

H10896

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.            NA

Registry No.        H-10896

**LOCALITY**

State                California

General Locality    Suisun Bay

Sublocality        ~~Carquinez Strait to Suisun Bay~~

1999

**CHIEF OF PARTY**

J.L. Dasler

**LIBRARY & ARCHIVES**

DATE

JAN 29 2001

HYDROGRAPHIC TITLE SHEET

H-10896

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.

NA

State California  
 General locality Suisun Bay  
 Locality Carquinez Strait to Suisun Bay  
 Scale 1:10,000 Date of survey July 13-26, 1999  
 Instructions dated October 1, 1998 \* Project No. OPR-L304-KR-98  
 Vessel R/V Osprey, Zepher  
 Chief of party J.L. Dasler  
 Surveyed by David Evans and Associates, Inc.

Soundings taken by echo sounder, hand lead, pole Reson 8101 Multibeam Sonar, Odom Echotrak DF3200  
 (for Comparison only)

Graphic record scaled by NA

Digital ~~Graphic~~ record checked by David Evans and Associates, Inc.

Verification by: B.A. Olmstead, G.C. Nelson Automated plot by HP-6500

Evaluation by: B.A. Olmstead

Soundings in ~~XXXXXX~~ feet at ~~MLW~~ MLLW

REMARKS: All times are UTC, revisions and marginal notes in black were generated during office processing. All separates are filed in a separate binder which accompanied the survey. As a result page numbering may be interrupted or non-sequential. All depths listed in this report are referenced to mean lower low water unless otherwise noted.

Smoothsheet Parameters:

UTM (zone 10), Central Meridian 123/00/00 W Scaling Factor: 0.9996

\* Change #1 dated June 4, 1999

*AWOIS ✓ SURF ✓ by MBH on 1/9/01*



## Descriptive Report to Accompany Hydrographic Survey H-10896

Field Number OPR-L304-KR-98

Scale 1:10,000

July 1999

David Evans and Associates, Inc.

Project Manager Jon Dasler

### A. PROJECT ✓

The navigable area survey was conducted in accordance with Hydrographic Project instructions OPR-L304-KR-98, San Francisco and Suisun Bays, California, dated October 1, 1998, and Change No.1, dated June 4, 1999.

The area has been designated sheet "D" as specified in the Project Instructions Registry Number H-10896.

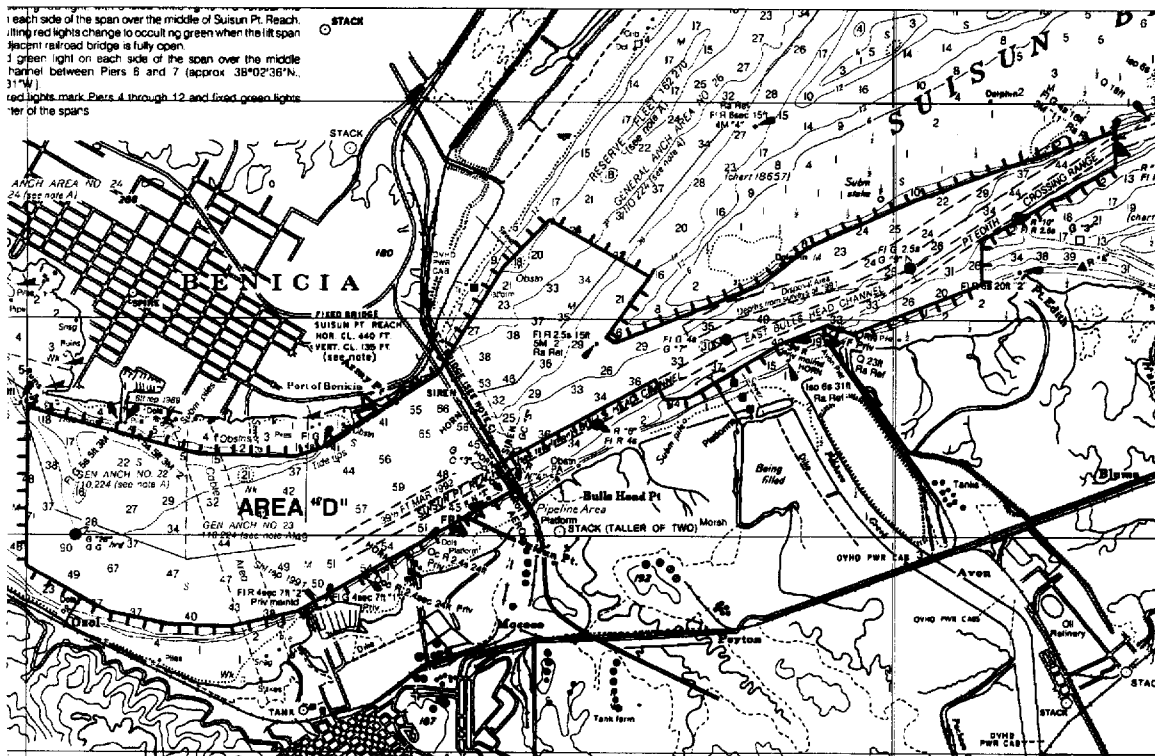
The purpose of the survey was to provide a hydrographic survey using multibeam sonar to update nautical charts, as requested by NOAA.

### B. AREA SURVEYED ✓ See Eval Rpt., Section B.

The area surveyed for H-10896 covers the navigable area of Suisun Bay, from Carquinez Strait to Suisun Bay, California. Hydrographic limits extend <sup>from Carquinez Strait Light "103"</sup> ~~from the buoy G-23~~ southwest of Benicia, California, eastward to the Reserve Fleet Anchorage Area of the northern portion of Suisun Bay, and to buoy R "12" at the end of East Bulls Head Channel. There were two\* sections in the survey in which sounding data was not collected. The first area is located south of buoy G"7, on the southern side of the East Bulls Head Channel. A pier structure extended into the survey area and no data was collected under the structure. The area behind the pier was surveyed to the sheet limits. The second area in which no data was collected was on the easternmost section of the sheet, where depths of less than 12 feet were recorded on both sides of the survey limits. Survey operations had extended to the survey limits as defined in the Statement of Work or to a depth of less than 18 feet, whichever occurred first.

The chartlet on the following page shows the approximate survey limits.

\* A third section not surveyed includes a portion of Bulls Head Channel north of Bulls Head Point.



STUDY AREA FOR SHEET D, SUISUN BAY, CALIFORNIA (NOAA CHART No. 18657, 16<sup>TH</sup> ED., JAN. 25, 1997)

Data acquisition was conducted from July 13, 1999 (Day Number 194) through July 26, 1999 (Day Number 207). *Concur*

**C. SURVEY VESSELS** ✓

For this project, two vessels were used to perform the requirements as specified in the statement of work.

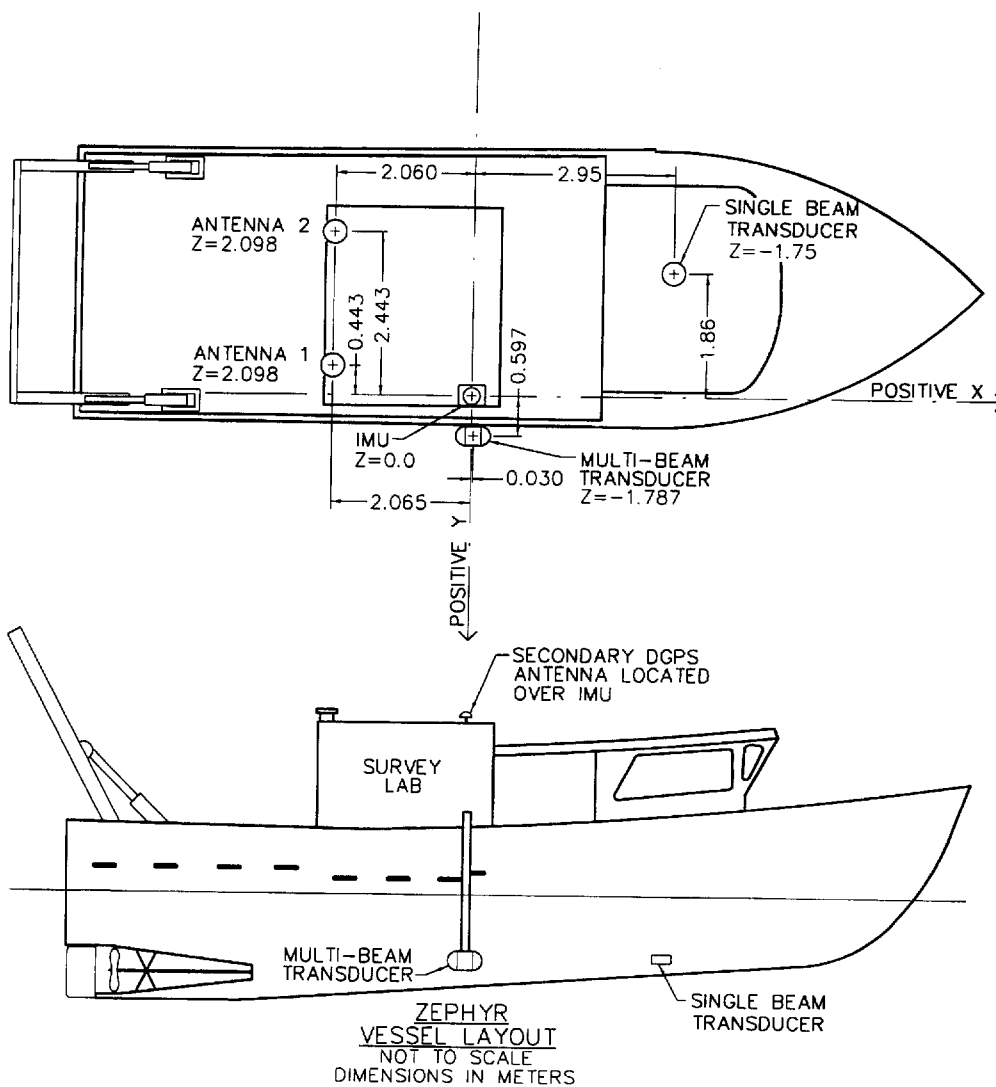
Vessel	Operation
R/V Osprey	Detached Positions
Zephyr	Multibeam data acquisition, sound velocity casts, DGPS position checks

The Osprey, registry #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 #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 an over-the-side mount designed

specifically for the vessel for the multibeam transducer and a data acquisition and processing lab for all survey work. No unusual sensor set-up configurations were required.

All sensor offsets was 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 below.



LAYOUT OF EQUIPMENT 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. Data was collected with predicted tides and calibration offsets applied real-time. Initial processing was performed aboard the Zephyr, while final processing and review was performed at the DEA office in Portland. A detailed description of the data acquisition and processing platform can be found in Appendix G.\*

\* Filed with the separates

During review of the data, an error of the heave lever arm was discovered. As heave was applied to the GSF data in real-time, a correction to the lever arm for remote heave was performed during post-processing. A routine written by Universal Systems Ltd., "Deacorrect.exe", was applied to every file to compute heave at the multibeam sonar head. The "Deacorrect.exe" program used original pitch and roll data to determine the DC component of heave to be added to each sonar ping. Applying this factor eliminated errors associated with an incorrect lever arm offset.



DATA ACQUISITION LAB ABOARD THE ZEPHYR

#### E. SONAR EQUIPMENT ✓

No sidescan operations were required for this project. *Concur*

#### F. SOUNDING EQUIPMENT ✓

A Reson 8101 multibeam sonar was used for the entire survey. The 8101 series, serial number 17024, 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 is used for coverage and sounding selection.

The Reson sonar head was installed on the Zephyr on June 29, 1999 (DN 180) alongside the Embarcadero Cove Marina in Alameda, California. The original installation of the sonar head and processor, motion sensor, and all ancillary sensors had been done on June 1-3, 1999 (DN 152-154) in Portland, Oregon, for initial testing and system check-out. The sonar head was removed for the transit to California and reinstalled just prior to the start of the survey. Once installation was complete, the vessel underwent system calibration and tests, including settlement and squat, alignment, and static vessel measurements.

During data collection, the Reson sonar range scale was adjusted to obtain the best coverage in different depths of water. In general, this range was kept at four to six times the water depth. Sheet D had water depths from 5 feet (1.5 meters) to ~~97~~<sup>98.2</sup> feet (29.5 meters), resulting in a sonar range of 25 to 150 meters. 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 10 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 and 5 Hz at the 150-meter range scale. Using the criteria as specified in the 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 be certain 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- and 150-meter range scale, the bottom coverage averaged 6.4-beam and 4.3-beam footprints every three meters.

