HORIZONTAL AND VERTICAL CONTROL REPORT

Project OPR-O119-FA
Ernest Sound, AK
April-June 2009
NOAA Ship *Fairweather*
Chief of Party: CAPT Douglas D. Baird Jr., NOAA

A. VERTICAL CONTROL

I. Project

The operating National Water Level Observation Network (NWLON) station at Ketchikan, AK (945-0460) will serve as datum control for the survey area and provide water level reducers for this project. A tertiary tide gauge station, Magnetic Point, Union Bay, Ernest Sound, AK (945-0753) and a short period station at Vixen Harbor, Ernest Sound, AK (945-0761) were established and maintained by the *Fairweather* for this project. The tidal datum for project OPR-O119-FA-09 is Mean Lower Low Water (MLLW). The Site Reports are located in Appendix A-I. The Field Tide Notes are located in Appendix A-II.

Verified observed water level correctors and the CO-OPS provided O119FA2009 zone definition file were used for vertical corrections in the field. NOAA Ship *Fairweather* will apply verified (smooth) tides to the survey data prior to submission.

II. Station Location

The tide station at Magnetic point, Union Bay, Ernest Sound, AK was located at 55° 47.29’N, 132° 11.45’W (GPS). A chartlet of the tide station location and a site sketch are located in Appendix A-III.

The tide station located in Vixen Harbor, Ernest Sound, AK was located at 55° 47' 59.17' N, 132° 09' 57.51'W (GPS).). A chartlet of the tide station location and a site sketch are located in Appendix A-III.

III. Gauge Type

Station Number	Gauge Type	Gauge Time	Installation Date	Removal Date	DCP S/N	Paros S/N	Gauge Number
945-0753	Sutron 8210	UTC	30 Apr 09	02 Jun 09	010799	97043	10
945-0761	Sutron 8210	UTC	25 May 09	02 Jun 09	023513	85173	12

V. Station Installation

Fairweather installed two tertiary water level stations for the project OPR-O119-FA-09. One tide station was established on Magnetic Point, Union Bay, Alaska and one in Vixen Inlet, Alaska. Thus one new tertiary tide station (Magnetic Point, Union Bay, 945-0753) was set up, along with the installation of 5 new benchmarks. Additionally, one new tertiary tide station (Vixen Harbor, AK, 945-0761) was installed, along with the installation of 3 new benchmarks.

The tide station at Magnetic Point, Union Bay, Ernest Sound, AK and Vixen Harbor, Ernest Sound, AK were established according to Section 4 of the *NOS Hydrographic Surveys Specifications and Deliverables* (April 2009) and the *User's Guide for the Installation of Bench Marks and Leveling Requirements for Water Level Stations* (1987). The Sutron 8210 "bubbler gauge" with field number 10 and serial number 010799 was installed on April 30, 2009 at the Magnetic Point location and a Sutron 8210 "bubbler gauge" with field number 12 and serial number 0253513 was installed on May 26, 2009. Each gauge was powered by two 12 volt batteries and a solar panel.

The orifice plates were secured with the rocks on the bottom and sections of chain, and the tubing was secured with sections of chain and cable ties. The remainder of the tubing was kept rolled up.

The gauges were connected to transmitting GOES antennas. The GOES antennas were installed near the station with a GOES West orientation, elevation 26.4°, azimuth (true) 184.4°. After the transmitted signal failed to be ingested by CO-OPS, it was concluded that the surrounding terrain and forest were blocking the transmission to the satellite. Weekly downloads were performed as a result.

Images of the stations are located in Appendix A-IV.

VI. Staff

Three meter graduated tide staffs were made by attaching a vitrified scale to a wooden two-by-four. The staffs were secured to a large flat rock face using support lumber

drilled into the rocks near the tide station with an angle iron, lag bolts and washers. The staffs were measured by a Brunton inclinometer and found to be vertical.

At the Magnetic Point location, One hundred eighty-six minutes (186) of opening staff observations were completed on April 30, 2009. A total of 774 minutes of additional observations were completed from April 30, 2009 through June 2, 2009, including a closing staff observation of 150 minutes on June 2, 2009. A complete three hour observation was not completed due to schedule issues. Manoj Samant of CO-OPS was contacted and gave verbal permission to continue with the observations that could be obtained. The staff observations and gauge data values were used to determine a gauge to staff mean difference. The staff observations and calculations are located in Appendix A-V.

At the Vixen Harbor location, One hundred forty-four minutes (144) of opening staff observations were completed on May 26, 2009. The complete three-hour observation was not complete due to the tide rising above the top of the staff. An additional hour of observations was completed the following day on May, 27, 2009. A total of 246 minutes of additional observations were completed from May 27, 2009 through June 2, 2009, including a closing staff observation of 186 minutes on June 2, 2009. The staff observations and gauge data values were used to determine a gauge to staff mean difference. The staff observations and calculations are located in Appendix A-V.

VII. Leveling

The tide stations were leveled based on the NOS publication *User's Guide for the Installation of Bench Marks and Leveling Requirements for Water Level Stations* (1987). *Fairweather* used a Zeiss NI2 optical level and conducted calculations by hand for both the opening and closing level runs. The level passed a Kukkamaki prior to the beginning of the project. At the Magnetic Point location, the opening level run was completed on April 30, 2009. The closing level run was conducted on June 2, 2009. No bracketing level runs were required or conducted. Both opening and closing level runs met the NOS closure tolerance for a third order station. The leveling abstract and comparisons between runs are located in Appendix A-VI. A U.S. Geodetic Survey Horizontal Control Mark (VIXEN HBR, 2009) was installed and incorporated into the opening and closing level runs at the Magnetic Point location.

At the Vixen Harbor location, the opening level run was completed on May 26, 2009. The closing level run was conducted on June 2, 2009. No bracketing level runs were required or conducted. Both opening and closing level runs met the NOS closure tolerance for a third order station. The leveling abstract and comparisons between runs are located in Appendix A-VI.

VIII. Benchmarks

Five new benchmarks were installed at the site located south of Vixen Point and north of Magnetic point on the eastern shore of Ernest Sound by the 2009 *Fairweather* crew. A new U.S. U.S. Geodetic Survey Horizontal Control Mark was also installed at this station (VIXEN HBR 2009).

Benchmark	**Location (DM)**
945-0753A 2009	**55° 47.296' N, 132° 11.451' W**
945-0753B 2009	**55° 47.283' N, 132° 11.444' W**
945-0753C 2009	**55° 47.303' N, 132° 11.432' W**
945-0753D 2009	**55° 47.319' N, 132° 11.443' W**
945-0753E 2009	**55° 47.279' N, 132° 11.463' W**
VIXEN HBR 2009	**55˚ 47.304' N, 132˚ 11.451' W**

The primary benchmark is "945-0753A 2009". The above positions were established with a hand held GPS using the NAD83 horizontal datum.

Benchmark descriptions are located in Appendix A-VII.

IX. Gauge Data

The gauges provided to the NOAA Ship *Fairweather* require the installation of a software program in order to download accurate data. Data was periodically downloaded directly from the gauge using the TS8210 Version 1.6 software and was sent to CO-OPS. Transmission of the data to the satellite was blocked by terrain and surrounding forest. Data from Gauge 10 (94507531) has been submitted digitally with this report in Appendix A-VIII.

X. Station Removal

The gauges, tide staffs, and accompanying equipment were removed on June 2, 2009 from both the Magnetic Point location and the Vixen Harbor location.

Horizontal Control Report

Project OPR-O119-FA-09
Ernest Sound and Eastern Passage, Alaska
May - June 2009
NOAA Ship *Fairweather*
Chief of Party: Captain Douglas D. Baird, NOAA

B. HORIZONTAL CONTROL

Horizontal control activities were conducted on a previously established horizontal control mark, on a new horizontal control mark, and on one Aid to Navigation (ATON). NOAA Ship *Fairweather* personnel conducted all fieldwork. The field parties were not equipped with weather instruments so weather data was not collected at the sites. No significant weather patterns occurred during the recording sessions.

Figure 1 below shows the general location of horizontal control marks CANOE and VIXEN HBR and of the ATON at Meyers Chuck.

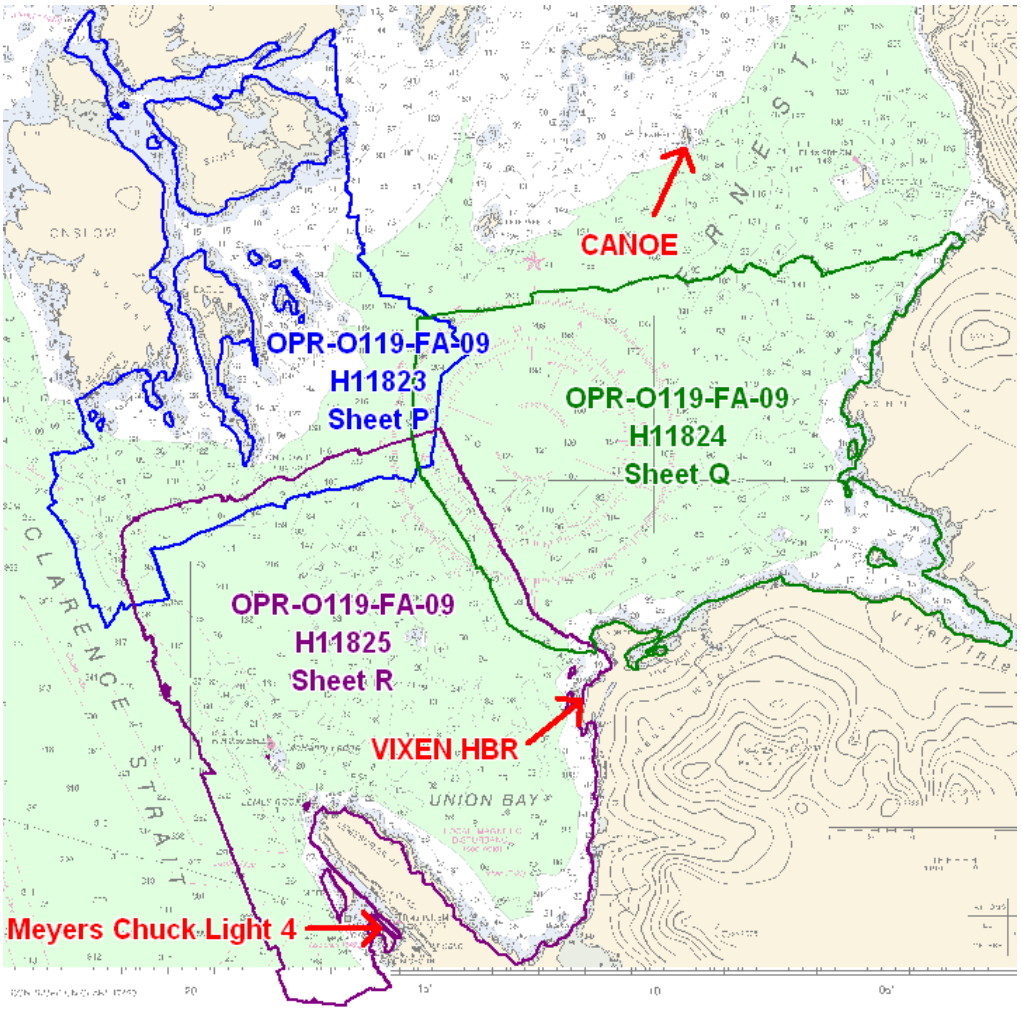


Figure 1 Location of Horizontal Control Activities

I. Soundings and Detached Positions

The Post Processing Kinematic method (PPK) was used as a method of horizontal positioning for soundings and detached positions during survey H11823, H11824, and H11825. For details on specific sheets refer to the descriptive report (DR). A GPS base station was set up on Westerly Island on horizontal control mark CANOE during hydrographic survey activities for use in PPK positioning. A second GPS base station was set up near Magnetic Point on horizontal control mark VIXEN HBR as a back-up to the station on CANOE.

The Differential Global Positioning System (DGPS) was used for horizontal positioning when PPK was not available or as indicated by the Hydrographer in the DR. The U.S. Coast Guard DGPS beacon at Annette Island (323 KHz) was the primary source of differential correctors for small boat operations. Annette Island and Level Island (295 kHz) served as the primary sources for the ship.

Where PPK was used as the sole method of positioning, quality control checks were used to ensure compliance with the positional accuracy requirements of NOS Hydrographic Surveys Specifications and Deliverables Manual, April 2008 (HSSDM), Sections 3.1 and 3.2. The following checks were conducted:

- North, East, and Down position error Root Mean Square (RMS) time series plots were reviewed and found to have a max RMS value less that 0.05 m.
- Entered Base Station coordinates were independently reviewed for consistency with published coordinates.
- The Altitude time series plot was reviewed for anomalous jumps corresponding to rapid oscillation of the x, y, or z accelerometer bias. While the navigation altitude was not used in this survey it is the experience of the Hydrographer that the Altitude time series can indicate poor quality solutions that are not reflected in the RMS values.

II. Fixed Aids to Navigation

The Aid to Navigation (ATON) Meyers Chuck Light 4 (Light List # 22445) was positioned using an Ashtech Z-Xtreme (SN: ZE1200339016) with Ashtech Geodetic IV antenna (SN: 8365) with ground-plane. It was processed with National Geodetic Survey (NGS) Online Positioning User Service Rapid Static (OPUS-RS). See Appendix B-I for OPUS-RS solutions.

Light List Name	Light List Number	NAD83 (CORS 96) (EPOCH:2003.0000)		Processing Method
		N. Latitude (Pk to Pk Err. (m))	W. Longitude (Pk to Pk Err. (m))	
MEYERS CHUCK LIGHT 4	22445	55° 44' 32.24953" (0.012)	132° 15' 46.35652" (0.006)	OPUS-RS

Table 1. ATON Positions as computed by NGS OPUS-RS

III. Horizontal Control Activities

The previously established control mark CANOE (PID: BBBH07) on the southern end of Westerly Island was occupied with a static GPS receiver which ran throughout survey operations to provide a base station for use in PPK data.

A horizontal control mark stamped “VIXEN HBR 2009” was established near Magnetic Point. This control mark was occupied with a static GPS receiver which ran throughout survey operations as a back-up to the primary station at CANOE.

The receiver recording intervals were set to one (1) second. The elevation mask for all sites was set at ten (10) degrees. For all sites a fixed height tripod was used. Table 2 contains equipment specifications used in this project.

Site	Day Numbers	Receiver Model	Receiver SN	Firmware	Antenna Model
ATON	148	Ashtech Z-Xtreme	ZE 1200339016	ZE21	Ashtech Geodetic IV
VIXEN HBR	120 to 127	Ashtech Z-Xtreme	ZE 1200339016	ZE21	Ashtech Geodetic IV
CANOE	125 to 153	Trimble NetR5	4910K61066	3.71	Zephyr Geodetic 2
VIXEN HBR	127 to 153	Trimble NetR5	4910K61054	3.71	Zephyr Geodetic 2

Table 2. Equipment specifications

Table 3 shows the latitude, longitude, and elevation of the horizontal control marks used for this project. CANOE is a published site with the National Geodetic Survey (NGS). VIXEN HBR was positioned using the NGS Online Positioning User Service Static (OPUS-S) from a 24 hour observation on day number 144. These positions were used for all PPK processing for the launches and the ship. See Appendix B-III for the NGS OPUS-S Solutions. The observation logs are provided in Appendix B-IV and provide the physical setup of each station.

Station Name	NAD83 (CORS 96) (EPOCH:2003.0000)		Ellipsoid Ht. (m) (Pk to Pk Err. (m))	Satellite Ephemeris File
	N. Latitude (Pk to Pk Err. (m))	W. Longitude (Pk to Pk Err. (m))		
CANOE	55° 54’ 08.50252” (0.010)	132° 09’ 21.01615” (0.013)	2.108 (0.120)	igr15025.eph
VIXEN HBR	55° 47’ 18.23776” (0.011)	132° 11’ 27.06533” (0.007)	1.332 (0.046)	igr15330.eph

Table 3. Horizontal control positions provided by NGS OPUS-S

VIXEN HBR Site Description and Photos

The mark is located on the east shore of Union Bay, about 0.4 miles north along the west shore of Magnetic Point, east of a small island, in the northerly of two rock outcroppings both topped by moss and stunted trees.

The mark is a standard 3 1/2 inch brass disc stamped VIXEN HBR 2009 cemented in a drill hole in solid rock, at the south end of the mossy cap, about 6 feet south of a dwarf hemlock, approx 3 feet above high water.

Figure 2: Close Up View

Figure 3: Horizontal View

Appendix A-I
SITE REPORT

TERTIARY TIDE STATION - SITE REPORT

(FA Form 08/10/05) NOAA - National Ocean Service - Center for Operational Oceanographic Products and Services

SITE INFO	**Station Name**	Magnetic Point, Ernest Sound, AK			**Station Number**	945-0753			
	Lat	59º28.1 N	Lon	151º33.9 W	Time Meridian	135º	GMT Offset	8	Datum NAD83
	Facility Name						Phone		
	Address								
	City						State		Zip
PROJECT INFO	**Project**	OPR-O119-FA-09			**Project Name**	Ernest Sound			
	Control Station Name	Ketchikan, AK			**Control Station Number**	945-0460			
	Zones served by hydro tide station	Entire Survey							
STATION INFO	Date and time established (UTC)	4/30/09 13:00	Date and time repaired (UTC)	N/A	Date and time removed (UTC)	6/2/2009 1330			
	Platform	NOAA Ship Fairweather			Tides Officer	ENS Matthew Forney			
	FOO	LT Matthew Ringel			CO	CDR Douglas D. Baird Jr.			
	CO Approval						Date		
	CO-OPS Approval						Date		
OWNER	Owner				Owner Contact				
	Work Phone		Work Fax		Cell Phone		Home Phone		
	Address				E-Mail				
	City						State		Zip
	Comments								
CONTACT	Contact Name	LCDR James Crocker., NOAA							
	Work Phone	(301) 713-2702 x112	Work Fax	N/A	Cell Phone	N/A	Home Phone	N/A	
	Address	1315 East West Highway, N/CS31, SSMC3, St. #6854			E-Mail	james.m.crocker@noaa.gov			
	City	Silver Spring					State	MD	Zip 20910
	Comments								
SHELTER	Shelter Type	N/A							
	Date Installed	N/A	AC Power?	No	Combo	N/A	Key Location	N/A	
	Comments	The Gauge was located on a rock ledge above high water adjacent to BM 945-0753-A 2009.							
STAFF	Staff Type	Vitrified	Staff Stop	2.5m	Staff Hinged?	No	Date installed	4/30/2009	
	Graduation Limit	0 to 5 m	Orifice at staff zero?	No	Staff changed?	No	Date removed	6/2/2009	
	note: if the staff was changed, see replacement staff attachment								
	Comments	A 3.0 m staff was made by attaching a section of vitrified scale to a wooden 2x4. The staff was secured to a flat easterly facing rock.							
ORIFICE	Orifice Type	Standard Brass			Orifice Plate?	Yes	Orifice Diameter	25 mm (ID)	
	Comments	The orifice was secured using the orifice plate with angle iron welded to the plate. Chain was used to anchor the plate to the seafloor.							
SATELLITE INFO	Unit ID	10	Azimuth	183º	Transmit Rate	2:32:05	Cable Length	60 ft	
	GOES ID	3344973C	Elevation	21.0º	Transmit Power	124 W	Magnetic Variation	22° E	
	Transmit Time	0:37:32	GOES Channel	Ch. 116					
	Comments	Gauge unable to transmit properly due to high terrain and trees blocking satellite.							

TERTIARY TIDE STATION - SITE REPORT

(FA Form 08/10/05) NOAA - National Ocean Service - Center for Operational Oceanographic Products and Services

SOLAR PANELS

Solar Panel	30 W	Elevation from Horizon	Unknown	Cable Length	20 ft
Comments	A solar panel was connected to the two gel cell batteries, which were connected to the gauge.				

SUTRON 8200/8210 DCP

Date installed	4/30/09	Type	8210	Power Source	2 Batteries and a solar panel	Battery Date	Unknown
Unit	10	DCP S/N	010799	GOES ID	116	Battery type	12 V
CPU S/N	unknown	PAROS S/N	97043	Amp gain	3.00 db	Battery amp-hour	26
Vent Value	18 psi, 14 flow meter	Gauge replaced?	No	Tiny Basic Prg	Unknown	Gauge Time	Unknown
	note: if gauge was replaced, see replacement gauge attachment						
Comments							

GAUGE TO STAFF COMPARISON

Opening Observations		Additional Observations		Overall Observations	
Minutes Completed	186	Minutes Completed	774	Minutes Completed	960
Avg Staff-Gauge Difference	10.325	Avg Staff-Gauge Difference	10.330	Avg Staff-Gauge Difference	10.329
Standard Deviation (+/-)	0.008053	Standard Deviation (+/-)	0.017654	Standard Deviation (+/-)	0.01622

Comments: Observations can only be made during high tidal ranges. Time, Personnel, and Equipment restraints did not allow for three-one hr of observations per week. Two-one hour observations were completed per week as a result.

LEVELS

Date of opening levels	04/30/09	Opening closed w/in NOS tolerances?	Yes	Bracket levels required?	No
Opening of cummulative diverg w/in tolerance	Yes	Closing closed w/in NOS tolerance?	Yes	Staff included in levels?	Yes
Date of closing levels	6/2/2009	Opening/closing agreement	0.0087m	Orifice included in levels?	No
Closing of cummulative diverg w/in tolerance?	Yes	Levels agree with history?	N/A	No. of benchmarks connected	6
Level type (optical / barcode / mixed)	Optical (Zeiss Ni2), S/N 103267			Downshot leveling required?	No
Comments					

BENCH MARKS

Primary BM stamping	945-0753-A 2009	Primary BM elevation above staff zero	4.6623 m
Number of benchmarks established	6	Number of benchmarks recovered	0
Established benchmarks	945-0753 A, 945-0753 B, 945-0753 C, 945-0753 D, 945-0753 E, and VIXEN HBR		
Recovered benchmarks			
Comments	This is a newly installed gauge. All benchmarks were installed by the tides party.		

