H10961

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey Hydrographic

Field No.

Registry No. H10961

LOCALITY

State California

General Locality San Francisco Bay

Sublocality South of Alcatraz and West of Treasure Island

2000

CHIEF OF PARTY
Jon L. Dasler

LIBRARY & ARCHIVES

DATE

NOAA FORM 77-28 (11-72)

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

REGISTER NO.
H10961

HYDROGRAPHIC TITLE SHEET

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

FIELD NO.

State: **California**

General Locality: **San Francisco Bay**

Sublocality: **South of Alcatraz and West of Treasure Island**

Scale: **1:10,000** Date of Survey: **03/10/2000-08/13/2000**

Instructions Date: **10/1/1998** * Project No.: **OPR-L304-KR-00**

***Changes: No 1 dated 6/4/99, No. 2 dated 11/22/99**

Vessel: **Zephyr (929931)**

Chief of Party: **Jon L. Dasler**

Surveyed by: **Orlinsky, Hawkins, Creech, Lazar, Olsen, Pattison, Pickworth, Cross**

Soundings taken by echo sounder, hand lead, pole: **Reson 8101**

Graphic record scaled by: **DEA Personnel**

Graphic record checked by: **DEA Personnel**

Evaluation by: **Gary C. Nelson** Automated plot by: **HP 750C Color Plotter**

Verification by: **Gary C. Nelson**

Soundings in: **Feet** at: **MLLW**

REMARKS: **ALL TIMES ARE RECORDED IN UTC UTM Zone 10**

PHB Revision: Report has been evaluated. Comments, revisions and corrections are entered as endnotes

David Evans and Assc., Inc.	**PLS Surveys**	**Zephyr Marine**
2828 SW Corbett Ave.	**2220 Livingston St.**	**PO Box 1575**
Portland, OR 97201	**Oakland, CA 94606**	**Petersburg, AK 99833**

Descriptive Report to Accompany Hydrographic Surveys[1]
H10960, H10961 and H10962

Project Numbers:
OPR-L304-KR-99[2]

Scale 1:10,000
September 2000
David Evans and Associates, Inc.
Project Manager Jon Dasler

A. PROJECT

David Evans and Associates, Inc. (DEA) conducted a navigable area survey of a portion of San Francisco Bay in accordance with Hydrographic Project Instructions OPR-L304-KR-99; Change No. 1, dated June 4, 1999; and Change No. 2, dated November 22, 1999.

Three areas are identified with this project. The south survey area has been designated sheet "A" and assigned Registry Number H10960.[3] The section by Angel Island, composed of two small survey areas, has been designated sheet "B" and assigned Registry Number H10961. The north survey area has been designated sheet "C" and assigned Registry Number H10962.[4]

The purpose of the project was to provide a hydrographic survey with 100 percent bottom coverage using shallow water multibeam sonar to update nautical charts.

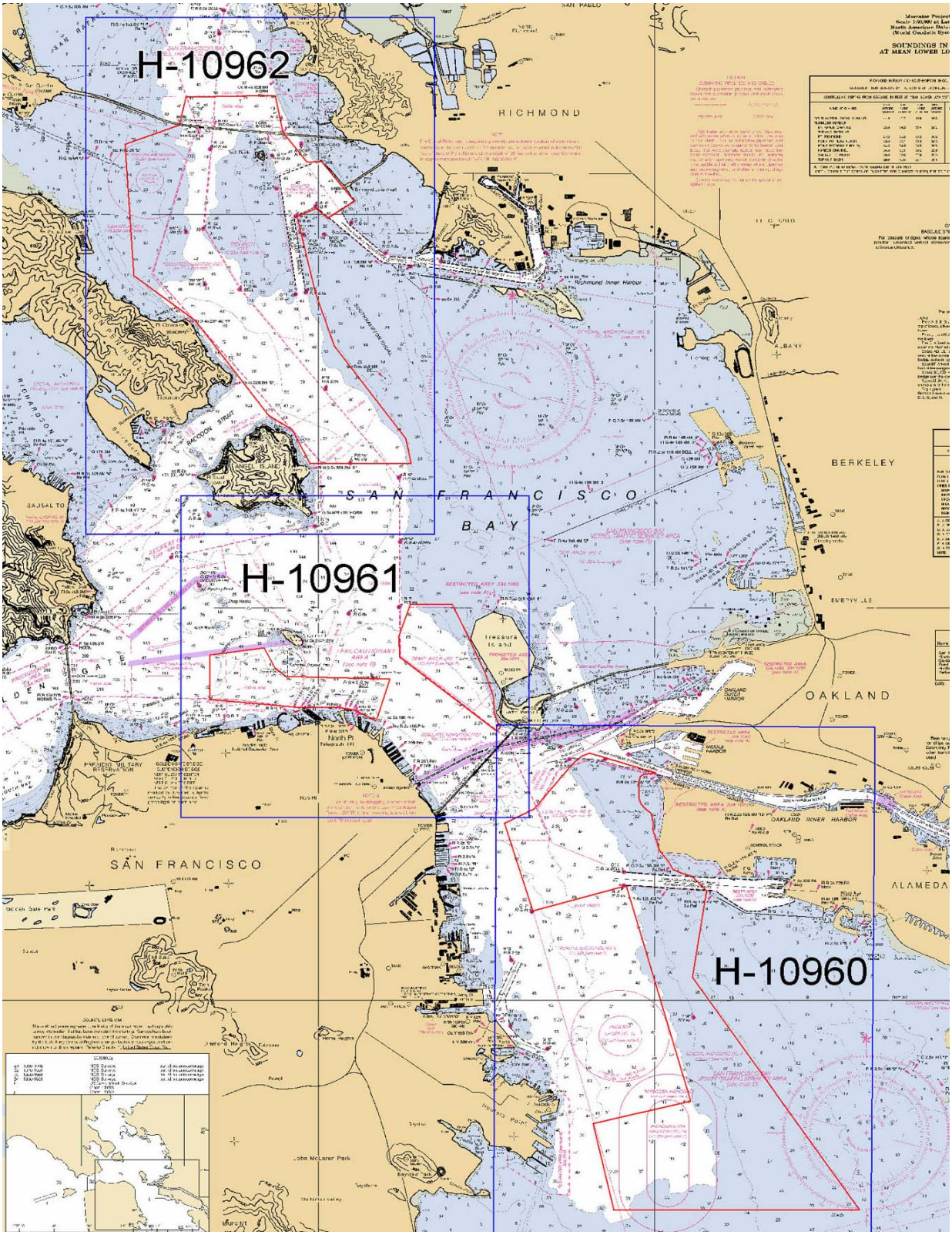
B. AREA SURVEYED

Registry Number H10960 (Sheet A) covers a portion of San Francisco Bay south and west of Alameda Island from Oakland to Hunters Point. The area encompasses 7.99 square nautical miles. Data acquisition was conducted from March 10, 2000 (Day Number 062) to August 13, 2000 (Day Number 226).[5]

Registry Number H10961 (Sheet B) consists of two areas near San Francisco. The first area covers the Temporary Anchorage area number 7, west of Treasure Island, and encompasses 0.97 square nautical miles. The second area covers a portion north of the San Francisco peninsula and south of Alcatraz Island, covering 1.01 square nautical miles. Data acquisition was conducted from April 10, 2000 (Day Number 101) to August 13, 2000 (Day Number 226).[6]

Registry Number H10962[7] (Sheet C) covers a portion of San Francisco Bay from Angel Island northward to the Richmond-San Rafael Bridge, and eastward to the Southampton Shoal. The area encompasses 8.00 square nautical miles. Data acquisition was conducted from April 21, 2000 (Day Number 112) to August 12, 2000 (Day Number 225).

The chartlet on the following page shows the survey limits and sheet layout.



STUDY AREA FOR SHEETS H10960, H10961, AND H10962, SAN FRANCISCO BAY, CALIFORNIA (NOAA CHART NO. 18649)

C. SURVEY VESSELS

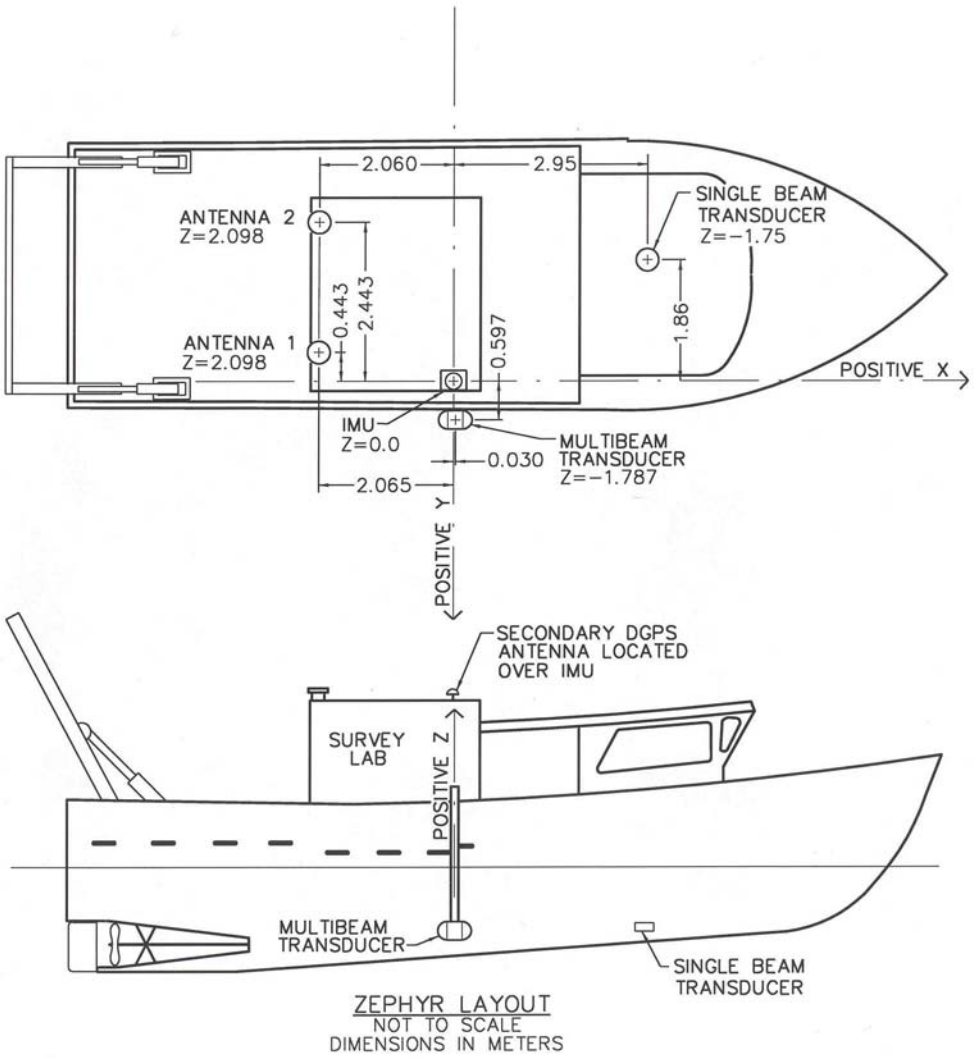
For this project, two vessels were used to perform the requirements as specified in the Statement of Work (SOW).

VESSEL	OPERATION
R/V Osprey	Detached Positions
Zephyr	Multibeam data acquisition, sound velocity casts, DGPS position checks

The Osprey, registry number OSD22048H697, is a 22-foot fiberglass vessel with an 8 1/2-foot beam and a draft of three feet. The primary work done by the Osprey was to position all buoys, day shapes and non-floating aids to navigation. The Osprey was equipped with a Leica MX-412 DGPS system.

The Zephyr, registry number 929931, is a 44-foot, 34 gross ton aluminum vessel with a 13-foot beam and a draft of five feet. The Zephyr was equipped with a data acquisition and processing lab for all survey work. An over-the-side mount for the multibeam transducer was designed for the vessel. No unusual sensor set-up configurations were required.

All sensor offsets were measured from the inertial motion unit (IMU) located inside the acquisition lab on the starboard side, close to the multibeam sensor. Offsets were applied to the data during acquisition, and no changes occurred throughout the survey period. A schematic of the vessel and sensor set-up is shown on the following page.



SENSOR LAYOUT ON THE R/V ZEPHYR

D. AUTOMATED DATA ACQUISITION AND PROCESSING

DEA developed and implemented a state-of-the-art data acquisition and preliminary processing system aboard the R/V Zephyr in accordance with NOAA standards and modern remote sensing techniques. Initial processing was performed aboard the Zephyr, while final processing and review was performed at the DEA office in Portland, Oregon. A detailed description of the data acquisition and processing platform can be found in Appendix G.[8]

The data collection utilized an acquisition and processing platform consisting of the Triton Elics Isis data acquisition system with Coastal Oceanographics Hypack navigation software and Caris NT HIPS processing software.

E. SONAR EQUIPMENT

No sidescan operations were required for this project.[9]

F. SOUNDING EQUIPMENT

A Reson 8101 multibeam sonar, serial number 17024, was used for the entire survey. The 8101 series operates at 240 kHz, producing a 150° swath of 101 uniform beams of 1.5° x 1.5°. To meet IHO standards, only 108° of the sonar swath are used for coverage and sounding selection.

The Reson sonar head and all sensors were installed on the Zephyr at the start of the 2000 field season, February 29 through March 2, 2000 (Day Numbers 060-062) alongside the Benicia Marina in Benicia, California. Once installation was complete, the vessel underwent system calibration tests, including settlement and squat, alignment, and static vessel measurement.

DATA ACQUISITION LAB ABOARD THE ZEPHYR

The multibeam sonar was operated at different range scales throughout the survey, by adjusting the depth range to obtain the best coverage in different depths of water. In general, the range was kept at four to six times the water depth. Sheets A had water depths from 11 feet (3.3 meters) to 66 feet (20.1 meters), resulting in a sonar range of 25 to 100 meters.[10] Sheets B had water depths from 12 feet (3.6 meters) to 124 feet (37.8 meters), resulting in a sonar range of 25 to 100 meters.[11] Sheets C had water depths from 3 feet (0.9 meters) to 183 feet (55.8 meters), resulting in a sonar range of 25 to 125 meters.[12] The majority of the survey was done at the 75-meter range scale.

The vessel maintained an average speed of seven knots throughout the survey. The sonar system was operated at up to 13 Hz, providing complete coverage in the along-track direction. Sonar limitations decreased the update rate to 7.5 Hz when operating at the 100-meter range scale. Using the criteria as specified in the Statement of Work (SOW), the multibeam sonar was able

to detect shoals that measure two meters by two meters horizontally and one meter vertically in depths of 40 meters or less. In addition, the speed of the vessel was adjusted to ensure that at least 3.2-beam footprints, center-to-center, fell within three meters in the along-track direction. Based on a sonar update rate of 10 Hz and a vessel speed of seven knots, the bottom coverage averaged 8.5-beam footprints every three meters. At slower speeds, the coverage increased significantly. When the sonar operated on the 100-meter range scale, the bottom coverage averaged 6.4-beam footprints every three meters.[13]

Line planning for the survey area H10960[14] and H10961 had a general north-south direction, in order to minimize turns and to survey approximately with depth contours. Line planning for H10962[15] ran parallel to the long axis of the sites. Line spacing was determined to ensure complete coverage based on using only +/- 54 degrees (2.75 times water depth), bottom topography, and maintaining at least five meters of overlap between successive lines. Line spacing ranged from 10 meters to 40 meters. The survey lines were run based upon obtaining depths to 18 feet or the sheet limits. In the area around Red Rock, depths to the 12-foot contour were obtained.

