barges on-load petroleum products for western Alaska and ships from Japan and Korea call frequently transporting pipe, drilling mud, construction materials and automobiles.



*A Container Ship at the Port of Anchorage in survey H-11031*

**Port MacKenzie**

The Port MacKenzie Dock was opened for limited use on May 15, 2001. It has been used primarily as a loading site for three barges carrying pre made houses and supplies to bush communities. There are construction plans for a ferry route between Anchorage and Port MacKenzie, and a deep draft shipping pier to be built off the dock extending into the inlet five to six hundred feet. There are land transport plans for more roads, rail access, tank farms and conveyor systems to load a variety of commercial materials such as coal, minerals and timber. The permit has been awarded for the ferry dock by the USACE; evidence that the plans are moving forward.



*Looking West at Port MacKenzie in Survey H-11031*

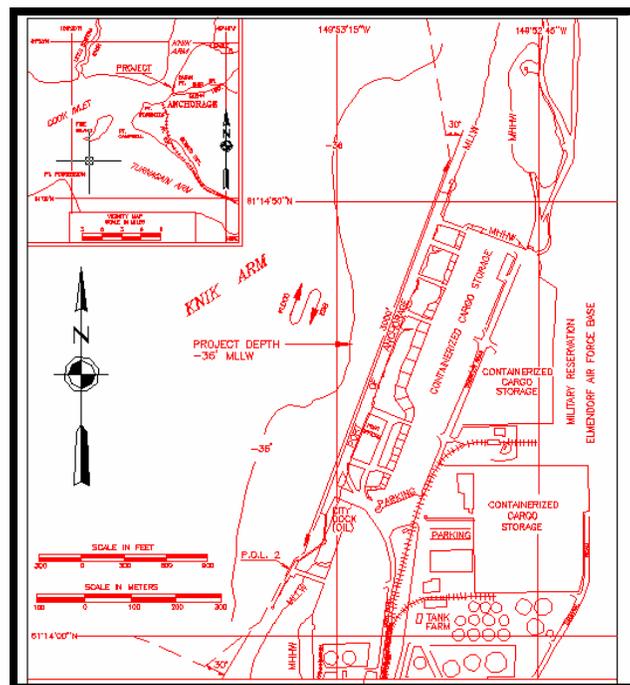
## USACE Activities

**Cook Inlet Navigation Channel Project**

The USACE has an important hand in Cook Inlet vessel safety.

- Originally called the Knik Arm Shoal Channel, the project is widening to encompass North Point Shoal, Fire Island Shoal and is now called The Cook Inlet Navigation Channel Project.
- Dredging for Knik Arm Shoal began in 1999 and was completed in 2000. It is maintained by USACE. While it is still unknown, at best this will involve major dredging every two to three years.
- USACE maintains an area off the Port of Anchorage to a project depth of 35 feet MLLW. The high sediment load that leads to shoaling keep costs high, about \$2,000,000 annually. The USACE has been conducting a feasibility study to increase the project depth to 45 feet MLLW at the Port of Anchorage. The Corps works with local interests, when they can, on a cost shared basis to fund these studies. Dredging spoils are dumped a minimum of 3000 feet off the face of the dock.

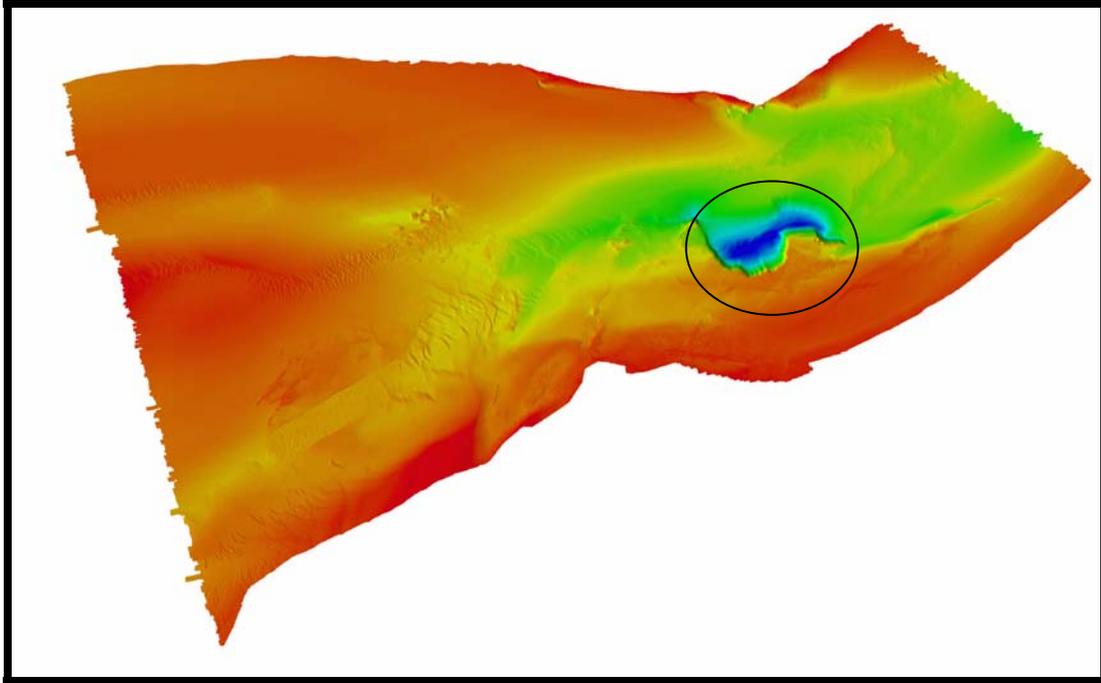
The Corps presence in Cook Inlet is confined to federally authorized projects. The needs of commerce and the users of the Inlet (shippers, ports, and fisherman) drive these projects. Congress must approve any Corp project, and further maintenance in Cook Inlet is limited to the struggle to secure federal dollars.