Line planing for Sheet D had a general east to west direction, minimizing turns and surveying approximately with depth contours. Three general areas were planned; a) west of the Benicia-Martinez Highway bridge, b) northern section of Suisun Bay, and c) Bulls Head Channel. Line spacing was determined to ensure complete coverage based on the criteria of 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 30 meters. The survey lines were run based upon obtaining depths to 18 feet or the sheet limits. Depths less than 18 feet were obtained from the off nadir beams of a planned survey line in 18 feet of water.

The ISS-2000 provided 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 sonar 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 sonar, 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.\*In general, a difference of less than 10 centimeters was observed daily.

\* Filed with the Separates

## G. CORRECTIONS TO SOUNDINGS ✓

### Tide and Water levels ✓

In accordance with Attachment #7, dated October 1, 1998 of the Project Instructions, the existing primary tide station at Port Chicago, CA (941-5144) was used for the survey.

Station Number	Station Name	Latitude	Longitude
941-5144	Port Chicago, CA	37° 03.4' N	122° 02.3' W

Three tide zones were established on Sheet D as specified by section 1.2.1 of the project instructions.

Tidal Zone	Time Corrector	Height Corrector Ratio
SF 63	-42 min	1.11
SF 64	-24 min	1.06
SF 65	0 min	1.00

The real-time unverified tide data from this gauge was downloaded from the Ocean and Lake Levels Division of the NOS web page and used during initial processing of the data with the ISS-2000 Geoswath data cleaning. When verified data was available, the data was downloaded and applied for final processing and production of smooth sheets. Using zone information from the SOW, Caris had calculated the tidal correctors to be applied in the data.

The Port Chicago tide station experienced no down time during periods of hydrographic survey. All data was successfully retrieved and is included on tape 1 with the processed data. *Concur*

### Velocity of Sound ✓

Corrections for the speed of sound through the water column were computed from the data obtained with a Seabird 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 fieldwork. Factory calibration results are included in Appendix E.\*

\* Filed with the separates

The downcast data was retrieved using the Seabird Term19 program and data was processed using the Seabird Datenv program. The velocity tables were then loaded into the Reson 6042 software to be applied during data acquisition. Casts were taken frequently throughout the day, generally within 2 hours of the previous cast. Each cast was graphically displayed in the acquisition software and compared to the previous one to verify that there was no significant



change in the water column. Throughout the survey, no change of greater than 2 m/s was seen between casts. A closing cast was taken at the end of each day to verify the sound velocity had not changed by more than two meters/second.

A total of 47 casts were taken, recording 94 sound velocity profiles. Casts were 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 5% in any event. Below is the list of 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).

### Sound Velocity Casts ✓

Day	Cast File Number	Start Cast	Depth Meters	Applied Cast	North Latitude	West Longitude
194	99194_1P1S	2041	25	1P	38 01 54	122 09 40
194	99194_2P,2S	2245	17	2P	38 02 44	122 07 23
195	99195_1P,1S	0012	19	N/A	38 02 16	122 07 54
195	99195_2P,2S	1536	20	2P	38 01 56	122 09 47
195	99195_3P,3S	1759	21	3P	38 02 07	122 10 00
195	99195_4P,4S	2006	18	4P	38 02 03	122 08 12
195	99195_5P,5S	2206	19	5P	38 02 10	122 07 55
196	99196_1P,1S	0004	16	1P	38 01 52	122 08 45
196	99196_2P,2S	0053	16	N/A	38 01 57	122 08 44
196	99196_3P,3S	1640	26	3P	38 01 57	122 09 01
196	99196_4P,4S	2004	28	4P	38 01 59	122 09 01
196	99196_5P,5S	2221	22	5P	38 02 23	122 10 10
197	99197_1P,1S	0102	17	N/A	38 02 10	122 09 49
197	99197_2P,2S	1430	27	2P	38 01 52	122 09 35
197	99197_3P,3S	1710	29	3P	38 01 53	122 09 39
197	99197_4P,4S	2046	28	4P	38 01 57	122 09 48
197	99197_5P,5S	2333	27	5P	38 01 56	122 09 48
198	99198_1P,1S	0416	16	N/A	38 02 04	122 08 12
198	99198_2P,2S	1516	29	2P	38 01 52	122 09 37
198	99198_3P,3S	1818	24	3P	38 02 35	122 07 03
198	99198_4P,4S	2116	28	4P	38 01 52	122 09 38
198	99198_5P,5S	2314	19	5P	38 02 24	122 07 39
199	99199_1P,1S	0042	18	N/A	38 02 14	122 08 01
199	99199_2P,2S	1621	24	2P	38 02 34	122 07 37
199	99199_3P,3S	1830	24	3P	38 02 34	122 07 36
199	99199_4P,4S	2135	24	4P	38 01 53	122 09 41
200	99200_1P,1S	0010	21	N/A	38 02 34	122 07 38
201	22201_1P,1S	1637	24	1P	38 02 34	122 07 37
201	99201_2P,2S	1918	24	2P	38 02 25	122 07 18
201	99201_3P,3S	2238	24	3P	38 02 33	122 07 38

Day	Cast File Number	Start Cast	Depth Meters	Applied Cast	North Latitude	West Longitude
202	99202_1P,1S	0208	24	N/A	38 02 34	122 07 37
202	99202_2P,2S	1450	22	2P	38 02 35	122 07 34
202	99202_3P,3S	1751	25	3P	38 02 35	122 07 34
202	99202_4P,4S	2057	18	4P	38 03 40	122 04 06
202	99202_5P,5S	2342	18	5P	38 03 37	122 07 03
203	99203_1P,1S	0208	24	N/A	38 02 35	122 07 34
203	99203_2P,2S	1504	23	2P	38 02 34	122 07 37
203	99203_3P,3S	1738	23	3P	38 02 34	122 07 35
203	99203_4P,4S	1952	24	4P	38 02 35	122 07 33
203	99203_5P,5S	2306	24	5P	38 02 35	122 07 35
204	99204_1P,1S	0130	26	N/A	38 02 34	122 07 36
206	99206_1P,1S	1617	19	1P	38 03 29	122 04 30
206	99206_2P,2S	1830	22	2P	38 02 32	122 07 36
206	99206_3P,3S	2039	26	3P	38 01 58	122 09 46
206	99206_4P,4S	2234	26	4S	38 02 35	122 07 35
207	99207_1P,1S	0034	25	1P	38 02 34	122 07 35
207	99207_2P,2S	0142	25	N/A	38 02 35	122 07 35

### Static Draft ✓

With the vessel out of the water, markings were placed on the aft quarters and the forward section of the hull providing measurements for vessel draft. These measurements were recorded daily 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 M/V 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 0.97 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 along side 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 0.65 to 0.67 meters throughout the survey.

## Dynamic Draft ✓

Settlement and squat measurements for the Zephyr were taken on June 29, 1999 (DN180) in the Alameda ship channel. Data from these measurements are included in Appendix E.\* These values were obtained by visually recording the vessel height at different ship RPM's during transects along a pier. 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 10 readings at the designated speed and then a 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.



MULTIBEAM MOUNT WITH DRAFT MARKS

Ship speeds in increments of 100-200 RPM's were observed from 650 to 1600 RPM's. Results from the settlement and squat tests can be found in Appendix E.\* These data from the settlement and squat tests were applied to the sonar data during acquisition in the ISS-2000 software. Changes in ship RPM were entered during acquisition to reflect new values for settlement and squat correctors. The average ship speed throughout the survey was 1300 RPM's, with a vessel settlement and squat correction of 7.8 cm.

\* Filed with the separates  
**Heave, Roll and Pitch corrections ✓**

A TSS POS M/V320 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 of an inertial motion unit (IMU), dual GPS antennas, and a data processor. The Reson 6042-software program recorded the ship heave, roll and pitch data at 25Hz through an Ethernet connection. A ComputerBoards, Inc. CIO-INT32 card installed in the 6042 hardware configuration was used to provide a one-millisecond clock for time stamping data.

The TSS POS M/V320 is a six-degree of freedom motion unit, with a stated accuracy's of 0.05m or 5% 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 accuracy's 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.

**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 was 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. These tests were conducted on July 2-3, 1999 (DN 182-183) on an area in Hydrographic Survey area Registry No. H-10895 in San Francisco Bay.

Roll alignment had been determined by running reciprocal lines 500-1000 meters long over a flat bottom, in the deepest part of the survey area. Pitch and latency errors were determined by running reciprocal lines 500-1000 meters in length, over a smooth slope perpendicular to the depth curves. The heading error was determined by running reciprocal lines, made on each side of a submerged feature, in shallow water. Lines had been run at 1000 RPM's to allow for cross track coverage and overlap.

To measure the alignment error in pitch, a selected pair of pitch lines were analyzed with the ISS-2000 software through a series of incremental changes in pitch angle over a specified range and differences computed. Similarly, yaw, roll and latency patch tests had been processed and corrections for each computed.

Two sets of lines were run and analyzed for pitch, latency, roll and heading. This duplication allowed for a complete analysis and to be certain that the bias obtained are correct.

The follow bias were determined from the Patch Test using SAIC software.

Alignment	Bias
Roll	1.09 ✓
Pitch	0.0 ✓
Yaw	0.0 ✓
Latency	0.0 ✓

To ensure no systematic errors were obtained, the entire data set was processed and analyzed with the Caris Patch Test routine for an independent check of the biases. Slight differences were seen and verified on multiple lines, including a line with a known feature. These additional biases listed in the table below were applied to the entire data set. Data from the GSF files that

had been converted to Caris for processing have the original bias applied. Thus any new corrector found is computed as an additional component and only that portion would be included in the Vessel Configuration file.

Alignment	SAIC Bias	Caris Bias	Total Vessel Bias
Roll	1.09	0.1	1.19 ✓
Pitch	0.0	-1.5	-1.5 ✓
Yaw	0.0	0.0	0.0 ✓
Latency	0.0	0.0	0.0 ✓

### Lead line Comparison ✓

Lead line checks were performed against the multibeam and single beam echosounders at the start and end of each day while the ship was tide up along side its berth in the marina. Lead line readings were taken on the port and starboard side directly abeam of 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 ISS software. Leadline data on the starboard side was compared to the Reson Nadir beam, while the data recorded on the port side was checked again the off-nadir beam at -3.9 m

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

Differences of less than 10 cm were seen throughout the survey. Lead line logs are attached in Appendix E. \*

\* Filed with the separates

### 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 *Concur* to MicroStation.

#### Positioning Equipment ✓

The primary positioning system for the survey was a TSS POS MV-320 integrated DGPS inertial reference system. For quality control, position data from a secondary positioning system was simultaneously acquired. The secondary system consisted of a Trimble 4000SE GPS receiver with differential capabilities. The ISS-2000 software, GPSmon, displayed in real-time the error between the two positioning systems. In general, differences of less than one



meter were seen throughout the survey. Differential corrections for both systems were provided by a Trimble ProBeacon receiver acquiring corrections from the U.S. Coast Guard beacons located at Point Blunt or at Pigeon Point.

The inertial component of POS/MV ensures continuity of all data during GPS dropouts, enabling continued operation in high multipath environments and around significant obstructions. After power-up the Inertial Measurement Unit (IMU) becomes the primary source of navigation data.

**Position Control** ✓

Differential GPS provided hydrographic control throughout the survey. The following beacons were used during hydrographic operations:

Reference Station	Frequency (kHz)	Surveying days
Point Blunt (station ID 268)	310	194-207

**DGPS Performance Checks** ✓

A DGPS performance check point was established at the Benicia Marina with a Leica MX412 roving DGPS receiver. A nail was set in the dock at slip 184, pier E, Benicia Marina, Benicia, California. The point was referenced as "Berth E184\_pt1". After a confidence check was observed on NGS control station "Army Point 3 1988", two DGPS positions were observed on "Berth E184\_pt1". The average of the two positions was used.

Station	Latitude	Longitude
Army Point 3	38 03 01.7475 N	122 07 48.9036 W
Berth E184_pt1	38 02 41.451 N	122 09 23.301 W

 ✓

Daily position confidence checks were conducted at this point by placing the Trimble DGPS antenna over the point and comparing the position obtained from the initial established position. The antenna was then moved to a point on the vessel directly above the IMU position and comparing the Trimble position with the position derived from the TSS POS MV system. Position differences of one meter or less were recorded throughout the survey. A complete log of daily position checks and detached position records are included in Appendix E. \*

\* Filed with the Separates

**I. SHORELINE** See Eval Rpt., section I

Not Applicable. Shoreline verification was not required. *Concur*

**J. CROSSLINES** ✓

A total of 18.55 nautical miles of crosslines, or 5% were run in the survey area. In general, the crosslines were in good agreement with the main scheme data. The statistical analysis of the data set was performed using the Universal Systems Limited (USL) makehist routine, version dated 12/10/98. A quality control report was created, listing statistics by beam number, and is attached in Appendix E. \*

\* Filed with the separates

Two areas, representing 10.8 percent of the survey area were included in the analysis. The two areas are on distinct sections of the survey area, with depths ranging from 18 feet to 54 feet, and is representative of the survey area. A 0.5-meter sort of all crosslines was compared to a 2-meter gridded DTM based upon a 0.5-meter sort of the section of mainscheme data.

