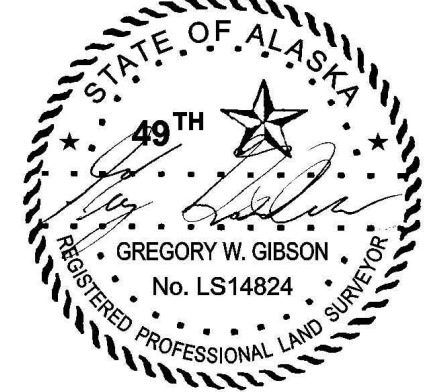


1. PRIMARY PROJECT HORIZONTAL CONTROL IS ALASKA STATE PLANE, ZONE 4, NAD83, (11/2010/00). IN US SURVEY FEET BASED ON A FULLY CONSTRAINED STATIC GPS NETWORK HOLDING THE PUBLISHED 2010 DATUM IS 1.744 768.90'. LOCAL DATUM VALUES FOR CORRS ARE: 1.742 595.079 FT AND 1.742 595.079 FT (D01524); 'KENA KENAI GCORS ARP' (D01D3031); 'TSEA ANCHORAGE CORRS PLANE' (D01A0952).
2. LOCAL PROJECT HORIZONTAL CONTROL IS ALASKA STATE PLANE, ZONE 4, NAD83, IN US SURVEY FEET HOLDING "5H-10" 2002 AS N 2,324,669.21 F AND E 1,742,595.079 FT AND "945 5090" P AS N 2,236,345.61 F, E 1,744,768.90'.
3. VERTICAL CONTROL IS MEAN LOWER LOW WATER (MLLW=0.0 FT), BASED ON THE NOAA/NDS TIDAL BENCH MARK ISLAND "345 5090 SEWARD, RESURRECTION BAY, ALASKA," PUBLISHED 09/30/2011. THIS TIDAL DATUM IS BASED ON THE 1983-2001 TIDAL EPOCH AND IS REFERENCED BY HOLDING NOAA/NDS TIDAL BENCH MARK "3455090" D ("VHM12925PIDB8FH75") AS 21.14 FT.
4. VERTICAL TIES TO THE NATIONAL SPATIAL REFERENCE SYSTEM ARE BASED ON PUBLISHED NAVD83 (GEODIN) ELEVATIONS HOLDING NOAA/NADS TIDAL BENCHMARK "945 5090" P (D01B730VHM915144) AS 25.94 FT.
5. SOUNDINGS ARE IN US SURVEY FEET AND ARE MNUS UNLESS OTHERWISE INDICATED.
6. BATHYMETRY WAS COLLECTED OCTOBER 4 - OCTOBER 5, 2017. SOUNDINGS WERE COLLECTED USING AN RSONIC 2000 MULTIBEAM ECHOSOUNDER OPERATING AT 300kHz. SOUND VELOCITY THROUGH THE WATER COLUMN WAS DETERMINED WITH AN AML BASE X-SOUND VELOCITY PROBE. POSITIONING AND VESSEL ORIENTATION WERE MEASURED USING AN APPLANIX PPMV/NAVEMASTER V5 SYSTEM. SOUNDING RTT CORRECTIONS FROM THE TIDE TO GPS555 GPS RECEIVER SET TO 5 SYSTEM. "2017-2002" SURVEY DATA WAS COLLECTED USING AN A11 AND PROCESSED USING OCEIRA 1.5.1 SOFTWARE. HORIZONTAL CONTROL WAS SURVEYED USING STATIC GNSS EQUIPMENT AND TECHNIQUES. VERTICAL CONTROL WAS SURVEYED USING DIFFERENTIAL LEVELING.
7. MOBILE TERRESTRIAL LASER SCANNING DATA WAS COLLECTED OCTOBER 6, 2017 USING A REIGL VZ400 LASER SCANNER. POSITION AND VESSEL ORIENTATION WERE MEASURED USING AN APPLANIX PPMV/NAVEMASTER V5 SYSTEM. RTT CORRECTIONS FROM THE TIDE TO GPS555 GPS RECEIVER SET TO 5 SYSTEM. "2017-2002" SURVEY DATA WAS COLLECTED USING AN A11 AND PROCESSED USING OCEIRA 1.5.1 SOFTWARE. HORIZONTAL CONTROL WAS SURVEYED USING STATIC GNSS EQUIPMENT AND TECHNIQUES. VERTICAL CONTROL WAS SURVEYED USING DIFFERENTIAL LEVELING.
8. MAP SOUNDINGS ARE BINNED AT 24 FEET AND ARE SHOAL BIASED. CONTOURS ARE BASED ON 12 FEET BINNED SHOAL-BIASED SOUNDINGS. VOLUME SOUNDINGS ARE BINNED AT 3 FEET AND ARE MEAN VALUE.