*USACE's Project Area for the Port of Anchorage*

### Observations of Interest

There is a very deep bowl shaped area in the eastern half of Survey H-11030. The depths drop dramatically from approximately 30 feet to 125 feet.



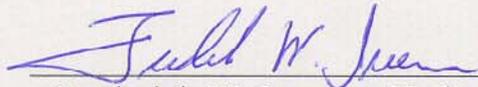
*The Digital Terrain Model for H-11030( Sheet B)*

LETTER OF APPROVAL  
REGISTRY NO. H-11030

This Report and the accompanying smooth sheet are respectfully submitted.

Field operations contributing to the accomplishment of survey H-11030 were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report, smooth sheet, digital data, and accompanying records have been closely reviewed and are considered complete and adequate as per the Statement of Work. Other reports to be submitted with this survey include Data Acquisition and Processing Report, Vertical and Horizontal Report, which were submitted in December 2001.

I believe this survey is complete and adequate for its intended purpose.

  
Frederick W. Iversen, Hydrographer  
Terra Surveys, LLC

Date DEC. 7<sup>th</sup> 2001

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**Revisions Compiled During Office Processing and Certification**

- <sup>1</sup> PHB Revision – All Separates are filed with the field data.
- <sup>2</sup> PHB Revision –~~2001~~ replace with 01
- <sup>3</sup> PHB Revision-attached to this report.
- <sup>4</sup> PHB Revision –minimum depth of 2 feet at datum.
- <sup>5</sup> PHB Revision –Filed with the survey records.
- <sup>6</sup> PHB Revision –Concur
- <sup>7</sup> PHB Revision –Filed with the survey records in the same binder labeled Separate III.
- <sup>8</sup> PHB Revision –Concur
- <sup>9</sup> PHB Revision –See the Project Wide Data Acquisition and Processing Report for OPR-P385-KR-2001 which is filed with the survey records.
- <sup>10</sup> PHB Revision –Strikeout ~~19~~ replace with 9.
- <sup>11</sup> PHB Revision –Concur
- <sup>12</sup> PHB Revision – Filed with the survey records.
- <sup>13</sup> PHB Revision –Concur
- <sup>14</sup> PHB Revision – Survey H-11030 junctions H-11029 to the west. Depth differences with this survey generally reflect 0-1 foot with no consistent shoal or deep bias. However, the area from latitude 61/12/30N to latitude 61/13/20W and from longitude 150/07/00W to longitude 150/07/30W reveals more significant differences of 3-8 feet. In this area H-11030 appears consistently deeper. Additional information regarding junctions and historic bottom changes is found in section B2, Quality Control and section D1, Chart Comparison and the Descriptive Report for Survey H-11029, section D1.
- <sup>15</sup> PHB Revision –Filed with the survey records along in the same binder as Separate III.
- <sup>16</sup> PHB Revision – Concur.
- <sup>17</sup> PHB Revision-Strikeout ~~OPR 385-KR-2001~~. and replace with OPR-P385-KR-01
- <sup>18</sup> PHB Revision – Filed with the survey records
- <sup>19</sup> PHB Revision – Filed with the survey records

- 
- <sup>20</sup> PHB Revision – Filed with the survey records
- <sup>21</sup> PHB Revision –PHP compared chart 16665, 7<sup>th</sup> Ed. dated March 31, 2001.
- <sup>22</sup> PHB Revision - DTON letters were submitted by the contractor and reviewed by PHB. PHB reported two DTON letters to the USCG, NIMA, and N/CS261. These DTON letters are attached to this report.
- <sup>23</sup> PHB Revision-Selected depths have been noted as “*Rk*” with the surrounding areas noted as “*rky*”.
- <sup>24</sup> PHB Revision-The surrounding area noted as “*rky*”.
- <sup>25</sup> PHP Revision-Selected depths have been noted as “*Rk*” with the surrounding areas noted as “*rky*”.
- <sup>26</sup> PHP Revision-Selected depths have been noted as “*Rk*” with the surrounding areas noted as “*rky*”.
- <sup>27</sup> PHP Revision-There is no “*11 Rk*” on smooth sheet at this position.
- <sup>28</sup> PHB Revision-Selected depths have been noted as “*Rk*” with the surrounding areas noted as “*rky*”.
- <sup>29</sup> PHB Revision-The surrounding area noted as “*rky*”.
- <sup>30</sup> PHB Revision-Chart areas as shown on smooth sheet.
- <sup>31</sup> PHB Revision – DTON letters were submitted by the contractor and reviewed by PHB. PHB reported three DTON letters to the USCG, NIMA, and N/CS261. These DTON letters are attached to this report.
- <sup>32</sup> PHP Revision-Do not concur, this area should continue to be included as a resurvey area to the “The National Survey Plan” (2001) and resurveyed at an interval appropriate to local conditions and available resources.
- <sup>33</sup> PHP Revision-Do not concur, this area should continue to be included as a resurvey area to the “The National Survey Plan” (2001) and resurveyed at an interval appropriate to local conditions and available resources.
- <sup>34</sup> PHP Revision-Do not concur, this area should continue to be included as a resurvey area to the “The National Survey Plan” (2001) and resurveyed at an interval appropriate to local conditions and available resources.
- <sup>35</sup> PHB Revision - DTON letters were submitted by the contractor and reviewed by PHB. PHB reported three DTON letters to the USCG, NIMA, and N/CS261. These DTON letters are attached to this report.

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<sup>36</sup> PHP Revision-Do not concur, this area should continue to be included as a resurvey area to the “The National Survey Plan” (2001) and resurveyed at an interval appropriate to local conditions and available resources.