The Mean difference of the data set ranged from 5 cm at the near nadir beams to 12 cm at the outermost beams of the port side. The majority of the differences was less than 7 centimeters. All beams fell within 98 percent at the 5 decimeter level. Except for a few beams near nadir and on the outer edge, all beams showed greater than 90 percent agreement at the 3 decimeter level.

Overall, the good agreement of the crosslines, taken on separate days from the mainscheme, show no systematic errors of the multibeam acquisition or processing routines. Slight differences can be attributed to migrating sand waves during the survey. Concur

**K. JUNCTIONS** ✓

Junctions were not required. Concur

**L. COMPARISON WITH PRIOR SURVEYS** See Eval Rpt., Section L.

Comparison with prior surveys was not required under this contract. See section N for comparison to the nautical charts.

**M. ITEM INVESTIGATION REPORTS** ✓ See Eval Rpt., Section N

No AWOIS items were assigned for the survey area. Two features that were found initiated a Danger to Navigation letter and reported to the Pacific Hydrographic Section, Seattle, WA. A summary of these items is below, and letters sent to PHS are attached in Appendix A. \*\*

\*\* Letters included in this report.

One feature located on the southern end of the sheet outside the entrance to the Martinez marina is a possible cargo container lying on the seafloor. The size and shape found both on sidescan and on the graphical display of the multibeam data indicated a rectangular shape object. The item rose 10.5 feet above the seafloor and is approximately 60 feet long. Two charts, 18656 and 18657, are affected by this item and it is recommended that the charts indicate this obstruction. The obstruction should be charted at latitude 38 01 41.84 N, longitude 122 08 28.82 W, with a depth of 33 feet. Concur Chart 33 Obstrn

A second feature was found on the north east section of the survey area, east of the Benicia bridge. The item rose 7.5 feet above the seafloor, and had a minimum depth of 37 feet. Two charts, 18656 and 18657 are affected by this item, and it is recommended that the charts indicate this obstruction. The obstruction should be charted at latitude 38 02 49.63' N, longitude 122 07 19.38 W with a depth of 37 feet. *Concur Chart 37 Obstr*

*One*  
On AWOIS item 51227, a 26-foot fiberglass sailboat was located in the survey area but required no further investigation in addition to the basic coverage as required in the Statement of Work. The wreck was found using the multibeam sonar and was observed on two adjacent survey lines. The least depth determined from the multibeam sonar was 25.4 feet and located within 8 meters of the stated position of the AWOIS listing. The wreck was previously surveyed by diver investigation in 1988 and had a least depth of 21.5 feet. The depth differences may be attributed to the high currents in the area that may have turned the wreck downward or caused the wreck to subside into the seabed. However, it is not recommended to use the new depth for charting until further investigation is performed. *Retain Charted 21 WK From H-10283 (1988). Concur*

**N. COMPARISON WITH THE CHART** *See Eval Rpt., Section N.*

Two published charts are within the survey area. From the selected sounding plot, comparisons were made to the depths on each of the charts.

Chart	Scale	Edition	Date
18657*	1:10,000	16	January 25, 1997
18658 *	1:10,000	28	September 20, 1997

*\* 17th and 29th used during PHB office processing*

In general, soundings were in agreement with the charts in the area, with the majority of soundings within 1 to 2 feet of the charted depths. Areas that have shown the greatest change are found in the central and southern side of the river, possibly *as described below* due to the nature of the river and currents. Depth differences of 10 feet deeper were found just west of the Benicia bridge, most likely a result of scour. Depth differences of five feet were found by *lighted* buoy G "25" at the western limit of the sheet. Little change was noted on the northern corridor of the Suisun River leading up to the Reserve Fleet Anchorage area, with 0 to 1 foot differences noted throughout the area. Some sections of the sheet experienced shoaling, with depths three to *fourteen* feet different than those reported on the chart. This was most significant at the northwestern section of the survey area and also on the north side of the East Bulls Head Channel by buoy G "9".

**O. ADEQUACY OF SURVEY** *See Eval Rpt., Section O.*

The survey is complete and should supercede all prior surveys. Multibeam sonar used on the survey allowed for completed bottom coverage, identifying all features and possible obstructions. *Do not concur*



**P. AIDS TO NAVIGATION** *See Eval Rpt. Section P.*

There are ~~ten~~<sup>eight</sup> navigational buoys and ~~five private~~<sup>seven fixed</sup> navigational aids within the survey limits. The positions of all buoys, except for R "4", were obtained by locating the buoy blocks with the multibeam data. Both the buoy blocks and the anchor chains were observed while surveying lines adjacent to the navigational aids. Buoy R "4" and all fixed aids were positioned using differential GPS. The positions of the buoys were compared to both the charted positions and to the position listed in the Light List (Volume 6, 1999), and the differences between the surveyed position and charted position are noted below.\* Each buoy properly served its function and was operating correctly. \* *See following page*

*Concur*

Aids to Navigation ✓

Name	Type	Surveyed Position	Charted Position	Position Difference (m)
G "25"	Buoy (lighted)	38 01.9690 ✓ 122 09.7013	38 01.9862 122 09.6938	34
R "2"	Nun buoy	38 02.2452 ✓ 122 07.3067	38 02.2400 122 07.3159	17
G "3"	Can Buoy	38 02.3137 ✓ 122 07.3588	38 02.3032 122 07.3676	23
G "5"	Can Buoy	38 02.3738 ✓ 122 07.2020	38 02.3603 122 07.2064	26
G "7"	Buoy (lighted)	38 02.8975 ✓ 122 05.9708	38 02.8988 122 05.9699	3
G "9"	Buoy (lighted)	38 03.2283 ✓ 122 04.9242	32 03.2334 122 04.9100	28
R "10"	Buoy (lighted)	38 03.4690 ✓ 122 04.0300	38 03.4716 122 04.2873	19
R "4"	Nun Buoy	38 02.3164 ✓ 122 07.1672	38 02.3138 122 07.1718	8
G "11" *	Day marker (Pile)	38 03.8541 ✓ 122 03.7401	38 03.8459 122 03.7399	15
R "2" **	Day marker (Pile)	38 02.8785 ✓ 122 06.7132	38 02.8756 122 06.7139	5
3 FR Priv ***	Day marker	38 02.8917 ✓ 122 05.6215	38 02.8878 122 05.6233	7
Horn F Priv ***	Day marker	38 02.9622 ✓ 122 05.3910	38 02.9525 122 05.4048	27
24 ft. Priv ****	Day marker (Dol)	38 01.9723 ✓ 122 07.7212	38 01.9741 122 07.7229	4
FR Priv ©	Day marker (Dol)	38 02.0785 ✓ 122 07.5114	38 02.0731 122 07.5143	11
FR Priv ©	Day marker (Dol)	38 02.1612 ✓ 122 07.3353	38 02.1553 122 07.3376	11

\* Suisun Bay Channel Light "11"  
 \*\* Suisun Bay North Channel Light "2"  
 \*\*\* Avon Wharf East and West Lights  
 \*\*\*\* Shell Oil Wharf East End Light  
 © Amoco Wharf East/West Lights

**Q. STATISTICS ✓**

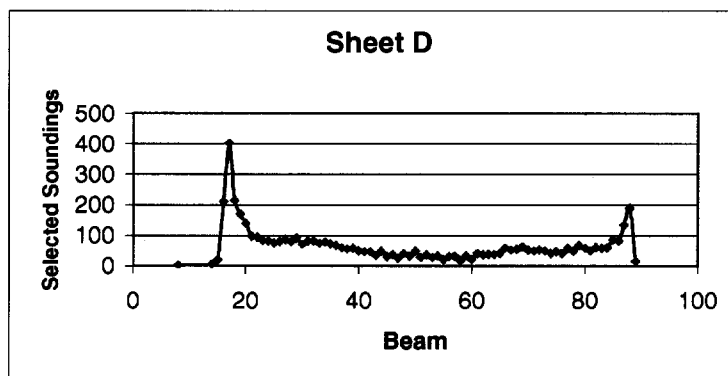
Description	Quantities
Days of Acquisition	13
Total Soundings	185,269,653
Total Soundings in 2m Sort	2,594,820
Total Selected Soundings	4933
Total Mainscheme (nm)	369.02
Total Crosslines (nm)	18.55
Total Mainscheme (no. of lines )	414
Total Crosslines ( no. of lines )	34
Total Detached Positions	9
Total Square Nautical Miles	3.0
Velocity Casts	<del>9447</del>
Tide Stations Installed	0

**R. MISCELLANEOUS ✓**

**Selected Soundings ✓**

A histogram of all selected soundings was made and is plotted below. The graph represents the number of times each beam was 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 examined the entire survey area and reduced the number of soundings to avoid text overwrites. A total of 4933 points were selected.

A high incidence of outer beams was observed in the sounding routine. This was investigated to determine if a systematic bias had been introduced into the data. No single source was found. It was concluded that the high selection of outer-beam data could be attributed to a number of factors. The primary is that, by its structure, a multibeam system will result in outer beams with lower incident angles. This may result in shoaler depths when comparing outer beams to the near nadir beams. All the beams used in the survey and analysis were taken at a dynamic 54 degrees from nadir and have exceeded Class I IHO depth standards. Additionally, the entire survey had overlapping lines, in some cases as much as 40 percent, which increased the number of outer beams being grouped with more nadir beams during the binning process. The drop off in selection of outer beams can be attributed to periodic rejection of these beams based on exceeding the dynamic 54-degree swath limit.



HISTOGRAM OF SELECTED SOUNDINGS

No magnetic disturbances were observed.

**S. RECOMMENDATIONS** ✓

It is recommended that further investigation of the AWOIS item 51227 be performed to confirm charted least depth. *Concur*

**T. REFERRAL TO REPORTS** ✓

None



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL OCEAN SERVICE  
OFFICE OF COAST SURVEY  
Pacific Hydrographic Branch  
Seattle, Washington 98115-0070

July 20, 1999

Commander(OAN)  
Eleventh U.S. Coast Guard District  
Coast Guard Island  
Building 50-6  
Alameda, CA 94501-5100

Dear Sir:

While conducting hydrographic survey operations in Carquinez Strait, California a potential danger to navigation was discovered which affects the following chart:

<u>Chart</u>	<u>Edition/Date</u>
18657	16th / Jan. 25, 1997

It is recommended that the enclosed Report of Dangers to Navigation be published in the Local Notice to Mariners.

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

Sincerely,

James C. Gardner  
Commander, NOAA  
Chief, Pacific Hydrographic Branch

Enclosures

cc: NIMA  
N/CS261



REPORT OF DANGER TO NAVIGATION

Hydrographic Survey Registry Number: H-10896

Survey Title:           State:           California  
                          Locality:       San Francisco Bay  
                          Sublocality:   Carquinez Strait

Project Number:   OPR-L304-KR-98

Survey Date:       July 16, 1999

Information is reduced to Mean Lower Low Water using predicted tides and positioned on NAD 83.