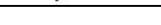
SURVEY CONTROL DATA				
STATION	NORTHING	EASTING	MLLW	DESCRIPTION
SH-8 RESET 2016	2,234,553.68	1,742,934.61	17.90	3 1/4 IN. DBC IN ROCK
SH-10 2002	2,234,669.21	1,742,593.79	17.15	3 1/4 IN. DBC IN ASPH.
SH-12 2006	2,234,535.55	1,743,605.56	20.59	3 1/4 IN. DBC IN ROCK
SH-13 2006	2,236,056.69	1,744,199.81	26.60	3 1/4 IN. DBC IN ROCK
SH-14 2009	2,236,080.45	1,743,820.56	16.30	3 1/4 IN. DBC IN ROCK
SH-15 2009	2,236,350.26	1,742,761.00	19.93	3 1/4 IN. DBC IN CONC.
SH-16	2,236,057.1	1,744,198.4	20.53	2 1/2 IN. BC IN ROCK
SH-19	2,234,898.93	1,743,830.60	20.52	2 1/2 IN. BC IN ROCK
SH-20	2,234,552.73	1,743,630.67	20.37	2 1/2 IN. BC IN ROCK

*BENCHMARKS WITH HORIZONTAL PRECISION OF 0.1" WERE MEASURED BY RTK GNSS.

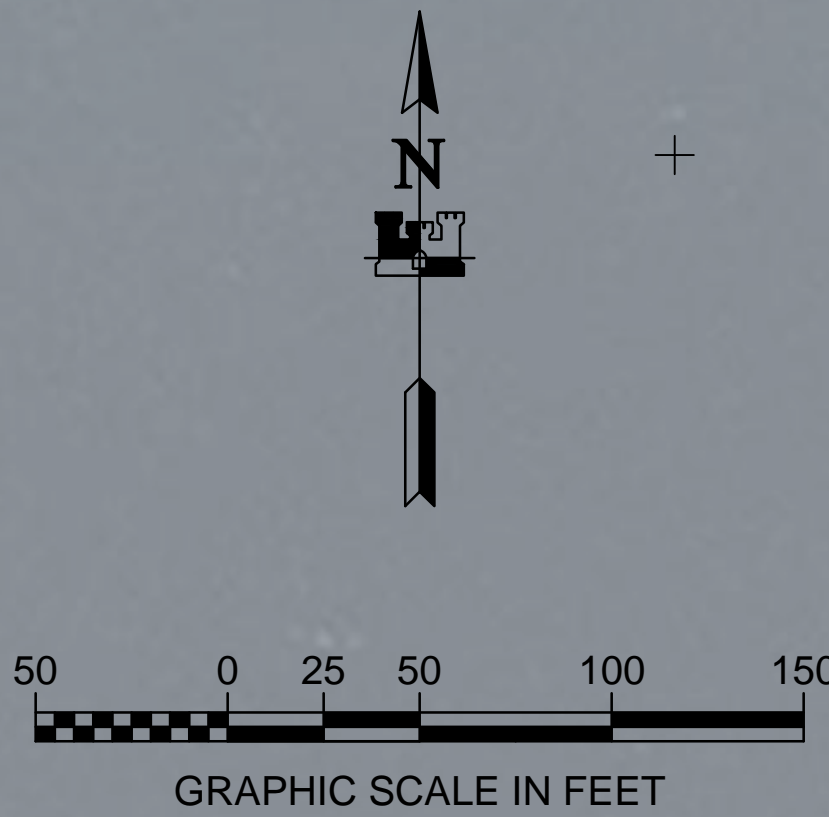
VOLUME COMPUTATIONS		
AREA A: ENTRANCE / MANEUVERING CHANNEL	MLLW=0	CJ. YD.
AVAILABLE TO PROJECT DEPTH (PD)	-15.0	3,761
AVAILABLE TO MAX PAY DEPTH (MP)	-16.0	6,260
AVAILABLE SIDE SLOPES (SS) AT 3:1 (H:V) & 25' WIDE	VARIES	4,994
AREA B: MOORING BASIN		
AVAILABLE TO PD	-12.5	295
AVAILABLE TO MP	-13.5	3,479
AVAILABLE SS AT 3:1 (H:V) & 25' WIDE	VARIES	18
TOTAL MAXIMUM VOLUME AVAILABLE (MP + SS)		14,751