The Isis BathyPro software provided near real-time coverage of multibeam sonar data and a color-coded depth display. The sonar coverage used a dynamic 54-degree cut-off angle for swath limits, and depths were color-coded based upon all applied offsets and predicted tides. The coverage plot was used to provide initial quality assurance checks of depth and to assure coverage throughout the area.

An Odom Echotrak DF 3200 MKII echosounder was used for a daily single beam comparison against the multibeam depths. The sonar, serial number 9414, is a 200 kHz sonar with a beam width of three degrees. During daily system checks, a lead line comparison was made to the Echotrak, followed by a comparison to the multibeam. The multibeam check required using an off-nadir beam of 1.9 meters to account for the differences of the sonar heads. A complete log of daily checks is included in Appendix E.[16] In general, a difference of less than 10 centimeters was observed daily.

G. CORRECTIONS TO SOUNDINGS

Tide and Water Levels[17]

In accordance with Attachment #7, dated November 22, 1999, of the Project Instructions,[18] National Ocean Service existing tide stations at San Francisco (941-4290), Alameda (941-4750) and Richmond (941-4863) were used for the survey.

STATION NUMBER	STATION NAME	LATITUDE	LONGITUDE
941-4290	San Francisco, CA	37° 48 24’ N	122° 27 54’ W
941-4750	Alameda, CA	37° 46 18’ N	122° 17 54’ W
941-4863	Richmond, CA	37° 55 42’ N	122° 24 00’ W

Four tide zones were established on H10960[19] as specified by Section 1.2.1 of the project instructions. The time corrector and ratio were based on data from the Alameda Station. Zone information is listed below.

ALAMEDA (941-4750)

TIDAL ZONE	TIME CORRECTOR	HEIGHT CORRECTOR RATIO
SF 6	-12	0.95
SF 7	0	1.00
SF 8	+6	1.05
SF 8A	+12	1.10

Four tide zones were established from two stations on H10961, as specified by Section 1.2.1 of the project instructions. The time corrector and ratio were based on data from the San Francisco and Alameda Stations. Zone information is listed below.

SAN FRANCISCO (941-4290)

TIDAL ZONE	TIME CORRECTOR	HEIGHT CORRECTOR RATIO
SF 2	0	1.00
SF 3	+18	1.00
SF 5	+24	1.04

ALAMEDA (941-4750)

TIDAL ZONE	TIME CORRECTOR	HEIGHT CORRECTOR RATIO
SF 6	-12	0.95

Five tide zones were established on H10962[20] as specified by Section 1.2.1 of the project instructions. The time corrector and ratio were based on data from the Richmond Station. Zone information is listed below.

RICHMOND (941-4863)

TIDAL ZONE	TIME CORRECTOR	HEIGHT CORRECTOR RATIO
SF 31	-6	1.00
SF 32	-6	0.96
SF 33	0	0.96
SF 34	0	1.00
SF 35	+12	0.98

For the 2000 field season, no preliminary data were applied during initial processing using Caris Swath editor. All data sets had verified tides with zone correctors applied during Caris sub-set editing.[21]

The three NOS tide stations experienced no down time during periods of hydrographic survey. All data were successfully retrieved and are included on the tape with the HDCS processed data.[22]

Velocity of Sound

Corrections for the speed of sound through the water column were computed from the data obtained with a Sea-Bird conductivity, temperature and depth (CTD) recorder. Two probes were deployed simultaneously, allowing for a confidence check on every sound velocity reading. The Seacat SBE, model 19-03, S/N 1919847-2691 (primary unit) and 1921127-2793 (secondary unit), were the two sensors used throughout the project. Each sensor had been calibrated prior to the start of the season's fieldwork. Factory calibration results are included in Appendix E.[23]

The downcast data were retrieved using the Sea-Bird Term19 program and data were processed using the Sea-Bird Datcnv program. The program Sv_clean (written at DEA) took data from the Datcnv program, removed the on-deck calibration and warm-up data, and formatted the downcast data to be used directly in Caris HIPS. Under this method, sound velocity data were applied only during processing.

Casts were taken frequently throughout the day, generally within two hours of the previous cast. Each cast was graphically displayed in the acquisition software and compared to the previous cast to verify that there was no significant change in the water column. Throughout the survey, no change of greater than two meters per second (m/s) was seen between casts. A closing cast was taken at the end of each day to verify that the sound velocity had not changed by more than 2 m/s.[24]

A total of 310 casts were taken, recording 575 sound velocity profiles. Casts were generally taken in the deepest sections of the survey area. Casts were extended by straight-line interpolation in the event a sounding was taken deeper than the cast. No cast was extrapolated more than five percent. Table 1 presents all sound velocity casts throughout the survey. Cast file names were designated by "yyddd_nu" where "yy" is year, "ddd" is Julian day number, "n" is daily cast number, and "u" is sensor unit ("p" for primary and "s" for secondary).

TABLE 1. SOUND VELOCITY CASTS

Registry No. H10960 – Sheet A[25]

DAY	CAST FILE NAME	START CAST TIME	DEPTH METERS	LATITUDE	LONGITUDE
070	00070_1p,1s	1646	16.6	37 43’25.43	122 20 47.57
070	00070_2p,2s	1917	16.9	37 43’23.19	122 21 46.94
070	00070_3p,3s	2119	9.05	37 43’30.74	122 18 30.40
070	00070_4p,4s	2340	18.7	37 43’25.28	122 20 47.75
071	00070_1p,1s	0120	17.9	37 43’33.55	122 20 48.55
071	00071_2p,2s	1721	16.3	37 43’27.03	122 2138.62
071	00071_3p,3s	1929	15.4	37 43’32.25	122 20 34.76
071	00071_4p,4s	2110	10.2	37 42’34.37	122 20 08.00
071	00071_5p,5s	2320	15.0	37 43’34.44”	122 20 24.77
072	00072_1p,1s	0141	9.7	37 43’35.84”	122 20 20.28
072	00072_2p,3	0230	15.6	37 43 36.59	122 20 25.72
072	00072_3p,3s	1615	14.6	37 43 40.79	122 20 19.68
072	00072_4p,4s	1724	14.1	37 43 44.99	122 20 12.43
072	00072_5p,5s	1730	15.8	37 43 47.91	122 20 27.40
072	00072_6p,6s	1741	14.2	37 43 50.77	122 20 21.79
072	00072_7p,7s	2002	13.5	37 43’39.28	122 19 53.09
072	00072_8p,8s	2129	15.7	37 44’09.15	122 20 08.30
072	00072_9p,9s	2354	10.7	37 42’14.24	122 19 27.76
073	00073_1p,1s	0020	14.9	37 43’43.75	122 19 54.05
073	00073_2p,2s	1627	14.2	37 43 40.42	122 19 48.83
073	00073_3p,3s	1653	9.5	37 42’14.71	122 19 18.38
073	00073_4p,4s	1834	13.3	37 43’51.06	122 19 46.99
073	00073_5p,5s	1914	13.1	37 43’49.08	122 19 46.60
073	00073_6p,6s	2031	9.6	37 42’14.69	122 19 06.93
073	00073_7p,7s	2117	12.3	37 43’46.13	122 19 37.57
074	00074_1p,1s	1643	13.1	37 47’44.45	122 19 34.19
074	00074_2p,2s	1722	10.6	37 42’16.13	122 19 03.51
074	00074_3p,3s	1858	11.7	37 43’56.56	122 19 33.57
074	00074_4p,4s	1953	10.1	37 42’15.95	122 18 57.42
074	00074_5p	2052	7.2	37 42’35.41	122 17 55.53
074	00074_6p	2131	13.1	37 43 47.43	122 19 40.68
074	00074_7p	2333	18.7	37 46 05.07	122 21 21.99
075	00075_1p	0108	19.1	37 46 17.81	122 22 10.71
075	00075_2p	0146	18.3	37 46 11.74	122 21 18.18
075	00075_3p	1612	19.6	37 45 57.20	122 21 04.57

DAY	CAST FILE NAME	START CAST TIME	DEPTH METERS	LATITUDE	LONGITUDE
075	00075_4p	1715	20.0	37 46 55.34	122 22 01.73
075	00075_5p,5s	1855	20.8	37 47 43.50	122 22 22.02
075	00075_6p,6s	2047	18.2	37 45 59.58	122 21 28.12
075	00075_7p,7s	2150	18.4	37 47 30.49	122 22 04.29
075	00075_8p,8s	2311	17.4	37 49 29.21	122 21 49.07
076	00076_1p,1s	0041	18.0	37 46 11.57	122 21 11.07
076	00076_2p,2s	1617	19.1	37 46 04.85	122 21 08.47
076	00076_3p,3s	1641	19.0	37 47 46.43	122 21 46.88
076	00076_4p,4s	1700	19.5	37 47 35.12	122 21 48.86
076	00076_5p,5s	1803	17.1	37 47 41.71	122 21 34.58
076	00076_6p,6s	1828	17.6	37 46 17.96	122 21 03.98
076	00076_7p,7s	1943	14.1	37 47 51.16	122 21 30.42
076	00076_8p,8s	2105	15.3	37 46 20.60	122 20 56.12
076	00076_9p,9s	2139	15.2	37 47 52.53	122 21 36.79
078	00078_1p,1s	1649	17.1	37 47 51.00	122 21 40.19
078	00078_2p,2s	1711	17.6	37 46 18.87	122 20 59.86
078	00078_3p,3s	1856	18.5	37 46 17.50	122 21 03.79
078	00078_4p,4s	2055	18.5	37 47 37.91	122 21 46.01
078	00078_5p,5s	2207	13.7	37 46 22.79	122 20 44.06
078	00078_6p,6s	2306	9.5	37 48 02.80	122 21 18.06
078	00078_7p,7s	2331	12.4	37 46 22.93	122 20 39.84
081	00081_1p,1s	1607	13.6	37 46 30.01	122 20 49.17
081	00081_2p,2s	1630	13.5	37 47 34.66	122 21 11.47
081	00081_3p,3s	1811	13.6	37 46 21.41	122 20 38.52
081	00081_4p,4s	2049	17.3	37 47 13.95	122 21 19.18
081	00081_5p,5s	2255	14.3	37 47 22.58	122 21 02.93
082	00082_1p,1s	0013	13.3	37 48 15.4	122 21 04.6
082	00082_2p,2s	1620	13.1	37 46 38.7	122 20 44.7
082	00082_3p,3s	1724	13.0	37 48 11.2	122 21 00.1
082	00082_4p,4s	1928	14.0	37 48 05.5	122 20 50.3
082	00082_5p,5s	2146	12.1	37 46 22.2	122 20 19.2
083	00083_1p,1s	0013	13.1	37 46 28.4	122 20 22.0
083	00083_2p,2s	1557	11.8	37 46 29.4	122 20 33.0
083	00083_3p,3s	1757	11.9	37 46 30.7	122 20 08.4
083	00083_4p,4s	2021	10.5	37 46 38.9	122 20 17.3
083	00083_5p,5s	2241	12.7	37 43 39.3	122 19 25.1
084	00084_1p,1s	1627	12.1	37 43 40.6	122 19 36.9

DAY	CAST FILE NAME	START CAST TIME	DEPTH METERS	LATITUDE	LONGITUDE
084	00084_2p,2s	1814	10.8	37 43 40.0	122 19 23.3
084	00084_3p,3s	2039	11.5	37 43 11.8	122 19 08.6
084	00084_4p,4s	2235	10.4	37 43 35.8	122 15 08.2
088	00088_1p,1s	1625	13.6	37 43 49.1	122 19 45.4
088	00088_2p,2s	1831	9.4	37 42 15.7	122 18 53.1
088	00088_3p,3s	2045	10.3	37 43 50.3	122 19 24.2
088	00088_4p,4s	2258	10.0	37 43 45.9	122 19 16.1
088	00088_5p,5s	0111	10.0	37 43 46.4	122 19 08.7
089	00089_1p,1s	1615	10.9	37 43 51.9	122 19 22.8
089	00089_2p,2s	1825	9.9	37 42 19.8	122 18 39.2
089	00089_3p,3s	2052	8.6	37 43 47.8	122 19 11.6
089	00089_4p,4s	2257	8.9	37 43 48.2	122 19 11.3
090	00090_1p,1s	0112	8.8	37 43 47.1	122 18 50.2
090	00090_2p,2s	1621	9.7	37 43 52.6	122 19 00.7
090	00090_3p,3s	1819	9.5	37 43 51.7	122 18 48.7
090	00090_4p,4s	2055	9.1	37 43 40.8	122 18 58.2
090	00090_5p,5s	2305	7.9	37 43 48.5	122 18 41.3
091	00091_1p,1s	0046	7.7	37 43 47.6	122 18 29.4
091	00091_2p,2s	1445	9.0	37 43 14.0	122 18 14.6
091	00091_3p,3s	1726		37 43 46.9	122 18 28.3
092	00092_1p,1s	1459	8.7	37 43 45.5	122 18 28.6
092	00092_2p,2s	1707	7.7	37 43 48.5	122 18 21.6
092	00092_3p,3s	1917	8.1	37 42 17.3	122 17 43.3
092	00092_4p.4s	2111	9.0	37 43 50.0	122 18 39.2
092	00092_5p,5s	2305	8.6	37 43 42.8	122 19 04.3
093	00093_1p,1s	0106	7.1	37 45 19.5	122 19 33.2
093	00093_2p,2s	1450	7.6	37 43 45.7	122 18 24.2
093	00093_3p,3s	1519	9.0	37 42 45.1	122 18 08.4
093	00093_4p,4s	1717	8.4	37 42 11.6	122 17 39.1
093	00093_5p,5s	1934	8.3	37 42 30.4	122 17 43.4
093	00093_6p,6s	2137	9.6	37 43 42.4	122 19 06.3
093	00093_7p,7s	2301	8.0	37 45 18.3	122 19 35.9
095	00095_1p,1s	1644	8.2	37 43 12.6	122 18 16.8
095	00095_2p,2s	1855	7.4	37 42 15.1	122 17 16.8
095	00095_3p,3s	2106	7.4	37 42 15.9	122 17 09.0
095	00095_4p,4s	2218	6.7	37 42 26.3	122 17 09.1
096	00096_1p,1s	1608	9.6	37 44 49.1	122 19 41.6