Chart Affected:   18657, 16<sup>th</sup> Edition, Jan. 25, 1997, Scale 1:10,000

<u>DANGER TO NAVIGATION</u>	<u>LATITUDE(N)</u>	<u>LONGITUDE(W)</u>
Submerged Obstruction, covered 9.2 meters	38/01/41.8	122/08/28.8

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

# CHART 18657

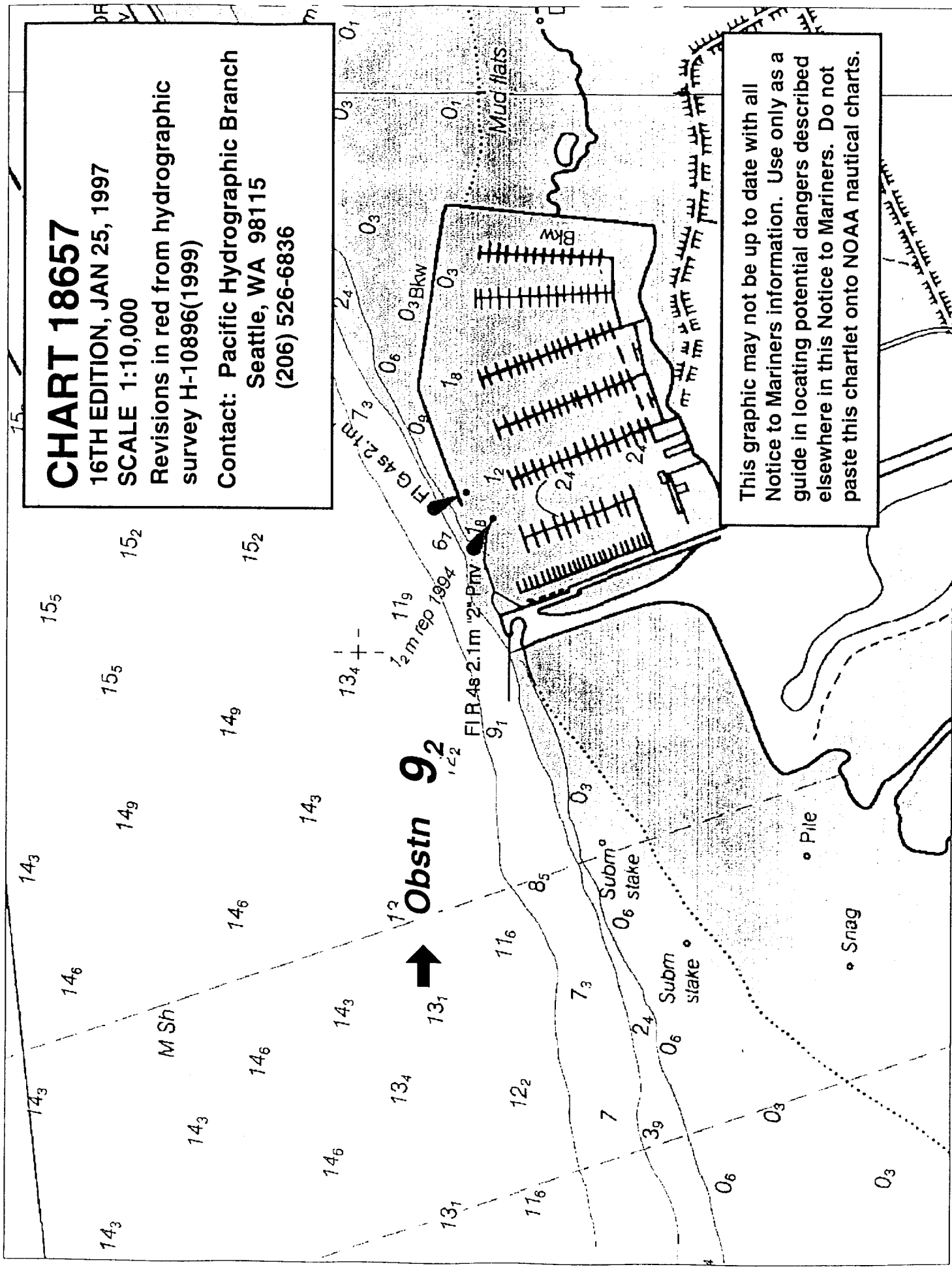
16TH EDITION, JAN 25, 1997

SCALE 1:10,000

Revisions in red from hydrographic survey H-10896(1999)

Contact: Pacific Hydrographic Branch  
 Seattle, WA 98115  
 (206) 526-6836

This graphic may not be up to date with all Notice to Mariners information. Use only as a guide in locating potential dangers described elsewhere in this Notice to Mariners. Do not paste this chartlet onto NOAA nautical charts.





UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL OCEAN SERVICE  
OFFICE OF COAST SURVEY  
Pacific Hydrographic Branch  
Seattle, Washington 98115-0070

July 26, 1999

Commander(OAN)  
Eleventh U.S. Coast Guard District  
Coast Guard Island  
Building 50-6  
Alameda, CA 94501-5100

Dear Sir:

While conducting hydrographic survey H-10896 in Suisun Bay, California a potential danger to navigation was discovered which affects the following charts:

<u>Chart</u>	<u>Edition/Date</u>
18656	50 <sup>th</sup> Edition/Aug. 8, 1992
18657	16 <sup>th</sup> Edition/Jan. 25, 1997

It is recommended that the enclosed Report of Dangers to Navigation be published in the Local Notice to Mariners.

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

Sincerely,

James C. Gardner  
Commander, NOAA  
Chief, Pacific Hydrographic Branch

Enclosures

cc: NIMA  
N/CS261





REPORT OF DANGER TO NAVIGATION

Hydrographic Survey Registry Number: H-10896

Survey Title:       State:       California  
                          Locality:   San Francisco  
                          Sublocality: Suisun Bay

Project Number: OPR-L304-KR-98

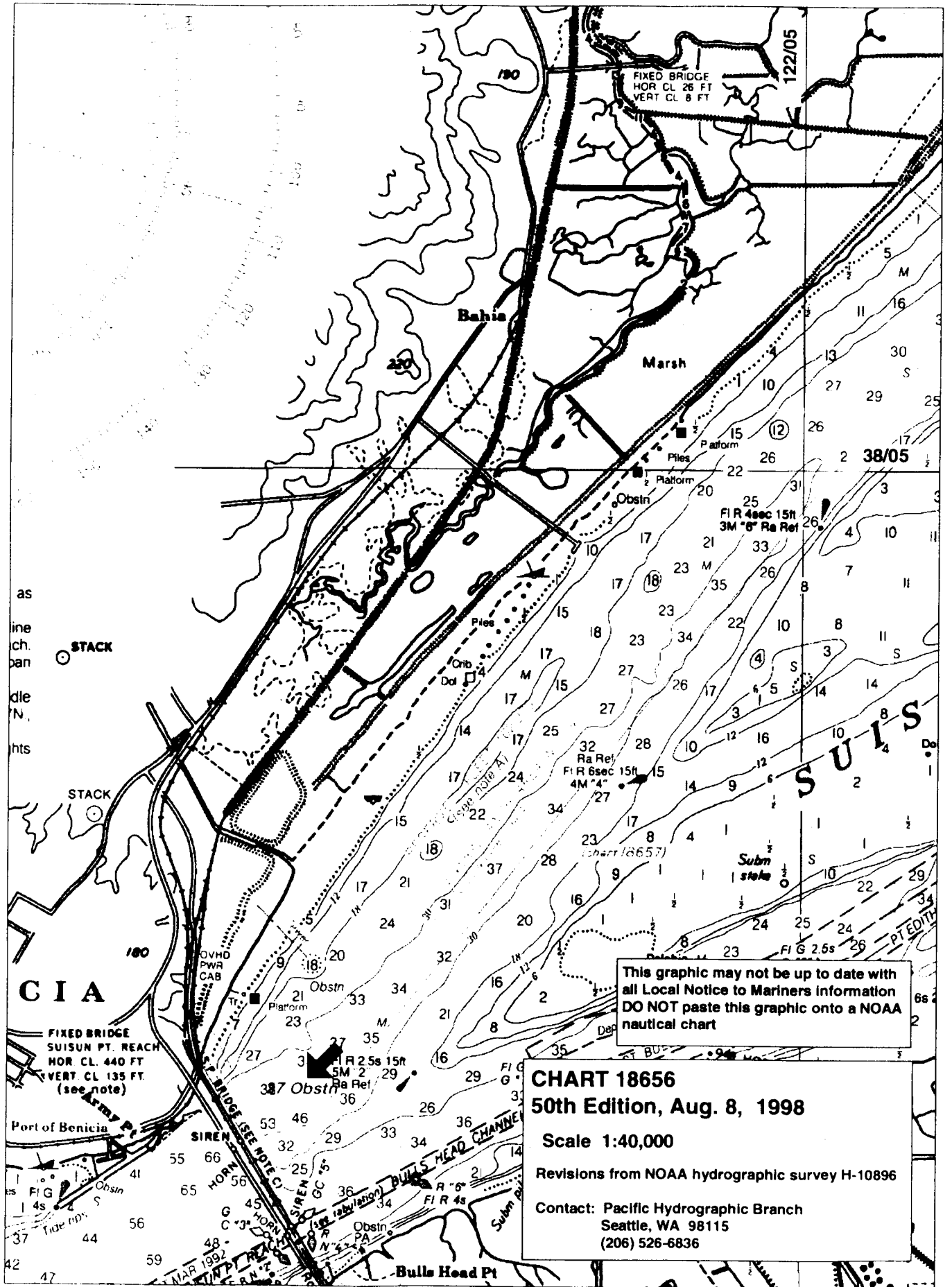
Survey Date:     July 23, 1999

Chart Affected:  18656, 50<sup>th</sup> Edition, Aug. 8, 1992, Scale 1:40,000  
                          18657, 16<sup>th</sup> Edition, Jan. 25, 1997, Scale 1:10,000

<u>DANGER TO NAVIGATION</u>	<u>LATITUDE(N)</u>	<u>LONGITUDE(W)</u>
Submerged Obstruction, covered 37 feet(11.3 meters)	38/02/49.6	122/07/19.4

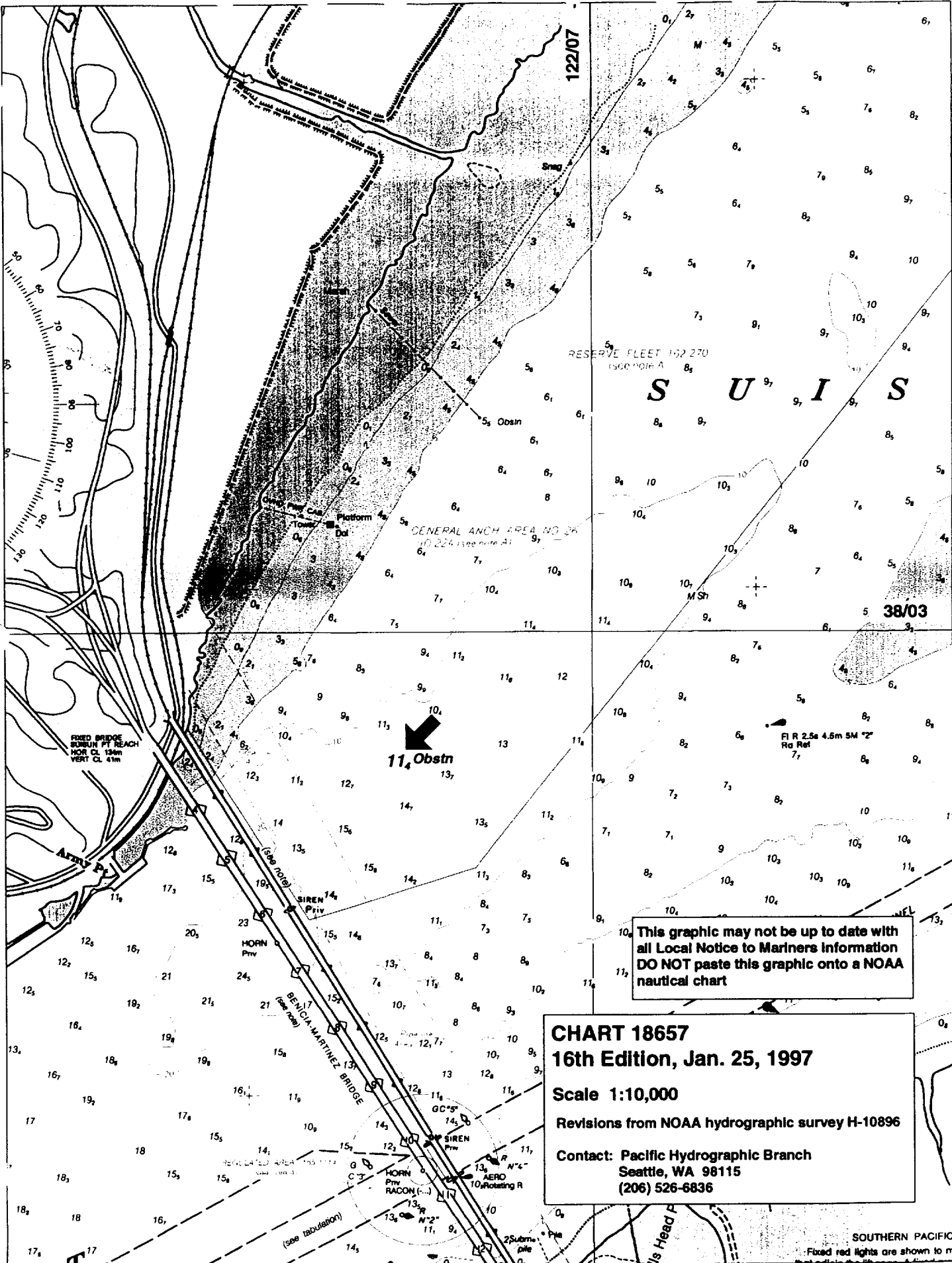
Unless otherwise indicated information is reduced to Mean Lower Low Water using predicted tides and positioned on NAD 83.