THIS HYDROGRAPHIC SURVEY WAS COMPLETED
UNDER THE OVERSIGHT OF AN ACSM/THSOA
CERTIFIED HYDROGRAPHER



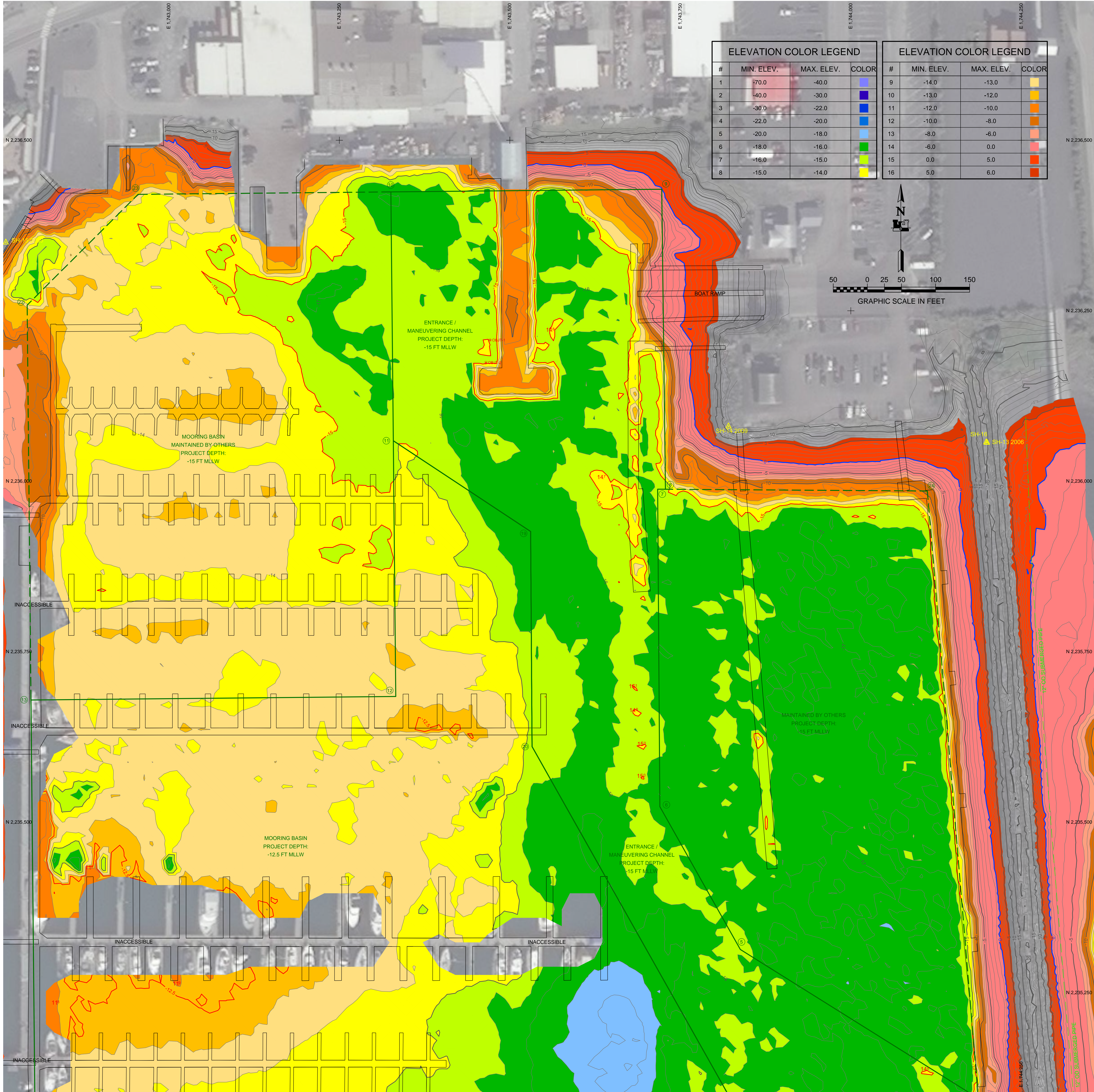
David R. Neff C.H. (275)