DAY	CAST FILE NAME	START CAST TIME	DEPTH METERS	LATITUDE	LONGITUDE
096	00096_2p,2s	1811	9.5	37 44 08.6	122 19 02.3
096	00096_3p,3s	2001	8.3	37 44 14.7	122 18 47.7
096	00096_4p,4s	2216	9.0	37 45 19.8	122 19 35.3
096	00096_5p,5s	2342	7.5	37 45 24.8	122 19 32.0
097	00097_1p,1s	1620	7.8	37 44 36.0	122 19 11.1
097	00097_2p,2s	1825	9.3	37 44 25.4	122 19 10.0
097	00097_3p,3s	2050	8.4	37 45 13.2	122 19 33.5
097	00097_4p,4s	2336	8.3	37 45 06.0	122 19 25.3
098	00098_1p,1s	1516	8.7	37 45 11.1	122 19 48.9
098	00098_2p,2s	1755	8.0	37 45 06.6	122 19 30.2
098	00098_3p,3s	1951	8.2	37 45 17.1	122 19 31.4
098	00098_4p,4s	2337	6.7	37 46 32.1	122 19 22.6
099	00099_1p,1s	1434	11.8	37 46 29.3	122 19 36.7
099	00099_2p,2s	1721	11.5	37 46 29.1	122 19 59.9
099	00099_3p,3s	2002	9.0	37 45 13.4	122 19 44.2
099	00099_4p,4s	2253	7.0	37 45 33.3	122 19 19.8
100	00100_1p,1s	0003	7.3	37 45 57.1	122 19 32.5
100	00100_2p,2s	1455	11.5	37 46 30.9	122 19 39.1
100	00100_3p,3s	1802	11.8	37 46 33.5	122 20 01.9
100	00100_4p,4s	2021	12.1	37 46 35.0	122 20 00.6
100	00100_5p,5s	2356	7.0	37 45 56.3	122 19 31.0
101	00101_3p,3s	2118	12.8	37 48 02.7	122 20 34.5
101	00101_4p,4s	0037	9.7	37 46 32.68	122 19 50.86
102	00102_3p,3s	2034	18.7	37 43 40.39	122 20 52.25
102	00102_4p,4s	2323	10.2	37 42 16.07	122 19 15.83
103	00103_3p,3s	2001	18.7	37 47 21.88	121 22 15.22
103	00103_4p,4s	2208	10.0	37 46 13.31	122 20 14.15
103	00103_5p,5s	2345	11.1	37 44 15.30	122 19 40.09
104	00104_3p,3s	2046	13.3	37 43 50.50	122 19 52.33
104	00104_4p,4s	2237	6.6	37 42 36.74	122 18 02.34
105	00105_1p,1s	1400	10.2	37 46 40.91	122 20 05.04
105	00105_2p,2s	1605	12.3	37 46 31.57	122 19 55.58
105	00105_3s	1814	11.7	37 46 32.83	122 19 46.10
105	00105_4p,4s	2040	6.9	37 47 47.21	122 20 32.90
105	00105_5p,5s	2147	6.5	37 47 25.37	122 20 23.41
108	00108_1p,1s	1539	12.8	37 43 00.76	122 19 48.27
108	00108_2p,2s	1801	13.1	37 45 15.24	122 20 15.86

DAY	CAST FILE NAME	START CAST TIME	DEPTH METERS	LATITUDE	LONGITUDE
141	00141_3p,3s	1631	5.1	37 45 53.16	122 19 32.12
141	00141_4p,4s	1657	9.9	37 45 30.38	122 19 57.79
226	00226_2p,2s	1739	19.9	37 46 54.91	122 21 54.60
226	00226_3p,3s	1841	13.8	37 43 03.51	122 20 30.33
226	00226_4p,4	2206	11.0	37 47 34.79	122 20 58.72

Registry No. H10961 – Sheet B

DAY	CAST FILE NAME	START CAST TIME	DEPTH METERS	LATITUDE	LONGITUDE
101	00101_1p,1s	1547	34.7	37 48 20.59	122 22 25.44
101	00101_2p.2s	1835	35.0	37 48 46.97	122 22 57.26
102	00102_1p,1s	1529	35.9	37 48 26.81	122 22 25.70
102	00102_2p,2s	1747	23.1	37 49 31.07	122 23 57.44
103	00103_1p,1s	1531	29.8	37 48 35.67	122 22 33.58
103	00103_2p,2s	1803	12.9	37 50 01.48	122 23 51.36
104	00104_1p,1s	1525	13.2	37 49 03.75	122 22 48.55
104	00104_2p,2s	1753	25.8	37 49 06.06	122 23 06.20
108	00108_3p,3s	2040	29.4	37 48 23.31	122 22 42.20
108	00108_4p,4s	2226	14.2	37 49 16.13	122 22 50.82
109	00109_1p,1s	1417	10.3	37 49 47.14	122 23 19.77
109	00109_2p,2s	1644	17.6	37 49 28.58	122 23 19.24
109	00109_3p,3s	1834	26.7	37 49 12.91	122 23 27.19
109	00109_4p,4s	2049	25.0	37 49 08.67	122 25 47.34
109	00109_5p,5s	2210	15.5	37 49 47.95	122 24 02.38
109	00109_6p,6s	2237	8.0	37 49 51.83	122 22 58.02
110	00110_1p,1s	1554	24.1	37 49 04.44	122 25 32.28
110	00110_2p,2s	1816	27.8	37 49 21.92	122 26 43.94
110	00110_3p,3s	2038	30.9	37 49 22.12	122 26 52.99
110	00110_4p,4s	2153	29.4	37 49 07.77	122 24 23.00
111	00111_1p,1s	1401	24.0	37 49 11.97	122 23 43.42
111	00111_2p,2s	1622	30.6	37 49 19.9	122 27 00.10
111	00111_3p,3s	1940	30.1	37 49 05.36	122 24 26.11
111	00111_4p,4s	2158	26.6	37 48 54.47	122 23 55.83
112	00112_1p,1s	1357	24.7	37 48 59.18	122 23 44.75
112	00112_2p,2s	1613	24.5	37 48 49.00	122 23 43.20
112	00112_3p,3s	1810	20.5	37 48 44.7	122 25 42.9
141	00141_1p,1s	1350	23.4	37 49 21.58	122 23 45.00
141	00141_2p,2s	1446	25.7	37 49 08.74	122 23 34.75
226	00226_1p,1s	1452	28.0	37 49 05.76	122 23 22.14

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DAY	CAST FILE NAME	START CAST TIME	DEPTH METERS	LATITUDE	LONGITUDE
112	00112_4p,4s	1946	55.4	37 52 28.77	122 25 53.45
112	00112_5p,5s	2059	19.1	37 53 51.50	122 26 53.35
112	00112_6p,6s	2322	21.2	37 51 46.74	122 24 54.19
113	00113_1p,1s	1354	14.8	37 51 36.66	122 23 50.04
113	00113_2p,2s	1435	13.4	37 53 54.94	122 25 16.35
113	00113_3p,3s	1615	13.5	37 53 53.46	122 25 13.84
113	00113_4p,4s	1640	11.9	37 51 51.22	122 23 47.12
113	00113_5p,5s	1936	14.3	37 51 31.7	122 23 47.62
113	00113_6p,6s	2116	10.1	37 51 44.43	122 23 42.70
115	00115_1p,1s	1348	26.9	37 51 20.89	122 24 08.56
115	00115_2p,2s	1424	14.0	37 53 47.44	122 25 46.59
115	00115_3p,3s	1626	18.6	37 51 33.81	122 23 56.11
115	00115_4p,4s	1709	14.5	37 53 34.45	122 25 51.90
115	00115_5p,5s	1948	31.6	37 51 03.50	122 24 12.65
115	00115_6p,6s	2226	26.4	37 51 37.81	122 24 20.12
116	00116_1p,1s	1339	33.0	37 51 17.06	122 24 21.57
116	00116_2p,2s	1626	48.1	37 52 29.56	122 25 58.59
116	00116_3p,3s	1948	32.1	37 52 48.23	122 26 00.55
116	00116_4p,4s	2238	20.6	37 51 46.43	122 24 05.32
117	00117_1p,1s	1343	18.9	37 51 34.34	122 23 56.06
117	00117_2p,2s	1556	20.9	37 53 22.90	122 25 55.45
117	00117_3p,3s	1837	23.5	37 52 08.82	122 25 01.41
117	00117_4p,4s	2038	26.1	37 51 38.22	122 24 15.42
117	00117_5p,5s	2232	19.9	37 51 44.79	122 24 03.23
118	00118_1s	1359	23.8	37 51 25.38	122 24 02.65
118	00118_2p	1702	13.8	37 51 51.37	122 23 52.84
118	00118_3p	1840	19.5	37 53 24.00	122 26 30.06
118	00118_4p	2019	21.7	37 53 42.19	122 26 46.28
120	00120_1s	1402	42.7	37 52 29.17	122 54 41.65
120	00120_2s	1622	31.1	37 52 44.08	122 26 03.07
120	00120_3s	1944	13.0	37 54 02.94	122 25 18.43
120	00120_4s	2111	18.5	37 53 51.45	122 26 51.10
121	00121_1s	1404	20.2	37 53 46.75	122 26 53.79
121	00121_2s	1430	6.4	37 56 00.42	122 27 40.98
121	00121_3s	1624	8.2	37 54 09.20	122 27 31.95
121	00121_4s	1924	9.9	37 55 45.20	122 27 28.11

DAY	CAST FILE NAME	START CAST TIME	DEPTH METERS	LATITUDE	LONGITUDE
121	00121_5s	2208	9.1	37 54 03.45	122 27 24.10
122	00122_1p,1s	1404	16.7	37 53 51.80	122 27 02.41
122	00122_2p,2s	1507	7.4	37 56 02.91	122 27 38.51
122	00122_3p,3s	1640	13.1	37 53 57.04	122 27 12.86
122	00122_4p,4s	1938	16.9	37 53 47.86	122 27 03.71
122	00122_5p,5s	2141	17.6	37 53 48.02	122 27 01.80
122	00122_6p,6s	2220	11.5	37 56 03.27	122 27 21.98
123	00123_1p,1s	1419	19.7	37 53 47.34	122 26 46.33
123	00123_2p,2s	1448	10.2	37 56 05.60	122 27 23.49
123	00123_3p,3s	1629	19.1	37 53 50.98	122 26 54.28
123	00123_4p,4s	1945	20.7	37 53 48.57	122 26 50.35
123	00123_5p,5s	2153	20.4	37 53 48.86	122 26 49.07
123	00123_6p,6s	2247	18.7	37 53 48.63	122 26 48.49
124	00124_1p,1s	1619	20.8	37 53 37.96	122 26 36.00
124	00124_2p,2s	1645	12.9	37 56 18.92	122 27 05.29
124	00124_3p,3s	1850	20.3	37 53 49.03	122 26 48.08
124	00124_4p,4s	2045	20.8	37 53 49.14	122 26 48.34
124	00124_5p,5s	2114	18.8	37 56 43.71	122 26 41.98
124	00124_6p,6s	2244	20.4	37 53 47.70	122 26 40.21
124	00124_7p,7s	2337	20.8	37 53 44.83	122 26 37.78
125	00125_1p,1s	1711	21.3	37 53 44.99	122 26 44.52
125	00125_2p,2s	1738	14.9	37 56 37.55	122 26 53.16
125	00125_3p,3s	2016	19.1	37 53 52.67	122 26 37.95
125	00125_4p,4s	2133	16.7	37 56 36.02	122 26 45.51
125	00125_5p,5s	2204	19.8	37 53 47.26	122 26 30.06
125	00125_6p,6s	2351	19.3	37 53 48.32	122 26 28.01
126	00126_1p,1s	1325	20.3	37 53 30.30	122 26 28.89
126	00126_2p,2s	1423	17.7	37 56 31.14	122 26 39.57
126	00126_3p,3s	1543	17.8	37 53 44.54	122 26 21.02
126	00126_4p,4s	1758	14.0	37 53 44.60	122 26 36.29
126	00126_5p,5s	1957	15.8	37 55 44.87	122 26 39.41
129	00129_1p,1s	1552	No data	37 53 24.31	122 26 12.62
129	00129_2p	1715	18.9	37 53 43.97	122 26 23.81
129	00129_3p	1929	18.0	37 56 42.47	122 26 38.51
129	00129_4p	2140	19.2	37 53 41.82	122 26 19.25
129	00129_5p	2145	No data	37 53 48.43	122 26 24.64
129	00129_6p	2153	No data	37 53 49.25	122 26 24.93

DAY	CAST FILE NAME	START CAST TIME	DEPTH METERS	LATITUDE	LONGITUDE
129	00129_7p	2220	16.8	37 56 38.85	122 26 24.39
129	00129_8p	2355	17.4	37 53 43.44	122 26 11.79
130	00130_1s	1412	19.1	37 53 37.64	122 26 14.94
130	00130_2s	1614	18.2	37 53 36.35	122 26 11.10
130	00130_3s	1830	15.6	37 53 47.72	122 26 13.81
130	00130_4s	1938	17.6	37 56 45.99	122 26 33.59
130	00130_5s	2008	14.1	37 53 40.51	122 26 03.83
130	00130_6s	2156	11.1	37 53 53.61	122 25 59.97
131	00131_1s	1400	19.6	37 53 34.33	122 26 10.28
131	00131_2s	1613	19.0	37 53 31.67	122 26 10.01
131	00131_3s	1708	16.3	37 56 37.65	122 26 07.45
132	00132_1p,1s	1403	20.0	37 53 21.91	122 25 50.35
132	00132_2p,2s	1443	19.0	37 56 49.97	122 26 22.63
132	00132_3p,3s	1653	18.6	37 53 28.73	122 26 07.48
132	00132_4p,4s	1929	16.1	37 53 27.81	122 25 39.33
132	00132_5p,5s	2139	13.4	37 53 45.11	122 25 41.27
133	00133_1p,1s	0004	12.6	37 53 53.14	122 25 41.43
133	00133_2p,2s	1406	21.1	37 55 46.16	122 25 29.15
133	00133_3p,3s	1614	21.6	37 55 48.35	122 25 38.69
133	00133_4p,4s	1822	14.0	37 55 00.09	122 24 51.71
133	00133_5p,5s	1849	18.9	37 55 59.55	122 25 27.88
133	00133_6p,6s	2100	17.6	37 55 54.16	122 25 38.27
133	00133_7p,7s	2229	13.8	37 55 26.95	122 24 52.27
134	00134_1p,1s	1403	14.4	37 53 57.37	122 25 15.00
134	00134_2p,2s	1607	21.6	37 53 46.77	122 25 35.78
134	00134_3p,3s	1820	20.5	37 55 52.28	122 25 39.02
134	00134_4p,4s	2010	20.6	37 56 57.55	122 26 30.46
134	00134_5p,5s	2216	19.9	37 56 58.21	122 26 27.04
135	00135_1p,1s	1357	15.3	37 53 38.70	122 25 41.25
135	00135_2p,2s	1422	19.1	37 55 48.49	122 25 39.45
135	00135_3p,3s	1635	23.5	37 55 49.79	122 25 42.34
135	00135_4p,4s	1813	11.2	37 53 53.97	122 25 22.63
136	00136_1p,1s	1534	14.6	37 53 56.49	122 25 15.98
136	00136_2p,2s	1738	22.4	37 55 48.86	122 25 39.64
136	00136_3p,3s	1952	15.2	37 53 52.63	122 25 14.56
136	00136_4p,4s	2211	14.2	37 53 42.94	122 25 12.89
137	00137_1p,1s	1415	20.8	37 53 42.97	122 26 41.57