<sup>37</sup> PHP Revision-Three AWOIS items were investigated during survey operations, 50758, 52649 and 52650. AWOIS item 50759 falls outside the survey area and was not investigated by the hydrographer.

<sup>38</sup> PHP Revision- Concur, chart area as shown on smooth sheet.

<sup>39</sup> PHP Revision- Concur, chart area as shown on smooth sheet.

<sup>40</sup> PHP Revision- Concur, chart area as shown on smooth sheet, add “*rky*” notations as shown on smooth sheet.

<sup>41</sup> PHP Revision- Concur.

<sup>42</sup> PHP Revision- Continuous Maintenance Drawing, dated 01/22/2003, shows this ATON as *G “5”*. Light List dated 2003, Volume VI list this buoy as “*Knik Arm Shoal Lighted Buoy 5*”, LL No. 26420.

<sup>43</sup> PHP Revision-Surveyed position is Latitude 61/12/12.139N, Longitude 150/05/23.803W

<sup>44</sup> PHP Revision-ATON R N “2Ka” is not shown on the Continuous Maintenance Drawing, dated 01/22/2003. It also is not listed in the 2003 Light List, Volume VI.

<sup>45</sup> PHP Revision-Retain *cable area* notations as shown on the H-drawing.

<sup>46</sup> PHP Revision-Filed with the survey records.

<sup>47</sup> PHP Revision- Strikeout ~~Compare~~ and replace with Chart.

<sup>48</sup> PHP Revision-Chart area as shown on smooth sheet.

**APPENDIX I**

**Danger To Navigation Reports**

This survey produced a Danger to Navigation Report. The report and the associated correspondence are included in this appendix. A list of the correspondence is below.

Date

Recipient

January 4, 2002

Commander Coast Guard District

CC: Gary Nelson NOAA (COTR)

Friday, January 04, 2002

Commander Coast Guard District

P.O. Box 25517

Juneau, Alaska 99802-5517

Reference: NOAA Survey Number H-11030

Contract Number OPR-P385-KR-01

Dear Sir:

While conducting hydrographic surveys operations for the approaches to Anchorage, Alaska (NOAA Survey H-11030), Terra Surveys, LLC found several areas of shoaling. Areas were found to be shallower than shown on Chart 16665. Attached is the Danger to Navigation Report.

Differential GPS and Multibeam sonar were used to determine the position and depths. These data are preliminary and subject to office review.

Sincerely,

Terra Surveys, LLC

Thomas S. Newman, PLS

Partner

Enclosures:

CC: Gary Nelson

NOAA (COTR)

## REPORT OF DANGER TO NAVIGATION

Hydrographic Survey Registry Number: H-11030  
State: Alaska  
General Locality: Cook Inlet  
Sublocality: Woronzof Shoal to Anchorage  
Project Number: OPR-P385-KR-01

The following was found during hydrographic survey operations:

- Object discovered: Shoaling along fairway. 40' Sounding found in an area depicted as 53' on chart. Position of sounding is:  
Lat. 61° 12' 49.79" N  
Long. 150° 02' 39.07" W
- Object discovered: Rock found on north side of Woronzof Shoal. Shoalest sounding on the rock is 8'. Position of sounding is:  
Lat. 61° 11' 32.44" N  
Long. 150° 05' 11.82" W
- Object discovered: Movement of Woronzof shoal. A representative sounding is:  
17' Sounding found offshore of the 30' curve. Position of sounding is:  
Lat. 61° 12' 11.44" N  
Long. 150° 02' 51.22" W
- Object discovered: Movement of Knik Arm Shoal. Representative soundings are:  
19' Sounding found offshore of the 30' curve. Position of sounding is:  
Lat. 61° 13' 13.68" N  
Long. 150° 07' 31.70" W  
18' Sounding found offshore of the 30' curve. Position of sounding is:  
Lat. 61° 13' 04.94" N  
Long. 150° 04' 43.04" W  
27' Sounding found offshore of the 30' curve near 48' sounding on chart. Position of sounding is:  
Lat. 61° 12' 11.52" N  
Long. 150° 06' 42.49" W

# Danger to Navigation Report

Hydrographic Survey Registry Numbers: H11029 & H11030

## ADVANCE INFORMATION

Survey Title: State: AK  
Locality: Cook Inlet  
Sub-localities: Fire Island Shoal to North Point Shoal  
Woronzof Shoal to Anchorage

Project Number: OPR-P385-KR-01

Survey Dates: May 2001 - September 2001

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>
16660	1:194,154	28 <sup>th</sup>	09/08/01
16663	1:100,000	6 <sup>th</sup>	05/12/01
16665	1:50,000	7 <sup>th</sup>	03/31/01

<u>Feature</u>	<u>Depth (ft)</u>	<u>Latitude (N)</u>	<u>Longitude (W)</u>
Sounding	30	61° 11' 01.2"	150° 19' 41.5"
Sounding	18	61° 11' 10.2"	150° 18' 33.4"
Sounding	14	61° 11' 34.5"	150° 16' 05.1"
Sounding	10	61° 12' 12.8"	150° 16' 14.0"
Sounding	17	61° 13' 13.3"	150° 14' 12.8"
Sounding	18	61° 13' 36.4"	150° 07' 25.6"
Sounding	18	61° 13' 13.6"	150° 06' 54.1"
Sounding	18	61° 13' 05.0"	150° 04' 43.5"
Sounding	30	61° 13' 09.5"	150° 04' 07.3"
Sounding	-4	61° 12' 51.4"	150° 08' 33.3"
Sounding	-3	61° 12' 30.0"	150° 13' 51.7"

**COMMENTS:** North Point Shoal has migrated approximately 2000 meters to the southwest, 600 meters to the north, and 1500 meters to the east. The shoal, in general, decreased in depth. Larger areas on the shoal uncover at MLLW.