DIGITAL RECORDS

File Name	94507531.LOG	From (UTC)	4/30/2009 18:19	To (UTC)	6/3/2009 01:25
File Name		From (UTC)		To (UTC)	
File Name		From (UTC)		To (UTC)	

GPS

GPS accomplished this AI?	Yes	GPS BM stamping	VIXEN HRB 2009	GPS elevation	1.371M (Ellipsoid Height)
Comments	Total hours of GPS observations: 8 hours.				

DIVE INFO

Installation dive time (hrs)	0.5	Last dive date	6/2/2009	Bottom type	Rock
Removal dive time (hrs)	0.5	Marine growth (low/med/high)	Low	Orifice depth	30 feet

STATION REMARKS

TERTIARY TIDE STATION - SITE REPORT

(FA Form 08/10/05) NOAA - National Ocean Service - Center for Operational Oceanographic Products and Services

SITE INFO	**Station Name**	Vixen Harbor, Ernest Sound, AK			**Station Number**	945-0761		
	Lat	55° 47.986'N	Lon	132° 09.986'W	Time Meridian	135°	GMT Offset 8	Datum NAD83
	Facility Name	N/A					Phone	N/A
	Address	N/A						
	City	N/A					State	AK	Zip N/A
PROJECT INFO	**Project**	OPR-O119-FA-09			**Project Name**	Ernest Sound		
	Control Station Name	Ketchikan, AK			**Control Station Number**	945-0460		
	Zones served by hydro tide station	Vixen Harbor						
STATION INFO	Date and time established (UTC)	5/26/2009 18:31	Date and time repaired (UTC)	N/A	Date and time removed (UTC)	6/2/2009 23:19		
	Platform	NOAA Ship FAIRWEATHER			Tides Officer	ENS Matthew Forney		
	FOO	LT Matthew Ringel			CO	CDR Douglas D. Baird, Jr., NOAA		
	CO Approval						Date	
	CO-OPS Approval						Date	
OWNER	Owner				Owner Contact			
	Work Phone		Work Fax		Cell Phone		Home Phone	
	Address				E-Mail			
	City						State	AK	Zip
	Comments							
CONTACT	Contact Name	LCDR James Crocker., NOAA						
	Work Phone	(301) 713-2777 x112	Work Fax	N/A	Cell Phone	N/A	Home Phone	N/A
	Address	1315 East West Highway, N/CS31, SSMC3, St. #6854			E-Mail	james.m.crocker@noaa.gov		
	City	Silver Spring					State	MD	Zip 20910
	Comments							
SHELTER	Shelter Type	N/A						
	Date Installed	N/A	AC Power?	No	Combo	N/A	Key Location	N/A
	Comments	The gauge was located in a protected area of rock, trees and moss away from high water. A tarp was used to cover the gauge with rocks to secure the tarp. The GOES antenna was connected to the gauge, but was not used for transmitting.						
STAFF	Staff Type	Vitrified	Staff Stop	2.5	Staff Hinged?	No	Date installed	5/26/2009
	Graduation Limit	0 to 3.0m	Orifice at staff zero?	No	Staff changed?	No	Date removed	6/2/2009
	note: if the staff was changed, see replacement staff attachment							
	Comments	A 3.0 meter staff was made by attaching a section of vitrified scale to a wooden 2x4. The staff was secured to a large flat rock face using support lumber drilled into the rocks.						
ORIFICE	Orifice Type	Standard Brass			Orifice Plate?	Yes	Orifice Diameter	25mm (ID)
	Comments	The orifice was secured to an orifice plate using hose clamps. The plate was then secured to a shelf on the ocean floor using sections of chain. The tubing was secured using chain, wire ties and rocks up to the tide gauge. The excess tubing was left coiled.						
SATELLITE INFO	Unit ID	12	Azimuth	unknown	Transmit Rate	unknown	Cable Length	25 m
	GOES ID	3344B1D0	Elevation	unknown	Transmit Power	124W	Magnetic Variation	22°
	Transmit Time	0:17:02	GOES Channel	Ch 116				
	Comments	We were unable to properly transmit due to terrain and trees blocking the path of the signal to the satellite.						

TERTIARY TIDE STATION - SITE REPORT

(FA Form 08/10/05) NOAA - National Ocean Service - Center for Operational Oceanographic Products and Services

SOLAR PANELS	Solar Panel	30 W	Elevation from Horizon	Unknown	Cable Length	20ft
	Comments	A solar panel was connected to the two gel cell batteries, which were connected to the gauge.				

SUTRON 8200/8210 DCP	Date installed	5/26/09	Type?	8210	Power Source	2 Batteries and a solar panel	Battery Date Unknown
	Unit	12	DCP S/N	23513	GOES ID	3344B1D0	Battery type 12v
	CPU S/N	Unknown	PAROS S/N	85173	Amp gain	3.00A	Battery amp-hour 26
	Vent Value	18psi @ Reg, 13psi @ flow meter	Gauge replaced?	No	Tiny Basic Prg	Unknown	Gauge Time UTC
		note: if gauge was replaced, see replacement gauge attachment					
	Comments	Gauge unable to transmit properly due to high terrain and trees blocking satellite.					

	Opening Observations		Additional Observations		Overall Observations	
GAUGE TO STAFF COMPARISON	Minutes Completed	150	Minutes Completed	246	Minutes Completed	396
	Avg Staff-Gauge Difference	4.176m	Avg Staff-Gauge Difference	4.212	Avg Staff-Gauge Difference	4.199
	Standard Deviation (+/-)	0.021799	Standard Deviation (+/-)	0.017559	Standard Deviation (+/-)	0.025869
	Comments					

LEVELS	Date of opening levels	05/26/09	Opening closed w/in NOS tolerances?	Yes	Bracket levels required?	No
	Opening of cummulative diverg w/in tolerance	Yes	Closing closed w/in NOS tolerance?	Yes	Staff included in levels?	Yes
	Date of closing levels	6/2/09	Opening/closing agreement	Yes	Orifice included in levels?	No
	Closing of cummulative diverg w/in tolerance?	Yes	Levels agree with history?	N/A	No. of benchmarks connected	3
	Level type (optical / barcode / mixed)	Optical (Zeiss Ni2), S/N 103267			Downshot leveling required?	No
	Comments					

BENCH MARKS	Primary BM stamping	945-0761-A 2009	Primary BM elevation above staff zero	4.277
	Number of benchmarks established	3	Number of benchmarks recovered	0
	Established benchmarks	945-0761 A, 945-0761 B, and 945-0761 C		
	Recovered benchmarks	N/A		
	Comments	This is a newly installed gauge. All benchmarks were installed by the tides party.		

DIGITAL RECORDS	File Name	94507611.LOG	From (UTC)	5/26/09 18:31	To (UTC)	6/2/09 23:19
	File Name	N/A	From (UTC)	N/A	To (UTC)	N/A
	File Name	N/A	From (UTC)	N/A	To (UTC)	N/A

GPS	GPS accomplished this AI?	No	GPS BM stamping		GPS elevation	
	Comments					

DIVE INFO	Installation dive time (hrs)	0	Last dive date	N/A	Bottom type	Mud
	Removal dive time (hrs)	0	Marine growth (low/med/high)	low	Orifice depth	4 m

STATION REMARKS	

Appendix A-II
FIELD TIDE NOTE

OPR-O119-FA-09, Ernest Sound, AK
Tide Station 9450753, Vixen Harbor, AK
2009

Field Tide Note

Station Installed: April 30, 2009
Station Removed: June 2, 2009

Positions (derived from handheld GPS, NAD83):

Bench mark	Location (DM)
945-0753 “A” 2009	55° 47.296’ N, 132° 11.451’ W
945-0753 “B” 2009	55° 47.283’ N, 132° 11.444’ W
945-0753 “C” 2009	55° 47.303’ N, 132° 11.432’ W
945-0753 “D” 2009	55° 47.319’ N, 132° 11.443’ W
945-0753 “E” 2009	55° 47.279’ N, 132° 11.463’ W

OPR-O119-FA-09, Vixen Harbor, Ernest Sound, AK
Tide Station 945-0761, Vixen Harbor, AK
2009

Field Tide Note

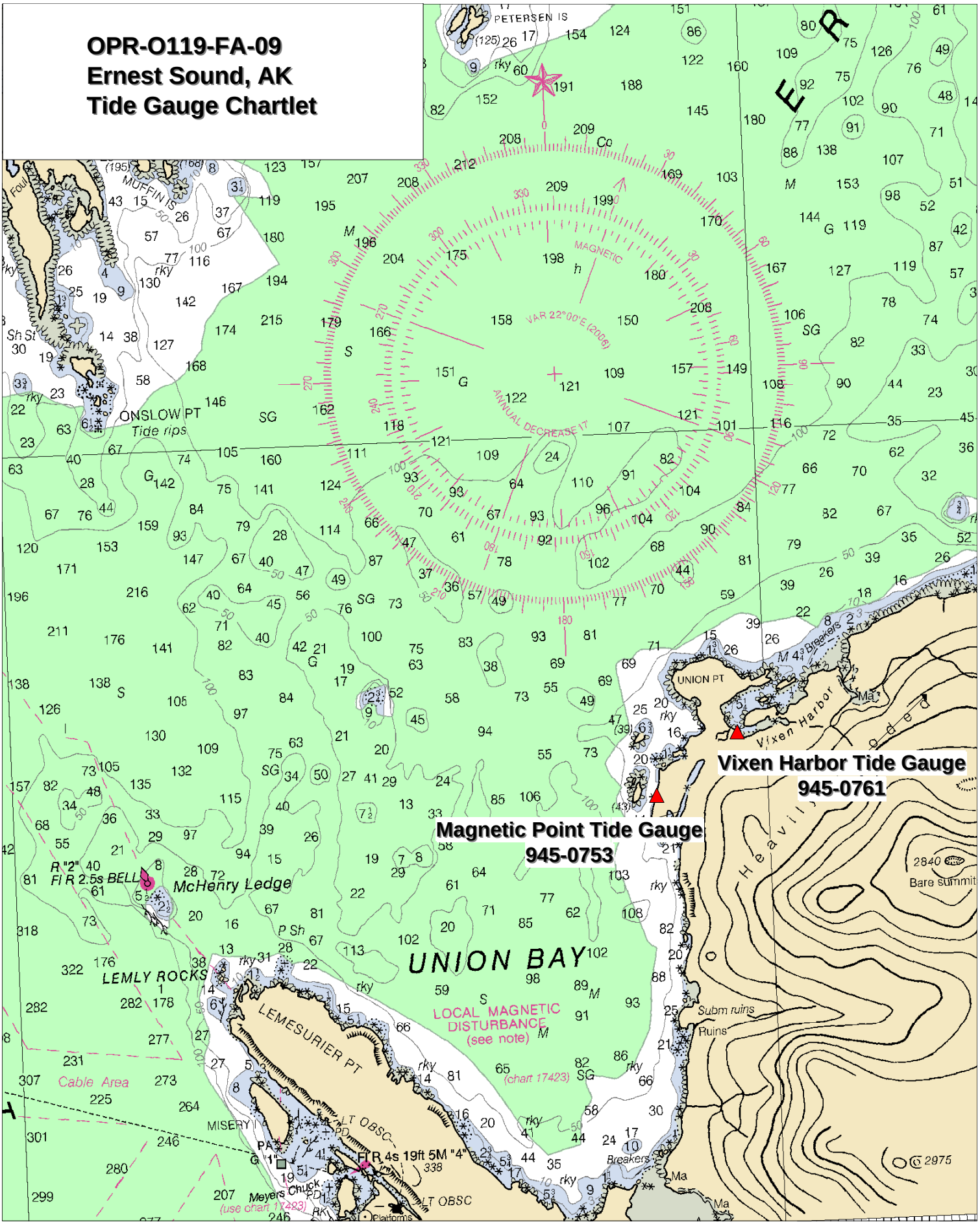
Station Installed: May 26, 2009
Station Removed: June 2, 2009

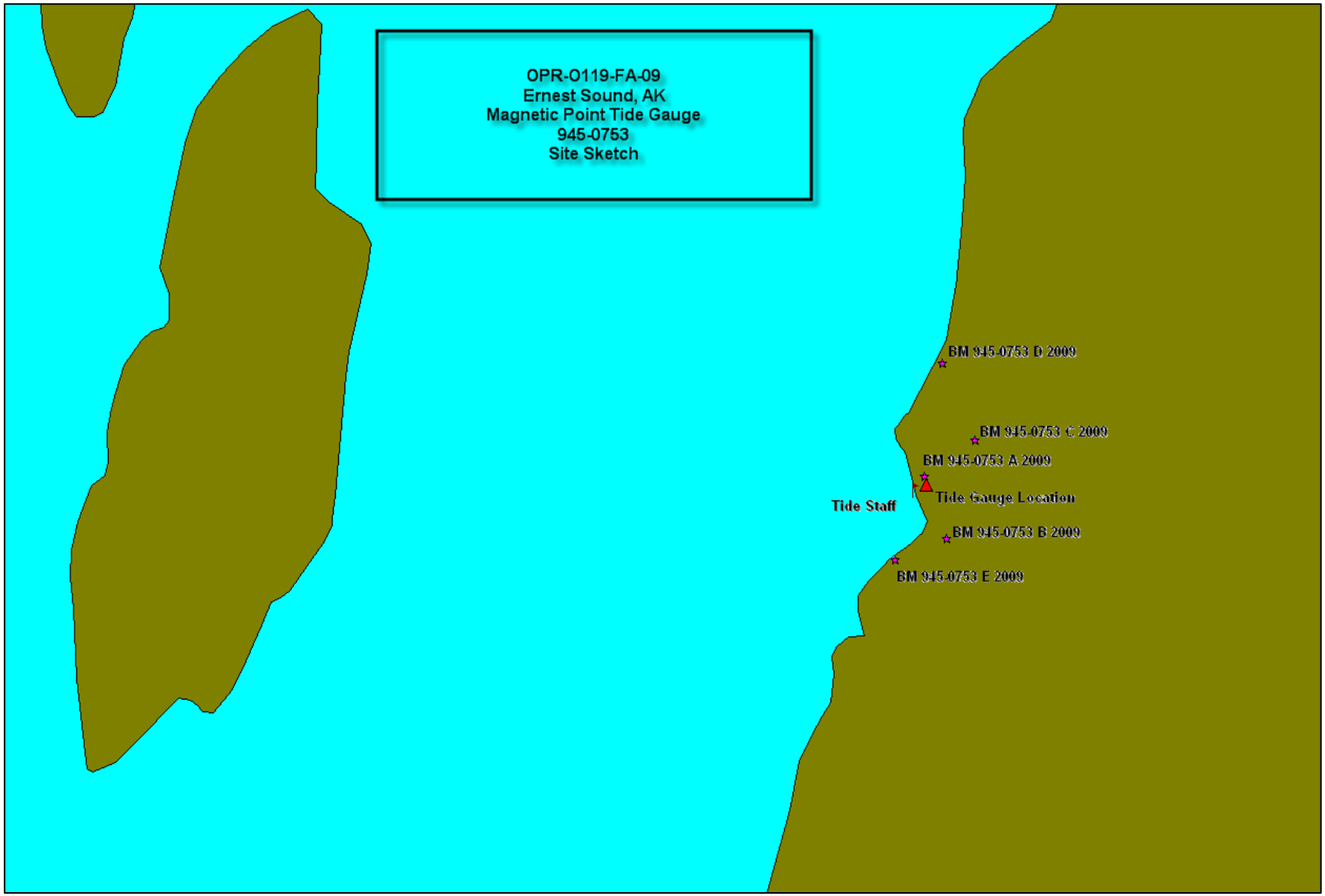
Positions (derived from handheld GPS, NAD83):

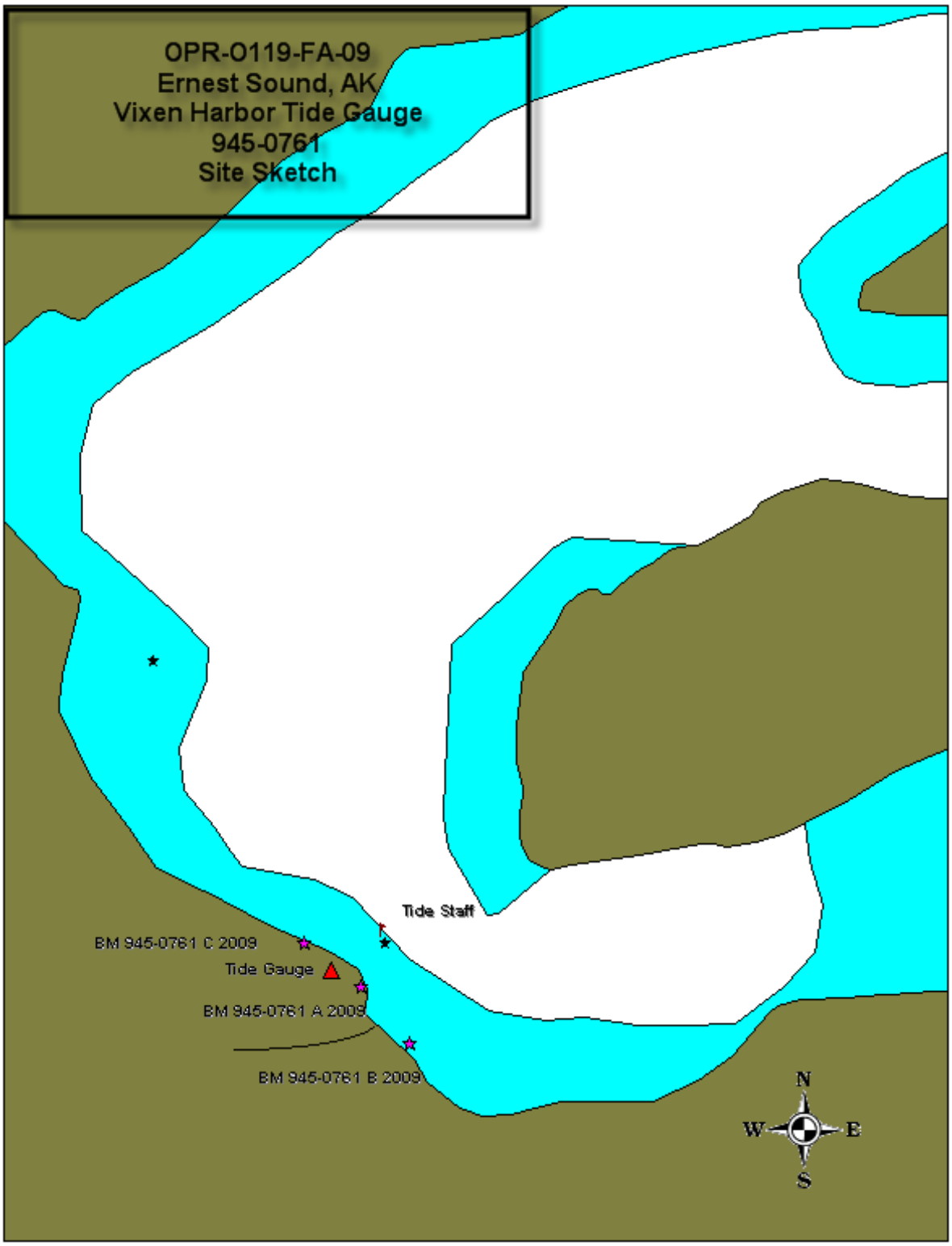
Bench mark	Location (DM)
945-0761 “A” 2009	55° 47.741’ N, 132° 10.352’ W
945-0761 “B” 2009	55° 47.723’ N, 132° 10.324’ W
945-0761 “C” 2009	55° 47.755’ N, 132° 10.384’ W

Appendix A-III
CHARTLET and SITE SKETCH

OPR-O119-FA-09
Ernest Sound, AK
Tide Gauge Chartlet

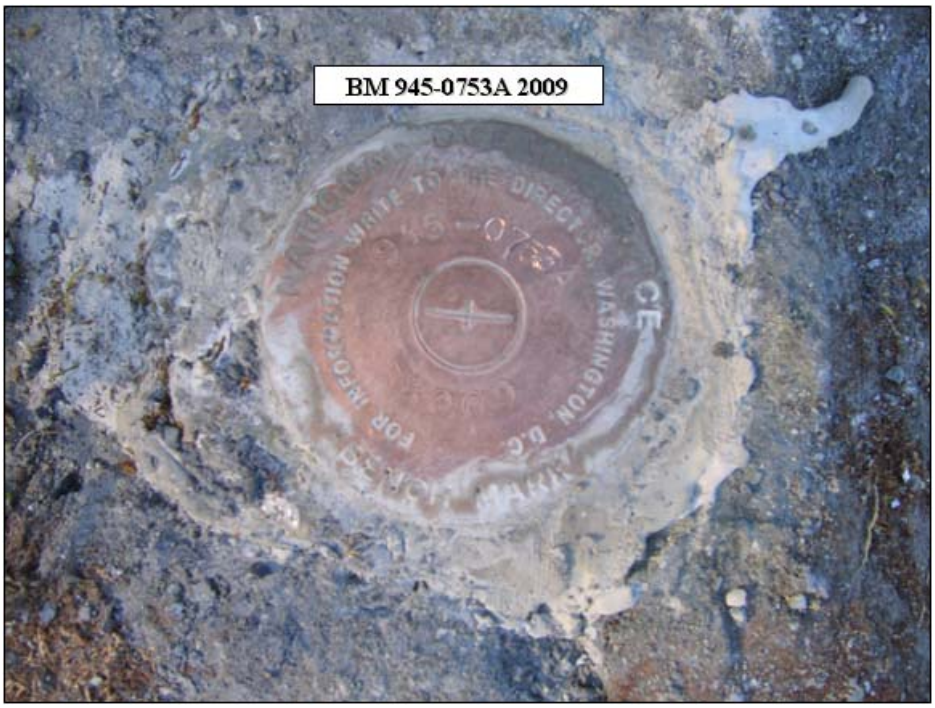



OPR-O119-FA-09
Ernest Sound, AK
Magnetic Point Tide Gauge
945-0753
Site Sketch
BM 945-0753 D 2009
BM 945-0753 C 2009
BM 945-0753 A 2009
Tide Gauge Location
Tide Staff
BM 945-0753 B 2009
BM 945-0753 E 2009