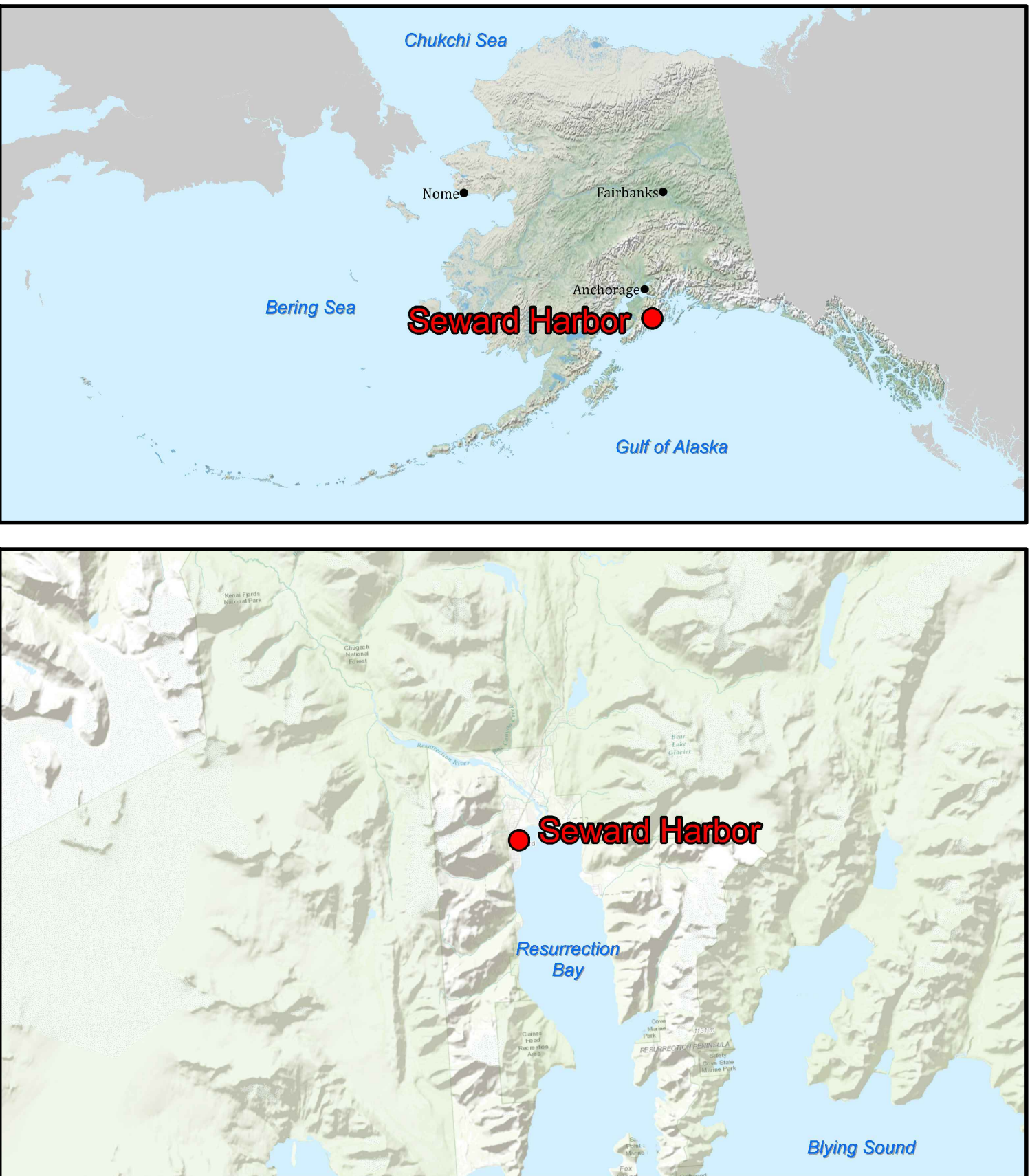
THIS HYDROGRAPHIC SURVEY WAS COMPLETED
UNDER THE OVERSIGHT OF AN ACSM/THSOA
CERTIFIED HYDROGRAPHER