The soundings shown above should be reported as dangers to navigation. Additional soundings shown in the chartlets and text file should be used to show the migration of the 18 foot and 30 foot contours.





# Danger to Navigation Report

Hydrographic Survey Registry Numbers: H11030

## ADVANCE INFORMATION

Survey Title: State: AK  
Locality: Cook Inlet  
Sub-locality: Woronzof Shoal to Anchorage

Project Number: OPR-P385-KR-01

Survey Dates: May 2001 - September 2001

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>
16660	1:194,154	28 <sup>th</sup>	09/08/01
16663	1:100,000	6 <sup>th</sup>	05/12/01
16665	1:50,000	7 <sup>th</sup>	03/31/01

<u>Feature</u>	<u>Depth (ft)</u>	<u>Latitude (N)</u>	<u>Longitude (W)</u>
Rock	39	61° 12' 50.4"	150° 01' 14.5"
Sounding	32	61° 12' 15.9"	150° 03' 31.7"
Sounding	14	61° 10' 48.8"	150° 06' 22.9"
Sounding	17	61° 11' 37.2"	150° 04' 43.1"
Sounding	-1	61° 11' 55.8"	150° 03' 11.1"
Sounding	6	61° 11' 41.3"	150° 03' 55.3"

**COMMENTS:** Woronzof Shoal has migrated approximately 750 meters to the northeast.

The soundings shown above should be reported as dangers to navigation. Additional soundings shown in the chartlet and text file should be used to show the migration of the 18 foot contour.

Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch (N/CS34) at (206) 526-6836.

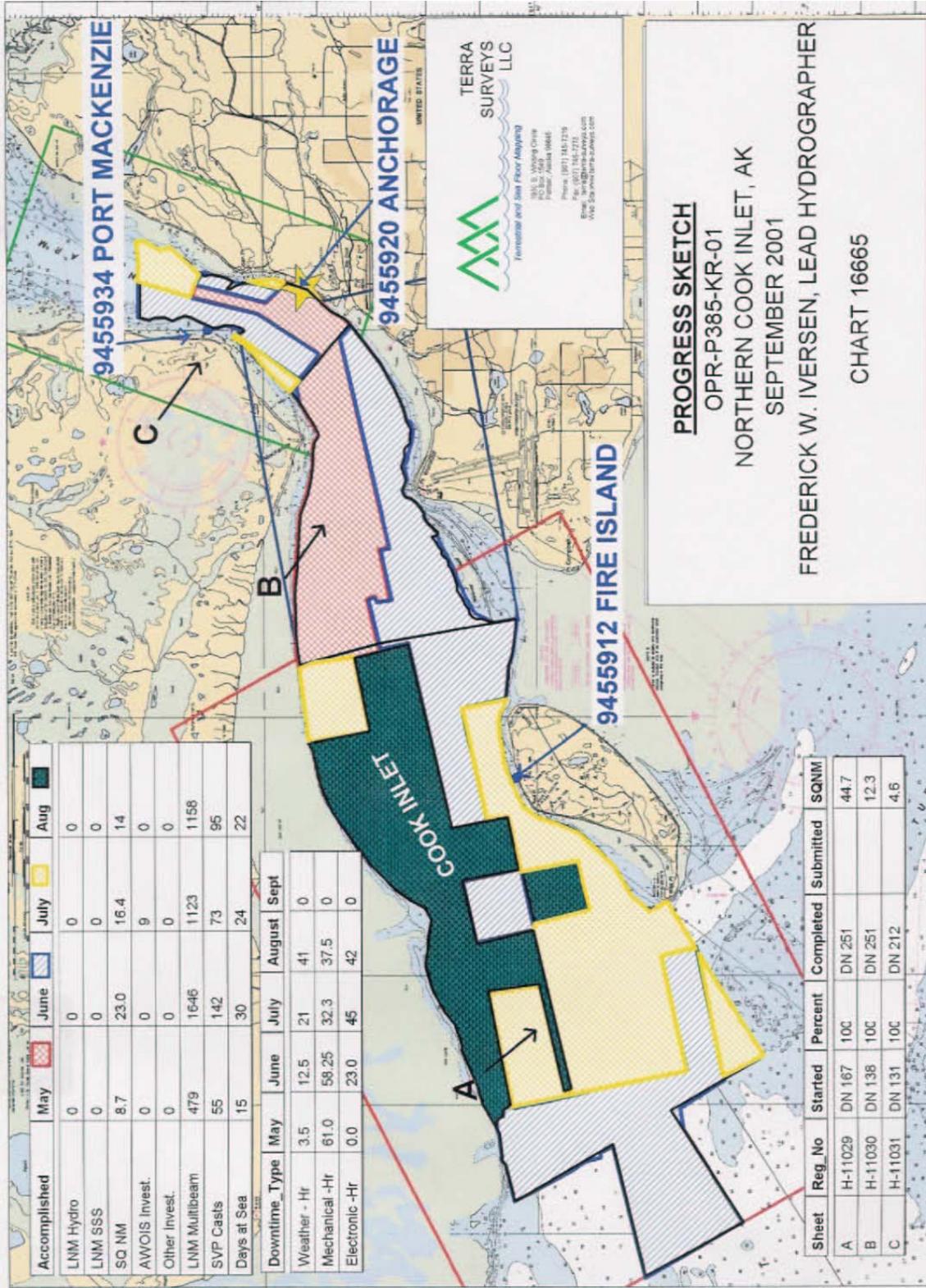
**APPENDIX II**

**List of Geographic Names**

No new geographic names, or changes to geographic names, were discovered in the survey area.