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



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**CHART 18656**  
**50th Edition, Aug. 8, 1998**  
**Scale 1:40,000**  
 Revisions from NOAA hydrographic survey H-10896  
 Contact: Pacific Hydrographic Branch  
 Seattle, WA 98115  
 (206) 526-6836



**CHART 18657**  
**16th Edition, Jan. 25, 1997**  
**Scale 1:10,000**  
 Revisions from NOAA hydrographic survey H-10896  
 Contact: Pacific Hydrographic Branch  
 Seattle, WA 98115  
 (206) 526-6836

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 nautical chart

SOUTHERN PACIFIC  
 Fixed red lights are shown to m



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
NATIONAL OCEAN SERVICE  
OFFICE OF COAST SURVEY  
Pacific Hydrographic Branch  
Seattle, Washington 98115-0070

June 6, 2000

Commander (OAN)  
Eleventh Coast Guard District  
Coast Guard Island  
Building 50-6  
Alameda, CA 94501-5100

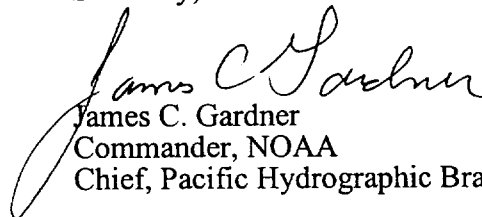
Dear Sir:

During office review of hydrographic survey H-10896, California, Suisun Bay, Carquinez Strait to Suisun Bay, thirty-three (33) potential dangers to navigation have been identified that affect the following charts.

<u>Chart</u>	<u>Edition/Date</u>	<u>Scale</u>	<u>Datum</u>
18657	17th/July 3, 1999	1:10,000	NAD 83
18658	29th/March 13, 1999	1:10,000	NAD 83

The attached information is provided for publication in the Local Notice to Mariners. Questions concerning this report should be directed to the Pacific Hydrographic Branch at (206) 526-6836.

Sincerely,

  
James C. Gardner  
Commander, NOAA  
Chief, Pacific Hydrographic Branch

Enclosures

cc: NIMA  
N/CS261  
Navigation Advisor, San Francisco Bay Area



## REPORT OF DANGERS TO NAVIGATION

Hydrographic Survey Registry Number: H-10896

Survey Title:           State:            CALIFORNIA  
                          Locality:        SUISUN BAY  
                          Sublocality:    CARQUINEZ STRAIT TO SUISUN BAY

Project Number: OPR-L304-KR-98

Survey Date:    July 13, 1999 to July 26, 1999

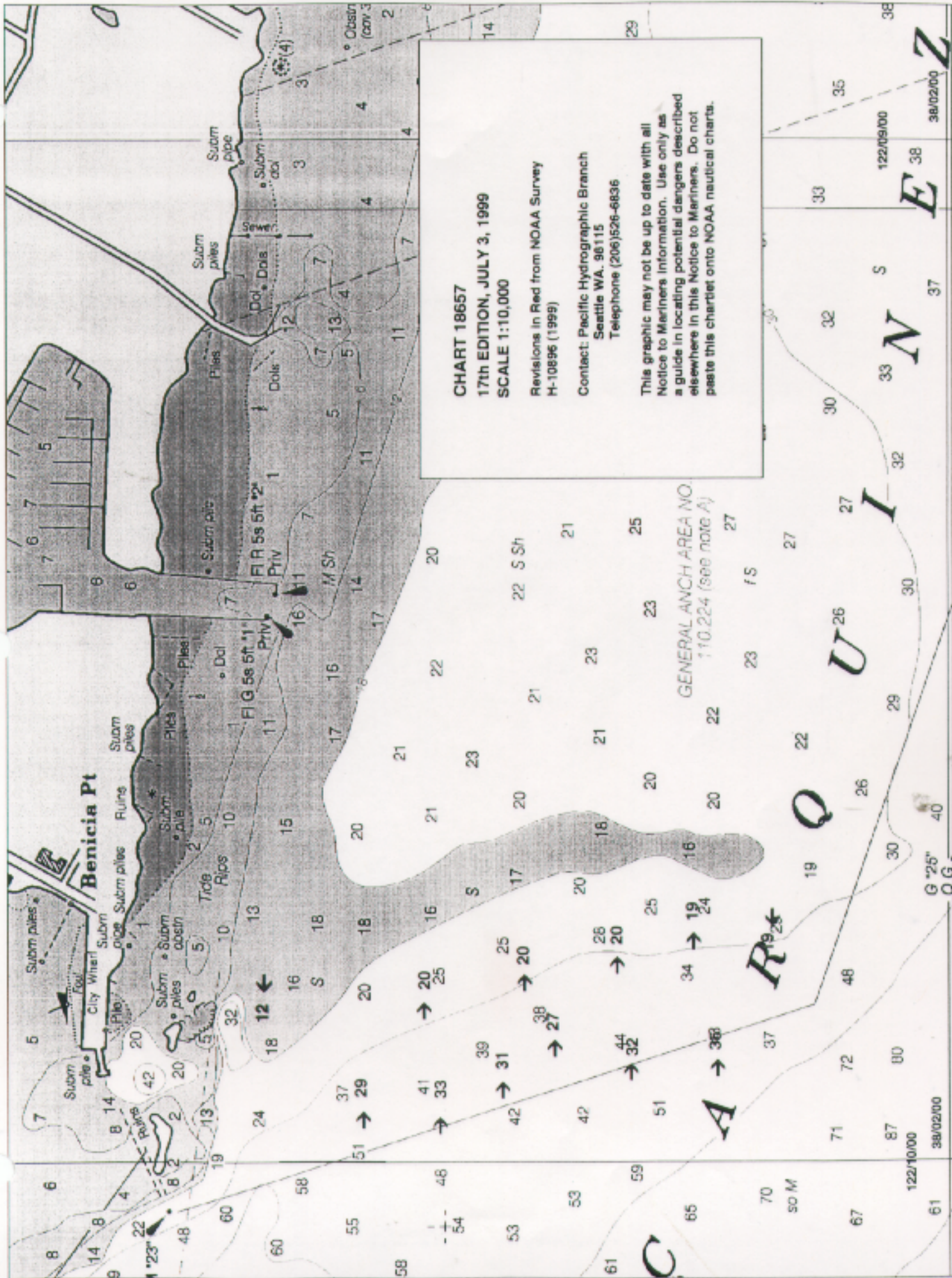
Soundings are reduced to Mean Lower Low Water using approved tides and are positioned on NAD 83.

Charts affected:    18657, 17th Edition/July 3, 1999, scale 1:10,000, NAD 83  
                          18658, 29<sup>th</sup> Edition/March 13, 1999, scale 1:10,000, NAD 83

<u>DANGER TO NAVIGATION</u>	<u>LATITUDE(N)</u>	<u>LONGITUDE(W)</u>
Shoal, covers 39 feet	38/02/13.15	122/07/36.32
Shoal, covers 38 feet	38/02/19.39	122/07/36.06
Shoal, covers 40 feet	38/02/24.65	122/07/30.88
Shoal, covers 25 feet	38/02//26.20	122/07/17.91
Shoal, covers 26 feet	38/02/30.05	122/07/20.70
Shoal, covers 28 feet	38/02/25.13	122/07/19.86
Shoal, covers 24 feet	38/02/26.88	122/07/12.15
Shoal, covers 23 feet	38/02/31.81	122/07/16.93
Shoal, covers 40 feet	38/02/36.40	122/07/25.11
Shoal, covers 33 feet	38/02/44.45	122/07/30.76
Shoal, covers 36 feet	38/02/38.59	122/07/47.02
Shoal, covers 25 feet	38/02/45.00	122/06/38.68
Shoal, covers 33 feet	38/02/46.99	122/06/16.51
Shoal, covers 30 feet	38/02/50.69	122/06/08.99
Shoal, covers 38 feet	38/02/56.01	122/05/54.76
Shoal, covers 39 feet	38/02/42.58	122/07/29.68
Shoal, covers 20 feet	38/03/16.74	122/04/36.26
Shoal, covers 18 feet	38/03/19.63	122/04/32.32
Shoal, covers 28 feet	38/03/28.21	122/04/19.43
Shoal, covers 20 feet	38/03/13.87	122/05/09.89
Shoal, covers 21 feet	38/03/13.07	122/05/25.15

Shoal, covers 12 feet	38/02/31.73	122/09/51.66
Shoal, covers 29 feet	38/02/27.17	122/09/56.15
Shoal, covers 33 feet	38/02/23.50	122/09/56.28
Shoal, covers 20 feet	38/02/24.10	122/09/49.83
Shoal, covers 31 feet	38/02/20.56	122/09/54.59
Shoal, covers 20 feet	38/02/19.57	122/09/48.40
Shoal, covers 27 feet	38/02/18.29	122/09/52.26
Shoal, covers 20 feet	38/02/15.22	122/09/47.19
Shoal, covers 32 feet	38/02/14.49	122/09/53.74
Shoal, covers 35 feet	38/02/10.69	122/09/53.35
Shoal, covers 19 feet	38/02/11.63	122/09/45.90
Shoal, covers 19 feet	38/02/08.20	122/09/47.77

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



**CHART 18657**  
**17th EDITION, JULY 3, 1999**  
**SCALE 1:10,000**

Revisions in Red from NOAA Survey  
 H-10896 (1999)

Contact: Pacific Hydrographic Branch  
 Seattle WA, 98115  
 Telephone (206)526-6836

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GENERAL ANCHOR AREA NO.  
 110.224 (see note A)