David R. Neff C.H. (275)



ELEVATION COLOR LEGEND				ELEVATION COLOR LEGEND			
#	MIN. ELEV.	MAX. ELEV.	COLOR	#	MIN. ELEV.	MAX. ELEV.	COLOR
1	-70.0	-40.0		9	-14.0	-13.0	
2	-40.0	-30.0		10	-13.0	-12.0	
3	-30.0	-22.0		11	-12.0	-10.0	
4	-22.0	-20.0		12	-10.0	-8.0	
5	-20.0	-18.0		13	-8.0	-6.0	
6	-18.0	-16.0		14	-6.0	0.0	
7	-16.0	-15.0		15	0.0	5.0	
8	-15.0	-14.0		16	5.0	6.0	

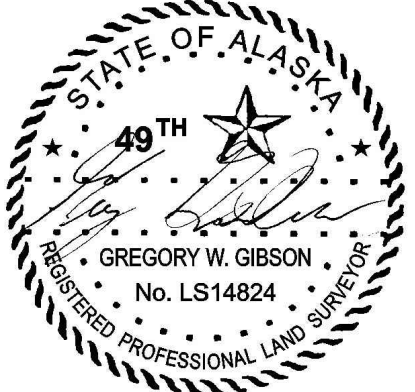


- NOTES**
- PRIMARY PROJECT HORIZONTAL CONTROL IS ALASKA STATE PLANE, ZONE 4, NAD83, (2011/2010.00), IN US SURVEY FEET BASED ON A FULLY CONSTRAINED STATIC GPS NETWORK HOLDING THE PUBLISHED NAD83 2010.00 EPOCH VALUES OF NOS CORS STATIONS: "AC79 MONTAGUE2_AK2010 CORS ARP" (PID D01824); "KENS KENAI CORS ARP" (PID D03031); "TSEA ANCHORAGE CORS ARP" (PID A00952).
 - LOCAL PROJECT HORIZONTAL CONTROL IS ALASKA STATE PLANE, ZONE 4, NAD83, IN US SURVEY FEET HOLDING "SH-10" 2002 AS N 2,234,669.21' E 1,742,593.79' AND "945 5090 P" AS N 2,236,345.61', E 1,744,768.90'.
 - VERTICAL CONTROL IS MEAN LOWER LOW WATER (MLLW=0.0 FT), BASED ON THE NOAA/NOS TIDAL BENCH MARK LIST "945 5090 SEWARD, RESURRECTION BAY, ALASKA", PUBLISHED 09/30/2011. THIS TIDAL DATUM IS BASED ON THE 1983-2001 TIDAL EPOCH AND IS REFERENCED BY HOLDING NOAA/NOS TIDAL BENCH MARK "9455090 B" (VMH1295/PIDBBFH75) AS 21.14 FT.
 - VERTICAL TIES TO THE NATIONAL SPATIAL REFERENCE SYSTEM ARE BASED ON PUBLISHED NAVD88 (GEOID 12B) ELEVATIONS HOLDING NOAA/USACE TIDAL BENCHMARK "945 5090 P" (PID BBFT30/VMH19144) AS 25.94 FT.
 - SOUNDINGS ARE IN US SURVEY FEET AND ARE MINUS UNLESS OTHERWISE INDICATED.