DAY	CAST FILE NAME	START CAST TIME	DEPTH METERS	LATITUDE	LONGITUDE
137	00137_2p,2s	1618	14.5	37 55 02.30	122 25 26.19
137	00137_3p,3s	1834	15.6	37 55 47.00	122 26 39.19
137	00137_4p,4s	2029	21.7	37 53 25.41	122 26 21.53
137	00137_5p,5s	2048	46.9	37 52 28.17	122 25 44.82
138	00138_1p,1s	1400	12.9	37 53 45.45	122 25 12.12
138	00138_2p,2s	1524	22.2	37 55 51.53	122 25 41.36
138	00138_3p,3s	1803	22.7	37 55 47.89	122 25 40.34
138	00138_4p,4s	2015	22.0	37 55 47.81	122 25 39.01
138	00138_5p,5s	2223	22.8	37 55 49.78	122 25 40.11
138	00138_6p,6s	2333	9.3	37 51 48.26	122 23 37.32
139	00139_1p,1s	1351	19.7	37 51 41.79	122 24 02.56
139	00139_2p,2s	1554	6.1	37 54 29.75	122 27 49.35
139	00139_3p,3s	1642	13.8	37 55 52.17	122 26 36.21
139	00139_4p,4s	1723	21.0	37 55 48.28	122 25 39.38
139	00139_5p,5s	2044	8.8	37 55 57.94	122 25 59.25
139	00139_6p,6s	2237	9.9	37 55 30.24	122 25 57.46
225	00225_1p,1s	1448	20.0	37 55 46.77	122 25 36.78
225	00225_2p,2s	1642	21.9	37 53 44.58	122 26 38.90
225	00225_3p,3s	1713	51.4	37 52 30.02	122 25 54.86
225	00225_4p,4s	1742	15.7	37 52 14.81	122 24 34.70
225	00225_5p,5s	1827	17.7	37 55 47.80	122 25 41.14
225	00225_6p,6s	2131	17.4	37 55 46.47	122 25 59.28

Static Draft

With the vessel out of the water, markings were placed on the aft quarters and the forward section of the hull, providing a means to monitor vessel draft. Static draft readings were recorded at the start of each survey day. Changes to vessel loads were kept at a minimum during the survey, resulting in small changes to both the vessel and transducer drafts. The multibeam mount was marked to provide a visual reading of the static draft of the transducer below the water line. Using the TSS POS/MV to monitor vessel roll, draft readings were observed only when roll was less than 0.2 degrees. The draft of the Reson multibeam sonar ranged from 0.96 to 0.98 meters throughout the survey. Markings along the port side of the vessel, in line with the Odom transducer, indicated the draft of the single beam sensor. With the vessel alongside the pier and a roll angle of less than 0.2 degrees, the draft of the transducer was recorded. The draft of the Odom single beam transducer ranged from 0.64 to 0.66 meters throughout the survey.

R/V ZEPHYR DRAFT MARKS

Dynamic Draft

Settlement and squat measurements for the Zephyr were taken on March 2, 2000 (Day Number 062) in the San Joaquin River, near the Antioch City Marina. Data from these measurements are included in Appendix E.[27]

The settlement and squat values were obtained by visually recording the vessel height at different ship speeds, measured in revolutions per minute (RPM) during transects along a pier. Ship speeds in increments of 100 to 200 RPM were observed from 650 to 1600 RPM. Using a Wild NA-2 level on a fixed pier, observations were taken to a metric rod, held along the centerline of the vessel, directly abeam of the sonar head and IMU location. During each transect, an initial value was recorded while the vessel was at rest, followed by ten readings at the designated speed, and then another reading with the ship at rest. The ship squat value was based on averaging the ten readings, then subtracting out the average rest values of the line.

For the survey, the data from these tests were not input in real-time. The Caris Vessel Configuration file (VCF) for settlement and squat correction is based solely on vessel speed over ground, not ship RPM. Due to the high currents in the survey area, it would be impractical to base the vessel speed on ship RPM. At 1200 RPMs, the average ship speed throughout the survey, a speed of 3 knots to 10 knots were recorded. The maximum settlement and squat observed through the tests were less than 3 centimeters, and no corrections to the data were made.[28]

Heave, Roll and Pitch Corrections

A TSS POS/MV 320 integrated DGPS (Differential Global Positioning System) and inertial reference system, serial number 040, was used for the motion sensor and primary navigation system for the Zephyr. The system comprised an inertial motion unit (IMU), dual GPS antennas, and a data processor. Data from the IMU was recorded directly in the Triton Isis XTF file. The data were logged at 9600 baud, allowing for an update rate of 25 Hz. No problems with time stamping or data spikes were observed during the acquisition.

The TSS POS/MV 320 is a six-degree of freedom motion unit, with a stated accuracy of 0.05-meter or 5 percent for heave, 0.02 degrees for roll and pitch and heading. Real-time displays of the vessel motion accuracy were monitored throughout the survey with the POS controller program. If any one of the vessel motion accuracies degraded to greater than 0.05 degrees, survey operations would stop until the inertial unit was able to obtain the higher degree of accuracy. There were no periods during the survey that the unit experienced degraded accuracy or performance.[29]

MULTIBEAM MOUNT WITH DRAFT MARKS

Initial System Calibration

To confirm alignment of the IMU sensor with the sonar transducer, and to verify delay times applied to the time-tagged sensor data, a Patch test was conducted. The Patch test consisted of a series of lines run in a specific pattern, which were then used in pairs to analyze roll, pitch and heading alignment bias angles as well as latency in the time tagging of the sensor data. The Patch test lines were run according to NOAA standards in the following order: pitch, latency, roll, and heading. The tests were conducted at the start of the 2000 field season, on March 2, 2000 (Day Number 062) in the San Joaquin River.

Roll alignment was determined by running reciprocal lines 300 to 500 meters long over a flat bottom, in the center of the San Joaquin River in a water depth of 17 meters. Pitch errors were determined by running reciprocal lines 300 to 500 meters in length, over a smooth slope perpendicular to the depth curves. The entrance to the Antioch Marina provided an excellent area for this test. From the center of the San Joaquin River to the entrance of marina, the bank sloped upward to a water depth of 2 meters. The heading error was determined by running

reciprocal lines at the entrance to the marina. Distinct bottom features in addition to the upward slope yielded accurate test results. Lines were run at 1000 RPM to allow for a cross track coverage and overlap.

To measure the alignment error in pitch, a selected pair of pitch lines was analyzed in Caris Sub-set under Calibration mode, through a series of incremental changes in pitch angle over a specified range. Visual inspection of the data confirmed each adjustment. Similarly, yaw, roll and latency patch tests were processed, and corrections for each were computed. Two sets of lines were run and analyzed for pitch, roll and heading. The second set was used to confirm the results of the data.

Latency of the Trimble 4000 SE GPS receiver with differential capabilities has been monitored during the past survey seasons, and a value of 0.860 milliseconds has been observed. Evaluation of sand wave alignment in hill shaded models confirmed that the proper latency was applied.

A different set-up of GPS equipment used beginning on Day Number 097 (see section H – Positioning Equipment). Data for both navigation systems were collected simultaneously in Isis throughout the survey. In Caris HIPS processing, the operator could choose which GPS system would be used to apply to the sounding data. This dual logging enabled the use of the Patch test lines on Day Number 062 to be analyzed with both sets of GPS navigation.

Table 3 shows the biases that were determined from the Patch test using Caris software. The different values used in latency area related to switching the primary and secondary positioning systems. From extensive testing, it was found that the Trimble 4000SE provided better positioning than the POS M/V when in open water (see section H – Positioning Equipment). The 0.86 second latency is for the Trimble 4000SE and the 0.0 latency is for the POS M/V. The *Zeph2000* Caris vessel configuration file was used from *Day Number 070 to 096 and Zeph2000-POS* was used for *Day Number 097 to* 226.

TABLE 3. BIASES USED FOR DATA ACQUISITION

FOR DN 070-096
ZEPH2000

ALIGNMENT	BIAS
Roll	1.75
Pitch	-0.6
Yaw	0.1
Latency	0.860

FOR DN 097-226
ZEPH2000-POS

ALIGNMENT	BIAS
Roll	1.75
Pitch	-0.6
Yaw	0.1
Latency	0.0

Lead Line and Single Beam Comparison

Lead line checks were performed against the multibeam and single beam echosounders at the start of each day, while the vessel was tied up alongside its berth in the marina. Lead line readings were taken on the starboard side, adjacent to the sonar transducer and on the port side, abeam to the single beam transducer. Lead line readings were recorded and compared to the multibeam data recorded in the Triton Isis beam confidence check dialog window. Leadline data on the starboard side were compared to the Reson nadir beam, while the data recorded on the port side for the Odom were compared to an off-nadir beam at 1.9 meters. Depending upon the water depth, this off-nadir beam varied between beam 22 to beam 31.

The Odom echosounder provided an analog output during lead line checks, and an event mark was recorded on the paper trace. All depths were recorded manually in the daily system check logs.[30]

Differences of less than 10 centimeters were seen throughout the survey. Lead line logs are included in Appendix E.[31]

H. HYDROGRAPHIC POSITION CONTROL

Horizontal Datum

The horizontal control datum for this project is North American Datum of 1983 (NAD83). A Universal Transverse Mercator, Zone 10, projection was used with metric units when exporting to MicroStation. MicroStation was used to prepare preliminary smooth sheets for the project.

Positioning Equipment

Survey data collected from Day Number 070 through Day Number 096 used a Trimble 4000 SE GPS receiver with differential capabilities as the primary positioning system. The TSS POS/MV 320 (version 3) integrated DGPS inertial reference system was used as a back-up due to some uncertainties with the new Novatel GPS cards installed within the unit. Position differences of 2 meters were observed with the TSS POS/MV system. After system tests it was determined that the Trimble system provided better DGPS positions than the Novatel cards in the POS/MV system. A Trimble ProBeacon receiver, acquiring corrections from the U.S. Coast Guard beacon located at Point Blunt, provided differential corrections for both systems.

Survey data collected from Day Number 097 to the end of the survey used the TSS POS/MV 320 (version 3) system using the Trimble 4000 SE GPS receiver for the navigation input. A configuration in the POS system allowed for an external GPS system to be used, bypassing the internal Novatel GPS cards. This method allowed the use of the TSS inertial positioning system without the navigational uncertainties of the Novatel GPS cards. The Trimble GPS data was designated as AUXGPS, providing DGPS positions to the POS system.

Positions from both systems were compared and displayed in real-time using Hypack Max. The POS/MV system position and heading were displayed as a vessel shape and the Trimble position was displayed with a circle and cross hair overlaid on the vessel shape in a different color. Position data from both systems were displayed and tracks from both systems were drawn in different colors such that a history of derived positions could be observed for quality control.

Position Control

Differential GPS provided hydrographic control throughout the survey. The following beacon was used during hydrographic operations:

REFERENCE STATION	FREQUENCY (KHZ)	SURVEYING DAYS
Point Blunt (station ID 268)	310	070 – 226 (2000)

DGPS Performance Checks

Two DGPS performance checkpoints were established at the Bellina Marina in Alameda, CA and at the Berkeley Marina with a Leica MX412 roving DGPS receiver. At the Bellina Marina, a nail was set at the west end of the slip and referenced as “Bellina H1”. At the Berkeley Marina, a checkpoint was established at the end of berth N120. A nail was set on the top of a pile and referenced as “Berkeley N120.”

STATION	LATITUDE	LONGITUDE
Bellina H1	37 45 57.28 N	122 16 58.08 W
Berkeley N120	37 51 55.59 N	122 19 00.17 W

Daily position confidence checks were conducted at the Bellina Marina during survey operations on Day Number 070 through Day Number 108, and at the Berkeley Marina during survey operations from Day Number 109 to Day Number 226. At the start of each day, the Trimble DGPS antenna was held over the point and compared the position obtained from the initial established position. Position differences of two meters or less were recorded throughout the survey. A complete log of daily position checks and detached position records is included in Appendix E.[32]

I. SHORELINE

Not applicable. Shoreline verification was not required for this project.[33]

J. CROSSLINES

A total of 121.82 nautical miles of crosslines, or 6.5 percent, was run in the survey area. This included 47.69nm on H10960[34], 11.59nm on H10961 and 62.54nm on H10962.[35] In general, the crosslines agreed well with the mainscheme data. Statistical analysis of the data set was conducted using the Universal Systems Limited (USL) makehist routine, version dated December 10, 1998. A quality control report was created listing statistics by beam number. The report is included in Appendix E.[36]

Four areas were examined within the survey limit using the makehist routine. A representative section on areas H10960[37], H10961 and H10962[38] were examined using the makehist routine. Additionally, an area on the eastern edge of sheet H10960[39], with depths of less than 25 feet, was analyzed. A total of 13.12nm of crosslines were used in the analysis. The area represented a cross-section of depths, ranging from 15.9 feet to 81.1 feet. A 0.5-meter sort of all crosslines was compared to a two-meter gridded Digital Terrain Model (DTM) based upon a 0.5-meter sort of the section of mainscheme data.

The mean difference of the data set ranged from 14 centimeters at the port beams to 11 centimeters on the outer starboard beams. The majority of the differences were less than 7 centimeters. All beams exhibited greater than 99 percent agreement at the five-decimeter level.

The analysis using the IHO standard equation of

$$\text{sqrt}((a^2 + (b * d)^2) \text{ with } a=0.500 \text{ and } b=0.013$$

showed agreement of greater than 98 percent throughout the entire data set.

The crossline set in shallow water analyzed all 101 beams of the sonar swath, rather than beams falling into the +/- 54-degree cut-off range. The sounding data used in shallow water relied on beams out to 60 degrees to ensure coverage in the shallow area of the survey area. Beams 3-100 exhibited agreement of greater than 98 percent at the Class I IHO standard listed above, and 98 percent at the 5-decimeter level.
The good agreement of the crosslines, surveyed prior to mainscheme acquisition, showed no systematic errors in multibeam acquisition and data processing routines. Minor differences could be attributed to sediment migration during the survey as large sand waves were observed.[40]

K. JUNCTIONS

A junction analysis was performed using data from the 1999 field season and comparing this data with data from the 2000 field season. Data from registry number H10895 and from H10960[41] are included in the analysis. Data junctions existed at the south, east and northern edge of the 1999 data set and the western parameter of the 2000 field season data. A total of 10 km of survey area overlapped between the two areas.

In general, the data showed good agreement, with all sounding deviations less than one foot. No sand migration or shoaling was observed between the two survey areas.