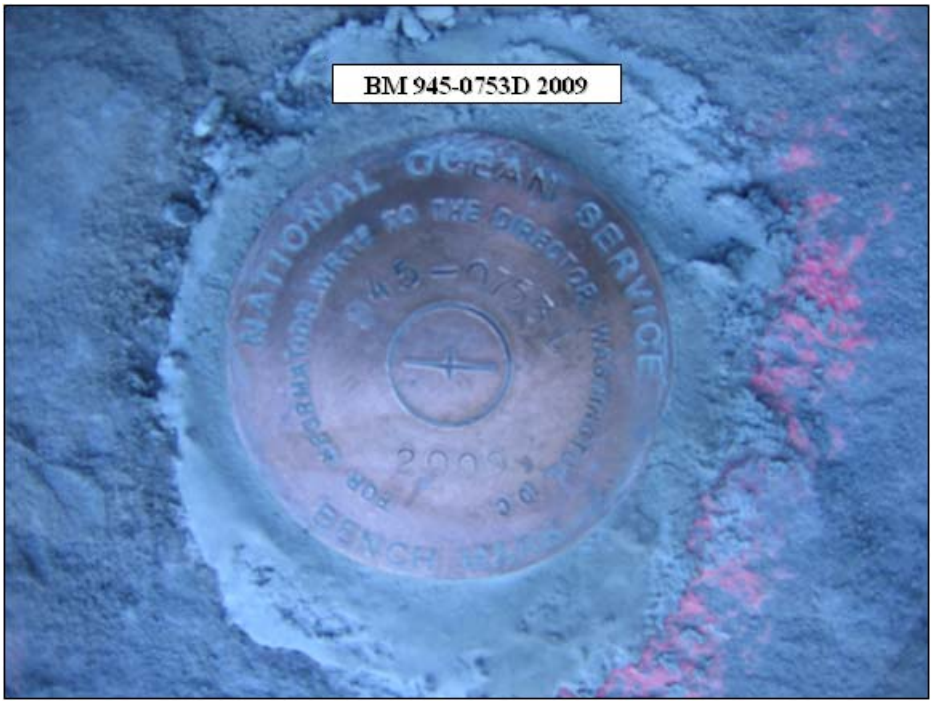

OPR-O119-FA-09
Ernest Sound, AK
Vixen Harbor Tide Gauge
945-0761
Site Sketch
Tide Staff
BM 945-0761 C 2009
Tide Gauge
BM 945-0761 A 2009
BM 945-0761 B 2009
N
W
E
S

Appendix A-IV
STATION IMAGES

Magnetic Point, Ernest Sound, Alaska 945-0753 Photos

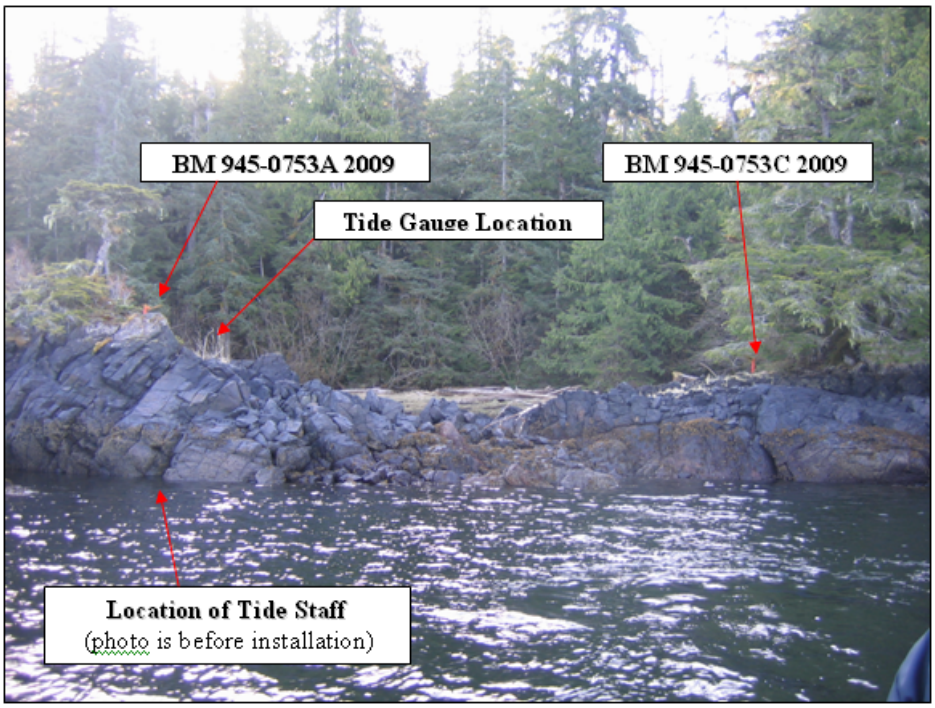


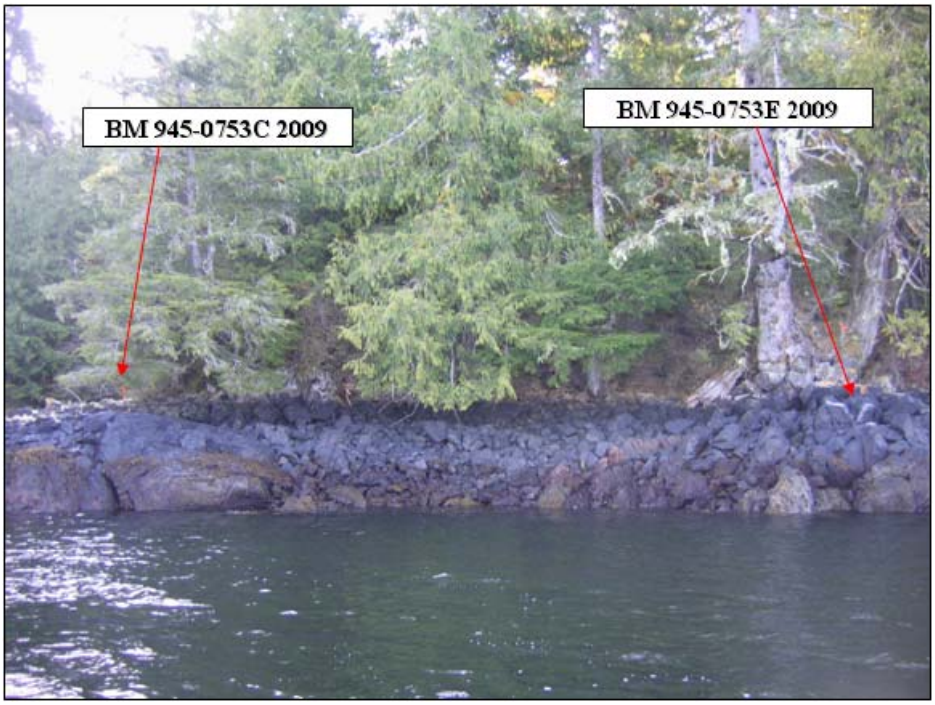
BM 945-0753C 2009
NATIONAL OCEAN SERVICE
WASHINGTON, D.C.
2009
BENCH MARK


BM 945-0753D 2009
NATIONAL OCEAN SERVICE
2009

BM 945-0753E 2009
NATIONAL OCEAN SERVICE
TO THE DIRECTOR, WASHINGTON, D.C.
945-0753E
2009
BENCH MARK

Horizontal Control VIXEN HBR 2009
NATIONAL OCEAN SERVICE
TO THE DIRECTOR, WASHINGTON, D.C.
2009


BM 945-0753A 2009
BM 945-0753C 2009
Tide Gauge Location
Location of Tide Staff
(photo is before installation)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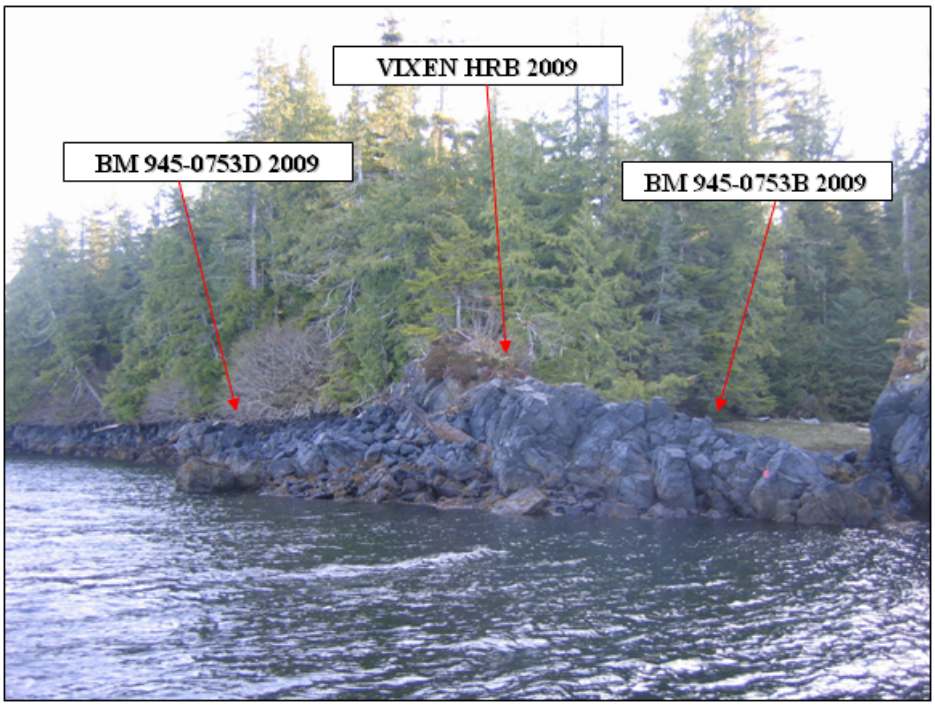
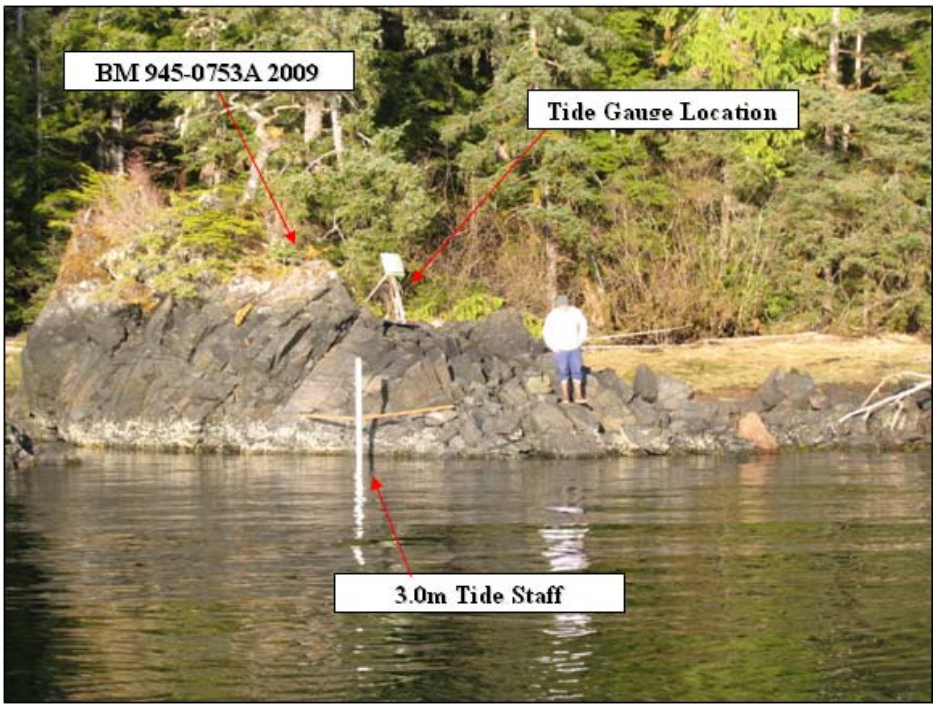
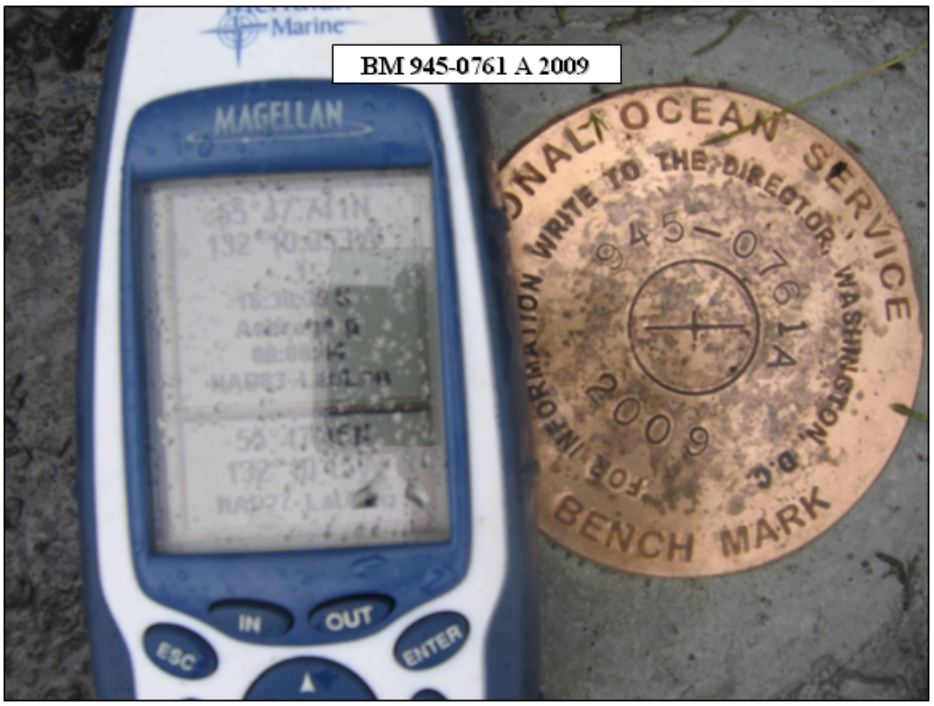
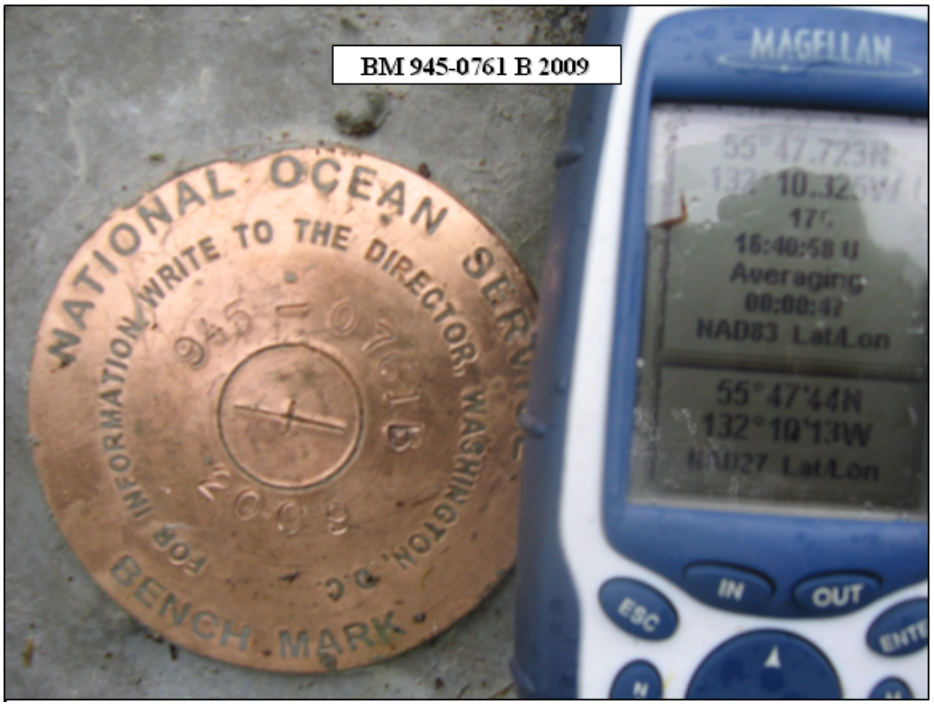
BM 945-0753E 2009


VIXEN HRB 2009
BM 945-0753D 2009
BM 945-0753B 2009

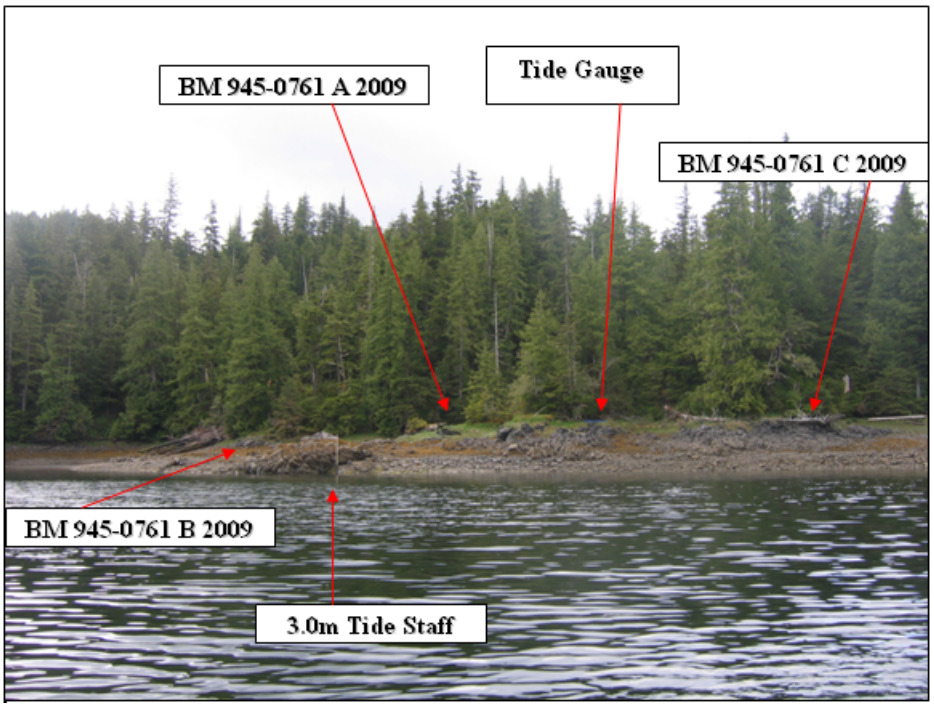

BM 945-0753A 2009
Tide Gauge Location
3.0m Tide Staff

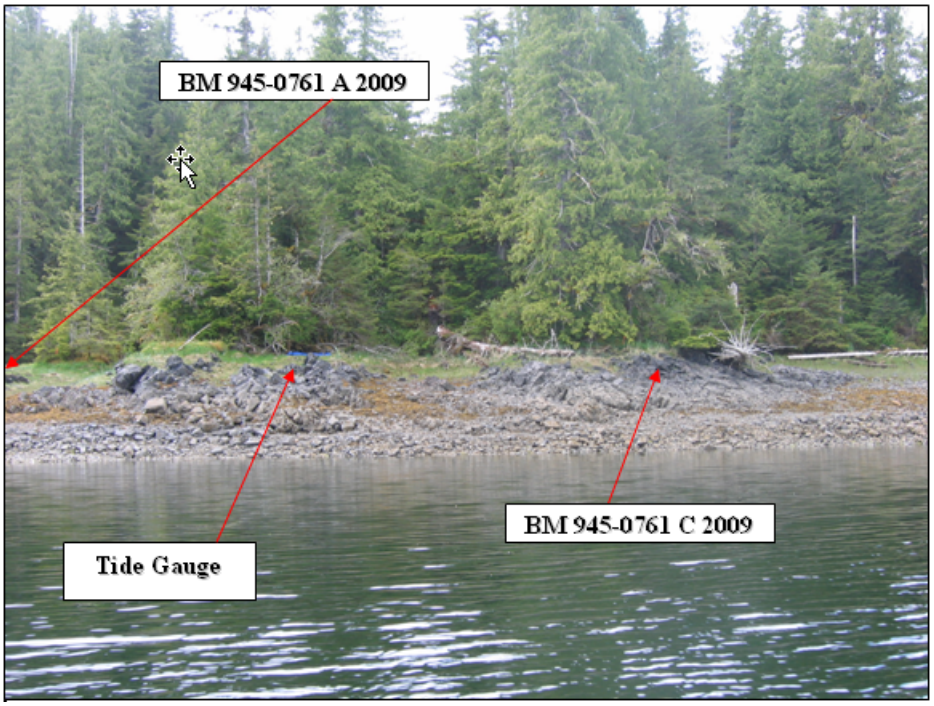
Vixen Harbor, Ernest Sound, Alaska 945-0761 Photos

