C. VERTICAL AND HORIZONTAL CONTROL

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

C.1 VERTICAL CONTROL

Vertical control for the survey was based on the Mean Lower Low Water tidal datum (MLLW). The operating National Water Level Observation Network (NWLON) station at Sand Point, AK (9459450) established vertical control for the LADS depth benchmark areas and for datum determination at the subordinate station installed at Cushing Bay, Mitrofania Island. The Mitrofania Island tide station served as vertical control for the survey areas around Mitrofania Island and Anchor Bay to Seal Bay.

Station details are as follows:

		WGS84	
Gauge	**Location**	**Latitude**	**Longitude**
9459450	Sand Point City Dock	55° 20.2' N	160° 30.1' W
9459016	Cushing Bay, Mitrofania Island	55° 53.3' N	158° 49.2' W

Table 4 – Sand Point and Cushing Bay Tide Gauge

C.2 ZONING

NOAA initially supplied tide zones that cover the extent of the survey, with time and range correctors relative to the Sand Point tide station. These were superseded by preliminary zones calculated prior to survey operations by John Oswald and Associates, LLC in Anchorage, AK. The preliminary zones were established by a 30-day comparison of simultaneous observations between Sand Point and Mitrofania Island. Analysis of crosslines and overlaps of the main lines of sounding concluded that preliminary tide zoning was adequate and therefore the preliminary tide zoning correctors have been considered to be the final zoning correctors.

Tide Zone	GS Identifier	Time Corrector	Range Corrector	Reference Station
M1	1	+0 minutes	x0.96	9459016
M2	2	+0 minutes	x1.00	9459016
M3	3	+0 minutes	x1.04	9459016
M4	4	+0 minutes	x1.08	9459016
SWA204A	5	+0 minutes	x1.00	9459450
SWA193A	6	+0 minutes	x1.02	9459450

Table 5 – Tide Zones

Abstract of Times of Hydrography

Start and End times refer to tidal applications requirement.

Time on Task indicates actual time of task in the survey area. All times and dates are in UTC.

04_4mitro1

Date Flown	JD	Sortie No	Start time	End Time	Time On Task
May-26-04	147	1	23:00	04:00	01:42
Jun-27-04	179	2	23:00	02:30	00:05
Jul-04-04	186	3	23:00	06:00	03:22
Jul-06-04	188	4	17:30	00:30	03:04
Jul-07-04	189	5	17:00	03:00	05:28
Jul-08-04	190	6	23:00	07:30	04:23
#Jul-18-04	200	8	23:30	08:00	05:30
Aug-02-04	215	9	23:30	06:00	02:43
Aug-04-04	217	11	18:00	01:00	03:20
Aug-06-04	219	12	17:30	24:00	04:48
Aug-07-04	220	13	18:00	01:00	03:30
Aug-15-04	228	14	20:00	04:30	03:05
*Aug-20-04	233	15	19:30	00:30	01:07
Sep-2-04	246	17	18:00	22:00	01:17

04_4mitro2

Date Flown	JD	Sortie No	Start time	End Time	Time On Task
May-29-04	150	1	22:30	04:30	03:31
May-30-04	151	2	21:00	05:30	05:45
Jun-04-04	156	3	23:30	05:30	2:29
Jun-05-04	157	4	16:00	18:30	00:16
Jun-12-04	164	5	23:00	05:30	03:19
Jun-13-04	165	6	23:00	04:30	03:29
Jun-26-04	178	8	20:30	05:30	04:53
Jul-04-04	186	10	23:00	06:00	03:22
Jul-05-04	187	11	18:00	02:30	04:30
Jul-06-04	188	12	17:30	05:00	03:04
Jul-10-04	192	14	20:30	05:30	04:33
#Jul-18-04	200	16	23:30	08:00	05:30
Jul-20-04	202	17	23:30	07:00	03:58

Date Flown	JD	Sortie No	Start time	End Time	Time On Task
Jul-23-04	205	18	20:00	05:30	03:23
Jul-28-04	210	19	22:30	03:30	00:19
Jul-29-04	211	20	22:00	07:00	04:52
Aug-07-04	220	21	23:00	05:00	01:40
Aug-15-04	228	22	21:00	04:30	03:05
*Aug-20-04	233	23	19:30	00:30	01:07
*Aug-31-04	244	25	21:45	02:27	00:10

04_4mitro3

Date Flown	JD	Sortie No	Start time	End Time	Time On Task
#Jul-18-04	200	8	23:30	08:00	05:30
Aug-19-04	232	12	18:00	22:00	00:57

Note:

* denotes that 04_4mitro1 and 04_4mitro2 were both flown in the same sortie.

\# denotes that 04_4mitro1, 04_4mitro2 and 04_4mitro3 were all flown in the same sortie.

04_4mitro3 was a database created for reconnaissance only.