 - BATHYMETRY WAS COLLECTED OCTOBER 4 - OCTOBER 5, 2017. SOUNDINGS WERE COLLECTED USING AN R2SONIC 2022 MULTIBEAM ECHOSOUNDER OPERATING AT 200KHZ. SOUND VELOCITY THROUGH THE WATER COLUMN WAS DETERMINED WITH AN AML BASE X SOUND VELOCITY PROBE. POSITIONING AND VESSEL ORIENTATION WERE MEASURED USING AN APPLANIX POSMV WAVEMASTER V5 SYSTEM RECEIVING RTK CORRECTIONS FROM A TRIMBLE SP885 GPS RECEIVER SET AT CONTROL STATION "SH-10 2002". SURVEY DATA WAS COLLECTED USING QINSY 8.1 AND PROCESSED USING QINERA 1.5.1 SOFTWARE. HORIZONTAL CONTROL WAS SURVEYED USING STATIC GNSS EQUIPMENT AND TECHNIQUES. VERTICAL CONTROL WAS SURVEYED USING DIFFERENTIAL LEVELING.
 - MOBILE TERRESTRIAL LASER SCANNING DATA WAS COLLECTED OCTOBER 6, 2017 USING A REIGL VZ400 LASER SCANNER. POSITION AND VESSEL ORIENTATION WERE MEASURED USING AN APPLANIX POSMV WAVEMASTER V5 RECEIVING RTK CORRECTIONS FROM A TRIMBLE SP885 GPS RECEIVER SET AT CONTROL STATION "SH-10 2002". MOBILE SCANNING WAS COLLECTED USING QINSY 8.1 AND PROCESSED USING RISCAN PRO 2.3 SOFTWARE.
 - THIS DRAWING INDICATES GENERAL CONDITIONS AT THE TIME OF THE SURVEY.
 - MAP SOUNDINGS ARE BINNED AT 24 FEET AND ARE SHOAL BIASED. CONTOURS ARE BASED ON 12 FEET BINNED SHOAL-BASED SOUNDINGS. VOLUME SOUNDINGS ARE BINNED AT 3 FEET AND ARE MEAN VALUE.

SURVEY CONTROL DATA				
STATION	NORTHING	EASTING	MLLW	DESCRIPTION
SH-8 RESET 2016	2,234,553.68	1,742,934.61	17.90	3 1/4 IN. DBC IN ROCK
SH-10 2002	2,234,669.21	1,742,593.79	17.15	3 1/4 IN. DBC IN ASPH.
SH-12 2006	2,234,535.55	1,743,605.56	20.59	3 1/4 IN. DBC IN ROCK
SH-13 2006	2,236,056.69	1,744,199.81	20.60	3 1/4 IN. DBC IN ROCK
SH-14 2009	2,236,080.45	1,743,820.56	16.30	3 1/4 IN. DBC IN ROCK
SH-15 2009	2,236,350.26	1,742,761.00	19.93	3 1/4 IN. DBC IN CONC.
SH-16	2,236,057.1	1,744,198.4	20.53	2 1/2 IN. BC IN ROCK
SH-19	2,234,898.93	1,743,830.60	20.52	2 1/2 IN. BC IN ROCK
SH-20	2,234,552.73	1,743,630.67	20.37	2 1/2 IN. BC IN ROCK

*BENCHMARKS WITH HORIZONTAL PRECISION OF 0.1" WERE MEASURED BY RTK GNSS.