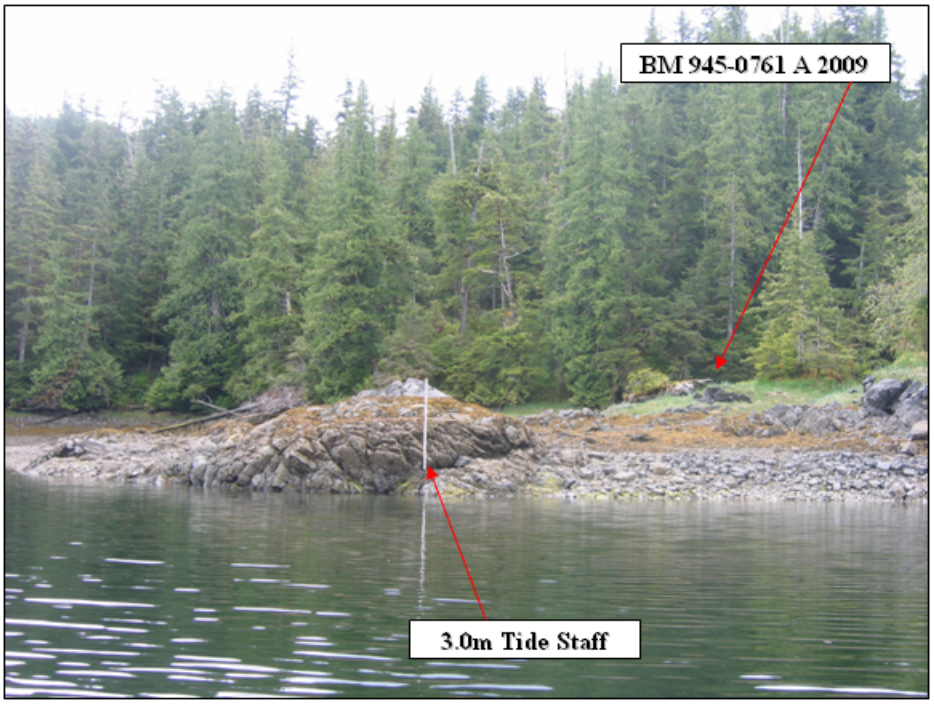


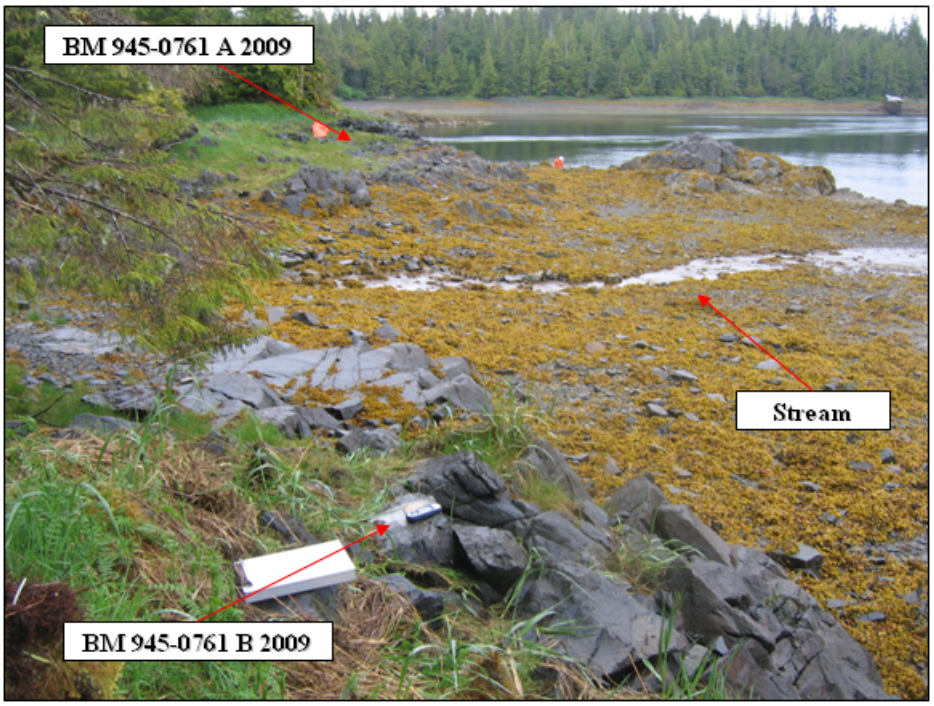


BM 945-0761 C 2009
MAGELLAN
BENCH MARK
FOR INFORMATION WRITE TO THE DIRECTOR
NATIONAL OCEAN SE


BM 945-0761 A 2009
Tide Gauge
BM 945-0761 C 2009
BM 945-0761 B 2009
3.0m Tide Staff


BM 945-0761 A 2009
Tide Gauge
BM 945-0761 C 2009


BM 945-0761 A 2009
3.0m Tide Staff


BM 945-0761 A 2009
Stream
BM 945-0761 B 2009

Appendix A-V
STAFF OBSERVATIONS AND CALCULATIONS

Station: 945-0753
Magnetic Point, Ernest Sound, AK
OPR-O119-FA-09

Gauge S/N: 010799
Staff Stop: 2.5m
PAROS S/N: 97043

Observers:
ENS Matthew Forney
SST Brenna Campbell

	Staff Time (UTC)	Staff High (m)	Staff Low (m)	Staff Mean (m)	Gauge Time (UTC)	Gauge Height (m)	Staff to Gauge Difference	Staff Plus Mean Difference
4/30/2009								
	23:31	0.04	0.00	0.020	23:31	10.338	10.318	10.345
	23:37	0.18	0.08	0.130	23:37	10.433	10.303	10.455
	23:43	0.24	0.18	0.210	23:43	10.528	10.318	10.535
	23:49	0.32	0.28	0.300	23:49	10.619	10.319	10.625
	23:55	0.41	0.37	0.390	23:55	10.709	10.319	10.715
5/1/2009	0:01	0.50	0.46	0.480	0:01	10.796	10.316	10.805
	0:07	0.60	0.54	0.570	0:07	10.883	10.313	10.895
	0:13	0.68	0.62	0.650	0:13	10.967	10.317	10.975
	0:19	0.76	0.70	0.730	0:19	11.047	10.317	11.055
	0:25	0.84	0.76	0.800	0:25	11.124	10.324	11.125
	0:31	0.91	0.85	0.880	0:31	11.198	10.318	11.205
	0:37	0.96	0.92	0.940	0:37	11.269	10.329	11.265
	0:43	1.04	0.98	1.010	0:43	11.336	10.326	11.335
	0:49	1.10	1.06	1.080	0:49	11.4	10.320	11.405
	0:55	1.16	1.12	1.140	0:55	11.462	10.322	11.465
	1:01	1.21	1.17	1.190	1:01	11.519	10.329	11.515
	1:07	1.26	1.22	1.240	1:07	11.571	10.331	11.565
	1:13	1.32	1.27	1.295	1:13	11.618	10.323	11.620
	1:19	1.36	1.32	1.340	1:19	11.663	10.323	11.665
	1:25	1.40	1.36	1.380	1:25	11.704	10.324	11.705
	1:31	1.43	1.39	1.410	1:31	11.739	10.329	11.735
	1:37	1.46	1.42	1.440	1:37	11.771	10.331	11.765
	1:43	1.49	1.45	1.470	1:43	11.796	10.326	11.795
	1:49	1.50	1.47	1.485	1:49	11.819	10.334	11.810
	1:55	1.52	1.49	1.505	1:55	11.836	10.331	11.830
	2:01	1.53	1.50	1.515	2:01	11.85	10.335	11.840
	2:07	1.54	1.52	1.530	2:07	11.859	10.329	11.855
	2:13	1.54	1.52	1.530	2:13	11.864	10.334	11.855
	2:19	1.54	1.52	1.530	2:19	11.864	10.334	11.855
	2:25	1.53	1.51	1.520	2:25	11.858	10.338	11.845
	2:31	1.53	1.49	1.510	2:31	11.85	10.340	11.835
						Mean	**10.325**	
						Std Dev	**0.008053**	

Observers:

SST Brenna Campbell

	Staff Time (UTC)	Staff High (m)	Staff Low (m)	Staff Mean (m)	Gauge Time (UTC)	Gauge Height (m)	Staff to Gauge Difference	Staff Plus Mean Difference
5/5/2009								
	19:07	2.22	2.18	2.200	19:07	12.543	10.343	12.544
	19:13	2.22	2.18	2.200	19:13	12.541	10.341	12.544
	19:19	2.21	2.17	2.190	19:19	12.532	10.342	12.534
	19:25	2.20	2.16	2.180	19:25	12.519	10.339	12.524
	19:31	2.18	2.14	2.160	19:31	12.501	10.341	12.504
	19:37	2.16	2.12	2.140	19:37	12.477	10.337	12.484
	19:43	2.12	2.08	2.100	19:43	12.448	10.348	12.444
	19:49	2.09	2.06	2.075	19:49	12.415	10.340	12.419
	19:55	2.04	1.98	2.010	19:55	12.376	10.366	12.354
	20:01	2.00	1.98	1.990	20:01	12.333	10.343	12.334
	20:07	1.96	1.92	1.940	20:07	12.285	10.345	12.284
						Mean	**10.344**	
						Std Dev	**0.007477**	

Observers:

ENS Matthew Forney
ENS Nicholas Morgan

	Staff Time (UTC)	Staff High (m)	Staff Low (m)	Staff Mean (m)	Gauge Time (UTC)	Gauge Height (m)	Staff to Gauge Difference	Staff Plus Mean Difference
5/8/2009								
	22:01	2.15	2.11	2.130	22:01	12.485	10.355	12.483
	22:07	2.12	2.08	2.100	22:07	12.453	10.353	12.453
	22:13	2.08	2.04	2.060	22:13	12.415	10.355	12.413
	22:19	2.03	2.01	2.020	22:19	12.371	10.351	12.373
	22:25	2.00	1.94	1.970	22:25	12.32	10.350	12.323
	22:31	1.93	1.89	1.910	22:31	12.264	10.354	12.263
	22:37	1.87	1.83	1.850	22:37	12.202	10.352	12.203
	22:43	1.80	1.75	1.775	22:43	12.133	10.358	12.128
	22:49	1.73	1.69	1.710	22:49	12.061	10.351	12.063
	22:55	1.66	1.60	1.630	22:55	11.985	10.355	11.983
	23:01	1.58	1.52	1.550	23:01	11.902	10.352	11.903
						Mean	**10.353**	
						Std Dev	**0.002260**	

Observers:
AST David Franksen
ENS Nicholas Morgan

	Staff Time (UTC)	Staff High (m)	Staff Low (m)	Staff Mean (m)	Gauge Time (UTC)	Gauge Height (m)	Staff to Gauge Difference	Staff Plus Mean Difference
5/11/2009								
	21:49	1.55	1.39	1.470	21:49	11.772	10.302	11.784
	21:55	1.61	1.49	1.550	21:55	11.857	10.307	11.864
	22:01	1.68	1.57	1.625	22:01	11.937	10.312	11.939
	22:07	1.76	1.65	1.705	22:07	12.012	10.307	12.019
	22:13	1.86	1.72	1.790	22:13	12.083	10.293	12.104
	22:19	1.90	1.77	1.835	22:19	12.151	10.316	12.149
	22:25	1.97	1.79	1.880	22:25	12.212	10.332	12.194
	22:31	2.05	1.86	1.955	22:31	12.267	10.312	12.269
	22:37	2.06	1.92	1.990	22:37	12.323	10.333	12.304
	22:43	2.12	1.97	2.045	22:43	12.372	10.327	12.359
						Mean	**10.314**	
						Std Dev	**0.012445**	

Observers:
ENS Matthew Forney
AST David Franksen

	Staff Time (UTC)	Staff High (m)	Staff Low (m)	Staff Mean (m)	Gauge Time (UTC)	Gauge Height (m)	Staff to Gauge Difference	Staff Plus Mean Difference
5/13/2009								
	22:43	0.85	0.82	0.835	22:43	11.149	10.314	11.148
	22:49	0.94	0.88	0.910	22:49	11.227	10.317	11.223
	22:55	1.00	0.97	0.985	22:55	11.301	10.316	11.298
	23:01	1.09	1.03	1.060	23:01	11.373	10.313	11.373
	23:07	1.16	1.12	1.140	23:07	11.443	10.303	11.453
	23:13	1.22	1.18	1.200	23:13	11.509	10.309	11.513
	23:19	1.30	1.24	1.270	23:19	11.572	10.302	11.583
	23:25	1.35	1.28	1.315	23:25	11.631	10.316	11.628
	23:31	1.40	1.34	1.370	23:31	11.685	10.315	11.683
	23:37	1.46	1.37	1.415	23:37	11.736	10.321	11.728
	23:43	1.50	1.44	1.470	23:43	11.783	10.313	11.783
						Mean	**10.313**	
						Std Dev	**0.005548**	

Observers:
ENS Matthew Forney
AST David Franksen

	Staff Time (UTC)	Staff High (m)	Staff Low (m)	Staff Mean (m)	Gauge Time (UTC)	Gauge Height (m)	Staff to Gauge Difference	Staff Plus Mean Difference
5/19/2009								
	16:55	1.28	1.22	1.250	16:55	11.582	10.332	11.585
	17:01	1.28	1.24	1.260	17:01	11.594	10.334	11.595
	17:07	1.29	1.25	1.270	17:07	11.604	10.334	11.605
	17:13	1.30	1.25	1.275	17:13	11.611	10.336	11.610
	17:19	1.30	1.26	1.280	17:19	11.614	10.334	11.615
	17:25	1.30	1.26	1.280	17:25	11.613	10.333	11.615
	17:31	1.29	1.26	1.275	17:31	11.612	10.337	11.610
	17:37	1.29	1.25	1.270	17:37	11.604	10.334	11.605
	17:43	1.28	1.24	1.260	17:43	11.595	10.335	11.595
	17:49	1.27	1.22	1.245	17:49	11.581	10.336	11.580
	17:55	1.25	1.21	1.230	17:55	11.565	10.335	11.565
						Mean	**10.335**	
						Std Dev	**0.001373**	

Observers:
AST David Franksen

	Staff Time (UTC)	Staff High (m)	Staff Low (m)	Staff Mean (m)	Gauge Time (UTC)	Gauge Height (m)	Staff to Gauge Difference	Staff Plus Mean Difference
5/21/2009								
	17:37	1.02	0.98	1.000	17:37	11.271	10.271	11.303
	17:43	1.08	1.00	1.040	17:43	11.343	10.303	11.343
	17:49	1.16	1.06	1.110	17:49	11.412	10.302	11.413
	17:55	1.22	1.14	1.180	17:55	11.477	10.297	11.483
	18:01	1.28	1.18	1.230	18:01	11.54	10.310	11.533
	18:07	1.32	1.25	1.285	18:07	11.598	10.313	11.588
	18:13	1.38	1.30	1.340	18:13	11.651	10.311	11.643
	18:19	1.45	1.36	1.405	18:19	11.702	10.297	11.708
	18:25	1.49	1.40	1.445	18:25	11.748	10.303	11.748
	18:31	1.50	1.45	1.475	18:31	11.79	10.315	11.778
	18:37	1.55	1.48	1.515	18:37	11.828	10.313	11.818
						Mean	**10.303**	
						Std Dev	**0.011884**	

Observers:

ENS Matthew Forney

ERT Albert Foster

	Staff Time (UTC)	Staff High (m)	Staff Low (m)	Staff Mean (m)	Gauge Time (UTC)	Gauge Height (m)	Staff to Gauge Difference	Staff Plus Mean Difference
5/25/2009								
	23:13	2.40	2.34	2.370	23:13	12.705	10.335	12.708
	23:19	2.36	2.28	2.320	23:19	12.66	10.340	12.658
	23:25	2.32	2.24	2.280	23:25	12.61	10.330	12.618
	23:31	2.26	2.18	2.220	23:31	12.554	10.334	12.558
	23:37	2.19	2.12	2.155	23:37	12.492	10.337	12.493
	23:43	2.12	2.06	2.090	23:43	12.424	10.334	12.428
	23:49	2.03	2.00	2.015	23:49	12.351	10.336	12.353
	23:55	1.95	1.91	1.930	23:55	12.272	10.342	12.268
5/26/2009	0:01	1.87	1.83	1.850	0:01	12.188	10.338	12.188
	0:07	1.78	1.74	1.760	0:07	12.104	10.344	12.098
	0:13	1.70	1.64	1.670	0:13	12.019	10.349	12.008
						Mean	**10.338**	
						Std Dev	**0.005107**	

Observers:

AST David Franksen

ENS Matthew Forney

ENS Nick Morgan

	Staff Time (UTC)	Staff High (m)	Staff Low (m)	Staff Mean (m)	Gauge Time (UTC)	Gauge Height (m)	Staff to Gauge Difference	Staff Plus Mean Difference
5/27/2009								
	22:13	1.17	1.09	1.130	22:13	11.432	10.302	11.455
	22:19	1.28	1.19	1.235	22:19	11.544	10.309	11.560
	22:25	1.37	1.30	1.335	22:25	11.652	10.317	11.660
	22:31	1.48	1.39	1.435	22:31	11.755	10.320	11.760
	22:37	1.56	1.50	1.530	22:37	11.854	10.324	11.855
	22:43	1.65	1.59	1.620	22:43	11.949	10.329	11.945
	22:49	1.74	1.70	1.720	22:49	12.038	10.318	12.045
	22:55	1.84	1.79	1.815	22:55	12.123	10.308	12.140
	23:01	1.84	1.79	1.815	23:01	12.202	10.387	12.140
	23:07	1.97	1.94	1.955	23:07	12.272	10.317	12.280
	23:13	2.01	1.98	1.995	23:13	12.337	10.342	12.320
						Mean	**10.325**	
						Std Dev	**0.022209**	

Observers:

INT Jeff Swindemann

	Staff Time (UTC)	Staff High (m)	Staff Low (m)	Staff Mean (m)	Gauge Time (UTC)	Gauge Height (m)	Staff to Gauge Difference	Staff Plus Mean Difference
6/2/2009								
	17:55	1.44	1.40	1.420	17:55	11.75	10.330	11.756
	18:01	1.41	1.38	1.395	18:01	11.735	10.340	11.731
	18:07	1.40	1.36	1.380	18:07	11.716	10.336	11.716
	18:13	1.37	1.34	1.355	18:13	11.691	10.336	11.691
	18:19	1.36	1.31	1.335	18:19	11.662	10.327	11.671
	18:25	1.31	1.27	1.290	18:25	11.631	10.341	11.626
	18:31	1.27	1.24	1.255	18:31	11.595	10.340	11.591
	18:37	1.24	1.20	1.220	18:37	11.556	10.336	11.556
	18:43	1.21	1.16	1.185	18:43	11.513	10.328	11.521
	18:49	1.16	1.09	1.125	18:49	11.465	10.340	11.461
	18:55	1.10	1.05	1.075	18:55	11.416	10.341	11.411
	19:01	1.06	1.02	1.040	19:01	11.361	10.321	11.376
	19:07	1.01	0.96	0.985	19:07	11.304	10.319	11.321
	19:13	0.94	0.89	0.915	19:13	11.245	10.330	11.251
	19:19	0.86	0.83	0.845	19:19	11.184	10.339	11.181
	19:25	0.82	0.76	0.790	19:25	11.119	10.329	11.126
	19:31	0.74	0.69	0.715	19:31	11.052	10.337	11.051
	19:37	0.66	0.62	0.640	19:37	10.984	10.344	10.976
	19:43	0.60	0.56	0.580	19:43	10.914	10.334	10.916
	19:49	0.52	0.49	0.505	19:49	10.843	10.338	10.841
	19:55	0.44	0.41	0.425	19:55	10.769	10.344	10.761
	20:01	0.36	0.34	0.350	20:01	10.694	10.344	10.686
	20:07	0.30	0.26	0.280	20:07	10.617	10.337	10.616
	20:13	0.25	0.16	0.205	20:13	10.541	10.336	10.541
	20:19	0.14	0.09	0.115	20:19	10.464	10.349	10.451
	20:25	0.08	0.01	0.045	20:25	10.386	10.341	10.381
						Mean	**10.336**	
						Std Dev	**0.007025**	

Note: The closing three-hour observation was not completed. The Observations were conducted on a day of transit for the ship. Due to scheduling and delays, the observations were not totally complete.
A phone call was placed to Manoj Samant, and a waiver was granted.

Station: 945-0761
Vixen Harbor, Ernest Sound, AK
OPR-O119-FA-09

Gauge S/N: 023513
Staff Stop: 2.5m
PAROS S/N: 85173

Observers:
ENS Nick Morgan
SST Brenna Campbell

Date	Staff Time (UTC)	Staff High (m)	Staff Low (m)	Staff Mean (m)	Gauge Time (UTC)	Gauge Height (m)	Staff to Gauge Difference	Staff Plus Mean Difference
5/26/2009								
	19:55	0.100	0.090	0.095	19:55	4.25	4.155	4.271
	20:01	0.235	0.250	0.243	20:01	4.391	4.149	4.419
	20:07	0.390	0.375	0.383	20:07	4.531	4.149	4.559
	20:13	0.530	0.520	0.525	20:13	4.673	4.148	4.701
	20:19	0.655	0.670	0.663	20:19	4.817	4.155	4.839
	20:25	0.800	0.810	0.805	20:25	4.957	4.152	4.981
	20:31	0.955	0.945	0.950	20:31	5.101	4.151	5.126
	20:37	1.100	1.085	1.093	20:37	5.242	4.150	5.269
	20:43	1.235	1.220	1.228	20:43	5.38	4.153	5.404
	20:49	1.375	1.365	1.370	20:49	5.522	4.152	5.546
	20:55	1.510	1.500	1.505	20:55	5.689	4.184	5.681
	21:01	1.635	1.630	1.633	21:01	5.831	4.199	5.809
	21:07	1.780	1.760	1.770	21:07	5.968	4.198	5.946
	21:13	1.900	1.890	1.895	21:13	6.098	4.203	6.071
	21:19	2.030	2.020	2.025	21:19	6.223	4.198	6.201
	21:25	2.160	2.140	2.150	21:25	6.346	4.196	2.172
	21:31	2.280	2.260	2.270	21:31	6.463	4.193	2.270
	21:37	2.390	2.380	2.385	21:37	6.58	4.195	2.385
	21:43	2.500	2.490	2.495	21:43	6.689	4.194	2.495
	21:49	2.605	2.595	2.600	21:49	6.791	4.191	2.600
	21:55	2.705	2.695	2.700	21:55	6.885	4.185	2.700
	22:01	2.800	2.790	2.795	22:01	6.982	4.187	6.971
	22:07	2.890	2.880	2.885	22:07	7.083	4.198	7.061
	22:13	2.970	2.960	2.965	22:13	7.166	4.201	7.141
						Mean	**4.176**	
						Std Dev	**0.021799**	

Note: The Initial three-hour observation was not completed. The Observations were conducted on a day of an extreme tide and the 3.0m staff was not tall enough to capture three hours of observations.