L. COMPARISON WITH PRIOR SURVEYS

Comparison with prior surveys was not required under this contract. See Section N for comparison to the nautical charts.[42]

M. ITEM INVESTIGATION REPORTS

Six AWOIS items were located inside the survey area. These items were included in the SOW for information only, with no additional survey requirements for investigating these items. A summary of each item, by registry number, is listed below. Additionally, eight items found during the survey initiated a Danger to Navigation report, submitted to the Pacific Hydrographic Branch (PHB), Seattle, Washington. A summary of the reports follows; copies of the letters sent to PHB are included in Appendix A.[43]

Registry Number H10960[44]

AWOIS 52504 was located during survey operations, in the vicinity of the charted Obstruction, 1100 meters south of the Inner Harbor Entrance channel in Alameda, California. This item was found at position 37 47 19.759 N 122 20 16.938 W with a least depth of 22.2 feet. This position is 4 meters northwest of the reported location in the AWOIS database. A reported depth of 22 feet was indicated in the AWOIS listing, which is consistent with the depth found during the survey.

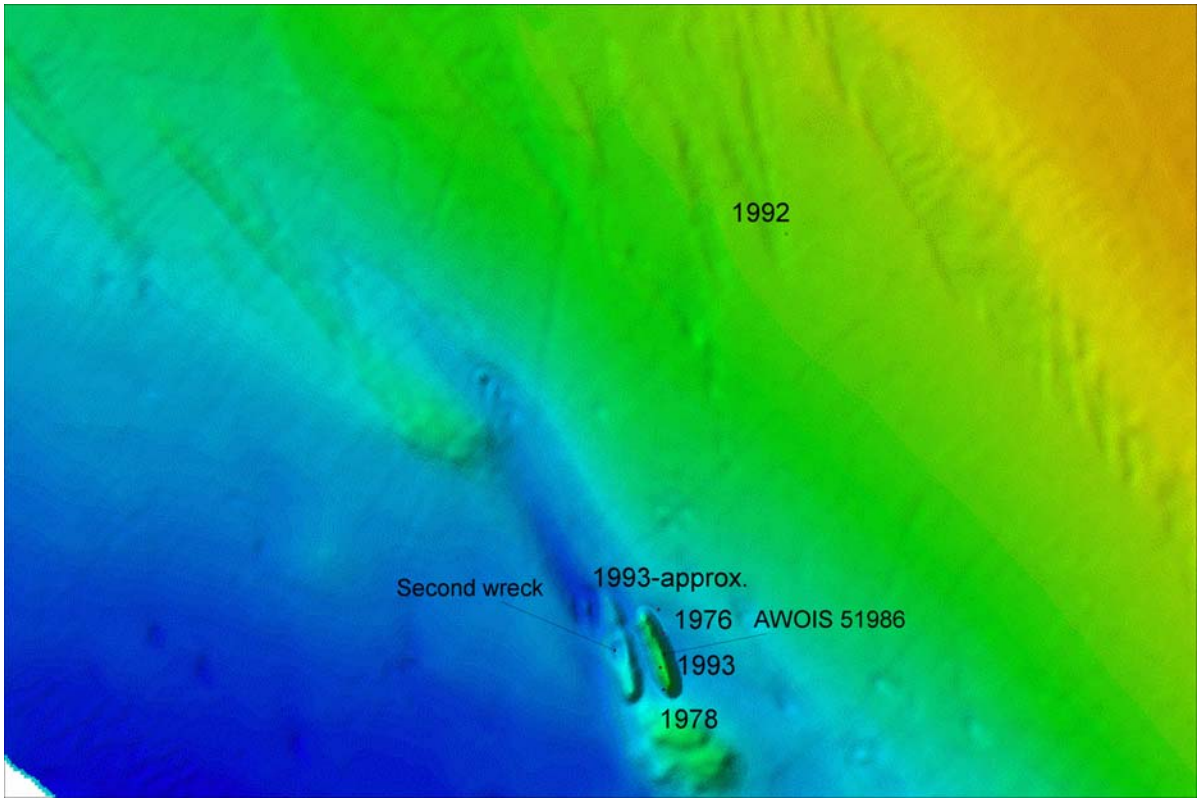
Registry Number H10961

AWOIS 51154 was not found during survey operations. An area of 600 meters around the reported position was examined with the multibeam data set. A small feature, rising off the seafloor by 1.6 feet was located at position 37 48 54.488 N, 122 24 41.697 W, 61 meters northeast of the reported location in the AWOIS database. This item may be the remnants of the vessel, although no conclusions can be made at this time. It is recommended that the ED descriptor remain charted at this time.[45]

AWOIS 51155 was located during survey operations, in the vicinity of the charted wreck, south of Blossom Rock. This wreck was found at position 37 49 00.738 N, 122 24 07.313 W with a least depth of 81.0 feet. This position is 16 meters northeast of the reported location in the AWOIS database. A depth of 77 feet was indicted on the AWOIS listing, obtained from a 1993 survey with an echosounder. It is recommended that the depth be revised to 81 feet.[46]

AWOIS 51986 was located during survey operations, in the vicinity of the charted Wreck 800 meters west of Treasure Island. This wreck was found at position 37 48 57.663 N, 122 22 56.707 W with a least depth of 69.4 feet. This position is 15 meters southeast of the reported location in the AWOIS database. The depth in the database was reported as 69.2 feet in 1976 and 75 feet in 1993. It is recommended that the depth of the wreck be revised to 69 feet. A second wreck, which was originally discovered in 1993, was located approximately 10 meters west of the AWOIS item. The wreck was found at position 37 48 57.543 N, 122 22 57.743 W with a least depth of 81.5 feet. It is recommended that the second wreck be added to the AWOIS database.[47]

Following is a hill shaded model of multibeam data from this survey, illustrating the orientation of the wrecks, and the history of AWOIS positions for AWOIS 51986.



HISTORY OF AWOIS ITEM #51986

Registry Number H10962[48]

AWOIS 52503 was not found during survey operations. This obstruction lies 130 meters east of the western boundary of the survey area. A full investigation with a search radius of 500 meters was not completed on the western side. No obstruction or rise off the seafloor was found in the survey area. The depth of the area was found to be 21 feet. It is recommended that the item is charted with a PA label.

AWOIS 51672 was located during survey operations, in the vicinity of the charted wreck 200 meters northeast of Point Simpton, Angel Island. This wreck was found at position 37 52 08.816 N, 122 25 15.259 W with a least depth of 55.5 feet. This position is 18 meters north of the reported location in the AWOIS database. A depth of 55 feet was indicted on the AWOIS listing.

The following is a list of the ten[49] Dangers to Navigation items that were sent off to the Pacific Hydrographic Branch during the field season. Additional multibeam data, beyond the project requirements, were obtained over items 1, 2, 4, and 5. Seven lines were run in a radial search pattern, centered on the least depth position obtained from the main scheme lines.

Danger number one,[50] an uncharted wreck, lies 6400 feet south of the Alameda Naval Channel, offshore Alameda Island, California. The wreck rises 9.8 feet off the seafloor with a least depth of 22.4 feet below MLLW. Multibeam sonar with beam number 55 detected the least depth. The wreck is approximately 40 to 60 feet in length. The charted depth in the area is 32 feet. Charts 18649 and 18650 are affected by this item. It is recommended that the charts indicate this wreck at position latitude 37 45 25.326 N, longitude 122 19 54.168 W with a depth of 22 feet.

Danger number two,[51] an uncharted wreck, lies 2500 feet south of the Alameda Naval Channel. The wreck rises 9.4 feet off the seafloor and has a least depth of 11.2 feet below MLLW. Multibeam sonar with beam number 82 detected the least depth. The wreck is approximately 40 feet in length and 14 feet wide. The charted depth in the area is 18 feet. Charts 18649 and 18650 are affected by this item. It is recommended that the charts indicate this wreck at position latitude 37 45 59.797 N, longitude 122 19 25.385 W with a depth of 11 feet.

Danger number three,[52] an uncharted obstruction, lies 8200 feet west of Alameda Island, on the western edge of General Anchorage area number 8. The object rises 8.1 feet off the seafloor and has a least depth of 53.6 feet below MLLW. Multibeam sonar with beam number 32 detected the least depth. The object is approximately 10 feet in length. The charted depth in the area is 59 feet. Charts 18649 and 18650 are affected by this item. It is recommended that the charts indicate this obstruction at position latitude 37 47 13.949 N, longitude 122 21 27.271 W with a depth of 53 feet.

Danger number four,[53] an uncharted wreck, is located 3300 feet off Paradise Cay in Tiburon, CA. The wreck rises 4.7 feet off the seafloor and has a least depth of 13.9 feet below MLLW. Multibeam sonar with beam number 80 detected the least depth. The wreck is approximately 60

feet in length. The charted depth in the area is 19 feet. Charts 18649 and 18653 are affected by this item. It is recommended that the charts indicate this wreck at position latitude 37 54 43.240 N, longitude 122 27 47.481 W with a depth of 14 feet.

Danger number five,[54] an uncharted obstruction, lies just south of the Richmond-San Rafael Bridge, between support columns 37 and 38. The object rises 7.0 feet off the seafloor and has a least depth of 38.0 feet below MLLW. Multibeam sonar with beam number 43 detected the least depth. The object is approximately 25 feet in length and could be a steel girder from the bridge construction. The charted depth in the area is 39 feet. Charts 18649 and 18653 are affected by this item. It is recommended that the charts indicate this obstruction at position latitude 37 56 03.631 N, longitude 122 26 23.911 W with a depth of 39 feet.

Danger number six,[55] an uncharted rock, lies 270 feet southeast of Red Rock Island. The rock rises 6.1 feet off the seafloor and has a least depth of 9.5 feet below MLLW. Multibeam sonar with beam number 29 detected the least depth. The charted depth in the area is 14 feet. Charts 18649 and 18653 are affected by this item. It is recommended that the charts indicate this obstruction at position latitude 37 55 39.451 N, longitude 122 25 46.273 W with a depth of 9 feet.

Danger number seven,[56] an uncharted obstruction, lies 2600 feet southwest of Molate Point in Richmond, CA. The object rises 9.0 feet off the seafloor and has a least depth of 41.6 feet below MLLW. Multibeam sonar with beam number 77 detected the least depth. The charted depth in the area is 46 feet. Charts 18649 and 18653 are affected by this item. It is recommended that the charts indicate this obstruction at position latitude 37 56 30.539 N, longitude 122 25 46.047 W with a depth of 41 feet.

Danger number eight, an uncharted rock, lies 600 feet west of Treasure Island. The rock rises 5.9 feet off the seafloor and has a least depth of 29.2 feet below MLLW. Multibeam sonar with beam number 85 detected the least depth. The charted depth in the area is 36 feet. Charts 18649 and 18650 are affected by this item. It is recommended that the charts indicate this rock at position latitude 37 49 11.279 N, longitude 122 22 37.295 W with a depth of 29 feet.[57]

Danger number nine indicated shoal soundings in the eastbound San Francisco Bay traffic lane, south of Alcatraz Island. Significant soundings and their positions were reported in the Danger to Navigation letters sent to PHB.[58]

Danger number ten indicated a shoaling west of Treasure Island, in Temporary Anchorage Number 7. Significant soundings and their positions were reported in the Danger to Navigation letter sent to PHB.[59]

N. COMPARISON WITH THE CHART

Three published charts, listed in Table 4, cover the survey area. From the selected sounding plot, comparisons were made to the depths on each of the charts.

TABLE 4. CHARTS COVERING THE SURVEY AREA

CHART	SCALE	EDITION	DATE
18649	1:40,000	61	January 22, 2000
18650	1:20,000	49	May 7, 1999
18653	1:20,000	8	July 17, 1999

Each survey area was compared to the following charts:

Survey Area:	Compared with Charts:
H10960	18649, 18650
H10961	18649, 18650
H10962	18649, 18653

Survey H10960 – Hunters Point to Oakland[60]

The area surveyed encompasses the southern section of San Francisco Bay, south of the San Francisco Bay Bridge, surrounding the general anchorage for large vessels in San Francisco Bay. Ships in excess of 800 feet were common throughout the area, transiting to and from the anchorage area. DEA surveyed the anchorage area in 1999 with registry number H10895.

A comparison to chart 18649 and 18650 indicated good agreement throughout the survey area. The majority of depths surveyed were primarily shoaler than charted depths with differences less than 3 feet. A slight shoaling of 2 feet was observed in the southern section of the survey data, east of the Forbidden Anchorage area. A few soundings in the northern portion of the survey exhibited a 3 foot shoaling.

Depths of 30 feet were observed in the vicinity of a sounding charted at 39 feet on 18650. The charted 39 feet is located on the northeast section of the Forbidden Anchorage area, east of Hunters Point. The charted sounding on chart 18649 closest to the 39 feet charted on 18650 is 29 feet. The survey found no unusual seabed or shoaling to exist in the area. The 39 on chart 18650 is presumed to have been mischarted and should have been 30 feet not 39.

The wreck on the northeast corner has been identified as an AWOIS item 52504. A least depth was found to be 22 feet, correctly charted on both charts. Two uncharted wrecks and one

obstruction were observed in the survey area and plotted on the preliminary smooth sheets. These items are described in Section M - Item Investigation Reports.

The Alameda Naval Channel was observed to have a minimum depth of 33 feet in the center and 31 feet on the left and right quarters. Slight shoaling, 1 to 3 feet, along the north and south channel limits was observed at the eastern end of the channel.