**APPENDIX III**

**Progress Sketch**



Accomplished	May	June	July	Aug
LNM Hydro	0	0	0	0
LNM SSS	0	0	0	0
SQ NM	8.7	23.0	16.4	14
AWOIS Invest.	0	0	9	0
Other Invest.	0	0	0	0
LNM Multibeam	479	1646	1123	1158
SVP Casts	55	142	73	96
Days at Sea	15	30	24	22

Downtime_Type	May	June	July	August	Sept
Weather - Hr	3.5	12.5	21	41	0
Mechanical -Hr	61.0	58.25	32.3	37.5	0
Electronic -Hr	0.0	23.0	45	42	0

Sheet	Reg_No	Started	Percent	Completed	Submitted	SQNM
A	H-11029	DN 167	100	DN 251	44.7	
B	H-11030	DN 138	100	DN 251	12.3	
C	H-11031	DN 131	100	DN 212	4.6	

**APPENDIX IV**

**Tides and Water Levels**

## APPENDIX IV

**Tides and Water Levels**

## Abstract of Times of Hydrography for Smooth Tides

Project: OPR-385-KR-2001      Registry No.: H-11030

Sheet Letter: B      Inclusive Dates: MAY 18 – SEPT 8, 2001

<b>Day (2001)</b>	<b>Time (UTC)</b>	
	<b>Start</b>	<b>End</b>
138	22:35:20	23:59:42
139	0:06:20	23:57:12
140	0:38:23	23:50:53
141	0:09:27	23:54:37
142	0:05:09	23:53:40
143	0:00:28	23:57:27
144	0:06:10	22:26:14
145	0:06:05	23:21:10
146	0:22:26	19:59:49
149	20:31:31	23:59:59
150	0:00:00	23:59:59
151	0:00:00	03:22:02
152	0:41:16	23:59:59
153	0:00:00	17:14:50

154	0:51:50	01:55:32
155	16:31:50	23:57:12
156	0:13:43	21:37:44
157	1:12:27	23:59:59
158	0:00:00	23:38:26
159	0:02:03	01:15:45
160	23:17:35	23:59:59
161	0:00:00	23:59:59
162	0:00:00	23:55:01
163	0:05:52	23:59:59
164	0:00:00	23:56:37
165	0:05:44	23:57:20
166	0:05:08	23:52:24
167	0:07:03	21:35:31
210	19:23:55	23:57:46
211	0:20:54	00:37:16
235	20:24:27	20:57:14
250	21:30:42	21:39:05

# TIDE PROCEDURES-LCMF, INC.

## OPR-P385-KR-2001

### Knik Arm, Cook Inlet

#### Project Planning

In conjunction with NOAA CO-OPS and the hydrographic survey contractor, LCMF developed a tidal zoning scheme in order to cover the project area. LCMF provided Terra Surveys with reconnaissance resources regarding the tide station locations including photographs, maps and GPS coordinates. If the site was a historical tide station, then the historical tide report and datum information was obtained from NOAA CO-OPS.

#### Calibration

Terra Surveys performed a calibration of the DAA H350XL/H355 digital tide gauge components prior to deployment and after demobilization. Prior to deployment, each tide gauge was run through a series of measurements in a controlled environment. The tide gauge orifice line was marked at one meter intervals and then lowered into a column of fresh water contained in a 9-meter long PVC pipe. Tide gauge depth readings were recorded every meter as the water column level was lowered and raised. The difference between the reference depth and the observed depth was calculated. After, demobilization, LCMF personnel brought the tide gauges to the NOS Pacific Regional Office for calibration by comparison to a Paroscientific transducer.

#### Installation

Using the information acquired in the project planning stages, Terra Surveys personnel determined a final location for the tide stations with regard to the ease of access, protection from open seas, freedom from obstructions for transmission to GOES satellites and the type of shoreline.

The tide gauges at both installations were powered by 12 volt 65 amp hour marine batteries with a solar cell for recharging. The tide gauges at Fire Island were housed in an 8' x 8' Weatherport tent. The tide gauge orifices at Fire Island were anchored to 700lb. welded railroad tie anchors and slung into the water by a helicopter. The tide gauges at Port MacKenzie were housed in a Rubbermaid garden hut and the orifices were attached to a bracket and welded to the dock. Nitrogen tanks were used to purge the orifice tubing before beginning operation. Three hours of staff shots were performed to confirm that the gauges were operating correctly.

At Port MacKenzie, six NOS benchmarks were installed using either standard NOS caps or ¾" stainless steel drive rod driven to refusal. Third order levels were double run through the benchmarks at both sites to NOS specifications. Two 5-hour GPS sessions with dual frequency geodetic quality receivers were performed on the primary benchmark at each site.

### **Field Maintenance Operation**

Terra field personnel made two or three visits per week to each tide station to ensure that the tide gauges were operating properly. During a tide station visit an hour of staff shots was performed and the gauge settings and diagnostics were inspected and recorded. Staff shots were analyzed at the tide station to check for outliers and changes to the staff constant that might indicate malfunctions or an unstable orifice. Water density readings were recorded during each visit in order to update the gauge with a current slope constant. Tide gauge data on flash cards was brought back to the Terra office in Palmer and emailed to the processing center at the LCMF office in Anchorage.

### **Data Processing and Quality Control**

Tide data arrived in the LCMF office either from a GOES transmission downloaded through the DAPS telnet site or by email from the Terra office in Palmer. As a preliminary quality control check, office personnel graphed the data and inspected the tide curve for gaps, jumps and outliers. The data from the multiple backup gauges at each site were compared to ensure consistency. The tide data from the primary gauge was then smoothed using a 5<sup>th</sup> degree polynomial curve fit program, reduced to MLLW datum and converted to the file format required by the contractor. The MLLW files were then emailed to the hydrographic survey processing team and posted on a secure ftp site.