Observers:

ENS Matthew Forney

AST David Franksen

ENS Nick Morgan

	Staff Time (UTC)	Staff High (m)	Staff Low (m)	Staff Mean (m)	Gauge Time (UTC)	Gauge Height (m)	Staff to Gauge Difference	Staff Plus Mean Difference
5/27/2009								
	20:43	0.085	0.070	0.078	20:43	4.326	4.249	4.317
	20:49	0.225	0.210	0.218	20:49	4.46	4.243	4.457
	20:55	0.365	0.350	0.358	20:55	4.597	4.240	4.597
	21:01	0.480	0.520	0.500	21:01	4.736	4.236	4.739
	21:07	0.645	0.625	0.635	21:07	4.876	4.241	4.874
	21:13	0.760	0.800	0.780	21:13	5.012	4.232	5.019
	21:19	0.920	0.905	0.913	21:19	5.151	4.239	5.152
	21:25	1.060	1.035	1.048	21:25	5.286	4.239	5.287
	21:31	1.195	1.175	1.185	21:31	5.42	4.235	5.424
	21:37	1.325	1.305	1.315	21:37	5.557	4.242	5.554
	21:43	1.455	1.445	1.450	21:43	5.689	4.239	5.689
						Mean	**4.239**	
						Std Dev	**0.004147**	

Observers:

ENS Glen Rice

PS Grant Froelich

ERT Andrew Clos

Date	Staff Time (UTC)	Staff High (m)	Staff Low (m)	Staff Mean (m)	Gauge Time (UTC)	Gauge Height (m)	Staff to Gauge Difference	Staff Plus Mean Difference
6/2/2009								
	18:31	2.260	2.240	2.250	18:31	6.44	4.190	6.453
	18:37	2.220	2.180	2.200	18:37	6.401	4.201	6.403
	18:43	2.180	2.150	2.165	18:43	6.361	4.196	6.368
	18:49	2.100	2.090	2.095	18:49	6.312	4.217	6.298
	18:55	2.080	2.050	2.065	18:55	6.262	4.197	6.268
	19:01	2.020	2.010	2.015	19:01	6.211	4.196	6.218
	19:07	1.960	1.950	1.955	19:07	6.154	4.199	6.158
	19:13	1.900	1.890	1.895	19:13	6.094	4.199	6.098
	19:19	1.840	1.830	1.835	19:19	6.033	4.198	6.038
	19:25	1.780	1.760	1.770	19:25	5.971	4.201	5.973
	19:31	1.705	1.700	1.703	19:31	5.905	4.203	5.905
	19:37	1.640	1.620	1.630	19:37	5.837	4.207	5.833
	19:43	1.580	1.560	1.570	19:43	5.767	4.197	5.773
	19:49	1.490	1.485	1.488	19:49	5.698	4.211	5.690
	19:55	1.420	1.410	1.415	19:55	5.625	4.210	5.618
	20:01	1.350	1.348	1.349	20:01	5.55	4.201	5.552
	20:07	1.270	1.260	1.265	20:07	5.475	4.210	5.468
	20:13	1.190	1.180	1.185	20:13	5.398	4.213	5.388
	20:19	1.120	1.115	1.118	20:19	5.319	4.202	5.320
	20:25	1.040	1.035	1.038	20:25	5.242	4.205	5.240
	20:31	0.950	0.950	0.950	20:31	5.167	4.217	5.153
	20:37	0.880	0.870	0.875	20:37	5.088	4.213	5.078
	20:43	0.830	0.810	0.820	20:43	5.012	4.192	5.023
	20:49	0.760	0.750	0.755	20:49	4.934	4.179	4.958
	20:55	0.660	0.650	0.655	20:55	4.858	4.203	4.858
	21:01	0.590	0.570	0.580	21:01	4.784	4.204	4.783
	21:07	0.500	0.500	0.500	21:07	4.71	4.210	4.703
	21:13	0.440	0.430	0.435	21:13	4.638	4.203	4.638
	21:19	0.360	0.360	0.360	21:19	4.568	4.208	4.563
	21:25	0.300	0.290	0.295	21:25	4.501	4.206	4.498
	21:31	0.240	0.230	0.235	21:31	4.437	4.202	4.438
						Mean	**4.203**	
						Std Dev	**0.007944**	

Appendix A-VI
LEVELING ABSTRACTS, LEVEL RUNS AND COMPARISON OF RUNS

NOAA FORM 76-183 (4-76)

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

SHEET | SHEETS OF

ABSTRACT OF PRECISE LEVELS

TIDE STATION	STATE	NUMBER
Magnetic Polar Ernest Sound AK Opening Levels	Alaska	945-0753

PARTY CHIEF	OBSERVER	LEVEL (Mfg. & type)	ROD (Mfg. & type)	ORDER	CLASS	DATE
CDR Doug Baird	ENS Matthew Forney	Zeiss Ni 2 103267	Leica			30 APR 2009

ROD TEMP °C	F OR B	DIFF. OF ELEV EACH RUNNING METERS	MEAN DIFFERENCE METERS	DIVERGENCE Ea. Sec. TENTHS OF MM	DIVERGENCE Σ TENTHS OF MM	DISTANCE Ea. Sec. KM	DISTANCE Σ KM	DESIGNATION OF SECTION	FIELD ELEVATIONS ABOVE STAFF ZERO METERS	FIELD ELEVATIONS ABOVE STAFF ZERO FEET	REMARKS ELEVATION OF ROD STOP ABOVE STAFF ZERO:
	F	+1.2323		0		0		945-0753-D	2.8805		
	B	-1.2317	+1.2320	+0.6	+0.6	0.07	0.07	945-0753-C	4.1125		
	F	-0.1900		+0.6		0.07		945-0753-C	4.1125		
	B	+0.1883	-0.1892	+1.7	+1.1	0.05	0.12	945-0753-B	3.9233		
	F	+0.7357		+1.1		0.12		945-0753-B	3.9233		
	B	-0.7837	+0.7342	+1.0	+2.1	0.04	0.20	Horcon	4.6575		
	F	+0.0043		+0.1		0.20		HORCON	4.6575		
	B	-0.0053	+0.0048	+1.0	+1.9	0.02	0.22	945-0753-A	4.6623		
	F	-1.2450		+1.9		0.22		945-0753-A	4.6623		
	B	+1.2457	-1.2454	+0.7	+0.7	0.04	0.26	945-0753-E	3.4169		
	F	-2.1613		+0.1		0.26		945-0753-A	4.6623		
	B	+2.1633	-2.1623	+2.0	+0.8	0.02	0.28	Staff (2.5m)	2.5000		

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: Magnetic Pt ~~VIXON HARBOR~~, AK

NUMBER: 945 — 0753

SHEET | OF

FROM B.M.: D

TO B.M.: C

WEATHER: CLEAR, SUNNY

TIME: 1926 UTC

DATE: 04/30/2009

ORDER, CLASS

BACKSIGHTS						FORESIGHTS				REMARKS
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	
1	1622					1922				
	1586	1586.3	36			1892	1891.7	30		
	1551	35	35	71		1861		31	61	
	4759					5675				
2	1687					0144				
	1662	1661.7	25			0124	0124	20		
	1636		26	+ 51		0104	20	20	40	
	4985					0372				
BS	9744			122mm	FS	6047			101mm	
		3248.0mm					2015.7mm			
					BS-FS =	9.744m	3.248m			
						-6.047m	-2.0157m		0.122m	
						3.697m	-1.2323m		+0.101m	
						÷ 3			0.223m	
						1.2323m			×333	
									74.259m	
									÷1000	
									0.07436km	

FORWARD RUN.....	1.2323m
BACKWARD RUN...	-1.2317m
DIFFERENCE.....	0.0006m
DISTANCE.....	0.074km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

D → C

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
1	1901					1600				(916)	
	1870	1870.3	31			1565	1565	35			
	1840		30	61		1530	35	35	70		
	5611					4695					
2	0158					1700					
	0138	0138	20			1675	1675	25			
	0118	20	20	+40		1650	25	25	50		
	414					5025					
BS	6025			101mm	FS	9720			120mm		
		2008.3mm					3240mm				
				BS − FS	=	6.025m	2.0083m				
						−9.720m	−3.240m		0.101m		
						−3.695m	−1.2317		+0.120m		
						÷ 3			0.221m		
						−1.2317			× 333		
									73.593m		
									÷1000		
									0.07365m		

NOAA FORM 75-29 (12-75)

★U.S. GPO:1982-564-008/1164-6

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: ~~Dixon Harbor~~ Magnetic Pt AK

NUMBER: 945 — 0753

SHEET: | OF

FROM B.M.: C

TO B.M.: B

WEATHER:

TIME: 1900 UTC

DATE: 30 APR 09

BACKSIGHTS | FORESIGHTS | ____ ORDER, CLASS ____

No. of Station	BACKSIGHTS THREAD READING	BACKSIGHTS MEAN	BACKSIGHTS THREAD INTERVAL	BACKSIGHTS SUM OF INTERVALS	ROD TEMP.	FORESIGHTS THREAD READING	FORESIGHTS MEAN	FORESIGHTS THREAD INTERVAL	FORESIGHTS SUM OF INTERVALS	REMARKS
	0319					0505				
	0275	0275.7	44			0466	0465.7	39		
	0233		42			0426		40		
	827			86		1397			179	
						827	0.2757		.086	
						1.397	0.4657		+.079	
						.57	0.1900		.165	
						÷ 3			× 333	
						0.1900			54.945	
									÷ 1000	
									0.054945	

FORWARD RUN..... −.19

BACKWARD RUN... +.1883

DIFFERENCE..... 0.0017

DISTANCE..... .054612

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

C → B

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	0490					0304					
	0451	0450.3	39			0262	0262	42			
	0410		41			0220		42			
	1351			80		786			84		
						1.351	90				
						− .786	0.4503		.084		
						.565	−0.2620		+ .080		
						÷ .1883	.1883		.164		
									× 333		
									54.612		
									÷ 1000		
									0.054612 Km		

NOAA FORM 75-29 (12-75)

*U.S. GPO:1982-564-008/1164-6

Compiled

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: ~~Viken Harbor~~ Magnetic Pt

NUMBER: 945 — 0753

SHEET: 1 OF

FROM B.M.: B

TO B.M.: HOTCON (VIKEN HBR)

WEATHER: Sunny, Clear

TIME: 1651 UTC

DATE: 30 APR 2009

ORDER, CLASS _____

	BACKSIGHTS					FORESIGHTS				
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	REMARKS
	0884		49			0808		50		
1	0835	0835	49			0758	0758	50		
	0786			98		0708			100	
	2505					2274				
	0858		11			0200		11		
2	0847	0847	11			0189	0189.5	10		
	0836			22		0179			21	
	2541					568				
	5046	1682		120		2842	947.3		121	

BS - FS = 5.046 m − 2.842 m = 2.204 ÷ 3 = 0.7347

1682.0 − 947.3 = 0.9473 − 0.7347 = 0.2126

.120 + .121 = .241 × 333 = 80.253 ÷ 1000 = 0.0803 km

FORWARD RUN.....	0.7347
BACKWARD RUN...	-0.7337
DIFFERENCE.....	-0.0010
DISTANCE.....	0.0803 km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

B → Horcon

BACKWARD RUN (See front side for FORWARD RUN and other information.)

WEATHER: Sunny, Clear

TIME: 1651 UTC

DATE: 30 APR 2009

No. of Station	BACKSIGHTS: THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	FORESIGHTS: THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	REMARKS
	0640		50			0715		49		
1	0590	0590	50			0666	0666	49		
	0540			100		0617			98	
	1770					1998				
	0178		11			0835		10		
2	0167	0167	11			0825	0824.7	11		
	0156			22		0814			21	
	501					2474				
	2271	757		122		4472	1490.7			

BS-FS = 2.271
-4.472
-2.201
÷ 3
-0.7337m

.757
-1.4907
-0.7337

0.122
+0.119
0.241
× 333
80.253
÷ 1000
0.0803km

NOAA FORM 75-29 (12-75)

★U.S. GPO:1982-564-008/1164-6

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: ~~VIXEN HARBOR~~ Magnetic Pt.

NUMBER: 945 — 0753

SHEET: OF

FROM B.M.: HORCON (VIXEN HBR)

TO B.M.: A

WEATHER: Clear & Sunny

TIME: 17:49 UTC

DATE: 30 APR 2009

ORDER, CLASS

BACKSIGHTS						FORESIGHTS				
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	REMARKS
	0198					0200				
1	0187	0187	11			0182	0182.7	18		
	0176		11			0166		16		
	0561			22		0548			34	
				BS - FS		0.561 m	0.187 m		0.022	
						-0.548 m	-0.1827 m		+0.034	
						0.013 m	0.0043 m		0.056	
						÷ 3			× 333	
						0.0043			18.65	
									÷ 1000	
									0.019 km	

FORWARD RUN..... 0.0043 m
BACKWARD RUN... -0.0053 m
DIFFERENCE..... 0.0010 m
DISTANCE..... 0.018 km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

HORCON → A

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	0183					0183					
1	0167	0166.7	16			0172	0172	11			
	0150		17			0161		11			
	0500			33		0516			22		
				BS - FS		0.500m	0.1667m		0.033m		
						-0.516m	-0.1720m		+0.022m		
						-0.016m	-0.0053m		0.055m		
						÷ 3			× 333		
						-0.0053m			18.31		
									÷ 1000		
									0.018 km		

NOAA FORM 75-29 (12-79)

★U.S. GPO:1982-564-008/1164-6

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: ~~Viken Harbor~~ Magnetic Pt. AK

FROM B.M.: A

WEATHER:

NUMBER: 945 — 0753

SHEET: OF

TO B.M.: E

TIME: 1820 UTL

DATE: 30APR09

ORDER, CLASS:

BACKSIGHTS						FORESIGHTS				REMARKS
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	
	0081					01331				SPUR
	0058	0057.3	23			1302	1302.3	29		.048
	0033		25			1274		28		+ .057
	172		48	48		3907			57	.105
										+ 333
		172								34.965
										÷ 1000
										.03450 km
							0.172	0.0573		
							- 3.907	- 1.3023		
							÷ 3.735	+ 1.245		
							1.2450			

FORWARD RUN..... -1.2450

BACKWARD RUN... +1.2457

DIFFERENCE..... .0007

DISTANCE..... .0350 km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

A → E

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	1390					0089					
	1311	1311	29			0065	65.3	24			
	1282		29			0042		23			
	3933		58			146			47		
						3737					
				3.933		1.311			.058		
				- 0.196		-0.653			+.047		
				3.737		1.2457			.105		
				÷ 3					× 333		
				1.2457					34.965		
									÷ 1000		
									.0350	Km	

NOAA FORM 75-29 (12-76)

★U.S. GPO:1982-564-008/1164-6

Magnetic Point

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: ~~VIXEN HARBOR~~, AK

NUMBER: 945 — 0753

SHEET: OF

FROM B.M.: A

TO B.M.: Staff @ 2.50

WEATHER: Clear & Sunny

TIME: 18:05 utc

DATE: 30 Apr 2009

ORDER, CLASS

BACKSIGHTS						FORESIGHTS				REMARKS
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	
	0183					2346				
1	0167	0166.3	16			2328	2327.7	18		
	0149		18			2309		19	37	
	0499			34		6983				
				BS - FS		0.499 m	0.1663 m		0.034 m	
						-6.983 m	-2.3277 m		+0.037 m	
						-6.484	-2.1614 m		0.071	
						÷ 3			× 333	
						-2.1613 m			236	
									÷1000	
									0.0236 km	

FORWARD RUN..... -2.1613 m

BACKWARD RUN... 2.1633 m

DIFFERENCE..... 0.0020 m

DISTANCE..... 0.0236 km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

A → Staff (2.5m)

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	~~2330~~					~~0178~~					
	2322		18			0161		17			
	2305		17			0144		17			
	~~6957~~			35		~~483~~			34	(6484)	74
	2336					0172					
	2318	2318.3	18			0155	0155	17			
	2301		17			0138		17			
	6955			35		465			34		
				BS - FS		6.955 m	2.3183 m		0.035		
						-0.465 m	-0.155 m		+0.034		
						6.4900	2.1633 m		0.069		
						÷ 3			× 333		
						2.1633 m			22.97		
									÷ 1000		
									0.0230		

NOAA FORM 75-29 (12-75)

★U.S. GPO:1982-564-008/1164-6

NOAA FORM 76-183 (4-76)

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

SHEET | SHEETS OF

ABSTRACT OF PRECISE LEVELS

TIDE STATION	STATE	NUMBER
Magnetic Point, Ernest Sound — Closing Levels	Alaska	945-0753

PARTY CHIEF	OBSERVER	LEVEL (Mfg. & type)	ROD (Mfg. & type)	ORDER	CLASS	DATE
CDR Doug Baird	Ens Matthew Forney	zeiss N: 2 103267	Leica			2 JUN 2009

ROD TEMP °C	F OR B	DIFF. OF ELEV. EACH RUNNING (METERS)	MEAN DIFFERENCE (METERS)	DIVERGENCE Ea. Sec (TENTHS OF MM)	DIVERGENCE Σ	DISTANCE Ea. Sec (KM)	DISTANCE Σ	DESIGNATION OF SECTION	FIELD ELEVATIONS ABOVE STAFF ZERO METERS	FIELD ELEVATIONS ABOVE STAFF ZERO FEET	REMARKS (ELEVATION OF ROD STOP ABOVE STAFF ZERO)
	F	+1.2297		0		0		945-0753-D	2.8960		
	B	-1.2283	+1.2290	+1.4	+1.4	0.08	0.08	945-0753-C	4.1250		
	F	-0.1890m		+1.4		0.08		945-0753-C	4.1250		
	B	+0.1893m	-0.18915	+0.3	+1.7	0.05	0.13	945-0753-B	3.9358		
	F	+0.7347m		+1.7		0.13		945-0753-B	3.9358		
	B	-0.7337m	+0.7342	-1.0	+0.7	0.06	0.19	HORCON	4.6700		
	F	+0.0047		+0.7		0.19		HORCON	4.6700		
	B	-0.0047	+0.0047	0.0	+0.7	0.02	0.21	945-0753-A	4.6653		
	F	-1.2430		+0.7		0.21		945-0753-A	4.6653		
	B	+1.2427	-1.24285	-0.3	+0.4	0.04	0.25	945-0753-E	3.4225		
	F	-2.1653		+0.4		0.25		945-0753-A	4.6653		
	B	+2.1653	-2.1653	0.0	+0.4	0.02	0.27	Staff (2.5m)	2.5000		

☆ U.S. GPO: 1977-765-005/1116 Region 6

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: MAGNETIC Pt

NUMBER: 945 —0753 | SHEET: 2 | OF

FROM B.M.: D

TO B.M.: C

WEATHER: Sunny, CLEAR, CALM

TIME:

DATE: 06/02/2009

_____ ORDER, CLASS _____

BACKSIGHTS						FORESIGHTS				
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	REMARKS
	1610					1914				
1	1575	1574.7	35			1883	1883	31		
	1539		36			1852		31		-(925mm)
	4724mm			71mm		5649mm			62mm	
	1675					0135				
2	1648	1648.3	27			0110	110.3	25		
	1622		26	53mm		0086		24	49mm	
	4945mm					0331mm				4614mm
	9669	3223				5980	1993.3			

BS-FS = 9.669 − 5.980 = 3.689 ÷ 3 = 1.2297

3223 − 1993.3 = 1.2297

FORWARD RUN..... 1.2297 m
BACKWARD RUN... −1.2283 m
DIFFERENCE..... 0.0014 m
DISTANCE..... 0.08Km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

D → C

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	1928					1626					
1	1899	1898.3	29			1589	1588.7	36		927mm	
	1868		31	60mm		1553		37	73mm		
	5695mm					4768mm					
	0152					1693					
2	0128		24			1666		27		BLUNDER	
	0103		25	49mm		1639		27		-4618mm	
	0383mm					5001					
	0136					1675					
2	0111	111.3	25			1649	1648.3	26			
2nd time	0087		24	49mm		1622		27	53mm	-4612	
	0334					4946					
	6029	2009.6		109		9714	3237		126		

BS - FS = 6.029m
-9.714m
-3.685m
÷ 3
-1.2283m

2.0096
-3.2370
-1.2274

.109
+.126
0.235
×333
78.255
÷ 1000
0.0782

NOAA FORM 75-29 (12-75)

*U.S. GPO:1982-564-008/1164-6

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: MAGNETIC POINT
NUMBER: —
SHEET: OF
FROM B.M.: C
TO B.M.: B
WEATHER:
TIME:
DATE: 2 Jun 2009
ORDER, CLASS

BACKSIGHTS						FORESIGHTS				
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	REMARKS
	0441					0638				
1	0404		37			0594		44		
	0368		36			0548		46		-567mm
	1213mm			73mm		1780			90mm	
	1390					0142				
2	1361		29			0118		24		BLUNDER
	1332		29			0094		24		3729mm
	4083mm			58mm		0354			48mm	