VOLUME COMPUTATIONS		
AREA A: ENTRANCE / MANEUVERING CHANNEL	MLLW=0	CU. YD.
AVAILABLE TO PROJECT DEPTH (PD)	-15.0	3,761
AVAILABLE TO MAX PAY DEPTH (MP)	-16.0	6,260
AVAILABLE SIDE SLOPES (SS) AT 3:1 (H:V) & 25' WIDE	VARIES	4,994
AREA B: MOORING BASIN		
AVAILABLE TO PD	-12.5	295
AVAILABLE TO MP	-13.5	3,479
AVAILABLE SS AT 3:1 (H:V) & 25' WIDE	VARIES	18
TOTAL MAXIMUM VOLUME AVAILABLE (MP + SS)		14,751



THIS HYDROGRAPHIC SURVEY WAS COMPLETED UNDER THE OVERSIGHT OF AN ACSM/THSOA CERTIFIED HYDROGRAPHER

David R. Neff C.H. (275)

US Army Corps of Engineers
of Engineers
ALASKA DISTRICT

CONTRACT NO. W9118B-14-0-0031 / 175090

CONTRACTOR: ETAC INC.

CITY: WASILLA

STATE: ALASKA

DATE: 10/07/2017

APPROVED BY: [Signature]

DESIGNED BY: [Signature]

PLANNED BY: [Signature]

FILED DATE: 10/07/2017

SCALE: 1" = 50'