After several weeks of tide data collection, a preliminary datum was computed through the method of simultaneous comparisons at each tide station based on the control station for the project. A tide-by-tide simultaneous comparison was computed for each 30-day water level series for each station using the primary gauge at the station. Comparisons by monthly means were also tabulated for each calendar month.

### **Demobilization**

After the completion of the hydrographic survey Terra Surveys field personnel demobilized the tide stations. Final staff shots were performed and closeout levels were run through all of the benchmarks.

### **Final Delivery**

LCMF was responsible for submitting to NOAA a tide report detailing the work completed which included the tide data and field information provided by Terra Surveys. The final report contains a chart section, vicinity map, tide station report, benchmark descriptions, field book information, photographs, gauge calibrations and the computations for determining the final datum at each tide station.

## 2001 FIELD and FINAL TIDE NOTE

## Hydrographic Sheet: H-11030

## Cook Inlet

## Woronzof Shoal to Anchorage

NOAA Project No:	OPR-P385-KR-2001 Alaska				
NOAA Contract No:	50-DGNC-0-90003				
The Anchorage, Alaska tide station (945-5920) served as control for the subordinate stations for this project. Datum determinations were made for the subordinate station at Fire Island (945-5912) and for the subordinate station at Port MacKenzie (945-5934). The NTDE 1960-78 was utilized.					
Location and Time Meridian	Name:	Lat (NAD 83)	Long (NAD 83)	Time Meridian:	
	Anchorage:	61° 14' 18"	149° 53' 24"	0° (UTC)	
	Fire Island:	61° 10' 21"	150° 12' 19"	0° (UTC)	
	Port MacKenzie:	61° 16' 03"	149° 55' 01"	0° (UTC)	
Time Period and Datum Reference	Name:	Established:	Removed:	MLLW	MHW units
	Anchorage:	<i>established and operated by NOS</i>		0.000	10.549 meters
	Fire Island:	05/24/2001	09/14/2001	0.000	7.953 meters
	Port MacKenzie:	05/22/2001	09/07/2001	0.000	8.609 meters
Tide observer	LCMF Incorporated 139 E. 51st Ave. Anchorage, Alaska 99503 (under subcontract to Terra Surveys LLC, Palmer, AK)				
Gauges	Design Analysis H350XL/355 bubbler systems at tertiary tide stations.				
Installation	Each gauge was secured inside a waterproof case, and fastened vertically to a wooden brace above the high water line. A tent covered the gauges at Fire Island. A pre-built shelter covered the installation at Port MacKenzie.  Refer to the tide station packages for additional site specific details of installation.				
Tide staff	None. At Fire Island, spirit leveling was observed between a nearby tidal bench mark and the water. The survey rod was outfitted with a stilling well to dampen wave action. At Port MacKenzie, a galvanized wire rope marked at 0.5m increments with a large iron disk at the end was lowered to the water.				
Benchmarks	The following benchmarks were installed at these sites:  Fire Island: none Port MacKenzie: 5934 A 2001, 5934 B 2001, 5934 C 2001, 5934 D 2001, 5934 E 2001, 5934 F 2001  The following benchmarks were recovered at these sites: Fire Island: Rife 1960, BM 12 1974, BM 13 1974, 5912 C 1998, 5912 D 1998, 5912 E 1998 Port MacKenzie: none				
Levels	Benchmarks were leveled at the installation and removal of each tidal station. The benchmarks and station datums were connected through frequent leveling to the water. The level runs closed within NOS tolerance.				
Final Tidal Zoning	The final tidal zoning from 11/1/01 follows this report (AutoCAD map with notes). This zoning was developed from a numerical analysis of historical bathymetric data.				
Reduction of Multibeam data	Terra Surveys LLC (the prime contractor) was provided preliminary datums developed by LCMF during July 2001 and MLLW correctors throughout the field season. In September, LCMF finalized datums and forwarded all data necessary to reduce soundings to the prime contractor.				

**APPENDIX V**

**Supplemental Survey Records and Correspondence**

Thursday, June 19, 2003

Rodger Graves  
Port of Anchorage  
Municipality of Anchorage  
2000 Anchorage Port Road  
Anchorage, Alaska 99501

Reference: Upper Cook Inlet Charting

Dear Mr. Graves,

Terra Surveys, LLC performed three surveys near Anchorage in support of NOAA's nautical charting efforts this past season. These surveys are now complete, have been through a preliminary review by NOAA and we have received authorization to release a preliminary copy to interested parties. LCDR Doug Baird of NOAA asked that we get a set of these drawings to you and your organization. Please understand these sheets are preliminary and have NOT received final approval by NOAA. In spite of their preliminary nature, the magnitude of changes found in this area of the inlet led to their early release on a limited basis.

Please call if you have any questions.

Sincerely,

Terra Surveys, LLC

Thomas S. Newman, PLS

enclosures

Friday, January 04, 2002

Captain Vince Tillion  
South West Alaska Pilots Association  
P.O. Box 977  
Homer, Alaska 99603-0977



Reference: Upper Cook Inlet Charting

Dear Captain Tillion,

Terra Surveys, LLC performed three surveys near Anchorage in support of NOAA's nautical charting efforts this past season. These surveys are now complete, have been through a preliminary review by NOAA and we have received authorization to release a preliminary copy to interested parties. LCDR Doug Baird of NOAA asked that we get a set of these drawings to you and your organization. Please understand these sheets are preliminary and have NOT received final approval by NOAA. In spite of their preliminary nature, the magnitude of changes found in this area of the inlet led to their early release on a limited basis.

Please call if you have any questions.