BS - FS = 1.213m
- 1.780m
-0.567m
÷ 3
-0.189m

.073
+.090
0.163
× 333
54.279
÷ 1000
0.0542

FORWARD RUN.....	-0.1890m
BACKWARD RUN...	0.1893m
DIFFERENCE.....	0.0003m
DISTANCE.....	0.05 Km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

C → B

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	0630					0432					
1	0585		45			0396		36			
	0540		45	90		0359		37		568mm	
	1755mm			90mm		1187mm			73mm		
	0132					1380					
2	0108		24			1350		30		BLUNDER	
	0083		25			1321		29		3728mm	
	0323mm			49mm		4051mm			59mm		
	BS-FS = 1.755m										
		- 1.187m									
		0.568m									
		÷ 3									
		0.1893									

NOAA FORM 75-29 (12-75)

★U.S. GPO:1982-564-008/1164-6

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: Magnetic Point

NUMBER: 945 — 0753

SHEET: 1 OF

FROM B.M.: B

TO B.M.: HORCON (VIXEN HBR)

WEATHER: Sunny

TIME:

DATE: 06/02/2009

_____ ORDER, CLASS _____

BACKSIGHTS						FORESIGHTS				
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	REMARKS
	0265					1612				
1	0231		34			1580		32		
	0199		32			1548		32		-4045mm
	0695			66mm		4740			64mm	
	2365					0274				
2	2346		19			0263		11		
	2326		20			0251		12		
	7037mm			39mm		0788mm			23mm	6249mm
	7732			105		5528			87	
		BS-FS=	7.732 m							
			-5.528 m						.105	
			2.204 m						+ .087	
			÷ 3						.192	
			+0.7347 m						× 333	
									63.936	
									÷ 1000	
									0.0639	
										FORWARD RUN..... 0.7347 m
										BACKWARD RUN... -0.7337 m
										DIFFERENCE..... 0.0010 m
										DISTANCE..... 0.06km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

B →) Horcon

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	1627					0278					
1	1594	1594.3	33			0246	245.7	32			
	1562		32			0213		33		4046mm	
	4783mm			65mm		0737mm			65mm		
	0280					2370					
2	0268	268.3	12			2351	2350.7	19			
	0257		11			2331		20		-6247mm	
	0805mm			23mm		7052mm			39mm		
	5588					7789					
		BS-FS =	5.588m								
			-7.789 m								
			-2.201								
			÷ 3								
			-0.7337m								

NOAA FORM 75-29 (12-75)

*U.S. GPO:1982-564-008/1164-6

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: MAGNETIC POINT

NUMBER: —

SHEET: | OF

FROM B.M.: HORCON (VIXEN HBR)

TO B.M.: A

WEATHER:

TIME:

DATE: 2 Jun 2009

_____ ORDER, CLASS _____

BACKSIGHTS						FORESIGHTS				
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	REMARKS
	0280					0279				
1	0268		12			0263		16		
	0256		12			0248		15		14mm
	0804			24mm		0790			31mm	
	BS-FS =	0.804 m								
		- 0.790 m						.024		
		0.014 m						+.031		
		÷ 3						0.055		
		0.0047 m						× 333		
								18.315		
								÷ 1000		
								0.0183 Km		

FORWARD RUN.....	0.0047m
BACKWARD RUN...	-0.0047m
DIFFERENCE.....	0.0000 m
DISTANCE.....	0.02 Km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

Horcon → A

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	0273					0273					
1	0257	257	16			0262	261.7	11			
	0241		16			0250		12		-14mm	
	0771			32mm		0785			23mm		
	BS-FS = 0.771m			0.257							
	-0.785 m			0.2617							
	0.014 m			-0.0047							
	÷ 3										
	-0.0047m										

NOAA FORM 75-29 (12-75)

* U.S. GPO:1982-564-008/1164-6

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: Magnetic Point

NUMBER: 945 — 0753

SHEET: | OF

FROM B.M.: A

TO B.M.: E

WEATHER: Sunny Clear Calm

TIME:

DATE: 2 Jun 2009

BACKSIGHTS | FORESIGHTS | ORDER, CLASS

No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	REMARKS
	0142		24			1390		29		
1	0118	118	24			1361	1361	29		3729
	0094			48		1332			58	
	354	118				4083	1361			

BS - FS = 0.354 0.118
- 4.083 - 1.361
- 3.729 m - 1.243
÷ 3
-1.243 m

.048
+ .058
.106
× 333
35.298
÷ 1000
0.0353

FORWARD RUN..... - 1.243
BACKWARD RUN... 1.2427
DIFFERENCE..... - 0.0003
DISTANCE..... 0.04 km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

A → E

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	1380		30			0132		24			
1	1350	1350.3	29			0108	108.7	25			
	1321			59		0083					
	4051	1350.3				0323	107.7				
		BS − FS =	4.051		1350.3						
			−0.323		−.1077						
			3.728m		1.2426						
			÷ 3								
			1.2427m								

NOAA FORM 75-29 (12-75)

*U.S. GPO:1982-564-008/1164-6

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: Magnetic Point

NUMBER: 945 — 0753

SHEET: | OF

FROM B.M.: A

TO B.M.: Staff (2.5m)

WEATHER: Sunny, Clear, CALM

TIME:

DATE: 2 Jun 2009

BACKSIGHTS | FORESIGHTS | ____ ORDER, CLASS ____

No. of Station	BACKSIGHTS THREAD READING	BACKSIGHTS MEAN	BACKSIGHTS THREAD INTERVAL	BACKSIGHTS SUM OF INTERVALS	ROD TEMP.	FORESIGHTS THREAD READING	FORESIGHTS MEAN	FORESIGHTS THREAD INTERVAL	FORESIGHTS SUM OF INTERVALS	REMARKS
	0272		15			2439		17		
1	0257	256.3	17			2422	2421.3	19		
	0240			32		2404			36	
	0769					7265				
		BS - FS =	0.769 m		.2563				.032	
			-7.265m		-2.423				+.036	
			-6.496m		-2.165m				0.068	
			÷ 3						×333	
			-2.1653m						22.644	
									÷1000	
									0.02264	

FORWARD RUN.....	-2.1653 m
BACKWARD RUN...	2.1653 m
DIFFERENCE.....	0.000 m
DISTANCE.....	0.02 Km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

A → Staff 2.5m

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	2438		17			0272		16			
1	2421	2421	17			0256	0255.7	17			
	2404			34		0239			33		
	7263					0767					
		BS-FS =	7.263								
			-0.767		2.421						
			6.496m		-0.767						
			÷ 3		2.1653						
			2.1653								

NOAA FORM 75-29 (12-75)

*U.S. GPO:1982-564-008/1164-6

OPR-O119-FA-09
Magnetic Point, Ernest Sound
945-0753

Agreement Between Opening and Closing Levels

Between BMs	Opening Run (m)	Closing Run (m)	Difference
D to C	1.232	1.229	0.0030
C to B	-1.1892	-1.18915	0.0001
B to Horcon	0.7342	0.7342	0.0000
Horcon to A	0.0048	0.0047	0.0001
A to E	-1.2454	-1.24285	0.0026
A to Staff (2.5m)	-2.1623	-2.1653	0.0030

Opening and closing runs agree within (m): 0.0087

NOAA FORM 76-183 (4-76)

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

SHEET | SHEETS OF

ABSTRACT OF PRECISE LEVELS

TIDE STATION	STATE	NUMBER
Vixen Harbor, Ernest Sound — Opening Levels	Alaska	945-0761

PARTY CHIEF	OBSERVER	LEVEL (Mfg. & type)	ROD (Mfg. & type)	ORDER	CLASS	DATE
CDR Doug Baird	SST Brenna Campbell	Zeiss N: 2 103267	Leica			26 MAY 2009

ROD TEMP °C	F OR B	DIFF. OF ELEV. EACH RUNNING METERS	MEAN DIFFERENCE METERS	DIVERGENCE Ea. Sec. TENTHS OF MM	DIVERGENCE Σ TENTHS OF MM	DISTANCE Ea. Sec. KM	DISTANCE Σ KM	DESIGNATION OF SECTION	FIELD ELEVATIONS ABOVE STAFF ZERO METERS	FIELD ELEVATIONS ABOVE STAFF ZERO FEET	REMARKS ELEVATION OF ROD STOP ABOVE STAFF ZERO:
	F	-0.0187		0		0		945-0761-C	4.2954		
	B	+0.0180	-0.01835	-0.7	-0.7	0.04	0.04	945-0761-A	4.2770		
	F	-0.2960		-0.7		0.04		945-0761-A	4.2770		
	B	+0.2957	-0.29585	-0.3	-1.0	0.05	0.09	945-0761-B	3.9812		
	F	-1.7770		-1.0		0.09		945-0761-A	4.2770		
	B	+1.7770	-1.7770	0.0	-1.0	0.04	0.13	Staff (25m)	2.5000		

☆ U.S. GPO: 1977-765-005/1116 Region 6

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: VIXEN HARBOR

NUMBER: 945 — 0761 | SHEET: 2 | OF: 3

FROM B.M.: C

TO B.M.: A

WEATHER: Rain

TIME:

DATE: 26 MAY 2009

_____ ORDER, CLASS _____

BACKSIGHTS						FORESIGHTS				
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	REMARKS
	1490		38			1498		28		
①	1452	1452	38			1470	1470.7	26		
	1414			76		1444			54	
	4356					4412				
BS	4356mm				FS	4412mm				
					BS-FS =	4.356m	1.452			
						-4.412m	-1.4707		0.076m	
						-0.056m	-0.0187m		0.054m	
						÷ 3			0.130m	
						-0.0187m		Stadia	x333	
									43.29m	
									÷ 1000	
									0.04329 km	

FORWARD RUN..... -0.0187m

BACKWARD RUN... 0.0180m

DIFFERENCE..... -0.0007m

DISTANCE..... 0.043 Km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

C → A

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	1479		27			1473		38			
	1452	1452.3	26			1435	1434.3	40			
	1426			53		1395			78		
	4357					4303					
					BS-FS	1.357m	1.4523				
						-4.303m	-1.4343		0.053m		
						0.054m	0.018m		-0.078m		
						÷ 3			-0.131m		
						0.018m		Stadia	×333		
									43.623m		
									÷1000		
									0.0436km		

NOAA FORM 75-29 (12-75)

*U.S. GPO:1982-564-008/1164-6

Switch

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: VIXEN HARBOR, AK

NUMBER: 945 —0761

SHEET: 1 OF 3

FROM B.M.: B

TO B.M.: A

WEATHER: Rain

TIME:

DATE: 26 MAY 2009

_____ ORDER, CLASS _____

BACKSIGHTS						FORESIGHTS				
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	REMARKS
	0550		15			1239		13		
1	0535	0535	15			1226	1226.3	12		
	0520			30		1214			25	
	1605					3679				
	1209		29			0210		17		
2	1180	1180.3	28			0193	0193	17		
	1152			57		0176			34	
	3541					0579				
	5146	1715.3		87		4258	1419.3		59	
				BS-FS=	5146 m				.087 m	
					-4258 m				+.059 m	
					0.888 m		1.7153		.146 m	
					÷ 3		-1.4193		× 333	
					0.296 m		0.296 m		48.618 m	
									÷ 1000	
									0.0486	

FORWARD RUN.....	0.296 m
BACKWARD RUN...	-0.2957 m
DIFFERENCE.....	-0.0003 m
DISTANCE.....	0.05 km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

B → A

BACKWARD RUN (See front side for FORWARD RUN and other information.)

WEATHER

TIME

DATE

BACKSIGHTS						FORESIGHTS				REMARKS
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	
	1230		13			0540		15		
1	1217	1216.7	14			0525	0525.3	14		
	1203			27		0511			29	
	3650					1576				
	0198		17			1196		29		
2	0181	0180.7	18			1167	1167.7	27		
	0163			35		1140			56	
	0542					3503				
	4192	1397.4		62		5079	1693		85	
		BS-FS =		4.192 m						
				-5.079 m					.062 m	
				-0.887 m		1,3974			+.085 m	
				÷ 3		-1,693			0.147	
				-0.2957 m		-2956 m			×333	
									48.951	
									÷1000	
									0.049	

NOAA FORM 75-29 (12-75)

★U.S. GPO:1982-564-008/1164-6

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: VIXEN HARBOR

NUMBER: 945 — 0761

SHEET: 3 OF 3

FROM B.M.: A

TO B.M.: Staff (2.5 m)

WEATHER: Rain

TIME:

DATE: 26 May 2009

_____ ORDER, CLASS _____

BACKSIGHTS						FORESIGHTS				
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	REMARKS
	1040		29			2821		33		
①	1011	1010.7	30			2788	2788	33		
	0981			59		2755			66	
	3032					8364				

BS-FS = 3.032 m
-8.364 m
-5.332
÷ 3
-1.777 m

1.0107
-2.788
-1.777 m

.059 m
+.066 m
.125 m
×333
41.625 m
÷ 1000
0.046 Km

FORWARD RUN..... -1.777 m
BACKWARD RUN... 1.777 m
DIFFERENCE..... 0.000 m
DISTANCE..... 0.04 Km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

A → Staff (2.5m)

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	2811		31			1032		30			
①	2780	2779.3	33			1002	1002.3	29			
	2747			64		0973			59		
	8338					3007					

BS - FS = 8.338 m
- 3.007 m
5.331
÷ 3
1.777 m

2.7793
- 1.0023
1.777 m

.064
+ .059
0.123
× 333
40.959
÷ 1000
0.041 km

NOAA FORM 75-29 (12-75)

★U.S. GPO:1982-564-008/1164-6

NOAA FORM 76-183 (4-76)

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

SHEET | SHEETS OF

ABSTRACT OF PRECISE LEVELS

TIDE STATION: VIXEN HARBOR, ERNEST SOUND — CLOSING LEVELS

STATE: ALASKA

NUMBER: 945-0761

PARTY CHIEF: LDR Doug Baird

OBSERVER: SST Brenna Campbell

LEVEL (Mfg. & type): ZEISS Ni2 103267

ROD (Mfg. & type): LEICA

ORDER | CLASS

DATE: 2 JUNE 2009

ROD TEMP °C	F OR B	DIFF. OF ELEV. EACH RUNNING METERS	MEAN DIFFERENCE METERS	DIVERGENCE Ea. Sec TENTHS OF MM	DIVERGENCE Σ TENTHS OF MM	DISTANCE Ea. Sec KM	DISTANCE Σ KM	DESIGNATION OF SECTION	FIELD ELEVATIONS ABOVE STAFF ZERO METERS	FIELD ELEVATIONS ABOVE STAFF ZERO FEET	REMARKS
	F	-0.0173		0		0		945-0761-C	4.2940		ELEVATION OF ROD STOP ABOVE STAFF ZERO:
	B	0.0167	-0.0170	-0.6	-0.6	0.04	0.04	945-0761-A	4.2770		
	F	-0.2960		-0.6		0.04		945-0761-A	4.2770		
	B	0.2957	-0.29585	-0.3	-0.9	0.05	0.09	945-0761-B	3.9812		
	F	-1.775		-0.9		0.09		945-0761-A	4.2770		
	B	1.774	-1.7745	-0.1	-1.0	0.04	0.13	STAFF (2.5m)	2.5000		

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: Vixen Hbr.

NUMBER: —

SHEET: 3 OF 3

FROM B.M.: A

TO B.M.: B

WEATHER: Sunny, warm.

TIME:

DATE: 6/2/2009

3rd ORDER, CLASS

BACKSIGHTS						FORESIGHTS				
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	REMARKS
	0282					1279				
A	0264	0.264	18			1251	1251.3	28		
	0246		18			1224		27		-2962
	0792			36		3754			55	
	0757		13			0068		15		
#2	0744	0744.3	12			0053	0053	15		2nd Setup.
	0732			25		0038			30	2074
	2233					0159				
	3025	1000.3		61		3913	1304.3		85	

BS-FS = 3.025 m
- 3.913 m
-0.888
÷ 3
-0.296 m

1000.3
- 1304.3
- 0.304

61
+85
0.146
× 333
48.618
÷ 1000
0.0486

FORWARD RUN..... -0.296 m
BACKWARD RUN... -0.2957 m
DIFFERENCE..... -0.0003 m
DISTANCE..... 0.05 Km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

A → B

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	1262					0265					
1	1234		28			0247	0246.7	18		2962	
	1206	1234	28			0228		19			
	3702			56		0740			37		
	0078					0768					
#2	0064	0063.7	14			0755	0755.3	13		-2075	
	0049		15			0743		12			
	0191			29		2266			25		
	3893	1297.7				3006	1002.0				
		BS - FS =	3.893 m			1.2977					
			-3.006 m			-1.0020					
			0.887 m			0.2957					
			÷ 3								
			0.2957								

NOAA FORM 75-29 (12-75)

* U.S. GPO:1982-564-008/1164-6

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: Vixen Hbr.

NUMBER: —

SHEET: 1 OF 3

FROM B.M.: C

TO B.M.: A

WEATHER: Sunny, warm

TIME: 13:50

DATE: 6/2/2009

ORDER, CLASS: 3

BACKSIGHTS						FORESIGHTS				
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	REMARKS
	1275	1236.3				1282	1253.7			
C	1236	39				1253	29			
	1198	38				1226	27			-52
	3709		77			3761		56		

BS-FS = 3709 m
-3761 m
-0.052 m
÷ 3
-0.0173

12363
12537
-0.0174

0.077 m
+0.056 m
0.133 m
× 333
44.289
÷ 1000
0.0443

FORWARD RUN..... -0.0173
BACKWARD RUN... 0.0167
DIFFERENCE..... -0.0006
DISTANCE..... 0.04 Km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

G → A

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE 6/02/2009
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	1293					1287					
A	1265	1265.3	28			1249	1248.7	38			
	1238		27			1210		39		+50 / good	
	3796			55		3746			77		
		BS-FS =	3.796	1.2653							
			-3.746	1.2487				0.055			
			0.050	0.0166				+0.077			
			÷ 3					0.132			
			0.0167					× 333			
								43.956			
								÷ 1000			
								0.044			

NOAA FORM 75-29 (12-75)

★U.S. GPO:1982-564-008/1164-6

NOAA FORM 75-29 (12-75)

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

PRECISE LEVELING

THREE-WIRE

FORWARD RUN (See reverse for BACKWARD RUN)

TIDE STATION: Dixen Hbr.

NUMBER: —

SHEET: 2 OF 3

FROM B.M.: A

TO B.M.: Staff (2.5m)

WEATHER: Sunny

TIME:

DATE: 6/2/2009

3rd ORDER, CLASS

BACKSIGHTS						FORESIGHTS				REMARKS
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	
	0350					2136				
A	0328	0328	22			2103	2103	33		
	0306		22			2070		33		-5.33 (-5325)
	0984			44		6309			66	

BS-FS = 0.984m
-6.309m
-5.325m
÷ 3
-1.775m

0.328m
-2.103m
-1.775m

44
+66
110
× 333
36.630
÷ 1000
.0366

FORWARD RUN..... -1.775m
BACKWARD RUN... 1.774 m
DIFFERENCE..... -0.001 m
DISTANCE..... 0.04 km

SUPERSEDES NOAA FORM 75-29, 11-72 EDITION, WHICH IS OBSOLETE.

A → Staff (2.5 m)

BACKWARD RUN (See front side for FORWARD RUN and other information.)						WEATHER				TIME	DATE
BACKSIGHTS						FORESIGHTS				REMARKS	
No. of Station	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS	ROD TEMP.	THREAD READING	MEAN	THREAD INTERVAL	SUM OF INTERVALS		
	2127					0342		22			
Staff	2094	2094.3	33			0320	0320	22			
	2062		32			0298				5.33 (5323)	
	6283			65		0960			44		
			BS-FS =	6.283		2.0943					
				-0.960		-0.320					
				5.323		1.7743					
				÷ 3							
				1.774 m							

NOAA FORM 75-29 (12-75)

★U.S. GPO:1982-564-008/1164-6

OPR-O119-FA-09
Vixen Harbor, Ernest Sound, AK
945-0761

Agreement Between Opening and Closing Levels

Between BMs	Opening Run (m)	Closing Run (m)	Difference
C to A	-0.01835	-0.017	0.0014
A to B	-0.29585	-0.29585	0.0000
A to Staff (2.5m)	-1.777	-1.7745	0.0025

Opening and closing runs agree within (m): 0.00385

Appendix A-VII
BENCHMARK DESCRIPTIONS

Bench Mark Descriptions
Station 9450753
Magnetic Point, Union Bay, Ernest Sound, AK

General Location
The Magnetic Point tidal benchmarks are located on the eastern shore of Ernest Sound south of Union Point and north of Magnetic point within Union Bay. In the northeast portion of Union Bay there are two islands. Specifically, the tidal benchmarks are located on the eastern shore due east of the southern island. The benchmarks are on private property that consists of densely wooded area surrounding intertidal grassland protected by two rock ledge peninsulas.

The Staff was positioned on a flat faced rock wall facing west located on a west facing rock ledge.

The primary benchmark 945-0753 A 2009 is located at 55° 47.296’ N, 132° 11.451’ W. Benchmarks A, B, and C are in the area surrounding the intertidal grassland with benchmark D located along the shore to the north, and benchmark E is located along the shore to the south. Additionally, there is a horizontal control marker that was incorporated into the leveling data. This horizontal control marker is located on the northern peninsular ledge that protects the intertidal grassland.