**CHART 18657**

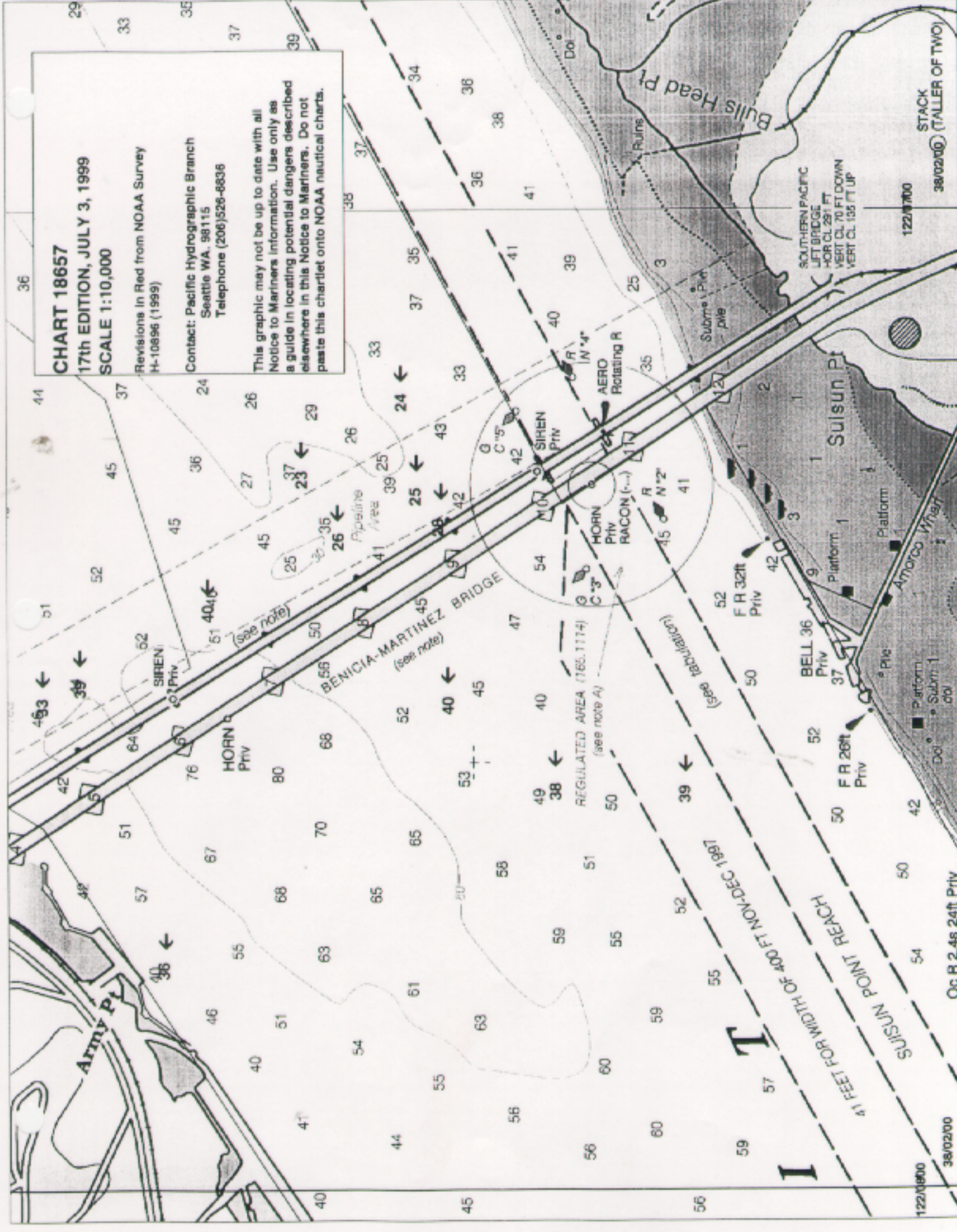
17th EDITION, JULY 3, 1999

SCALE 1:10,000

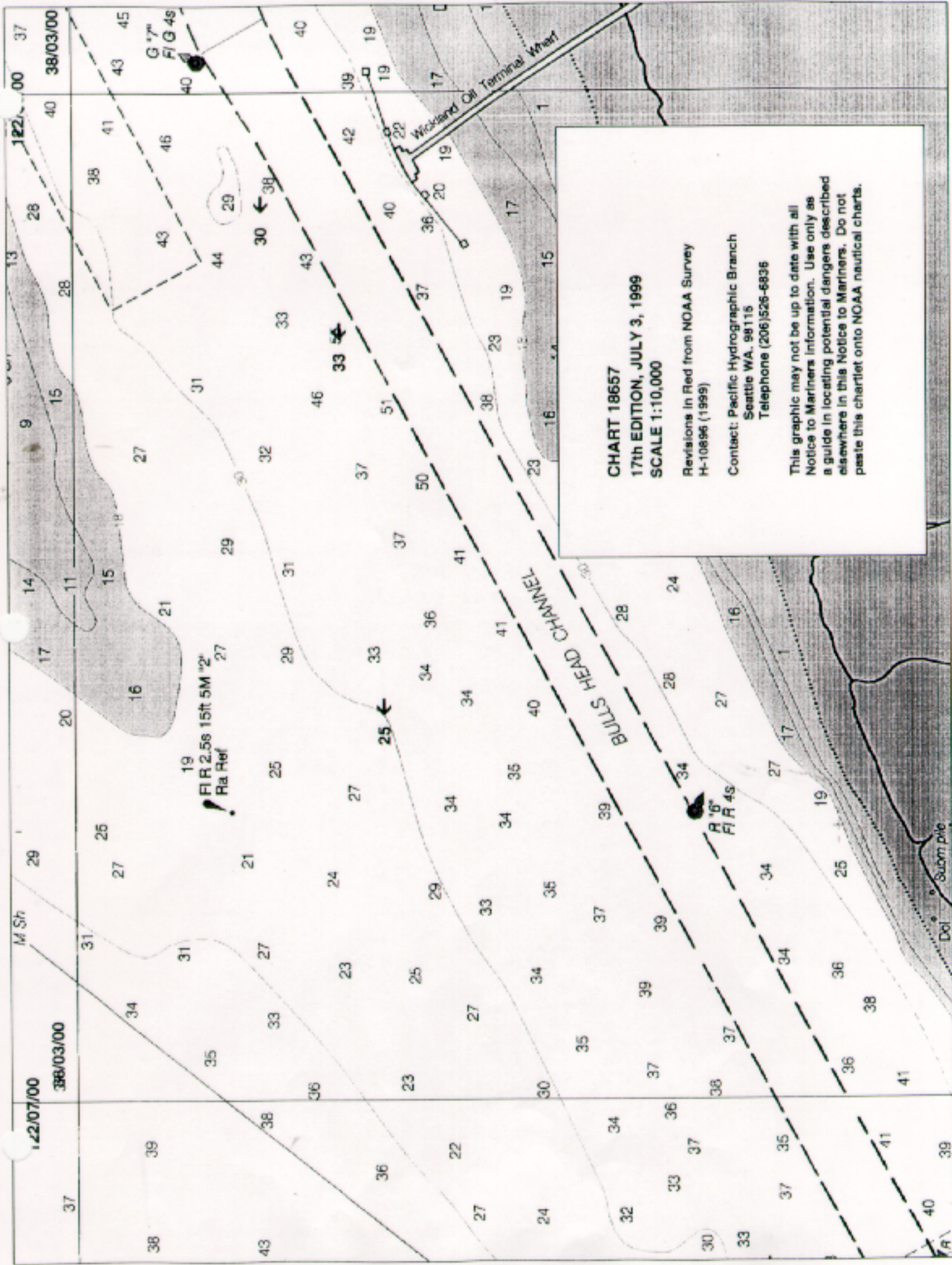
Revisions in Red from NOAA Survey  
H-10896 (1999)

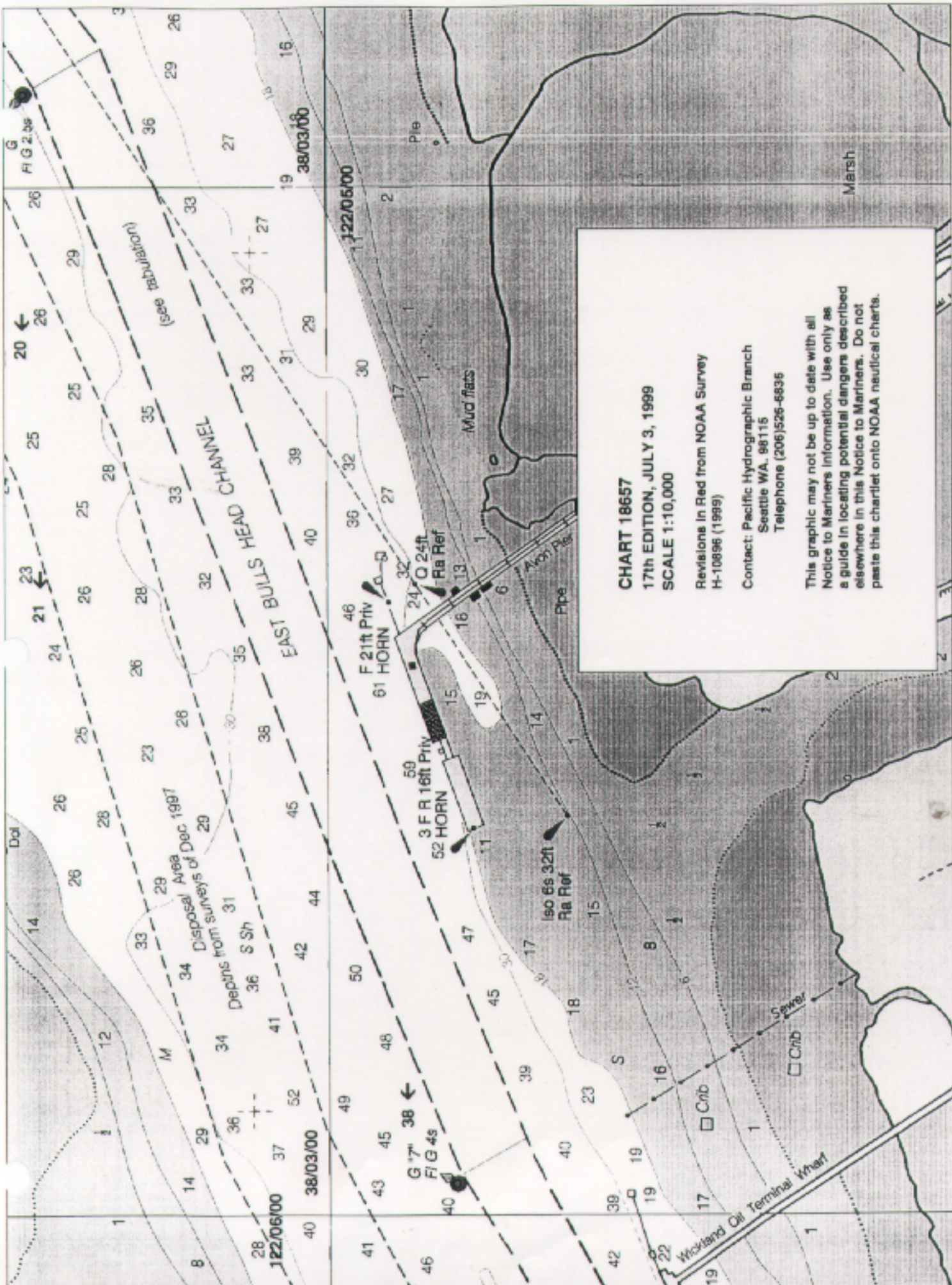
Contact: Pacific Hydrographic Branch  
Seattle WA, 98115  
Telephone (206)526-6836

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**CHART 18657**  
 17th EDITION, JULY 3, 1999  
 SCALE 1:10,000

Revisions in Red from NOAA Survey  
 H-10896 (1999)

Contact: Pacific Hydrographic Branch  
 Seattle WA, 98115  
 Telephone (206)526-6836

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# CHART 18658

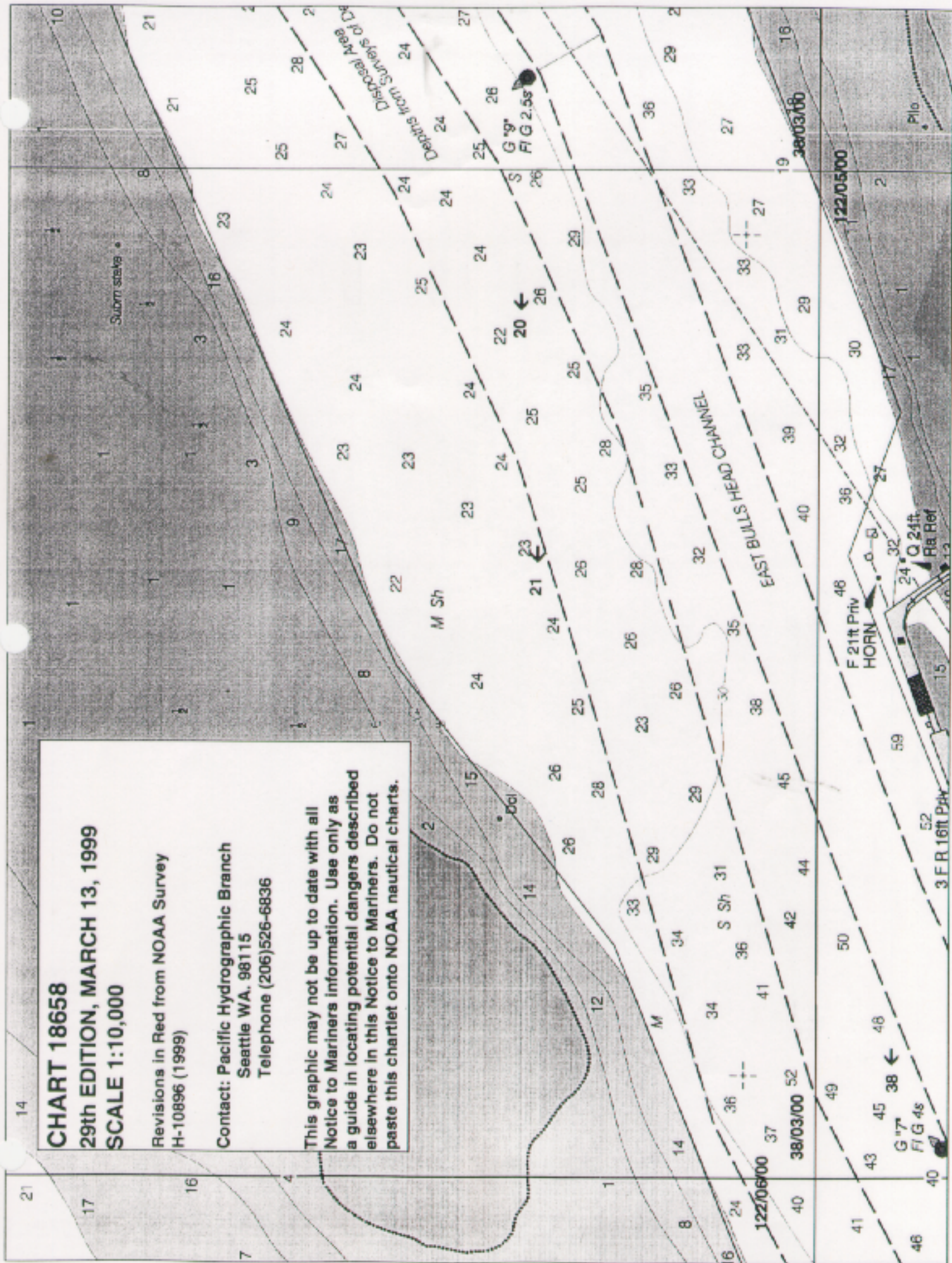
29th EDITION, MARCH 13, 1999

SCALE 1:10,000

Revisions in Red from NOAA Survey  
H-10896 (1999)

Contact: Pacific Hydrographic Branch  
Seattle WA. 98115  
Telephone (206)526-6836

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elsewhere in this Notice to Mariners. Do not  
paste this chartlet onto NOAA nautical charts.