Tide Station Report
Mitrofania Island
945-9016

Position:	*Latitude (NAD 83)* 55° 53' 22"	*Longitude (NAD83)* 158° 49' 11"	*Time Meridian* 0° (UTC)
Owner:	*Tidelands* State of Alaska		*Uplands* USFWS Alaska National Maritime Refuge
Type of Station:	Tertiary		
Density Observations:	Yes		
Project Type:	Hydrographic		
Established:	4/20/04		
Removed:	9/804		
Tide Observer:	John Oswald & Associates, LLC (JOA) 2000 East Dowling Rd., Suite 10 Anchorage, Alaska 99507 Phone: (907) 561-0136 Fax: (907) 561-0143		
Project Manager:	John Oswald, PLS, CHS		
Prime Contractor:	Tenix LADS Inc. (ATTN: Darren Stephenson)		
NOS Project No:	OPR-P182-KRL-04		
NOS Contract No:	DG 133C-03-CQ-0011		
JOA WO No:	24		
Tide House and Platform:	Tide gauges were housed in a 4' X 4' X 8' plywood box covered with a camouflage tarp located approximately 15 m above the beach in grass. The orifices for gauge 1 and 2 are attached to separate sheet pile anchors, weighing about 250 lbs each, in 7.5 m of water. The orifice for tide gauge 3 has an approximately 400 lb I-beam as an anchor and is located in approximately 9.5 m of water. The anchors were set offshore using the F/V Captain "G". The tubing from each orifice to the respective tide gauge is approximately 110 m in length.		
Tide staff:	None. Spirit leveling was observed between a nearby tidal bench mark and the water. The survey rod was outfitted with a stilling well to dampen wave action.		
Tide Gauge:	Three tide gauges were installed at this site. Each gauge is a Design Analysis Associates H350XL/H355 digital bubbler. Each system is powered by a 12vdc battery and solar cells for recharging. Data was transmitted via GOES telemetry for each gauge using Signal Engineering radios and Yagi antennas.		

Tide Gauge	Date	Tide Gauge S/N
1	4/20/04	1043
2	4/20/04	1042
3	4/20/04	1038

Primary Benchmark:	9016 E 2004	
Initial leveling:	4/22/04	9016 A 2004, 9016 B 2004, 9016 C 2004, 9016 D 2004, 9016 E 2004
Close-out leveling:	9/8/04	
Existing tidal bench marks:	0	
New tidal bench marks:	5	
JOA Field Book:	2004.02	

Tide Station Location
Mitrofania Island
945-9016

Position:	*Latitude (NAD 83)* 55° 53' 22"	*Longitude (NAD83)* 158° 49' 11"	*Time Meridian* 0° (UTC)
Owner:	*Tidelands* State of Alaska	*Uplands* USFWS Alaska National Maritime Refuge	
Established: Removed:	4/20/04 9/804		
Tide Observer: Project Manager: Prime Contractor:	John Oswald & Associates, LLC (JOA) 2000 East Dowling Rd., Suite 10 Anchorage, Alaska 99507 Phone: (907) 561-0136 Fax: (907) 561-0143 John Oswald, PLS, CHS Tenix LADS Inc. (ATTN: Darren Stephenson)		
NGS Project No: NGS Contract No: JOA WO No:	OPR-P182-KRL-04 DG 133C-03-CQ-0011 24		
Location:	To reach the bench marks from the harbor in Sand Point, AK, proceed NE 20.5 km (11 nm) to the north point of Korovin Island, then proceed ENE 46 km (25 nm) to the SE point of Kupreanof Point, then proceed NE 60 km (32 nm) to a west facing cove on the north side of Mitrofania Island. The benchmarks are located in the NE corner of the cove. The tide gauge orifices are located approximately 110 m offshore.		
GPS Tie:	Primary benchmark 9016 E 2004 was observed multiple times at a minimum of six hours each. Observations were processed and adjusted using NGS Pages NT and NGS Adjust. Methodology and results were documented in a comprehensive report (Fall 2004).		
Existing tidal bench marks: New tidal bench marks: Primary Bench Mark:	0 5 9016 E 2004		

An analysis of simultaneous tides at Sand Point and Mitrofania Island for the period May 1, 2004 to Aug 30, 2004 enabled John Oswald and Associates to compute final datum for the Mitrofania Island tide station. Full details of this analysis can be found in the Mitrofania Island Tide Station Report prepared by John Oswald and Associates dated November 5, 2004. This report has been supplied digitally with the H11260 AJ Report CD in the tides directory in PDF format and sent to CO-OPS.

The derived value at the Mitrofania tide gauge for the difference between MLLW and MHW is 2.121 meters. From the tide zoning a range factor of 1.00 was used for Sheet AU to determine a MHW value of 2.121 meters or 1.160 fathoms.

The verified tides were supplied by John Oswald and Associates. The verified tide data was checked against predicted tides to ensure there were no meteorological effects at the tide gauge. The corrected gauge data was smoothed using a fifth order polynomial of five hours length and then supplied to Tenix LADS, Inc. for the application of tides.

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

C.3 HORIZONTAL CONTROL

Data collection and processing were conducted on the Airborne and Ground Systems in World Geodetic System (WGS 84) on Universal Transverse Mercator (Northern Hemisphere) projection UTM (N) in Zone 4, Central Meridian 159° West. All units are in meters. This data was post-processed and all soundings are relative to the North American Datum 1983 (NAD 83).

C.3.1 LADS Local GPS Base Station – Sand Point

Real-time positions were determined using an Ashtech GG24 GPS receiver. A local GPS base station was coordinated by John Oswald and Associates on the roof of the Popof Pizza Building at the processing facility, Sand Point, AK on March 28 - 29, 2004.

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

NAD 83		**UTM (N) Zone 4**		
Latitude (N)	Longitude (W)	Easting (m)	Northing (m)	Ellipsoidal Height (m)
55°20’42.544”	160°28’53.447”	406 048.735	6 134 199.851	72.980

Table 6 – GPS Base Station