Survey H10961: South of Alcatraz

The area surveyed encompasses the navigable area between Alcatraz Island and the northern portion of the San Francisco Peninsula. A comparison to chart 18649 and 18650 showed differences of up to 10 feet in the area around Alcatraz Shoal. An area to the west of the Shoal exhibited depths 9 feet deeper than the charted soundings, and to the east of the charted Shoal, depths were 10 feet shallower. The extent of the Alcatraz Shoal migrated to the east approximately 150 meters.[61]

An area 380 meters southeast of the Prohibited Disposal Area and 750 meters north of the San Francisco city breakwater exhibited shoaling of up to 5 feet from the charted soundings. This area extends 250 meters in the east-west direction, and about 120 meters in the north-south direction. This area is clearly seen on the DTM model. This area could be remnants of the disposal area migrating to the southeast.[62]

On chart 18650, an area just north of Fisherman's Terminal at pier 45, soundings were found to be 6 to 9 feet deeper than the charted soundings.[63]

On chart 18649, four lights are charted north of the breakwater by pier 45. These lights- "A", "B", "1" and "2" were all observed to be located on the breakwater. Positions of these lights are listed in Section P – Aids to Navigation.[64]

The charted shoal at the eastern section of the survey area, northeast of North Point, was surveyed to have a least depth of 43 feet. This is a difference of 4 feet shoaler from the charted depth of 47 feet. The extent of the shoal area is approximately the same size as indicted on the charts.[65]

The wreck on the northeast corner has been identified as an AWOIS item 51155. A least depth was found to be 81 feet, 4 feet deeper than charted.[66]

The wreck 500 meters offshore of North Point, charted with an ED descriptor, was not found during survey operations. This wreck is AWOIS 51154, and is discussed in Section M – Item Investigation Reports.[67]

There are two cable areas within the survey limit. No hazard to navigation exists, and the charts appear to correctly show the general area of these submerged objects. Warning signs on the shore indicate that cables are present.[68]

An area to the southwest of the survey shows scallop holes, in an area approximately 500-meter radius. This may be a borrow site area with the holes caused by dredge operation. This area is easily identified on the DTM.[69]

The western section of the survey limit exhibited large sand waves throughout the area. The sand waves are approximately 10 feet in height and spaced approximately 300 feet along the seafloor. The DTM model highlights this area.[70]

Survey H10961: West of Treasure Island[71]

The area surveyed encompasses the area west of Treasure Island in the Temporary Anchorage Area Number 7. A comparison to chart 18649 and 18650 indicated that the 30, 36 and 60 foot contours migrated to the west approximately 50 meters at the northern portion of the survey limit. Charted soundings differed by up to 5 feet in this area. The shoaling was significant and a Danger to Navigation letter was sent to PHB.[72] The western extent and southeastern extent of the survey area showed good agreement to both charts, with differences of less than 2 feet throughout the area.[73]

A submerged pile was located in the vicinity of the charted submerged piling on charts 18649 and 18650. A least depth of 13 feet was obtained with the sonar, and is indicated on the smooth sheet sounding plot.[74]

The charted pier on the West Side of Treasure Island was outside the survey limits and not observed during the survey. A scour hole on the western edge of the pier can be seen on the DTM.[75]

Two wrecks were observed in the vicinity of the charted wreck on the southwestern section of the survey area. The area containing these wrecks corresponds to AWOIS item 51986 and is included in Section M. A least depth of 69 feet was found on this item.[76]

Survey H10962 – Angel Island to Richmond[77]

The survey area encompasses two main shipping channels on the northern portion of San Francisco Bay. Large container ships and oil cargo vessels were common in this area. On the western side of the survey is a regulated Navigational Area and on the eastern side is the Southampton Shoal Channel.

A comparison to chart 18649 and 18653 showed good agreement over most of the survey area with a general shoaling trend. Differences of less than 2 feet were observed, with some

exceptions, and a general trend indicating shoaler depths in the area. The area has a depth range of 3 feet to 183 feet.

There are two main shipping channels within the survey area. On the western side, the area is indicated as a regulated Navigational Area and on the eastern side is the Southampton Shoal Channel. The minimum depth for these shipping lanes is 33 feet. The Southampton Shoal Channel is clearly visible on the DTM of the area. The channel has a minimum depth of 43 feet on the left and right sides and 44 feet in the center of the channel. These depths are slightly shoaler than those observed during the US Army Corps of Engineers Survey in June 1997.

Along the East Coast of the Tiburon Peninsula, a shoaling of up to 8 feet was observed when comparing to chart 18653. Differences of 5 feet were observed in this region with a comparison to chart 18649. This shoaling occurred from Pt. Chauncey southward to Bluff Point out to 300 meters off the coast.

An area around Red Rock was surveyed to a depth of 12 feet. Numerous uncharted rocks were surveyed along the south shore and northwest shore of the island. On Day Number 225, one survey line (File 225-2051.xtf) ran through the southern most charted islet at the south end of Red Rock. The preliminary smooth sheet depicts a depth of 9 feet at the center of the islet when laid over Chart 18653 in MapInfo. Outer beams from the multibeam data could be used to provide a better position of the islet.[78] A detached position and estimated height (within 1 foot) was observed on a rock located at the northwest corner of Red Rock. The Trimble GPS antenna (device 1 in Hypack) was held over the rock on an extended pole and a Hypack file (007_1437.raw included on the data tapes) was recorded at 1437 UTC on day number 225. The average of four recorded positions in the file was used as the observed position. All four positions were within 0.2 meters. An exposed height of the rock was estimated at 0.8 meters as the rock could not be accessed for an accurate measurement. A zoned tidal height of 0.41 meters above MLLW was calculated using data obtained from Richmond Station 941-4290 at 1437 UTC on day number 225. The height of the rock was calculated at 1.2 meters or 4 feet above MLLW. The preliminary smooth sheet indicates the rock as awash at 4 feet MLLW at 37° 55’ 48.01” N and 122° 25’ 56.31” W. The rock is charted as awash 10 meters north of the observed position on Chart 18653.

The wreck offshore Pt. Simpton was observed with a minimum depth of 55 feet. Both charts correctly indicated the least depth of this feature. This wreck is AWOIS 51672 and discussed in Section M – Item Investigation Reports.

The Obstruction charted in the northwest section of the survey area, in the Forbidden Anchorage, was not observed during the survey. No debris or remnants of a navigational aid was found. This item is AWOIS 52503 and discussed in Section M – Item Investigation reports.

The Richmond-San Rafael Bridge crosses the northern section of the survey from east to west. The bridge spans 2200 meters of the survey area with a total of 20 bridge piers. There are two

main navigation channels under the bridge. The eastern channel has a horizontal clearance of 970 feet and a vertical clearance of 135 feet above MSL. The western channel has a horizontal clearance of 1000 feet and a vertical clearance of 185 feet above MSL. These values were obtained from the *US Coast Pilot 2000* (Volume 7, 2nd Edition, p. 303, item 347).

The Southampton Shoal Channel is clearly visible on the DTM of the area. The channel has a minimum depth of 43 feet on the left and right sides, and 44 feet in the center of the channel. These depths are slightly shoaler than those observed during the U.S. Army Corps of Engineers Survey, in June 1997.

The south end of the survey has a charted Cable Area extending from Angel Island to the buoy Iso R 6s 32 ft 6M Bell. No indication of cables can be seen on the DTM.

O. ADEQUACY OF SURVEY

The survey should supercede all common areas of depths of prior surveys.[79] No shoreline verification or bottom samples were taken during the survey.[80] Shoreline around Red Rock was obtained from digitizing a raster nautical chart. Multibeam sonar used on the survey allowed for complete bottom coverage, identifying all features and possible obstructions. Hill shaded images of multibeam data were generated for quality control analysis. Hill shaded images of 2 meter binned data were provided for H10960[81], H10961 and H10962.[82] Additionally multibeam backscatter mosaic data were provided for H10961.[83]

P. AIDS TO NAVIGATION

Thirty-seven navigational aids are within the survey limits. The aids were positioned using differential GPS on board the R/V Osprey, by averaging two detached positions observed at each aid. A detached position record is included in Appendix E.[84] The positions of the navigational buoys were obtained by locating the buoy blocks with the multibeam data. Both the anchor blocks and chains were observed while surveying lines adjacent to the navigational aids. GPS derived buoy positions were used to verify anchor block positions. Positions of all the aids were compared to both the charted positions and to the position listed in the Light List (Volume 6, 1999); differences are noted below in Table 5.[85] Each aid properly served its function and was operating correctly.[86] The light list ID number is indicated below each navigational aid's name.

TABLE 5. POSITIONS OF AIDS TO NAVIGATION

NAVIGATIONAL AIDS FOR H10960[87]

Name	Type	Survey Position	Chart 18649 Position	Chart 18650 Position	Chart 18653 Position
G "7" 4673	Pile	37 48 00.22 122 19 54.15	37 47 59.74 122 19 54.01 * 15.19 m	37 47 59.90 122 19 53.93 * 11.24 m	
R "8" 4675	Pile	37 47 51.98 122 19 57.39	37 47 51.46 122 19 57.37 * 16.04 m	37 47 51.48 122 19 57.43 * 15.45 m	
R "4" 4669	Buoy	37 48 02.92 122 20 52.82	37 48 04.05 122 20 43.97 * 219.29 m	37 48 03.45 122 20 43.23 * 235.18 m	
G "1" 4745	Buoy	37 46 38.00 122 20 26.67	37 46 37.77 122 20 27.16 * 13.93 m	37 46 38.11 122 20 26.73 * 3.70 m	
R "2" 4750	Buoy	37 46 26.77 122 20 26.72	37 46 27.46 122 20 27.64 * 30.98 m	37 46 27.29 122 20 27.68 * 28.44 m	
R "4" 4760	Pile	37 46 24.03 122 19 48.52	37 46 24.48 122 19 48.94 * 16.98 m	37 46 24.20 122 19 48.59 * 5.51 m	
G "3" 4755	Pile	37 46 36.36 122 19 51.83	37 46 36.71 122 19 52.24 * 14.74 m	37 46 36.67 122 19 51.82 * 9.56 m	
G "1" 4820	Buoy	37 46 08.00 122 21 49.10	37 46 07.47 122 21 49.61 * 20.56 m	37 46 07.84 122 21 48.69 * 11.18 m	
R "6" 4672	Buoy	37 47 55.54 122 20 13.40	New buoy	New buoy	
R "6" 4770	Pile	37 46 21.43 122 19 07.24	37 46 21.41 122 19 07.40 * 3.96 m	37 46 21.41 122 19 07.40 * 3.96 m	
Y "A" 4825	Buoy	37 44 45.80 122 19 25.63	37 44 46.65 122 19 25.28 * 26.63 m	37 44 45.79 122 19 25.38 * 6.13 m	

NAVIGATIONAL AIDS FOR H10961[88]

Name	Type	Survey Positions	Chart 18649 Position	Chart 18650 Position	Chart 18653 Position
Pile "C" 4525	Pile	37 48 40.61 122 24 30.65	37 48 41.15 122 24 30.65 * 16.65 m	37 48 40.84 122 24 30.52 * 7.77 m	
Pile "B" 4520	Pile	37 48 41.05 122 24 33.64	37 48 41.77 122 24 33.53 * 22.36 m	37 48 41.24 122 24 33.49 * 6.91 m	
Pile "A" 4515	Pile	37 48 41.42 122 24 36.59	37 48 41.95 122 24 36.72 * 16.65m	37 48 41.62 122 24 36.46 * 6.94 m	
R "4" 4500	Pile	37 48 40.41 122 24 41.40	37 48 40.23 122 24 42.38 * 24.61 m	37 48 40.01 122 24 41.20 * 13.27 m	
R "2" 4309	Pile	37 48 43.26 122 25 11.30	37 48 44.29 122 25 12.02 * 36.31 m	37 48 44.49 122 25 11.56 * 38.45 m	
Y "B" 4308	Pile	37 48 42.18 122 25 16.56	37 48 42.99 122 25 17.56 * 34.96 m	37 48 43.27 122 25 16.36 * 33.96 m	
Y "A" 4307	Pile	37 48 40.35 122 25 21.52	37 48 40.93 122 25 22.21 * 24.59 m	37 48 40.18 122 25 21.18 * 26.81 m	
G "1" 4306	Pile	37 48 38.10 122 25 25.05	37 48 38.81 122 25 25.63 * 26.09m	37 48 38.74 122 25 24.76 * 20.97 m	
GR "BR" 4415	Buoy	37 49 05.95 122 24 11.41	37 49 06.05 122 24 11.47 * 3.42 m	37 49 06.23 122 24 12.16 * 20.27 m	
Pier 45 E 4490	Pile	37 48 41.43 122 25 13.31	37 48 42.12 122 25 13.2 * 21.44 m	37 48 41.65 122 25 12.91 * 11.91 m	
Pier 45 W 4495	Pile	37 48 40.66 122 25 14.12	37 48 41.2 122 25 14.22 * 16.83 m	37 48 40.87 122 25 13.93 * 7.97 m	

NAVIGATIONAL AIDS FOR H10962[89]

Name	Type	Average Block Positions	Chart 18649 Position	Chart 18650 Position	Chart 18653 Position
RW "A" Mo (A) 5410	Buoy	37 51 48.91 122 24 31.40	37 51 50.17 122 24 31.62 * 39.22 m		37 51 49.60 122 24 32.00 * 25.84 m
R "8" 5485	Buoy	37 52 45.61 122 24 53.84	37 52 46.66 122 24 53.93 * 32.45 m		37 52 46.73 122 24 53.99 * 34.73m
R "10" 5500	Buoy	37 54 03.80 122 26 10.24	37 54 02.73 122 26 10.48 * 33.51 m		37 54 02.62 122 26 10.32 * 36.43m
RW "B" Mo (A) 5495	Buoy	37 54 06.26 122 26 40.67	37 54 06.53 122 26 41.39 * 19.46 m		37 54 06.62 122 26 40.94 * 12.92 m
R "12" 5505	Buoy	37 54 48.51 122 26 42.38	37 54 49.06 122 26 43.03 * 23.23 m		37 54 48.70 122 26 42.47 * 6.26 m
RW "C" 5510	Buoy	37 54 46.65 122 26 57.90	37 54 46.51 122 26 58.18 * 8.09 m		37 54 46.58 122 26 57.91 * 2.17 m
R "14" 5515	Buoy	37 55 49.68 122 26 36.33	37 55 49.90 122 26 36.81 * 13.54 m		37 55 49.70 122 26 36.27 * 1.59 m
GC "15" 5635	Buoy	37 56 14.29 122 26 47.45	37 56 15.07 122 26 47.28 * 23.95 m		37 56 15.16 122 26 46.34 * 38.13 m
RN "6" 5785	Buoy	37 56 11.12 122 25 33.91	37 56 11.70 122 25 34.08 * 18.36 m		37 56 11.44 122 25 33.62 * 12.15 m
G "5" 5660	Buoy	37 55 18.82 122 25 37.79	37 55 19.72 122 25 37.48 * 28.76 m		37 55 19.07 122 25 36.99 * 21.01 m
R "4" 5655	Buoy	37 54 57.84 122 25 19.45	37 54 58.71 122 25 20.54 * 37.79 m		37 54 58.35 122 25 20.50 * 30.08 m
G "1" 5770	Buoy	37 55 45.09 122 25 40.06	37 55 45.04 122 25 41.5 * 9.60 m		37 55 44.97 122 25 40.95 * 22.05 m
R "2" 5665	Buoy	37 55 06.17 122 25 03.62	37 55 06.29 122 25 02.69 * 23.02 m		37 55 06.33 122 25 03.62 * 4.93 m
G "1" 5640	Buoy	37 53 58.78 122 25 20.22	37 53 59.19 122 25 20.50		37 53 58.54 122 25 20.91

			14.37 m		18.41 m
R "2" 5645	Buoy	37 53 59.06 122 25 11.14	37 54 00.48 122 25 11.43 * 37.67 m		37 53 59.65 122 25 11.03 * 18.39 m

***DIFFERENCE BETWEEN CHART AND SURVEY POSITION.**

Q. STATISTICS

Table 6 shows statistical information of the survey conducted for this project.