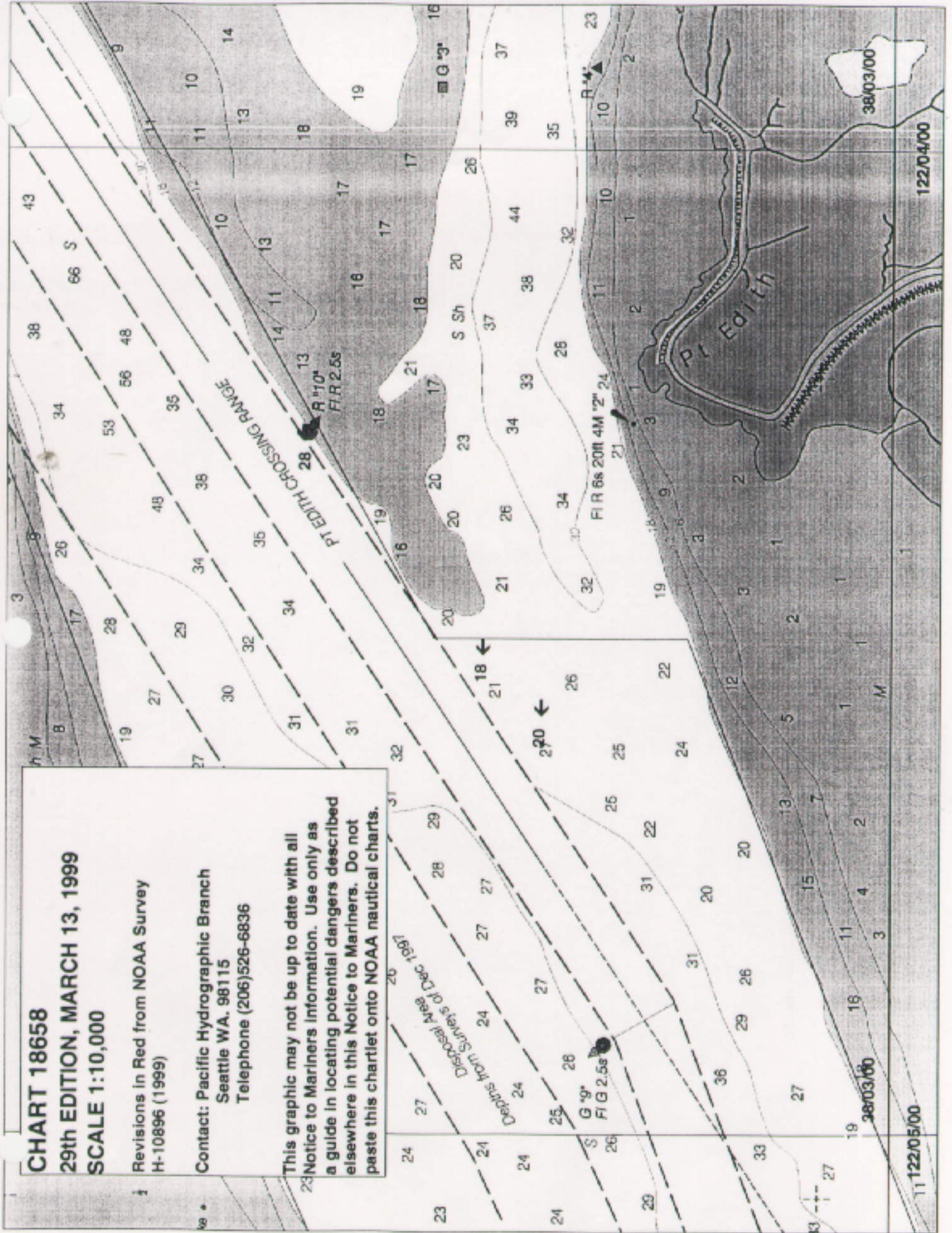


**CHART 18658**  
**29th EDITION, MARCH 13, 1999**  
**SCALE 1:10,000**

Revisions in Red from NOAA Survey  
H-10896 (1999)

Contact: Pacific Hydrographic Branch  
Seattle WA. 98115  
Telephone (206)526-6836

This graphic may not be up to date with all  
Notice to Mariners information. Use only as  
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elsewhere in this Notice to Mariners. Do not  
paste this chartlet onto NOAA nautical charts.



**Detached Position Record  
David Evans and Associates, Inc.**

Registry No.: H-10896

Sheet: D

Locality: Suisun Bay

Sub-locality: Carquinez Strait to Suisun Bay

Detached Position Identification: R "4" ✓				
Description: Nun Buoy				
Observer: Joe Brajkovich		Positioning System: Leica MX412 GPS Navigator		
Differential Reference Station: Pigeon Pt. #266				
DP 1		DP 2		Prior Established Position
Day Number	UTC Time	Day Number	UTC Time	
216	1811	216	1952	Latitude:
HDOP	Number Sats	HDOP	Number Sats	Longitude:
<1.0	7	<1.0	7	Averaged DP Position
Latitude: 38 02.3144		Latitude: 38 02.3184		Latitude: 38 02.3164 ✓
Longitude: 122 07.1699		Longitude: 122 07.1645		Longitude: 122 07.1672 ✓
DP Difference: 10.82m		Prior / Averaged Difference:		
Detached Position Identification: G "11" ✓ <i>Suisun Bay Channel Light "11"</i>				
Description: Day Marker				
Observer: Joe Brajkovich		Positioning System: Leica MX412 GPS Navigator		
Differential Reference Station: Pigeon Pt #266				
DP 1		DP 2		Prior Established Position
Day Number	UTC Time	Day Number	UTC Time	
216	1850	216	1908	Latitude:
HDOP	Number Sats	HDOP	Number Sats	Longitude:
<1.0	7	<1.0	7	Averaged DP Position
Latitude: 38 03.8552		Latitude: 38 03.8531		Latitude: 38 03.8541 ✓
Longitude: 122 03.7410		Longitude: 122 03.7393		Longitude: 122 03.7401 ✓
DP Difference: 4.61m		Prior / Adjusted Difference:		

**Detached Position Record  
David Evans and Associates, Inc.**

Registry No.: H-10896

Sheet: D

Locality: Suisun Bay

Sub-locality: Carquinez Strait to Suisun Bay

Detached Position Identification: R "2" ✓ <i>Suisun Bay / North Channel Light "2"</i>				
Description: <del>Day Marker</del> Concur				
Observer: Joe Brajkovich		Positioning System: Leica MX412 GPS Navigator		
Differential Reference Station: Pigeon Pt. #266				
DP 1		DP 2		Prior Established Position
Day Number	UTC Time	Day Number	UTC Time	
216	1817	216	1945	Latitude:
HDOP	Number Sats	HDOP	Number Sats	Longitude:
<1.0	7	<1.3	8	Averaged DP Position
Latitude: 38 02.8787		Latitude: 38 02.8784		Latitude: 38 02.8785 ✓
Longitude: 122 06.7131		Longitude: 122 06.7132		Longitude: 122 06.7132 ✓
DP Difference: 0.57m		Prior / Averaged Difference:		
Detached Position Identification: Priv "3" ✓				
Description: Dock End				
Observer: Joe Brajkovich		Positioning System: Leica MX412 GPS Navigator		
Differential Reference Station: Pigeon Pt #266				
DP 1		DP 2		Prior Established Position
Day Number	UTC Time	Day Number	UTC Time	
216	1827	216	NA	Latitude:
HDOP	Number Sats	HDOP	Number Sats	Longitude:
<1.0	7	1.1	7	Averaged DP Position
Latitude: 38 02.8916		Latitude: 38 02.8917		Latitude: 38 02.8917 ✓
Longitude: 122 05.6219		Longitude: 122 05.6210		Longitude: 122 05.6215 ✓
DP Difference: 1.33m		Prior / Adjusted Difference:		

**Detached Position Record  
David Evans and Associates, Inc.**

Registry No.: H-10896

Sheet: D

Locality: Suisun Bay

Sub-locality: Carquinez Strait to Suisun Bay

Detached Position Identification: Horn Priv ✓				
Description: Dock End				
Observer: Joe Brajkovich		Positioning System: Leica MX412 GPS Navigator		
Differential Reference Station: Pigeon Pt. #266				
DP 1		DP 2		Prior Established Position
Day Number	UTC Time	Day Number	UTC Time	
216	1836	216	1927	Latitude:
HDOP	Number Sats	HDOP	Number Sats	Longitude:
<1.0	7	<1.0	7	Averaged DP Position
Latitude: 38 02.9623		Latitude: 38 02.9621		Latitude: 38 02.9622 ✓
Longitude: 122 05.3910		Longitude: 122 05.3911		Longitude: 122 05.3910 ✓
DP Difference: 0.40m		Prior / Averaged Difference:		
Detached Position Identification: Priv 24 ft ✓ <i>Shell Oil Wharf East End Light</i>				
Description: Day Marker				
Observer: Joe Brajkovich		Positioning System: Leica MX412 GPS Navigator		
Differential Reference Station: Pigeon Pt #266				
DP 1		DP 2		Prior Established Position
Day Number	UTC Time	Day Number	UTC Time	
216	1757	216	2004	Latitude:
HDOP	Number Sats	HDOP	Number Sats	Longitude:
<1.0	7	<1.0	7	Averaged DP Position
Latitude: 38 01.9722		Latitude: 38 01.9724		Latitude: 38 01.9723 ✓
Longitude: 122 07.7213		Longitude: 122 07.7210		Longitude: 122 07.7212 ✓
DP Difference: 0.57m		Prior / Adjusted Difference:		

**Detached Position Record**  
**David Evans and Associates, Inc.**

Registry No.: H-10896

Sheet: D

Locality: Suisun Bay

Sub-locality: Carquinez Strait to Suisun Bay

Detached Position Identification: Priv FR ✓ <i>Amorco Wharf West End Light</i>				
Description: Day Marker				
Observer: Joe Brajkovich		Positioning System: Leica MX412 GPS Navigator		
Differential Reference Station: Pigeon Pt. #266				
DP 1		DP 2		Prior Established Position
Day Number	UTC Time	Day Number	UTC Time	
216	1802	216	2001	Latitude:
HDOP	Number Sats	HDOP	Number Sats	Longitude:
<1.0	7	<1.0	7	Averaged DP Position
Latitude: 38 02.0778		Latitude: 38 02.0792		Latitude: 38 02.0785 ✓
Longitude: 122 07.5116		Longitude: 122 07.5111		Longitude: 122 07.5114 ✓
DP Difference: 2.69m			Prior / Averaged Difference:	
Detached Position Identification: Priv 9.7m ✓ <i>Amorco Wharf East End Light</i>				
Description: Day Marker				
Observer: Joe Brajkovich		Positioning System: Leica MX412 GPS Navigator		
Differential Reference Station: Pigeon Pt #266				
DP 1		DP 2		Prior Established Position
Day Number	UTC Time	Day Number	UTC Time	
216	1804	216	1957	Latitude:
HDOP	Number Sats	HDOP	Number Sats	Longitude:
<1.0	7	<1.0	7	Averaged DP Position
Latitude: 38 02.1610		Latitude: 38 02.1614		Latitude: 38 02.1612 ✓
Longitude: 122 07.3353		Longitude: 122 07.3354		Longitude: 122 07.3353 ✓
DP Difference: 0.75m			Prior / Adjusted Difference:	



**Detached Position Record  
David Evans and Associates, Inc.**

Registry No.: H-10896

Sheet: D

Locality: Suisun Bay

Sub-locality: Carquinez Strait to Suisun Bay

Detached Position Identification: Army Point 3 1988 ✓				
Description: Bronze disk set into terra cotta pipe. Station is on top of cut slope east of the Benica Bridge Toll Plaza on the north side of Carquinez Strait.				
Observer: Joe Brajkovich		Positioning System: Lecia MX412 GPS Navigator		
Differential Reference Station: Pigeon Point #266				
DP 1		DP 2		Prior Established Position
Day Number	UTC Time	Day Number	UTC Time	
196	1823	196	1825	Latitude: 38 03 01.7475 ✓
HDOP	Number Sats	HDOP	Number Sats	Longitude: 122 07 48.9036 ✓
	7		7	Averaged DP Position
Latitude:	38 03 01.602	Latitude:	38 03 01.626	Latitude: 38 03 01.614
Longitude:	122 07 48.942	Longitude:	122 07 48.954	Longitude: 122 07 48.948
DP Difference: N 0.75m W 0.29m		Prior / Averaged Difference: N 4.12m W 1.04m		
Detached Position Identification: Berth E 184_pt 1 ✓				
Description: Pk nail set in wood finger pier on east side of Berth 184 on row E at Benicia Marina.				
Observer: Joe Brajkovich		Positioning System: Lecia MX412 GPS Navigator		
Differential Reference Station: Pigeon Point #266				
DP 1		DP 2		Prior Established Position
Day Number	UTC Time	Day Number	UTC Time	
196	1914	196	1916	Latitude:
HDOP	Number Sats	HDOP	Number Sats	Longitude:
	5		5	Averaged DP Position
Latitude:	38 02 41.448	Latitude:	38 02 41.454	Latitude: 38 02 41.451 ✓
Longitude:	122 09 23.304	Longitude:	122 09 23.298	Longitude: 122 09 23.301 ✓
DP Difference: N 0.18m W 0.15m		Prior / Adjusted Difference:		

## APPROVAL SHEET

for

**H-10896**

Standard field surveying and processing procedures were followed in producing this survey in accordance with the Hydrographic Manual, Fourth Edition; the Hydrographic Survey Guidelines; and the Field Procedures Manual, as updated for 1997. The data were reviewed daily during acquisition and processing.