Newly installed benchmark- Benchmark 945-0753 A 2009
The benchmark A is the primary benchmark and was installed on the shore facing the west. It is set flush on a rock ledge just in front of the intertidal zone.
Installation of the benchmark places it at position: 55° 47.296’ N, 132° 11.451’ W

Newly installed benchmark- Benchmark 945-0753 B 2009
Benchmark B is located on the southern inshore edge of the forest and the intertidal zone.
Installation of the benchmark places it at position: 55° 47.283’ N, 132° 11.444’ W

Newly installed benchmark- Benchmark 945-0753 C 2009
Benchmark C is located on the northern inshore edge of the forest and intertidal zone.
Installation of the benchmark places it at position: 55° 47.303’ N, 132° 11.432’ W

Newly installed benchmark- Benchmark 945-0753 D 2009
Benchmark D is located on the shore facing west. The disc is set flush into bedrock north of the intertidal zone.
Installation of the benchmark places it at position: 55° 47.319’ N, 132° 11.443’ W

Newly installed benchmark- Benchmark 945-0753 E 2009
Benchmark E is located on a rock ledge that faces the west. It is set flush into bedrock horizontally south of the intertidal zone.
Installation of the benchmark places it at position: 55° 47.279’ N, 132° 11.463’ W

Bench Mark Descriptions
Station 945-0761
Vixen Harbor, Ernest Sound, AK

General Location
The Vixen Harbor tidal benchmarks are located on the south east shore of Vixen Harbor south of the charted rock. The benchmarks are on private property that consists of densely wooded area with a stream separating Benchmarks 945-0761 A 2009 and 945-0761 B 2009.

The Staff was positioned on the charted, flat faced rock wall facing north located just north of Benchmark 945-0761 A 2009.

The primary benchmark 945-0761 A 2009 is located at 55° 47.741' N, 132° 10.352' W. Benchmark 945-0761 B 2009 is located north east and across a stream from benchmark 945-0761 A 2009. Benchmark 945-0761 C 2009 is located to the west of benchmark 945-0761 A 2009.

Newly installed benchmark- Benchmark 945-0761 A 2009
The benchmark A is the primary benchmark and was installed on the shore facing the north. It is set flush on a bedrock ledge protruding out of the grass, above high water, west of the stream. Installation of the benchmark places it at position: 55° 47.741' N, 132° 10.352' W.

Newly installed benchmark- Benchmark 945-0761 B 2009
Benchmark B is located on the south east shore of Vixen Harbor on the edge of the forest. It is set flush on a ledge that is above high water northeast of the stream.
Installation of the benchmark places it at position: 55° 47.723' N, 132° 10.324' W.

Newly installed benchmark- Benchmark 945-0761 C 2009
Benchmark C is located on southern shore of Vixen harbor on the edge of the forest above high water set flush into bed rock.
Installation of the benchmark places it at position: 55° 47.755' N, 132° 10.384' W.

Appendix A-VIII
GAUGE DATA

(data submitted digitally)

Appendix B-I

ATON OPUS-RS Solutions

```
FILE: RED41482.09O 000969805

 1008 NOTE: Antenna offsets supplied by the user were zero. Coordinates
 1008 returned will be for the antenna reference point (ARP).
 1008
 6011 Warning - OPUS-RS was able to find a set of reference stations
 6011 with data suitable for use with your dataset. However, your
 6011 position does not fall within the polygon enclosing these reference
 6011 stations. This means that the geographic interpolation algorithms
 6011 performed within OPUS-RS must instead perform extrapolation.
 6011 Extrapolation, especially if your position is far from the
 6011 reference stations, is prone to error. Use this solution with
 6011 caution.
        Your station is 3.0 KM outside the polygon enclosing the reference stations.

                              NGS OPUS-RS SOLUTION REPORT
                              ===========================

      USER: mark.s.andrews@noaa.gov DATE: June 07, 2009
RINEX FILE: red4148s.09o TIME: 21:46:53 UTC


  SOFTWARE: rsgps 1.32 RS41.prl 1.53b START: 2009/05/28 18:20:17
 EPHEMERIS: igr15334.eph [rapid] STOP: 2009/05/28 19:26:10
  NAV FILE: brdc1480.09n OBS USED: 1818 / 2169 : 84%
  ANT NAME: ASH701975.01AGP QUALITY IND. 37.65/ 62.53
ARP HEIGHT: 0.0 NORMALIZED RMS: 0.318


 REF FRAME: NAD_83(CORS96)(EPOCH:2003.0000) ITRF00 (EPOCH:2009.40490)

         X: -2420175.889(m) 0.004(m) -2420176.739(m) 0.004(m)
         Y: -2663203.011(m) 0.005(m) -2663201.911(m) 0.005(m)
         Z: 5248348.466(m) 0.021(m) 5248348.642(m) 0.021(m)

       LAT: 55 44 32.24953 0.012(m) 55 44 32.25921 0.012(m)
     E LON: 227 44 13.64348 0.006(m) 227 44 13.56502 0.006(m)
     W LON: 132 15 46.35652 0.006(m) 132 15 46.43498 0.006(m)
    EL HGT: 5.645(m) 0.018(m) 5.654(m) 0.018(m)
 ORTHO HGT: 10.096(m) 0.121(m) [NAVD88 (Computed using GEOID06)]

                         UTM COORDINATES STATE PLANE COORDINATES
                          UTM (Zone 08) SPC (5001 AK 1)
Northing (Y) [meters] 6180791.045 435969.866
Easting (X) [meters] 671818.674 906838.406
Convergence [degrees] 2.26281951 1.17043768
Point Scale 0.99996212 0.99990208
Combined Factor 0.99996124 0.00000000

US NATIONAL GRID DESIGNATOR: 8UPG7181980791(NAD 83)



                              BASE STATIONS USED
PID DESIGNATION LATITUDE LONGITUDE DISTANCE(m)
DK6482 AIS5 ANNETTE ISLAND 5 CORS ARP N550408.647 W1313558.255 85925.5
DJ3035 LEV6 LEVEL ISLAND 6 CORS ARP N562756.364 W1330532.511 95659.4
DK6423 BIS5 BIORKA ISLAND 5 CORS ARP N565116.162 W1353221.387 237611.3

                  NEAREST NGS PUBLISHED CONTROL POINT
UV6027 MIS 1915 N554450.969 W1321642.405 1134.4
```

```
    OPUS-RS Extended Output, Level 2



     FINAL COORDINATES (ITRF at epoch of observations)

  ais5 -2430154.029 -2737192.966 5205816.677
  lev6 -2412812.282 -2579074.251 5293282.189
  bis5 -2494921.285 -2448390.944 5317113.653
  red4 -2420176.739 -2663201.911 5248348.642

Covariance matrix of the stations:
    1 5.8580E-07 4.8740E-07 -7.6800E-07 -1.0890E-07 -2.4150E-07 3.7610E-07
-1.4480E-07 -2.4440E-07 3.9190E-07 1.4520E-07 1.9260E-08 -5.2560E-08
    2 4.8740E-07 7.8400E-07 -8.3670E-07 -2.7970E-07 -2.0800E-07 4.0780E-07
-2.0950E-07 -2.4260E-07 4.3070E-07 -1.1040E-07 3.5530E-08 1.7000E-07
    3 -7.6800E-07 -8.3670E-07 1.6760E-06 3.7260E-07 4.2200E-07 -6.7490E-07
3.9630E-07 4.1200E-07 -6.6760E-07 -3.1160E-08 -1.4510E-08 1.6940E-07
    4 -1.0890E-07 -2.7970E-07 3.7260E-07 5.9570E-07 4.9180E-07 -7.5410E-07
-1.5360E-07 -2.1170E-07 3.8110E-07 1.7020E-07 3.5120E-08 -8.1430E-08
    5 -2.4150E-07 -2.0800E-07 4.2200E-07 4.9180E-07 6.9250E-07 -8.1440E-07
-2.5050E-07 -1.5090E-07 3.9230E-07 2.5680E-08 1.2380E-07 -2.8340E-08
    6 3.7610E-07 4.0780E-07 -6.7490E-07 -7.5410E-07 -8.1440E-07 1.6850E-06
3.7850E-07 4.0650E-07 -6.7730E-07 3.0510E-08 2.7350E-08 3.9960E-08
    7 -1.4480E-07 -2.0950E-07 3.9630E-07 -1.5360E-07 -2.5050E-07 3.7850E-07
6.3290E-07 4.5810E-07 -7.7440E-07 1.7100E-08 -5.5590E-08 1.3500E-07
    8 -2.4440E-07 -2.4260E-07 4.1200E-07 -2.1170E-07 -1.5090E-07 4.0650E-07
4.5810E-07 7.2640E-07 -8.2030E-07 8.5960E-08 1.7450E-07 -1.4360E-07
    9 3.9190E-07 4.3070E-07 -6.6760E-07 3.8110E-07 3.9230E-07 -6.7730E-07
-7.7440E-07 -8.2030E-07 1.6780E-06 2.2120E-10 -1.2230E-08 1.2460E-07
   10 1.4520E-07 -1.1040E-07 -3.1160E-08 1.7020E-07 2.5680E-08 3.0510E-08 1.7100E-08
8.5960E-08 2.2120E-10 8.1600E-06 8.4460E-06 -1.3230E-05
   11 1.9260E-08 3.5530E-08 -1.4510E-08 3.5120E-08 1.2380E-07 2.7350E-08 -5.5590E-08
1.7450E-07 -1.2230E-08 8.4460E-06 1.0290E-05 -1.4410E-05
   12 -5.2560E-08 1.7000E-07 1.6940E-07 -8.1430E-08 -2.8340E-08 3.9960E-08
1.3500E-07 -1.4360E-07 1.2460E-07 -1.3230E-05 -1.4410E-05 2.7200E-05

 Covariance Matrix for the xyz OPUS Rover Position (meters^2).
    0.0000081600 0.0000084460 -0.0000132300
    0.0000084460 0.0000102900 -0.0000144100
   -0.0000132300 -0.0000144100 0.0000272000

 Covariance Matrix for the enu OPUS Position (meters^2).
    0.0000007159 -0.0000002663 0.0000000615
   -0.0000002663 0.0000025140 -0.0000026357
    0.0000000615 -0.0000026357 0.0000424201

 Horizontal network accuracy = 0.00327 meters.
 Vertical network accuracy = 0.01277 meters.


                      Vectors
To From X Y Z
ais5 red4 -9977.290 -73991.055 -42531.965
lev6 red4 7364.457 84127.660 44933.548
bis5 red4 -74744.546 214810.968 68765.012

Covariance matrix of the 3 vectors
    1 8.4554E-06 9.0245E-06 -1.3914E-05 7.7357E-06 8.1596E-06 -1.2832E-05 7.8529E-06
8.0964E-06 -1.2786E-05
    2 9.0245E-06 1.1003E-05 -1.5402E-05 8.2416E-06 9.9227E-06 -1.4200E-05 8.4025E-06
9.8374E-06 -1.4137E-05
```

```
    3 -1.3914E-05 -1.5402E-05 2.8537E-05 -1.2745E-05 -1.3945E-05 2.6316E-05
-1.2938E-05 -1.3840E-05 2.6238E-05
    4 7.7357E-06 8.2416E-06 -1.2745E-05 8.4153E-06 8.8770E-06 -1.3933E-05 7.8191E-06
8.1132E-06 -1.2768E-05
    5 8.1596E-06 9.9227E-06 -1.3945E-05 8.8770E-06 1.0735E-05 -1.5223E-05 8.2254E-06
9.8408E-06 -1.3977E-05
    6 -1.2832E-05 -1.4200E-05 2.6316E-05 -1.3933E-05 -1.5223E-05 2.8805E-05
-1.3017E-05 -1.3887E-05 2.6358E-05
    7 7.8529E-06 8.4025E-06 -1.2938E-05 7.8191E-06 8.2254E-06 -1.3017E-05 8.7587E-06
8.8737E-06 -1.4140E-05
    8 8.0964E-06 9.8374E-06 -1.3840E-05 8.1132E-06 9.8408E-06 -1.3887E-05 8.8737E-06
1.0667E-05 -1.5074E-05
    9 -1.2786E-05 -1.4137E-05 2.6238E-05 -1.2768E-05 -1.3977E-05 2.6358E-05
-1.4140E-05 -1.5074E-05 2.8629E-05

Correlation matrix of the 3 vectors
    1 1.0000E+00 9.3563E-01 -8.9575E-01 9.1706E-01 8.5645E-01 -8.2222E-01 9.1252E-01
8.5250E-01 -8.2178E-01
    2 9.3563E-01 1.0000E+00 -8.6921E-01 8.5649E-01 9.1301E-01 -7.9760E-01 8.5592E-01
9.0802E-01 -7.9653E-01
    3 -8.9575E-01 -8.6921E-01 1.0000E+00 -8.2242E-01 -7.9674E-01 9.1786E-01
-8.1833E-01 -7.9323E-01 9.1797E-01
    4 9.1706E-01 8.5649E-01 -8.2242E-01 1.0000E+00 9.3397E-01 -8.9491E-01 9.1076E-01
8.5631E-01 -8.2258E-01
    5 8.5645E-01 9.1301E-01 -7.9674E-01 9.3397E-01 1.0000E+00 -8.6572E-01 8.4828E-01
9.1961E-01 -7.9729E-01
    6 -8.2222E-01 -7.9760E-01 9.1786E-01 -8.9491E-01 -8.6572E-01 1.0000E+00
-8.1951E-01 -7.9223E-01 9.1786E-01
    7 9.1252E-01 8.5592E-01 -8.1833E-01 9.1076E-01 8.4828E-01 -8.1951E-01 1.0000E+00
9.1803E-01 -8.9293E-01
    8 8.5250E-01 9.0802E-01 -7.9323E-01 8.5631E-01 9.1961E-01 -7.9223E-01 9.1803E-01
1.0000E+00 -8.6260E-01
    9 -8.2178E-01 -7.9653E-01 9.1797E-01 -8.2258E-01 -7.9729E-01 9.1786E-01
-8.9293E-01 -8.6260E-01 1.0000E+00


                    G-FILE for the vectors

Axx2009 5282009 528
B2009052818002009052819003 rsgps 1.32IGS
Iant_info.003 NGS
C00040001 -99772896 29 -739910547 33 -425319651 53
C00040002 73644566 29 841276601 32 449335475 53
C00040003 -747445463 29-2146857619 32 687650118 53
D 1 2 9356288 1 3 -8957523 1 4 9170599 1 5 8564473 1 6 -8222192
D 1 7 9125216 1 8 8525002 1 9 -8217844 2 3 -8692054 2 4 8564880
D 2 5 9130092 2 6 -7976009 2 7 8559212 2 8 9080198 2 9 -7965324
D 3 4 -8224185 3 5 -7967434 3 6 9178577 3 7 -8183257 3 8 -7932273
D 3 9 9179733 4 5 9339689 4 6 -8949131 4 7 9107562 4 8 8563063
D 4 9 -8225759 5 6 -8657218 5 7 8482790 5 8 9196066 5 9 -7972920
D 6 7 -8195149 6 8 -7922320 6 9 9178646 7 8 9180304 7 9 -8929278
D 8 9 -8626034

   ITRF position of red4 as determined by individual baselines
               X Y Z
ais5 -2420176.742 -2663201.906 5248348.615
lev6 -2420176.735 -2663201.915 5248348.645
bis5 -2420176.735 -2663201.909 5248348.655

   Residuals of position determined by individual baselines from the final position
               X Y Z East North Up
ais5 -0.003 0.006 -0.027 -0.006 -0.013 -0.023
lev6 0.004 -0.003 0.003 0.005 0.002 0.003
```

bis5 0.004 0.003 0.013 0.001 0.011 0.008

dop from interpolation is 0.722
scatter (mean square distance from rover) is 24323.108
average edop for rover is 0.800
average ndop for rover is 1.160
average hdop for rover is 1.409
average vdop for rover is 1.690
average gdop for rover is 2.490

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

Appendix B-II

ATON Observation Logs

(Not Applicable)

Appendix B-III

Control OPUS-S Solutions

```
 FILE: 10541440A.09o 000054645

                            NGS OPUS SOLUTION REPORT
                            ========================

All computed coordinate accuracies are listed as peak-to-peak values.
For additional information:
www.ngs.noaa.gov/OPUS/Using_OPUS.html#accuracy

      USER: glen.rice@noaa.gov                      DATE: June 06, 2009
RINEX FILE: 1054144i.09o                            TIME: 23:07:03 UTC


  SOFTWARE: page5  0810.20 master50.pl 081023      START: 2009/05/24
08:00:00
 EPHEMERIS: igr15330.eph [rapid]                    STOP: 2009/05/25
07:57:30
  NAV FILE: brdc1440.09n                        OBS USED: 44233 / 50231
:  88%
  ANT NAME: TRM55971.00     NONE             # FIXED AMB:   293 /   325
:  90%
ARP HEIGHT: 1.5                              OVERALL RMS: 0.016(m)


 REF FRAME: NAD_83(CORS96)(EPOCH:2003.0000)            ITRF00
(EPOCH:2009.3940)

         X:     -2413974.142(m)   0.024(m)          -2413974.992(m)
0.024(m)
         Y:     -2663096.955(m)   0.025(m)          -2663095.855(m)
0.025(m)
         Z:      5251232.944(m)   0.032(m)           5251233.120(m)
0.032(m)

       LAT:   55 47 18.23776      0.011(m)        55 47 18.24749
0.011(m)
     E LON:  227 48 32.93467      0.007(m)       227 48 32.85613
0.007(m)
     W LON:  132 11 27.06533      0.007(m)       132 11 27.14387
0.007(m)
    EL HGT:            1.332(m)   0.046(m)                 1.340(m)
0.046(m)
 ORTHO HGT:            5.769(m)   0.128(m) [NAVD88 (Computed using
GEOID06)]

                        UTM COORDINATES    STATE PLANE COORDINATES
                         UTM (Zone 08)         SPC (5001 AK 1)
Northing (Y) [meters]     6186101.219           441196.454
Easting (X)  [meters]      676130.566           911250.502
Convergence  [degrees]     2.32366463           1.22996333
Point Scale                0.99998052           0.99990050
Combined Factor            0.99998032           0.00000000

US NATIONAL GRID DESIGNATOR:  8UPG7613186101(NAD 83)
```

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DK6423	BIS5 BIORKA ISLAND 5 CORS ARP	N565116.162	W1353221.387	238727.3
DJ3035	LEV6 LEVEL ISLAND 6 CORS ARP	N562756.364	W1330532.511	93963.3
DK6482	AIS5 ANNETTE ISLAND 5 CORS ARP	N550408.647	W1313558.255	88401.4