TABLE 6. SURVEY STATISTICS

	H10960	H10961	H10962
DESCRIPTION	**QUANTITIES**	**QUANTITIES**	**QUANTITIES**
Days of Acquisition	32	11	25
Total Soundings (mainscheme)	670,971,886	97,048,274	519,160,301
Total Selected Soundings	12,206	3,739	12,911
Total Mainscheme (nm)	953.7	164.2	750.8
Total Crosslines (nm)	47.69	11.59	62.54
Total Mainscheme (no. of lines)	1069	259	625
Total Crosslines (no. of lines)	32	20	38
Total Detached Positions	5	10	0
Total Square Nautical Miles	8.71	2.29	8.37
Velocity Casts	151	30	129
Tide Stations Installed	0	0	0

R. MISCELLANEOUS

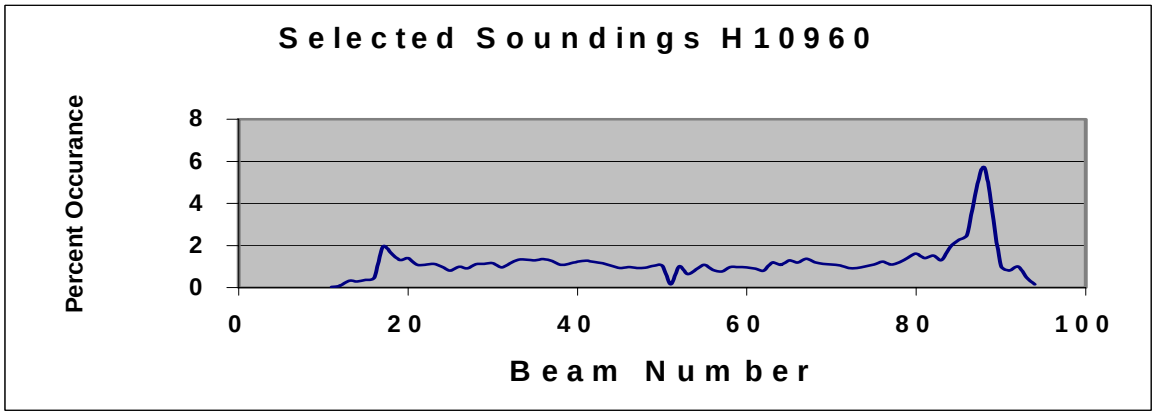
Selected Soundings

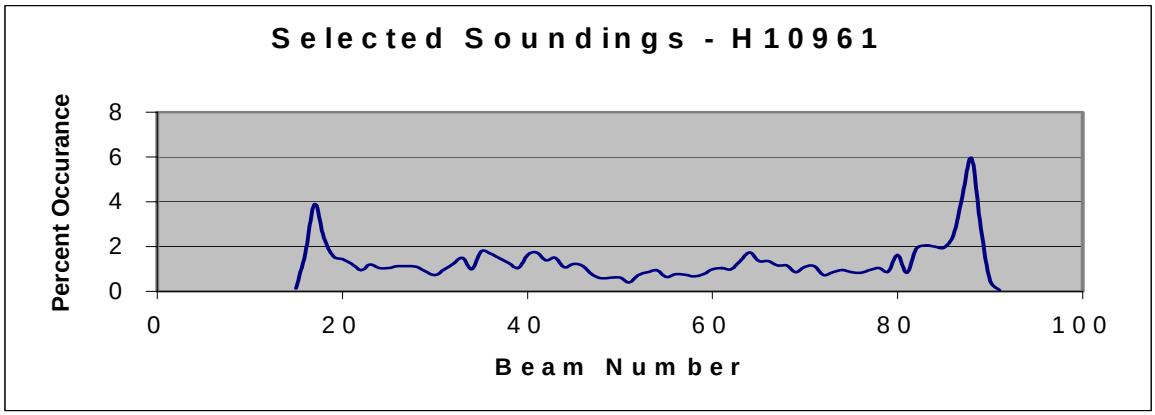
The majority of the beams used in the selected soundings was taken at +/- 54 degrees from nadir. Fewer than 1 percent of the soundings were selected out to 60 degrees from nadir to provide coverage in one area of ping dropouts and in areas of shallow water. All selected soundings exceeded Class I IHO standards above 97 percent.[90]

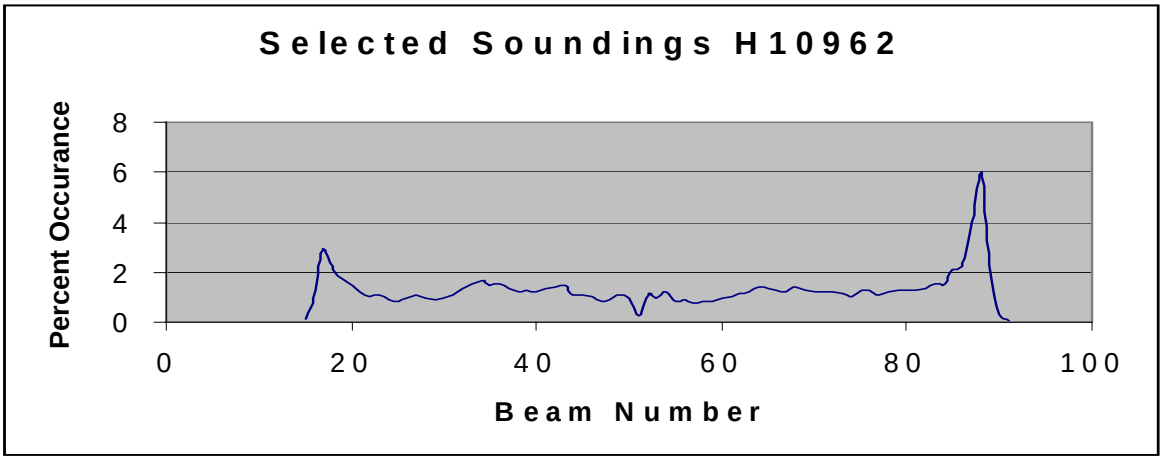
The entire survey had overlapping lines, in some cases as much as 40 percent, increasing the number of outer beams being grouped with more nadir beams during the binning process.

A histogram of all selected soundings was made and is plotted below. The graph represents the number of times each beam is used as a selected sounding. The selected sounding process was a shoal-biased selection, based on a 10-meter bin selection and exported through a Caris overplot

routine. This procedure examines the entire survey area and reduces the number of soundings to avoid text overwrites.







A high incidence of outer beams was selected in the sounding routine and investigated to determine if a systematic bias was introduced into the data. No single source was found. The selected data can be attributed to a number of factors; the primary reason is due to the nature of a multibeam system with outer beams having a lower incident angle. This may result in shoaler depths when comparing outer beams to near nadir beams.

No magnetic disturbances were observed.

S. RECOMMENDATIONS

Least depths were obtained over uncharted wrecks in the survey area within the multibeam sonar. It is possible that masts or other obstructions could be rising above these features, and it is recommended that dive investigations be performed to verify least depths.[91] The correspondence section includes an email sent on July 20, 2000 to Jeffrey Ferguson, of NOAA, regarding the wrecks, with hill shade images of the wrecks.[92]

Sand migration was indicated on the area around Alcatraz Island.[93] This area is very dynamic and shoaling may occur in a relatively short time. It is recommended that this area be surveyed on a regular basis to ensure safe navigation through San Francisco Bay.[94]

Islets around Red Rock are mischarted. It is recommended that a shoreline verification be conducted around Red Rock. Outer beams from the multibeam data could be used to analyze shoreline accuracy.[95]

T. REFERRAL TO REPORTS

None

APPENDICES

APPENDIX A DANGER TO NAVIGATION REPORTS
APPENDIX B LANDMARKS AND NON-FLOATING AIDS TO NAVIGATION LISTS[96]
APPENDIX C GEOGRAPHIC NAMES[97]
APPENDIX D TIDES AND WATER LEVELS
APPENDIX E CALIBRATION DATA[98]
APPENDIX F DGPS VERIFICATION DATA[99]
APPENDIX G DATA PROCESSING ROUTINE[100]
APPENDIX H DATA ACQUISITION AND PROCESSING SOFTWARE[101]
APPENDIX I SOUND VELOCITY PROFILE DATA[102]
APPENDIX J SUPPLEMENTAL CORRESPONDENCE[103]
APPENDIX K APPROVAL SHEET

SEPARATE DATA FOLLOWS APPENDICES[104]

APPENDIX A
DANGER TO NAVIGATION REPORTS

REPORT OF DANGER TO NAVIGATION

Hydrographic Survey Registry Number: H10961

Survey Title: State: CALIFORNIA
Locality: San Francisco Bay
Sublocality: South of Alcatraz and West of Treasure Island

Project Number: OPR-L316-KR-99

Survey Date: April 10, 2000 – August 13, 2000

Features are reduced to Mean Lower Water using verified tides and are positioned on NAD 83.

Charts affected:
18649 61st Edition/22 Jan 00, scale 1:40,000, NAD 83
18650 49th Edition/7 May 99, scale 1:20,000, NAD 83

DANGERS TO NAVIGATION

Shoal soundings were found on the west side of Treasure Island during survey operations. Significant soundings are listed below.

DEPTH (FT)	LATITUDE (N)	LONGITUDE (W)
31	37° 49' 54.660"	122° 23' 18.813"
44	37° 49' 45.110"	122° 23' 29.446"
37	37° 49' 41.777"	122° 23' 12.333"
52	37° 49' 34.106"	122° 23' 22.296"
36	37° 49' 33.983"	122° 22' 58.612"
48	37° 49' 28.786"	122° 23' 09.987"
48	37° 49' 18.893"	122° 22' 58.247"
42	37° 49' 13.933"	122° 22' 46.753"
40	37° 49' 05.083"	122° 22' 42.124"
37	37° 48' 58.810"	122° 22' 33.874"
50	37° 48' 50.050"	122° 22' 33.988"
48	37° 48' 46.420"	122° 22' 28.661"

Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch at (206) 562-6836.

REPORT OF DANGER TO NAVIGATION

Hydrographic Survey Registry Number: H10961

Survey Title: State: CALIFORNIA
Locality: San Francisco Bay
Sublocality: South of Alcatraz and West of Treasure Island

Project Number: OPR-L316-KR-99

Survey Date: April 10, 2000 – August 13, 2000

Features are reduced to Mean Lower Water using verified tides and are positioned on NAD 83.

Charts affected:	18649	61st Edition/22 Jan 00, scale 1:40,000, NAD 83
	18650	49th Edition/7 May 99, scale 1:20,000, NAD 83

DANGERS TO NAVIGATION

Shoal soundings were found in the Eastbound San Francisco Bay Traffic Lane during survey operations. The area southwest of Alcatraz Island, southeast of the charted Dumping Ground south of Alcatraz Island and south of Blossom Rock containing significant soundings are listed below.

DEPTH (FT)	LATITUDE (N)	LONZGITUDE (W)
43	37° 48' 49.931"	122° 24' 10.099"
48	37° 49' 28.297"	122° 25' 57.863"
57	37° 49' 07.994"	122° 25' 06.235"

Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch at (206) 562-6836.

Danger to Navigation Report

Hydrographic Survey Registry No.: H10961

State: California

General Locality: San Francisco Bay

Sublocality: South of Alcatraz and West of Treasure Island

Project Number: OPR-L304-KR-99

The following item was found during hydrographic survey operations:

Object discovered: Rock

Description: On day number 104 at 16:42:54.4 UTC, an obstruction was found to be 5.9 feet above the seafloor. A least depth was obtained from beam #85. Using smooth tides, a depth of 29.2 feet below MLLW was computer from multibeam data. The object has an approximate length of 6 feet and width of 4 feet. The charted depth in this area is 36 feet.

Afftected nautical charts:

Chart Number	Edition		Reported Depth	Charted Horiz. Datum	Geographic Position	
	No.	Date			Latitude	Longitude
18650	49	7-May-99	29 ft MLLW	NAD 83	37° 49' 11.279" N	122° 22' 37.295" W
18649	61	22-Jan-00				

David Evans and Associates, Inc.
Contract: 50-DGNC-9-90011 Task: 56-DGNC-0-29003

APPENDIX D
TIDES AND WATER LEVELS

Registry #H10961 (Sheet C) – Tides were observed from NOS Tidal Station #941-4290 at San Francisco, California.

Verified tides were applied to the data through Caris processing; verified tides were obtained from the NOAA website (www.co-ops.nos.noaa.gov). Predicted tides were not used.

Appendix D

Abstract of Times of Hydrography
For Smooth Tides or Water Levels

Project:	**OPR-L304-KR-99**	Registry No.:	**H10961**
Contractor Name:	**David Evans and Associates, Inc.**	Date:	**August 30, 2000**
Sheet Letter:	B		
Inclusive Dates:	**April 10, 2000 – Aug 13, 2000**		

Field work is complete.

Day	Time (UTC)		Year
	Start	End	
101	1547	2100	2000
102	1529	1907	2000
103	1531	1921	2000
104	1525	1907	2000
108	2040	2222	2000
109	1417	2233	2000
110	1554	2148	2000
111	1401	2154	2000
112	1357	2322	2000
141	1350	1547	2000
226	1505	1607	2000

RECRD	51154	VESSLTERMS	UNKNOWN	CHART	18649	AREA	L
		CARTOCODE	0100	SNDINGCODE		DEPTH	0

NATIVLAT	37/48/53.00	NATIVLON	122/24/39.00	Convert		NATIVDATUM	6
LAT83	37/48/52.74	LONG83	122/24/42.89	Update GP		GPQUALITY	Med
	37 48 52.74		122 24 42.89			GPSOURCE	Direct
LATDEC	37.81465	LONDEC	122.41191388889				

PROJECT	OPR-L430	ITEMSTATUS	Disproved	SEARCHTYPE	None
RADIUS	300	INIT	MCR	ASSIGNED	11/4/1992
TECNIQ	S2,MB,ES,BD,DI,SD				
Techniqnote	THIS ITEM MAY HAVE BEEN DISPROVED BY OPR-L304-KR, CONTRACT SURVEY, INQUIRE WITH PHB				

History

HISTORY
H9794/78--57-61FT DEPTHS EXIST IN VICINITY.
LNM42/85(10/17/85)--12TH CGD; DANG SUBM WK, PA, 26FT SAIL BOAT REPORTED SUNK APPROX 350YDS NORTH OF PIER 39, IN LAT 37-48.5N, LONG 122-24.4W IN 40 FT OF WATER.
LNM50/85(12/12/85)--12TH CGD; GP REVISED TO LAT 37-48-53N, LONG 122-24-39W, NOTICE STATED THAT VESSEL COULD NOT BE LOCATED.
NM2/86--DANG WK PA, IN LAT 37-48-53N, LONG 122-24-39W. (ENTERED 12/86 RWD)
H10456/93--WRECK NOT CONSIDERED DISPROVED WITH 150M RADIUS, 12M ES INVESTIGATION. REVISE PA TO ED. (UPDATED 1/95 RWD).
H11360/OO-OPR-L304-KR-00; WAS NOT FOUND DURING SURVEY OPERATIONS. A SMALL OBJECT RISING 1.6 FT OFF THE BOTTOM WAS FOUND. UPDATED 11/04 MCR
F00477/01--OPR-L430-NRB; THE ONLY CONTACT OBSERVED ON THE SONARGRAM WAS AN INDISTINCT FEATURE WHICH SUGGESTED DEBRIS (CONTACT 11658.0P) THIS CONTACT, EVEN THOUGH INSIGNIFICANT, WAS FULLY DEVELOPED WITH 5-TO-10-METER LINE SPACING; NO OBSTRUCTION WAS FOUND. DELETE CHARTED WRECK. UPDATED 11/03 MCR.