Sincerely,



Terra Surveys, LLC  
Thomas S. Newman, PLS

enclosures

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**Revisions Compiled During Office Processing and Certification**

MEMORANDUM FOR: Jeffrey Ferguson, NOAA  
Contracting Officer's Technical Representative

FROM: Gary C. Nelson  
Assistant Contracting Officer's Technical Representative  
Pacific Hydrographic Branch

SUBJECT: 30-DAY Acceptance Review of H-11030

The Pacific Hydrographic Branch has conducted a 30-day acceptance review of the following contract hydrographic survey:

Registry No: H-11030  
State: Alaska  
General Locality: Cook Inlet  
Locality: Woronzof Shoal to Anchorage  
Contractor: Terra Surveys, LLC  
Project: OPR-P385-KR-01  
Contract No: 50-DGCN-0-90003  
Date Received by PHB: March 23, 2002  
30 Day Review by: April 22, 2002

The data submitted for H-11030 was reviewed for compliancy with the Statement of Work.

The 30-day review included but was not limited to the following:

1. An inventory of specified deliverables
2. A review of the SWMB Patch Test data to confirm proper bias values
3. A qualitative review of SWMB cross line comparison data.
4. An examination of the DTM, created by Terra Surveys, with the smooth sheet overlaid to ensure shoal areas were portrayed correctly on the smooth sheet.
5. A CARIS workfile of selected shoal soundings was created to compare with the smooth sheet. The comparison was used to verify valid shoal soundings were carried through to the smooth sheet.
6. A preliminary comparison of prior surveys and appropriate nautical charts with the smooth sheet was completed.
7. The data were reviewed for appropriate application of biases, sound velocity, and tides.
8. A preliminary review of the Descriptive Report and smooth sheet. (Note: The results of the final review will be detailed in the Evaluation Report).

Based upon the review, it is concluded that H-11030 has no major deficiencies that would deem it out of compliance with the Statement of Work. It is recommended that H-11030 be accepted.

cc: John Lowell  
Dennis Hill

RECRD  VESSLTERMS  CHART  AREA   
CARTOCODE  SNDINGCODE  DEPTH

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LAT83	<input type="text" value="61/12/01.87"/>	LONG83	<input type="text" value="150/04/39.07"/>	<input type="button" value="Update GP"/>	GPQUALITY	<input type="text" value="Med"/>
	<input type="text" value="61"/> <input type="text" value="12"/> <input type="text" value="1.87"/>		<input type="text" value="150"/> <input type="text" value="4"/> <input type="text" value="39.07"/>		GPSOURCE	<input type="text" value="Scaled"/>
LATDEC	<input type="text" value="61.200519444444"/>	LONDEC	<input type="text" value="150.077519444444"/>			

PROJECT  ITEMSTATUS  SEARCHTYPE   
RADIUS  INIT  ASSIGNED   
TECNIQ

Techniqnote

History

Fieldnote

INVESTIGATION  
DATE(S): 5/18/01 - 9/8/01  
VN: Sea Ducer TIME:N/A  
INVESTIGATION METHODS USED: 100% Multibeam  
SURVEYED POSITION: LAT. 61-12-01.9 LON. 150-04-38.7  
POSITION DETERMINED BY: DIFFERENTIAL GPS  
INVESTIGATION SUMMARY:  
The area has full coverage. The least depth for the site is 29 feet and can be found at the south edge of the site. The charted depth for this area is 21 feet. This area has changed due to dredging and maintenance.  
EVALUATOR COMMENTS: Chart area as shown on the smooth sheet.

Proprietary

YEARSUNK  NIMANUM  SYSTEMNUM

RECRD  VESLTERMS  CHART  AREA   
CARTOCODE  SENDINGCODE  DEPTH

NATIVLAT	<input type="text" value="61/13/10.00"/>	NATIVLON	<input type="text" value="150/00/20.00"/>	<input type="button" value="convert"/>	NATIVDATUM	<input type="text" value="31"/>
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	<input type="text" value="61"/> <input type="text" value="13"/> <input type="text" value="10"/>		<input type="text" value="150"/> <input type="text" value="0"/> <input type="text" value="20"/>		GPSOURCE	<input type="text" value="Scaled"/>
LATDEC	<input type="text" value="61.2194444444444"/>	LONDEC	<input type="text" value="150.0055555555556"/>			

PROJECT  ITEMSTATUS  SEARCHTYPE   
RADIUS  INIT  ASSIGNED   
TECNIQ

Techniqnote

History   
61RK IN LAT. 61/13/15.5N, LONG. 150/00/52.8W (NAD83)  
38RK IN LAT. 61/13/16.2N, LONG. 149/59/57.3W (NAD83)  
45RK IN LAT. 61/13/02.8N, LONG. 150/00/21.9W (NAD83)  
45RK IN LAT. 61/13/03.2N, LONG. 150/00/09.8W (NAD83)  
31RK IN LAT. 61/13/00.7N, LONG. 149/59/45.3W (NAD83)  
34RK IN LAT. 61/12/58.0N, LONG. 149/59/47.8W (NAD83)  
THE AWOIS POSITION IS THE GENERAL CENTER OF THIS GROUP OF ROCKS.  
(ENTERED 1/01 BY MBH)

Fieldnote   
DATE(S): 5/18/01 - 9/8/01  
VN: Sea Ducer TIME:N/A  
INVESTIGATION METHODS USED: 100% Multibeam  
SURVEYED POSITION: LAT. 61-12-52.7 LON. 150-00-28.6  
POSITION DETERMINED BY: DIFFERENTIAL GPS  
INVESTIGATION SUMMARY:  
The area has full coverage. A large number of rocks exist in the area. They range in depth from 33 feet to 91 feet.  
EVALUATOR COMMENTS: Chart area as shown on smooth sheet. Add "rky" notations as shown on smooth sheet.