DATE: 11 November 2017

CONTRACT NO.: W9118B-14-0-0031 / 175090

JOB NO.: 1617

FILE NAME: 077016-17-01-DWG

U.S. ARMY CORPS OF ENGINEERS
ALASKA DISTRICT
JBER, ALASKA 99506-8608

eTAC, Inc.
617 S. Kille-Goose Bay Road
Wasilla, AK 99586

SEWARD, ALASKA
SEWARD HARBOR
PROJECT CONDITION SURVEY
OCTOBER 2 - OCTOBER 7, 2017

SHEET IDENTIFICATION
3-SEW-92-07-14
Sheet 3 of 5



1. PRIMARY PROJECT HORIZONTAL CONTROL IS ALASKA STATE PLANE, ZONE 4, NAD83, (2010/2010). IN US SURVEY FEET BASED ON A FULLY CONSTRAINED STATIC GPS NETWORK HOLDING THE PUBLISHED NAD83 DATUM. LOCAL GRID VALUES ARE BASED ON THE 1983-2002 TIDAL DATUM. LOCAL GRID VALUES ARE IN US SURVEY FEET. LOCAL KENAI COORS ARP (P.DJ3031), "TSEA ANCHORAGE COAST PLANE, ZONE 4" (P.DJ062).
2. KENAI PROJECT HORIZONTAL CONTROL IS ALASKA STATE PLANE, ZONE 4, NAD83, IN US SURVEY FEET HOLDING "SH-10" 2002 AS N 23,669 281 FT E 1,742 393 979 FT AND "945 5090" P AS N 23,636 345 FT E 1,744 768 393 FT.
3. VERTICAL CONTROL IS MEAN LOW LOW WATER (MLLW=0) FT, BASED ON THE NOAA/OS TIDAL BENCH MARK SLAT "945 5090 SEWARD, RESURRECTION BAY, ALASKA," PUBLISHED 09/30/2011. THIS TIDAL DATUM IS BASED ON THE 1983-2001 TIDAL EPOCH AND IS REFERENCED BY HOLDING NOAA/OS TIDAL BENCH MARK "9455090 B" (VM11295/P08BFH75) AS N 21, 14, 17 FT.
4. VERTICAL TIES TO THE NATIONAL REFERENCE SYSTEM ARE BASED ON PUBLISHED NAVD08 (EGM 12B) ELEVATIONS HOLDING NOAA/USACE TIDAL BENCHMARK "945 5090" P (P.DJ BFB730/VM19144) AS 25.64 FT.
5. SOUNDINGS ARE IN US SURVEY FEET AND ARE MINUS UNLESS OTHERWISE INDICATED.
6. BATHYMETRY WAS COLLECTED OCTOBER 4 - OCTOBER 5, 2017. SOUNDINGS WERE COLLECTED USING AN RSONIC 202 MULTIBeam ECHOSOUNDER OPERATING AT 200KHZ, SOUND VELOCITY THROUGH THE WATER COLUMN WAS DETERMINED WITH A RSONIC 9 SOUND VELOCITY PROFILE. POSITION AND VESSEL ORIENTATION WERE MEASURED USING AN APPLANIX POSMV VMEVASTER V SYSTEM. RECEIVING RTK CORRECTIONS FROM A TRIMBLE SPB585 GPS RECEIVER SET AT CONTROL STATION "945 5090". SURVEY DATA WAS COLLECTED USING QINSY 8.1 AND PROCESSED USING QINSY 8.1.5. PROJECT HORIZONTAL CONTROL WAS SURVEYED USING STATIC GNSS EQUIPMENT AND TECHNIQUES. VERTICAL CONTROL WAS SURVEYED USING DIFFERENTIAL LEVELING.
7. MOBILE TERRESTRIAL LASER SCANNING DATA WAS COLLECTED OCTOBER 6, 2017 USING A REIGL ZV400 LASER SCANNER. POSITION AND VESSEL ORIENTATION WERE MEASURED USING AN APPLANIX POSMV VMEVASTER V SYSTEM. RECEIVING RTK CORRECTIONS FROM A TRIMBLE SPB585 GPS RECEIVER SET AT CONTROL STATION "SH-10 2002". MOBILE SCANNING WAS COLLECTED USING QINSY 8.1 AND PROCESSED USING RASCAN PRO 2.3 SOFTWARE.
8. THIS DRAWING INDICATES GENERAL CONDITIONS AT THE TIME OF THE SURVEY.
9. MAP SOUNDINGS ARE BINNED AT 24 FEET AND ARE SHOAL BIASED. CONTOURS ARE BASED ON 12 FEET BINNED SHOAL-BIASED SOUNDINGS. VOLUME SOUNDINGS ARE BINNED AT 3 FEET AND ARE MEAN VALUE.

STATION	NORTHING	EASTING	MLLW	DESCRIPTION
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SH-13 2006	2,236,056.69	1,744,199.81	20.60	3 1/4 IN. DBC IN ROCK
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SH-15 2009	2,236,350.26	1,742,761.00	19.93	3 1/4 IN. DBC IN CONC.
SH-16	2,236,057.1	1,744,198.4	20.53	2 1/2 IN. BC IN ROCK
SH-19	2,234,898.93	1,743,830.60	20.52	2 1/2 IN. BC IN ROCK
SH-20	2,234,552.73	1,743,630.67	20.37	2 1/2 IN. BC IN ROCK

AREA A: ENTRANCE / MANEUVERING CHANNEL	MLLV=0	CU. YD.
AVAILABLE TO PROJECT DEPTH (PD)	-15.0	3,761
AVAILABLE TO MAX PAY DEPTH (MP)	-16.0	6,260
AVAILABLE SIDE SLOPES (SS) AT 3:1 (H:V) & 25' WIDE	VARIES	4,994
AREA B: MOORING BASIN		
AVAILABLE TO PD	-12.5	295
AVAILABLE TO MP	-13.5	3,479
AVAILABLE SS AT 3:1 (H:V) & 25' WIDE	VARIES	18
TOTAL MAXIMUM VOLUME AVAILABLE (MP + SS)		14,751