Fieldnote

Proprietary

YEARSUNK		NIMANUM		SYSTEMNUM	9762	Print Record

RECRD 51155 VESSLTERMS UNKNOWN CHART 18650 AREA L

CARTOCODE 0102 SNDINGCODE 711 DEPTH 23.7

NATIVLAT NATIVLON Convert NATIVDATUM 31

LAT83 37/49/00.73 LONG83 122/24/07.31 Update GP GPQUALITY High

37 49 0.73 122 24 7.31 GPSOURCE Direct

LATDEC 37.816869444445 LONDEC 122.40203055556

PROJECT OPR-L304 ITEMSTATUS Completed SEARCHTYPE Information

RADIUS 100 INIT RWD ASSIGNED 11/4/1992

TECNIQ S2,ES,BD,SD

Techniqnote

History

HISTORY
H9794/78--94-99FT DEPTHS EXIST IN VICINITY.
LNM45/86(11/5/86)--12TH CGD; DANG SUBM WK, PA, FLAT BARGE 100FT X 30FT SUNK ì□IN APPROX LAT 37-49-01.8N, LONG 122-24-06.0W. IN APPROX 50FT WATER, NEAR ì□BLOSSOM ROCK LIGHTED BELL BUOY. (ENTERED 12/86 RWD)
H10456/93-- BARGE (SUBM 23.7M AT MLLW), 5M ES INVESTIGATION ON ì□AN APPROX 41X98FT BARGE, POSITION GIVEN IN LAT 37-49-00.55N, LONG ì□122-24-07.92W. (UPDATED 1/95 RWD)
H10961/00--OPR-L304-KR-00: THIS WRECK WAS FOUND AT POSITION 37 49 00.738 N, 122 24 07.313 W WITH A LEAST DEPTH OF 81.0 FEET. THIS POSITION IS 16 METERS NORTHEAST OF THE REPORTED LOCATION IN THE AWOIS DATABASE. A DEPTH OF 77 FEET WAS INDICTED ON THE AWOIS LISTING, OBTAINED FROM A 1993 SURVEY WITH AN ECHOSOUNDER. IT IS RECOMMENDED THAT THE DEPTH BE REVISED TO 81 FEET. UPDATED 11/04 MCR

Fieldnote

Proprietary

YEARSUNK NIMANUM SYSTEMNUM 9763 Print Record

RECRD	51986	VESSLTERMS	UNKNOWN	CHART	18650	AREA	L
		CARTOCODE	0102	SNDINGCODE	711	DEPTH	23

NATIVLAT		NATIVLON		Convert		NATIVDATUM	31
LAT83	37 48 57.66	LONG83	122 22 56.70	Update GP		GPQUALITY	High
	37 48 57.66		122 22 56.7			GPSOURCE	Direct
LATDEC	37.816016666667	LONDEC	122.38241666667				

PROJECT	OPR-L304	ITEMSTATUS	Completed	SEARCHTYPE	Information
RADIUS	150	INIT	RWD	ASSIGNED	11/4/1992
TECNIQ	S2,ES,BD,DI,SD				

Techniqnote

History

CL579/61--OBSTR REPORTED 260DEG. 1100YDS FROM CUPOLA, TREASURE ì□ISLAND, NM20/61 ISSUED.
CL716/76--CAS; WK LOCATED BY ECHOSOUNDER AND WIRE SWEEP ì□INVESTIGATION. ECHOSOUNDER LEAST DEPTH OF 68.5FT AND A ì□LEADLINE/DIVER LEAST DEPTH OF 69.2FT BOTH REDUCED TO PREDICTED ì□TIDES WERE OBTAINED. THE WK, BELIEVED TO BE A METAL BARGE WITH NO ì□PROTRUDING MAST WAS POSITIONED IN LAT 37-48-59N, LONG ì□122-22-53W(NAD27).
H9794/78--70FT WK LOCATED IN LAT 37-48-58N, LONG ì□122-22-53W(NAD27). EVALUATOR RECOMMENDS CHART PRESENT SURVEY DATA.
CL82/92--USCG; "REMOVE THE WRECK CHARTED IN ANCHORAGE 7 IN POSITION ì□LAT 37-49.1N, LONG 122-22.9W(NAD83). ON DECEMBER 8, 1991, DIVERS ì□FROM US NAVY MOBILE DIVING SALVAGE UNIT ONE VERIFIED THE WRECK NO ì□LONGER EXISTS WITHIN A 100 METER RADIUS OF THE CHARTED POSITION." ì□CHARTING ACTION; REVISED TO ED. (ENTERED 11/92 RWD)
H10456/93--WK (SUBM 23.0M(75FT) AT MLLW), 12M ES INVESTIGATION ON AN ì□APPROX 30X75FT BARGE LIKE FEATURE, POSITION GIVEN IN LAT ì□37-48-58.13N, LONG 122/22/56.97W. ANOTHER WK LIKE FEATURE WITH A ì□LEAST DEPTH OF 23.7M WAS LOCATED ABOUT 30M NORTH. (UPDATED 1/95 ì□RWD)
H10961/00--OPR-L304-KR-00: WRECK WAS FOUND AT POSITION 37 48 57.663 N, 122 22 56.707 W WITH A LEAST DEPTH OF 69.4 FEET. THIS POSITION IS 15 METERS SOUTHEAST OF THE REPORTED LOCATION IN THE AWOIS DATABASE. THE DEPTH IN THE DATABASE WAS REPORTED AS 69.2 FEET IN 1976 AND 75 FEET IN 1993. IT IS RECOMMENDED THAT THE DEPTH OF THE WRECK BE REVISED TO 69 FEET. A SECOND WRECK, WHICH WAS ORIGINALLY DISCOVERED IN 1993, WAS LOCATED APPROXIMATELY 10 METERS WEST OF THE AWOIS ITEM. THE WRECK WAS FOUND AT POSITION 37 48 57.543 N, 122 22 57.743 W WITH A LEAST DEPTH OF 81.5 FEET. IT IS RECOMMENDED THAT THE SECOND WRECK BE ADDED TO THE AWOIS DATABASE. FOLLOWING IS A HILL SHADED MODEL OF MULTIBEAM DATA FROM THIS SURVEY, ILLUSTRATING THE ORIENTATION. ENTERED 11/04 MCR

Fieldnote

Proprietary

YEARSUNK		NIMANUM		SYSTEMNUM	10213	Print Record

[1] PHB Revision – This Descriptive Report contains information for three surveys. Revisions compiled during office processing and certification. The endnotes for this copy to the Descriptive Report pertain only to survey H10961. Surveys H10960 and H10962 will be submitted separately and discussed during office processing and approval.
[2] PHB Revision – The project number throughout this report should read OPR-L304-KR-00.
[3] PHB Revision – See endnote 1.
[4] PHB Revision – See endnote 1.
[5] PHB Revision – See endnote 1.
[6] PHB Revision – Concur.
[7] PHB Revision – See endnote 1.
[8] PHB Revision – Filed with the hydrographic records.
[9] PHB Revision – Concur.
[10] PHB Revision – See endnote 1.
[11] PHB Revision – Concur.
[12] PHB Revision – See endnote 1.
[13] PHB Revision – Concur.
[14] PHB Revision – See endnote 1.
[15] PHB Revision – See endnote 1.
[16] PHB Revision – Filed with the hydrographic records.
[17] PHB Revision – Filed with the hydrographic records.
[18] PHB Revision – Filed with the hydrographic records.
[19] PHB Revision – See endnote 1.
[20] PHB Revision – See endnote 1.
[21] PHB Revision - Concur
[22] PHB Revision – Concur, filed with the hydrographic records.
[23] PHB Revision – Filed with the hydrographic records.
[24] PHB Revision – Concur.
[25] PHB Revision – See endnote 1.
[26] PHB Revision – See endnote 1.
[27] PHB Revision – Filed with the hydrographic records.
[28] PHB Revision – Concur.
[29] PHB Revision – Concur.
[30] PHB Revision – Concur.
[31] PHB Revision – Filed with the hydrographic records.
[32] PHB Revision – Filed with the hydrographic records.
[33] PHB Revision – Concur
[34] PHB Revision – See endnote 1.
[35] PHB Revision – See endnote 1.
[36] PHB Revision – Filed with the hydrographic records.
[37] PHB Revision – See endnote 1.
[38] PHB Revision – See endnote 1.
[39] PHB Revision – See endnote 1.
[40] PHB Revision - Concur

[41] PHB Revision – See endnote 1.
[42] PHB Revision – A prior survey comparison was not completed by PHB. The survey area was fully ensonified using 100% multibeam. The survey is adequate to supercede all prior surveys within the common area.
[43] PHB Revision – Do not concur. H10961 generated three DTON Reports which were submitted to MCD. Copies of the DTON Reports are included in Appendix A of this report.
[44] PHB Revision – See endnote 1.
[45] PHB Revision – Do not concur. This item was disproved during survey F00477 (2001). See AWOIS Record 51154 attached to this report.
[46] PHB Revision – Concur. Chart 81' Wk.
[47] PHB Revision – Concur with clarification. Chart a 69' Wks at 37° 48' 57.7 N, 122° 22' 56.7" W.
[48] PHB Revision – See endnote 1.
[49] PHB Revision – See endnote 43.
[50] PHB Revision – See endnote 1.
[51] PHB Revision – See endnote 1.
[52] PHB Revision – See endnote 1.
[53] PHB Revision – See endnote 1.
[54] PHB Revision – See endnote 1.
[55] PHB Revision – See endnote 1.
[56] PHB Revision – See endnote 1.
[57] PHB Revision – Concur. Retain as charted. Source DTON Report for H10961.
[58] PHB Revision – Concur with clarification. Depth information reported in the danger to navigation letters may not have been portrayed on the Hdrawing based on final office processing.
[59] PHB Revision – See endnote 58.
[60] PHB Revision – See endnote 1.
[61] PHB Revision – Concur.
[62] PHB Revision – Concur with clarification. The most current chart edition reflects application of depths from survey of 2003. The evaluator recommends retaining the charted depths and notes.
[63] PHB Revision – Concur.
[64] PHB Revision – Eleven fixed and floating aids were positioned within the area of H10961. Chart all navigational aids within the survey area with the most current information.
[65] PHB Revision – See endnote 1.
[66] PHB Revision – Concur. See endnote 46.
[67] PHB Revision – See endnote 45.
[68] PHB Revision – Concur.
[69] PHB Revision – Concur.
[70] PHB Revision – Concur.
[71] PHB Revision – The continuous maintenance drawing for chart 18650, last revised 11/04/04 was used for chart comparisons during office processing. The area west of Treasure Island showed good agreement +/- 1 to 2 feet, between survey H10961 and the chart. The area south

of Alcatraz Island demonstrated a deepening trend with survey H10961 generally being 1 to 5 feet shoaler. Larger differences between survey H10961 and the chart were noted in the Alcatraz Shoal area, +/- 2 to 8 feet.

[72] PHB Revision – Concur. A copy of the DTON Report is included in Appendix A of this report.

[73] PHB Revision – Concur.

[74] PHB Revision – Do not concur. This is a series of submerged pilings (37° 49' 22.0" N, 122° 22' 37.0" W) at the limit of or outside of the survey area. Retain as charted.

[75] PHB Revision – Concur with clarification. The term "observed" should be positioned. The pier is located at 37° 49' 12.5" N, 122° 22' 31.0" W. Retain as charted.

[76] PHB Revision – Concur. See endnote 47.

[77] PHB Revision – See endnote 1.

[78] PHB Revision – Do not concur. Shoreline verification was not required. The area was not fully surveyed. Retain the islet as charted.

[79] PHB Revision – Concur. Survey H10961 is adequate to supersede all other surveys and the chart within the common area with the exception of the following: See endnote 62.

[80] PHB Revision – Retain charted bottom samples.

[81] PHB Revision – See endnote 1.

[82] PHB Revision – See endnote 1.

[83] PHB Revision – Concur.

[84] PHB Revision – Filed with the hydrographic records.

[85] PHB Revision – Attached to this report.

[86] PHB Revision – Concur.

[87] PHB Revision – See endnote 1.

[88] PHB Revision – See endnote 64.

[89] PHB Revision – See endnote 1.

[90] PHB Revision – Concur.

[91] PHB Revision – Do not concur. The COTR's review determined dive investigations were not necessary.

[92] PHB Revision – Correspondence is filed with the COTR's records.

[93] PHB Revision – Concur.

[94] PHB Revision – Do not concur. This area should be resurveyed at an interval appropriate to local conditions and available resources. See "National Survey Priorities" (2004).

[95] PHB Revision – See endnote 1.

[96] PHB Revision – Filed with the hydrographic records.

[97] PHB Revision – Filed with the hydrographic records.

[98] PHB Revision – Filed with the hydrographic records.

[99] PHB Revision – Filed with the hydrographic records.

[100] PHB Revision – Filed with the hydrographic records.

[101] PHB Revision – Filed with the hydrographic records.

[102] PHB Revision – Filed with the hydrographic records.

[103] PHB Revision – Filed with the hydrographic records.

[104] PHB Revision – Filed with the hydrographic records.

APPROVAL SHEET
H10961

Initial Approvals:

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

Gary C. Nelson Date: 17 Dec. 2004

Gary C. Nelson
Chief, Cartographic Team
Pacific Hydrographic Branch

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

, LCDR/NOAA Date: 17 DEC 2004

Donald W. Haines
LCDR, NOAA
Chief, Pacific Hydrographic Branch

Jennifer Sherry

Digitally signed by Jennifer Sherry
DN: CN = Jennifer Sherry, C = US, O = HSD, OU = Operations Branch
Reason: AWOIS/SURF check
Location: Operations Branch, HSD
Date: 2005.03.09 08:00:36 -05'00'

NOAA FORM 75-96
(10-83)

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

MARINE CHART BRANCH

RECORD OF APPLICATION TO CHARTS

FILE WITH DESCRIPTIVE REPORT OF SURVEY NO. H10961

INSTRUCTIONS

A basic hydrographic or topographic survey supersedes all information of like nature on the uncorrected chart.
1. Letter all information.
2. In "Remarks" column cross out words that do not apply.
3. Give reasons for deviations, if any, from recommendations made under "Comparison with Charts" in the Review.

CHART	DATE	CARTOGRAPHER	REMARKS
18650	1/5/04	NELSON/MIHALIOV	Full ~~Part Before~~ After Marine Center Approval Signed Via FULL APPLICATION
			Drawing No. OF SNDGS AND FEATURES FROM SMOOTH
			SHEET
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
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			Drawing No.

SUPERSEDES C&GS FORM 8352 WHICH MAY BE USED.