Proprietary

YEARSUNK  NIMANUM  SYSTEMNUM

RECRD  VESSLTERMS  CHART  AREA   
CARTOCODE  SENDINGCODE  DEPTH

NATIVLAT	<input type="text" value="61/12/19.00"/>	NATIVLON	<input type="text" value="150/05/18.00"/>	<input type="button" value="convert"/>	NATIVDATUM	<input type="text" value="8"/>
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	<input type="text" value="61"/> <input type="text" value="12"/> <input type="text" value="17.01"/>		<input type="text" value="150"/> <input type="text" value="5"/> <input type="text" value="25.99"/>		GPSOURCE	<input type="text" value="N/A"/>
LATDEC	<input type="text" value="61.204725"/>	LONDEC	<input type="text" value="150.09055277778"/>			

PROJECT  ITEMSTATUS  SEARCHTYPE   
RADIUS  INIT  ASSIGNED   
TECNIQ   
Techniqnote

History

H9442/74  
H9760/78  
H10000/82--OPR-P358-RA-82: MINI-RANGER III R/R/CONTROL; KNIK ARM SHOAL LIES IN LAT.61-12-19N, LONG.150-05-18W AND HAS AN ECHO SOUNDER LD OF 14FT. IT PRESENTLY LIES MIDCHANNEL BETWEEN BUOYS "2KA" AND "7" AND IS ORIENTED IN A NORTH EASTERLY DIRECTION EXTENDING FROM LAT.61-12-15N, LONG.150-05-30W TO LAT.61-12-30N, LONG.150-05-10W. (ENTERED, 3/21/84, MJF)  
H10538/94--OPR-P395-RA: FOUND NUMEROUS SHOAL SOUNDINGS RANGING FROM 18-23 FEET (MLLW) ON THE KNIK ARM SHOAL. GENERALLY THE SHOAL REMAINS IN THE ARE BETWEEN THE TWO BUOYS PREVIOUSLY NOTED. (UPDATED 1/01 BY MBH)

Fieldnote

INVESTIGATION  
DATE(S): 5/18/01 - 9/8/01  
VN: Sea Ducer TIME:N/A  
INVESTIGATION METHODS USED: 100% Multibeam  
SURVEYED POSITION: LAT, 61-12-18.2 LON, 150-05-21.9  
POSITION DETERMINED BY: DIFFERENTIAL GPS  
INVESTIGATION SUMMARY:  
Remove Buoy "2KA" from the chart. Adjust the contour line to the North to note the migration of the shoal.  
EVALUATOR COMMENTS: Chart area as shown on the smooth sheet.

Proprietary

YEARSUNK  NIMANUM  SYSTEMNUM

**HYDROGRAPHIC SURVEY STATISTICS**

**H-11030**

RECORDS ACCOMPANYING SURVEY: To be completed when survey is processed

RECORD DESCRIPTION		AMOUNT	RECORD DESCRIPTION		AMOUNT
SMOOTH SHEET		1	SMOOTH OVERLAYS: POS., ARC, EXCESS		
DESCRIPTIVE REPORT		1	FIELD SHEETS AND OTHER OVERLAYS		
DESCRIP-TION	DEPTH/POS RECORDS	HORIZ. CONT. RECORDS	SONAR-GRAMS	PRINTOUTS	ABSTRACTS/SOURCE DOCUMENTS
ACCORDION FILES					
ENVELOPES					
VOLUMES					
CAHERS					
BOXES					

**SHORELINE DATA**

- SHORELINE MAPS (List):
- PHOTOBATHYMETRIC MAPS (List):
- NOTES TO THE HYDROGRAPHER (List):
- SPECIAL REPORTS (List):
- NAUTICAL CHARTS (List):

**OFFICE PROCESSING ACTIVITIES**

The following statistics will be submitted with the cartographer's report on the survey

PROCESSING ACTIVITY	AMOUNTS		
	VERIFICATION	EVALUATION	TOTALS
POSITIONS ON SHEET			
POSITIONS REVISED			
FINDINGS REVISED			
CONTROL STATIONS REVISED			
	TIME-HOURS		
	VERIFICATION	EVALUATION	TOTALS
PRE-PROCESSING EXAMINATION			
VERIFICATION OF CONTROL			
VERIFICATION OF POSITIONS			
VERIFICATION OF SOUNDINGS			
VERIFICATION OF JUNCTIONS			
APPLICATION OF PHOTOBATHYMETRY			
SHORELINE APPLICATION-VERIFICATION			
COMPILATION OF SMOOTH SHEET			10
COMPARISON WITH PRIOR SURVEYS AND CHARTS			
EVALUATION OF SIDE SCAN SONAR RECORDS			
EVALUATION OF WIRE DRAGS AND SWEEPS			
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Pre-processing Examination by	Beginning Date	04/22/2002	Ending Date	
Compilation of Field Data by	Time (Hours)	10	Ending Date	
Contract Compliance By G. Nelson				
Verification Check by	Time (Hours)	48	Ending Date	
Evaluation and Analysis by	Time (Hours)	47	Ending Date	05/15/2003
G. Nelson, B. Mikhailov				
Inspection by	Time (Hours)	10	Ending Date	5/5/2003
G. Nelson				

APPROVAL SHEET  
H11030

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 disproof 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.

*DC* *Gary C. Nelson* Date: *22 May 2003*  
Dennis Hill  
Chief, Cartographic Team  
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.

*J E Lowell Jr* Date: *6/19/03*  
John E. Lowell, Jr.  
Commander, NOAA  
Chief, Pacific Hydrographic Branch

*AWOIS ✓ & SURF ✓ by MBH 7-14-03*