NEAREST NGS PUBLISHED CONTROL POINT

UV5996	LOOK 1916	N554728.961	W1321123.951	336.0

BASE STATION INFORMATION

```
 STATION NAME: bis5  a    2 (Biorka Island 5; Biorka Island, Alaska  USA)
  MONUMENT: NO DOMES NUMBER
 XYZ  -2494921.0833  -2448390.9914   5317113.6533  MON @ 1997.0000 (M)
 XYZ        -0.0164         0.0037         0.0005  VEL (M/YR)
 NEU         0.0000         0.0000         0.0000  MON TO ARP (M)
 NEU        -0.0034        -0.0019         0.0813  ARP TO L1 PHASE CENTER
(M)
 NEU        -0.0037        -0.0015         0.0689  ARP TO L2 PHASE CENTER
(M)
 XYZ        -0.2033         0.0459         0.0062  VEL TIMES 12.3940 YRS
 XYZ         0.0000         0.0000         0.0000  MON TO ARP
 XYZ        -0.0351        -0.0318         0.0662  ARP TO L1 PHASE CENTER
 XYZ  -2494921.3217  -2448390.9773   5317113.7257  L1 PHS CEN @ 2009.3940
 XYZ         0.0001        -0.0001        -0.0000  + XYZ ADJUSTMENTS
 XYZ  -2494921.3215  -2448390.9774   5317113.7257  NEW L1 PHS CEN @
2009.3940
 XYZ  -2494921.2864  -2448390.9456   5317113.6595  NEW ARP @ 2009.3940
 XYZ  -2494921.2864  -2448390.9456   5317113.6595  NEW MON @ 2009.3940
 LLH  56 51 16.17150  224 27 38.53072     66.8352  NEW L1 PHS CEN @
2009.3940
 LLH  56 51 16.17161  224 27 38.53083     66.7539  NEW ARP @ 2009.3940
 LLH  56 51 16.17161  224 27 38.53083     66.7539  NEW MON @ 2009.3940

 STATION NAME: lev6  a    2 (Level Island 6; Level Island, Alaska  USA)
  MONUMENT: NO DOMES NUMBER
 XYZ  -2412812.0457  -2579074.2577   5293282.2476  MON @ 1997.0000 (M)
 XYZ        -0.0190         0.0003        -0.0044  VEL (M/YR)
 NEU         0.0000         0.0000         0.0000  MON TO ARP (M)
 NEU        -0.0034        -0.0019         0.0813  ARP TO L1 PHASE CENTER
(M)
 NEU        -0.0037        -0.0015         0.0689  ARP TO L2 PHASE CENTER
(M)
```

```
 XYZ        -0.2355         0.0037        -0.0545  VEL TIMES 12.3940 YRS
 XYZ         0.0000         0.0000         0.0000  MON TO ARP
 XYZ        -0.0340        -0.0336         0.0659  ARP TO L1 PHASE CENTER
 XYZ  -2412812.3152  -2579074.2876   5293282.2590  L1 PHS CEN @ 2009.3940
 XYZ         0.0000        -0.0001        -0.0000  + XYZ ADJUSTMENTS
 XYZ  -2412812.3152  -2579074.2876   5293282.2589  NEW L1 PHS CEN @
2009.3940
 XYZ  -2412812.2812  -2579074.2540   5293282.1930  NEW ARP @ 2009.3940
 XYZ  -2412812.2812  -2579074.2540   5293282.1930  NEW MON @ 2009.3940
 LLH  56 27 56.37382  226 54 27.40780     25.4803  NEW L1 PHS CEN @
2009.3940
 LLH  56 27 56.37393  226 54 27.40791     25.3990  NEW ARP @ 2009.3940
 LLH  56 27 56.37393  226 54 27.40791     25.3990  NEW MON @ 2009.3940

 STATION NAME: ais5  a    2 (Annette Island 5; Annette Island, Alaska
USA)
  MONUMENT: NO DOMES NUMBER
 XYZ  -2430153.8469  -2737192.9494   5205816.7670  MON @ 1997.0000 (M)
 XYZ        -0.0147        -0.0013        -0.0087  VEL (M/YR)
 NEU         0.0000         0.0000         0.0000  MON TO ARP (M)
 NEU        -0.0034        -0.0019         0.0813  ARP TO L1 PHASE CENTER
(M)
 NEU        -0.0037        -0.0015         0.0689  ARP TO L2 PHASE CENTER
(M)
 XYZ        -0.1822        -0.0161        -0.1078  VEL TIMES 12.3940 YRS
 XYZ         0.0000         0.0000         0.0000  MON TO ARP
 XYZ        -0.0342        -0.0356         0.0647  ARP TO L1 PHASE CENTER
 XYZ  -2430154.0633  -2737193.0011   5205816.7239  L1 PHS CEN @ 2009.3940
 XYZ         0.0000        -0.0000        -0.0000  + XYZ ADJUSTMENTS
 XYZ  -2430154.0633  -2737193.0012   5205816.7239  NEW L1 PHS CEN @
2009.3940
 XYZ  -2430154.0291  -2737192.9655   5205816.6592  NEW ARP @ 2009.3940
 XYZ  -2430154.0291  -2737192.9655   5205816.6592  NEW MON @ 2009.3940
 LLH  55  4  8.65791  228 24  1.66882     32.4118  NEW L1 PHS CEN @
2009.3940
 LLH  55  4  8.65802  228 24  1.66893     32.3305  NEW ARP @ 2009.3940
 LLH  55  4  8.65802  228 24  1.66893     32.3305  NEW MON @ 2009.3940

                        REMOTE STATION INFORMATION

 STATION NAME: 1054       1
  MONUMENT: NO DOMES NUMBER
 XYZ  -2413975.7182  -2663096.3242   5251234.5092  MON @ 2009.3927 (M)
 NEU        -0.0016        -0.0007         1.5000  MON TO ARP (M)
 NEU         0.0016         0.0007         0.0850  ARP TO L1 PHASE CENTER
(M)
 NEU         0.0008         0.0012         0.0701  ARP TO L2 PHASE CENTER
(M)
 XYZ        -0.5678        -0.6254         1.2396  MON TO ARP
 XYZ        -0.0307        -0.0349         0.0712  ARP TO L1 PHASE CENTER
 XYZ  -2413976.3167  -2663096.9845   5251235.8199  L1 PHS CEN @ 2009.3940

 BASELINE NAME:   bis5  1054
 XYZ         0.7196         0.4686        -1.3889  + XYZ ADJUSTMENTS
```

```
 XYZ  -2413975.5971  -2663096.5159   5251234.4310  NEW L1 PHS CEN @
2009.3940
 XYZ  -2413975.5664  -2663096.4810   5251234.3598  NEW ARP @ 2009.3940
 XYZ  -2413974.9986  -2663095.8556   5251233.1203  NEW MON @ 2009.3940
 LLH  55 47 18.24737  227 48 32.85588      2.9283  NEW L1 PHS CEN @
2009.3940
 LLH  55 47 18.24731  227 48 32.85584      2.8433  NEW ARP @ 2009.3940
 LLH  55 47 18.24737  227 48 32.85588      1.3433  NEW MON @ 2009.3940

 BASELINE NAME:   lev6  1054
 XYZ         0.7177         0.4572        -1.3733  + XYZ ADJUSTMENTS
 XYZ  -2413975.5990  -2663096.5273   5251234.4467  NEW L1 PHS CEN @
2009.3940
 XYZ  -2413975.5683  -2663096.4924   5251234.3755  NEW ARP @ 2009.3940
 XYZ  -2413975.0005  -2663095.8670   5251233.1359  NEW MON @ 2009.3940
 LLH  55 47 18.24739  227 48 32.85623      2.9467  NEW L1 PHS CEN @
2009.3940
 LLH  55 47 18.24734  227 48 32.85619      2.8617  NEW ARP @ 2009.3940
 LLH  55 47 18.24739  227 48 32.85623      1.3617  NEW MON @ 2009.3940

 BASELINE NAME:   ais5  1054
 XYZ         0.7412         0.4820        -1.4055  + XYZ ADJUSTMENTS
 XYZ  -2413975.5755  -2663096.5025   5251234.4145  NEW L1 PHS CEN @
2009.3940
 XYZ  -2413975.5448  -2663096.4676   5251234.3433  NEW ARP @ 2009.3940
 XYZ  -2413974.9770  -2663095.8422   5251233.1037  NEW MON @ 2009.3940
 LLH  55 47 18.24772  227 48 32.85628      2.9008  NEW L1 PHS CEN @
2009.3940
 LLH  55 47 18.24767  227 48 32.85624      2.8158  NEW ARP @ 2009.3940
 LLH  55 47 18.24772  227 48 32.85628      1.3158  NEW MON @ 2009.3940
```

G-FILES

```
Axx2009 524   9 525
B2009 524 759   9 525 757 1 page5 v0810.20IGS     226 1 2 27NGS   2009 6
6IFDDFX
Iant_info.003        NGS   20090521
C00090001 -809462879   13 2147049100   17  658805392   20
X1449A1054X1449ABIS5
D  1  2  3810207  1  3 -9033872  2  3 -4443556

Axx2009 524   9 525
B2009 524 759   9 525 757 1 page5 v0810.20IGS     226 1 2 27NGS   2009 6
6IFDDFX
Iant_info.003        NGS   20090521
C00090002   11627193   14  840216130   18  420490571   24
X1449A1054X1449ALEV6
D  1  2  6699898  1  3 -8353699  2  3 -3347313

Axx2009 524   9 525
B2009 524 759   9 525 757 1 page5 v0810.20IGS     226 1 2 27NGS   2009 6
6IFDDFX
Iant_info.003        NGS   20090521
```

```
C00090003 -161790521   18 -740971233   25 -454164446   29
X1449A1054X1449AAIS5
D  1  2  7698870  1  3 -6409897  2  3 -1550150

                    POST-FIT RMS BY SATELLITE VS. BASELINE

            OVERALL     02     03     04     06     07     08     09
10
 bis5-1054|  0.016  0.014  0.012  0.022  0.013  0.014  0.014  0.021
0.019
               11     12     13     14     15     16     17     18
19
 bis5-1054|  0.013  0.016  0.013  0.018  0.014  0.015  0.017  0.016
0.015
               20     21     22     23     24     25     26     27
28
 bis5-1054|  0.012  0.017  0.015  0.012  0.014  0.017  0.020  0.019
0.022
               29     30     31     32
 bis5-1054|  0.012  0.015  0.018  0.020

            OVERALL     01     02     03     04     05     06     07
08
 lev6-1054|  0.016    ...  0.019  0.013  0.022    ...  0.012  0.021
0.015
               09     10     11     12     13     14     15     16
17
 lev6-1054|  0.023  0.018  0.015  0.015  0.015  0.018  0.020  0.017
0.019
               18     19     20     21     22     23     24     25
26
 lev6-1054|  0.016  0.015  0.013  0.015  0.014  0.015  0.014  0.015
0.019
               27     28     29     30     31     32
 lev6-1054|  0.020  0.017  0.011  0.018  0.017  0.017

            OVERALL     02     03     04     06     07     08     09
10
 ais5-1054|  0.016  0.016  0.014  0.021  0.013  0.015  0.015  0.023
0.021
               11     12     13     14     15     16     17     18
19
 ais5-1054|  0.013  0.015  0.015  0.017  0.017  0.016  0.020  0.015
0.016
               20     21     22     23     24     25     26     27
28
 ais5-1054|  0.014  0.017  0.016  0.013  0.014  0.021  0.019  0.020
0.023
               29     30     31     32
 ais5-1054|  0.011  0.014  0.023  0.019

                         OBS BY SATELLITE VS. BASELINE
```

```
            OVERALL     02     03     04     06     07     08     09
10
 bis5-1054|  15577    455    515    724    551    623    653    499
668
               11     12     13     14     15     16     17     18
19
 bis5-1054|    540    583    634    660    500    670    549    629
518
               20     21     22     23     24     25     26     27
28
 bis5-1054|    589    181    311    609    583    102    669    556
234
               29     30     31     32
 bis5-1054|    667    183    715    207
            OVERALL     01     02     03     04     05     06     07
08
 lev6-1054|  14868    ...    448    524    593    ...    544     80
616
               09     10     11     12     13     14     15     16
17
 lev6-1054|    504    684    541    584    614    691    543    621
507
               18     19     20     21     22     23     24     25
26
 lev6-1054|    626    538    530     71    160    585    582    592
602
               27     28     29     30     31     32
 lev6-1054|    512    280    651    177    698    170
            OVERALL     02     03     04     06     07     08     09
10
 ais5-1054|  13788    316    462    605    486    604    607    438
593
               11     12     13     14     15     16     17     18
19
 ais5-1054|    450    544    616    477    484    570    442    511
461
               20     21     22     23     24     25     26     27
28
 ais5-1054|    566    120    265    596    583     99    640    511
159
               29     30     31     32
 ais5-1054|    580    150    744    109


 Covariance Matrix for the xyz OPUS Position (meters2).
    0.0000015311     0.0000001332    -0.0000001889
    0.0000001332     0.0000027511    -0.0000000907
   -0.0000001889    -0.0000000907     0.0000040378

 Covariance Matrix for the enu OPUS Position (meters2).
    0.0000019488    -0.0000005349     0.0000002703
   -0.0000005349     0.0000026963     0.0000007242
    0.0000002703     0.0000007242     0.0000036749
```

Horizontal network accuracy = 0.00377 meters.
Vertical network accuracy = 0.00376 meters.

Derivation of NAD 83 vector components

Position of reference station ARP in NAD_83(CORS96)(EPOCH:2003.0000).

	Xa(m)	Ya(m)	Za(m)	
BIS5	-2494920.44060	-2448392.05858	5317113.38841	2003.00
LEV6	-2412811.42529	-2579075.35282	5293281.97185	2003.00
AIS5	-2430153.20716	-2737194.06415	5205816.48535	2003.00

Position of reference station monument in NAD_83(CORS96)(EPOCH:2003.0000).

	Xr(m)	Yr(m)	Zr(m)	
BIS5	-2494920.44060	-2448392.05858	5317113.38841	2003.00
LEV6	-2412811.42529	-2579075.35282	5293281.97185	2003.00
AIS5	-2430153.20716	-2737194.06415	5205816.48535	2003.00

Velocity of reference station monument in NAD_83(CORS96)(EPOCH:2003.0000).

	Vx (m/yr)	Vy (m/yr)	Vz (m/yr)
BIS5	0.00490	0.00450	0.00990
LEV6	0.00220	0.00120	0.00480
AIS5	0.00620	-0.00040	0.00060

Vectors from unknown station monument to reference station monument in NAD_83(CORS96)(EPOCH:2003.0000).

	Xr-X= DX(m)	Yr-Y= DY(m)	Zr-Z= DZ(m)	
BIS5	-80946.29860	214704.89642	65880.44441	2003.00
LEV6	1162.71671	84021.60218	42049.02785	2003.00
AIS5	-16179.06516	-74097.10915	-45416.45865	2003.00

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

SURVEY DATASHEET (Version 1.0)

PID: BBBH07
Designation: WESTERLY CANOE
Stamping: CANOE 2008
Stability: Most reliable; expected to hold position well
Setting: In rock outcrop or ledge
Description: The mark is in a mossy ledge on the Westerly of two southerly projecting points of rock on the southern end of Westerly Island, Earnest Sound, AK.

Located approx 4 ft above high water, 16.7 ft S of a triangular blaze in a 16" hemlock, approx 40 ft N of the southerly most point of land.
Observed: 2008-10-24T23:42:00Z
Source: OPUS - page5 0810.20

Close Up View

REF_FRAME:	EPOCH:	SOURCE:	UNITS:	SET PROFILE	DETAILS
NAD_83(CORS96)	2003.0000	NAVD88 (Computed using GEOID06)	m		

LAT:	55° 54' 8.50259"	± 0.003	m
LON:	-132° 9' 21.01610"	± 0.011	m
ELL HT:	2.105	± 0.013	m
X:	-2405299.464	± 0.004	m
Y:	-2656788.063	± 0.011	m
Z:	5258357.247	± 0.012	m
ORTHO HT:	6.478	± 0.121	m

	UTM 8	**SPC** 5001(AK 1)
NORTHING:	6198868.447m	453928.290m
EASTING:	677804.022m	913167.543m
CONVERGENCE:	2.35581545°	1.25891659°
POINT SCALE:	0.99998778	0.99990012
COMBINED FACTOR:	0.99998745	0.00000000

CONTRIBUTED BY

weston.renoud
National Oceanic and Atmospheric Administration

Horizontal View

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equiqment or field operating procedure used.

Appendix B-IV

Control Observation Logs

FIELD OBSERVATION LOG

DATE: 5/5/09 SESSION:
WX CONDITIONS: Clear/Sunny
OBSERVER(S): WR
DN: 125
4 CHAR. SITE ID: CANOE
SESS. FILE NAME: 10661250A .T01
ELEV. MASK: 10 degrees
RECORDING INTERVAL: 1 sec.s

PROJECT NAME: Ernest Sound OPR-0119-FA-09
SITE NAME: CANOE SITE PHOTO(S): Y / N
SITE TYPE: HORZ / VERT. / ATON / BM / NEW / _____
RECEIVER #: 4910K61066 FIXED HEIGHT? Y / N
ANTENNA #: 3076794I SPACER? Y / N

ANT. MEASUREMENTS		ANT. CONSTANTS	
ANT. SLANT HEIGHT (S)		ANT. RAD. (R)	V. OFFSET (C)
START	STOP		
1.5 m	1.5 m	/ m	/ m
/ ft	/ ft		

OBSERVATION TIMES AND STATUS

RECEIVER TIME (UTC)	PDOP	LOCAL TIME	# of SV's	POWER
START: 18:20	2.5		6	13.06
STOP:				

INSTRUCTIONS:

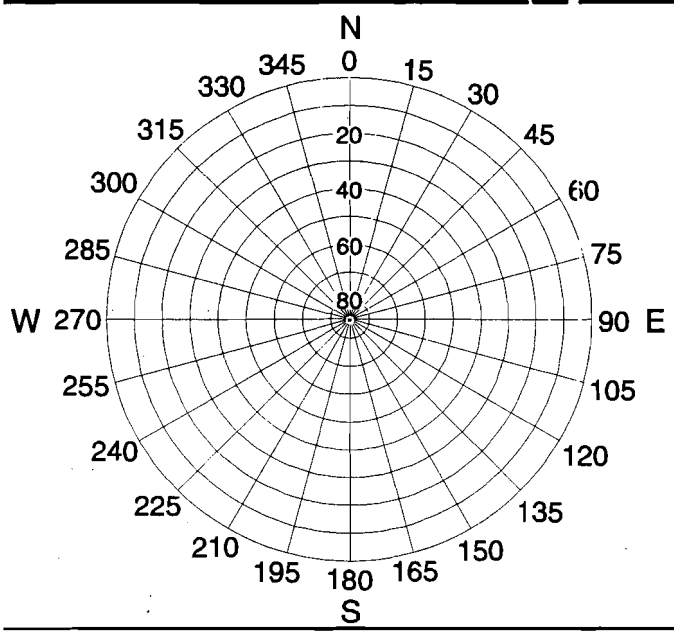
Office Check by:

HI to ARP=((SQRT(S^2-R^2) – C): (m)

SITE SKETCH/LOC./NOTES:

This is a temporary station that will run for the length of the project.

OBSTRUCTION DIAGRAM



MONUMENT RUBBING / DESCRIPTION

FIELD OBSERVATION LOG

DATE: 05 MAY 2009 **SESSION:**

WX CONDITIONS: CLEAR, CALM

OBSERVER(S): ANDREWS, RICE

DN: 125

4 CHAR. SITE ID: VIXEB09.125

SESS. FILE NAME: VIXE

ELEV. MASK: 10 degrees

RECORDING INTERVAL: 1 Hz sec.s

PROJECT NAME:

SITE NAME: VIXEN HBR **SITE PHOTO(S):** (Y) / N

SITE TYPE: (HORZ) / VERT. / ATON / BM / NEW / _____

RECEIVER #: ASHTECH **FIXED HEIGHT?** (Y) N

ANTENNA #: ZE12083 9016 **SPACER?** Y / (N)

ANT. MEASUREMENTS		ANT. CONSTANTS	
ANT. SLANT HEIGHT (S)		ANT. RAD. (R)	V. OFFSET (C)
START	STOP		
_____ m	_____ m	0 m	1.5 m
_____ ft	_____ ft		

OBSERVATION TIMES AND STATUS

RECEIVER TIME (UTC)	PDOP	LOCAL TIME	# of SV's	POWER
START:	1.8	1859	8	—
STOP:				

INSTRUCTIONS: 991.7 mb, 54.3°F Dry, 42.9°F wet, 2.5 mph, MCLR

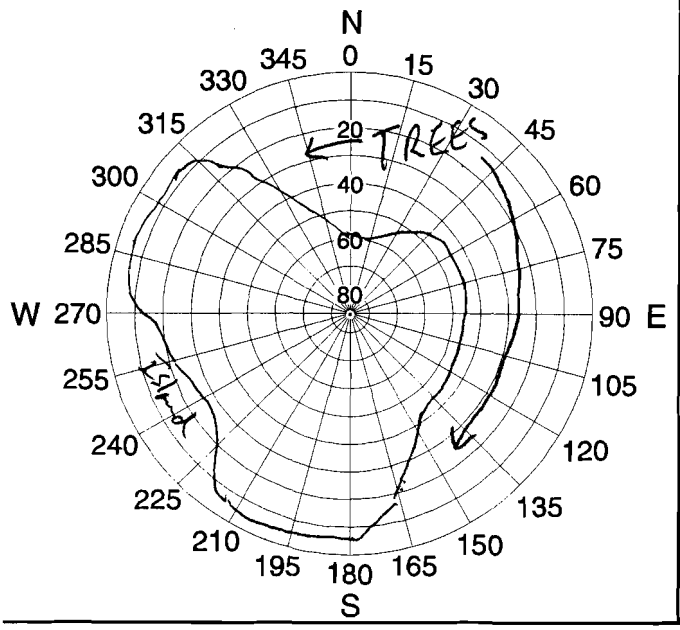
Office Check by:

HI to ARP=((SQRT(S^2-R^2) – C): **(m)**

SITE SKETCH/LOC./NOTES:

Sloping location, two legs on rock, one in soft soil, tied down to three eye bolts. 1 large battery used for primary power. Standard instalation

OBSTRUCTION DIAGRAM



MONUMENT RUBBING / DESCRIPTION

FIELD OBSERVATION LOG

DATE: 5/7/09 **SESSION:**
WX CONDITIONS: Clear/Sunny
OBSERVER(S): WL / MA
DN: 127
4 CHAR. SITE ID:

SESS. FILE NAME:
ELEV. MASK: 10 degrees
RECORDING INTERVAL: 1 sec.s

PROJECT NAME: OPR0119-FA-09
SITE NAME: VIXEN HBR **SITE PHOTO(S):** (Y) / N
SITE TYPE: HORZ. / VERT. / ATON / BM / NEW / _____
RECEIVER #: 4910K61054 **FIXED HEIGHT?** (Y) / N
ANTENNA #: 30767996 **SPACER?** Y / (N)

ANT. MEASUREMENTS		ANT. CONSTANTS	
ANT. SLANT HEIGHT (S)		ANT. RAD. (R)	V. OFFSET (C)
START	STOP		
1.5 m	1.5 m	— m	— m
— ft	— ft		

OBSERVATION TIMES AND STATUS

RECEIVER TIME (UTC)	PDOP	LOCAL TIME	# of SV's	POWER
START: 1745	2.2		6	12.7
STOP:		See Note		

INSTRUCTIONS:

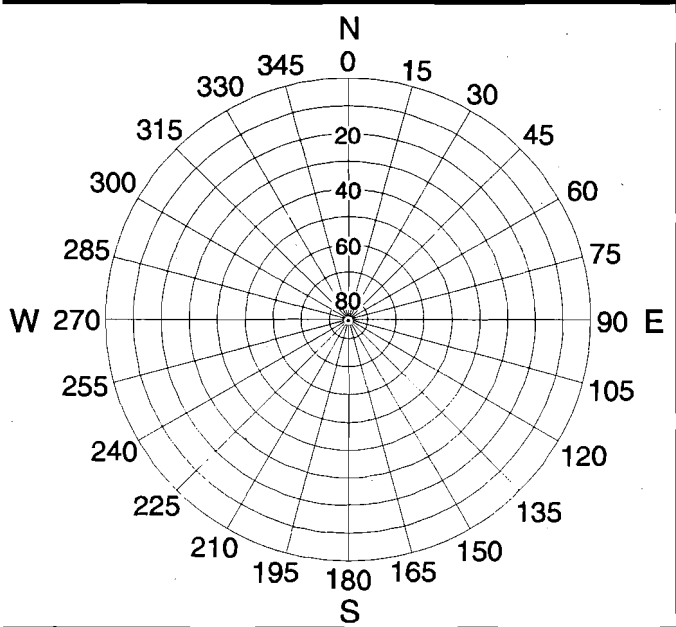
Office Check by:

HI to ARP=((SQRT(S^2-R^2) – C): **(m)**

SITE SKETCH/LOC./NOTES:

This station will be run continuous breaking files at 0800 UTC.

OBSTRUCTION DIAGRAM



MONUMENT RUBBING / DESCRIPTION