The digital data and supporting records have been reviewed by me, are considered complete and adequate for charting purposes, and are approved. All records are forwarded for final review and processing to N/CS34, Pacific Hydrographic Branch.

Approved and forwarded,

 10/28/99

Jonathan L. Dasler, P.E., P.L.S.  
Director of Hydrographic Services  
David Evans and Associates, Inc.

GEOGRAPHIC NAMES

H-10896

Name on Survey	A ON CHART NO. 18657, 18658 B ON PREVIOUS SURVEY NO. YES C ON U.S. QUADRANGLE MAPS D FROM LOCAL INFORMATION E ON LOCAL MAPS F P.O. GUIDE OR MAP G RAND McNALLY ATLAS H U.S. LIGHT LIST K										
	A	B	C	D	E	F	G	H	K		
ARMY POINT	X		X								1
BENICIA (pp1)	X		X								2
BENICIA POINT	X		X								3
BULLS HEAD POINT	X		X								4
CALIFORNIA (title)	X		X								5
CARQUINEZ STRAIT	X		X								6
EDITH, POINT	X		X								7
MARTINEZ	X		X								8
OZOL	X		X								9
PORT OF BENICIA	X										10
SUISUN BAY	X		X								11
SUISUN POINT	X		X								12
											13
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											19
											20
											21
											22
											23
											24
											25

*Dennis J. Ramsey*  
JUN - 6 2000

**HYDROGRAPHIC SURVEY STATISTICS**

H-10896

RECORDS ACCOMPANYING SURVEY: To be completed when survey is processed.

RECORD DESCRIPTION	AMOUNT	RECORD DESCRIPTION	AMOUNT
MOOTH SHEET	1	SMOOTH OVERLAYS: POS., ARC, EXCESS	NA
DESCRIPTIVE REPORT	1	FIELD SHEETS AND OTHER OVERLAYS	NA

DESCRIP-TION	DEPTH/POS RECORDS	HORIZ. CONT. RECORDS	SONAR-GRAMS	PRINTOUTS	ABSTRACTS/ SOURCE DOCUMENTS
ACCORDION FILES					
ENVELOPES					
VOLUMES					
CAHIERS					
BOXES					

**SHORELINE DATA**

SHORELINE MAPS (List):	NA
PHOTOBATHYMETRIC MAPS (List):	NA
NOTES TO THE HYDROGRAPHER (List):	NA
SPECIAL REPORTS (List):	NA

NAUTICAL CHARTS (List): Chart 18657 17th ED., July 3, 1999, 18658 29th ED., March 13, 1999

OFFICE PROCESSING ACTIVITIES

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

PROCESSING ACTIVITY	AMOUNTS		
	VERIFICATION	EVALUATION	TOTALS
POSITIONS ON SHEET			
POSITIONS REVISED			
SOUNDINGS REVISED			
CONTROL STATIONS REVISED			

	TIME-HOURS		
	VERIFICATION	EVALUATION	TOTALS
PRE-PROCESSING EXAMINATION	29.5		29.5
VERIFICATION OF CONTROL			
VERIFICATION OF POSITIONS			
VERIFICATION OF SOUNDINGS			
VERIFICATION OF JUNCTIONS			
APPLICATION OF PHOTOBATHYMETRY			
SHORELINE APPLICATION/VERIFICATION			
COMPILATION OF SMOOTH SHEET	124		124
COMPARISON WITH PRIOR SURVEYS AND CHARTS			
EVALUATION OF SIDE SCAN SONAR RECORDS			
EVALUATION OF WIRE DRAGS AND SWEEPS			
EVALUATION REPORT		19	19
GEOGRAPHIC NAMES			
OTHER (Chart Compilation)	94		94
USE OTHER SIDE OF FORM FOR REMARKS			
<b>TOTALS</b>	<b>247.5</b>	<b>19</b>	<b>266.5</b>

Pre-processing Examination by <b>G. Nelson</b>	Beginning Date 12/20/1999	Ending Date 4/26/2000
Verification of Field Data by <b>B. Olmstead, G. Nelson</b>	Time (Hours) 228.5	Ending Date 7/6/2000
Verification Check by <b>R. Davies</b>	Time (Hours) 2	Ending Date 11/30/2000
Evaluation and Analysis by <b>B. Olmstead</b>	Time (Hours) 19	Ending Date 11/29/2000
Inspection by <b>R. Davies</b>	Time (Hours) 4	Ending Date 11/30/2000

## EVALUATION REPORT

H-10896

### A. PROJECT

Survey H-10896 was conducted under contract number 50-DGNC-9-90011. NOAA/NOS issued the Statement of Work (SOW) containing specific requirements to the contracted services and the areas of performance. This contract survey was conducted by David Evans and Associates, Inc. (Portland, Oregon). Specific information pertaining to this contract may be obtained from National Ocean Service, Coast Survey, Hydrographic Survey Division (N/CS3).

Additional information is found in the hydrographer's report, section A.

### B. AREA SURVEYED

The survey area is adequately described in the hydrographer's report and supplemented as noted below.

The inshore limits of this survey are generally the 18-foot depth curve with the exception of a portion of Bulls head Channel, along the south side of Carquinez Strait, and from the Port of Benicia northeast into Suisun Bay. In addition, the hydrographer was not required to conduct shoreline verification and collect bottom samples. Charted features and soundings inshore of the survey limit line have not been specifically addressed during hydrographic operations and should be retained as charted. A page-size plot of the charted area depicting the specific limits of supersession accompanies this report as Attachments 1 and 2.

The bottom consists mainly of mud and sand. Depths range from 5-99 feet. The deepest depths are found in the central portions of Carquinez Strait. Depths in excess of 30 feet are generally found along and within the central portions of the federally maintained channels from Benicia Point to Point Edith.

### C. SURVEY VESSELS

The hydrographer's report contains adequate information relating to survey vessels.

### D. AUTOMATED DATA ACQUISITION AND PROCESSING

The acquisition and processing of data in the field has been adequately addressed in the hydrographer's report, section D.

Office processing of survey data was conducted using the same Computer Aided Resource Information System (CARIS) and MicroStation 95 as used by the hydrographer. MicroStation 95 was used during office processing to compile the smooth sheet.

Processed digital data for this survey exists in the CARIS format, a database format using the .dat extension. In addition, the smooth sheet drawing is filed in the MicroStation format, i.e., .dgn extension. Copies of these files have been forwarded to the Hydrographic Surveys Division and a backup copy retained at PHB. Database records forwarded are in the Internal Data Format (IDF) and are in compliance with specifications in existence at the time of survey processing.

The drawing files necessarily contain information that is not part of the CARIS data set such as geographic names text, line-type data, and minor symbolization. In addition, those soundings deleted from the drawing for clarity purposes remain unrevised in the CARIS digital files to preserve the integrity of the original hydrographic data set. Cartographic codes used to describe the digital data are those authorized by Hydrographic Survey Guideline No. 35 and No. 75.

The data are plotted using a Universal Transverse Mercator (UTM) projection and are depicted on a single sheet.

#### **E. SONAR EQUIPMENT**

Side scan sonar equipment was not used during survey H-10896

#### **F. SOUNDING EQUIPMENT**

Sounding equipment has been adequately addressed in the hydrographer's report.

#### **G. CORRECTIONS TO SOUNDINGS**

Soundings and elevations below Mean High Water (MHW) have been reduced to Mean Lower Low Water (MLLW). The reducers include corrections for an actual tide, dynamic draft, and sound velocity. Additional reducers for multibeam survey data include heave, pitch and roll. These reducers have been reviewed and are consistent with NOS specifications.

Real-time unverified tide data was used during initial field processing of the survey data. During final field processing soundings have been reduced to Mean Lower Low Water (MLLW) or Mean High Water (MHW) as appropriate using zone information from the statement of work (SOW) and verified tide data information using Port Chicago tide gage, 941-5144. Additional information is found in the hydrographer's report, section G.

#### **H. CONTROL STATIONS**

Section H of the hydrographer's report contains an adequate discussion of horizontal control and hydrographic positioning.

The positions of horizontal control stations used during hydrographic operations are published values based on NAD 83. The geographic positions of all survey data are based on NAD 83. The smooth sheet is annotated with an NAD 27 adjustment tick based on values determined with the NGS program NADCON. Geographic positions based on NAD 27 may be plotted on the smooth sheet utilizing the NAD 83 projection by applying the following corrections:

Latitude:	-288 seconds	(-8.865 meters)
Longitude:	3.876 seconds	( 94.490 meters)

#### **I. HYDROGRAPHIC POSITION CONTROL**

Differential GPS (DGPS) was used to control this survey. A horizontal dilution of precision (HDOP) not to exceed 4.0 for 1:10,000 was computed for survey operations. There were no apparent problems with the positional data as collected during survey operations.

DGPS performance checks were conducted in the field. Additional information concerning specific control system type, calibrations and system checks, can be found in the hydrographer's report, section H.

#### **J. SHORELINE**

Shoreline verification was not required. Shoreline shown on the smooth sheet originates from prior surveys H-10283 (1988) and H-10306 (1989) and has been shown in brown for orientation only. The brown shoreline and the hydrographic data were merged in MicroStation during the compilation of the smooth sheet.

#### **K. CROSSLINES**

Crosslines are adequately discussed in the hydrographer's report.

#### **L. JUNCTIONS**

There are no contemporary hydrographic surveys that junction H-10896.

#### **M. COMPARISON WITH PRIOR SURVEYS**

The following prior surveys fall within the common area of the present survey and have been compared with during office processing.

<u>Survey</u>	<u>Year</u>	<u>Scale</u>	<u>Datum</u>
H-10283	1988	1:10,000	NAD 27
H-10306	1988-89	1:10,000	NAD 27

Prior surveys H-10283 and H-10306 are the source data for much of the existing charted soundings and features. These surveys were conducted using single beam echo sounders and a pneumatic depth gage for dive investigations. Positioning was accomplished using Mirr-ranger. Comparison with H-10896 was made using digital copies of the prior surveys. The registration and legibility of the prior survey work to the present survey was good.

H-10283 and H-10306 cover the area from Benicia Point to Point Edith, which includes Carquinez Strait and a portion of Suisun Bay. Within these boundaries reside several federally maintained channels and a disposal area. Portions of H-10283 and H-10306 have been superseded by Corps of Engineer surveys along and in the vicinity of the federally maintained channels and the charted disposal area. Discussion with this miscellaneous source data is discussed in comparison with the chart. Except as noted above, a comparison of the remaining soundings with the present survey reveals general differences of 1-2 feet in the areas east of Benicia Point to Suisun Bay and Point Edith. The present survey appears to reflect a slightly shoaler bias. However, there are four distinct areas that show more dramatic changes (shoaler/deeper) since 1988-89 with discussion as follows;

- a.) The present survey found consistently shoaler depths ranging from 2-14 feet south of Benicia Point. This area is defined as from latitude 38/02/07N to latitude 38/02/33N, longitude 122/09/45W to longitude 122/10/00W and extends for approximately 800 meters south of Benicia Point. The 18-foot and 30-foot depth curves have shifted west and north approximately 50-150 meters since the prior survey conducted in 1988.
- b.) Depth differences of 2-10 feet were readily evident on both the east and west sides of the Benicia-Martinez Highway Bridge just north of Suisun Point Reach. The present survey depths appear to reflect a shoaler bias.
- c.) The present survey found shoaler depths ranging from 7-10 feet along the southern face of Benicia Wharf.
- d.) Depths from the present survey were generally found to be consistently deeper from 5-10 feet along the Avon Wharf.

The large depth differences with the prior surveys are likely attributed to cultural activity involving constant dredging and dumping of sediment to support channel maintenance and shipping activity from Benicia Point to Point Edith. The shoal located off Benicia Point is likely affected by the strong tidal currents, which laterally shifts the bottom sedimentation thru this area.

Several charted items originating from the prior survey were not adequately addressed and/or investigated during survey operations. These items been transferred in color to the smooth sheet and are listed below.

<u>Item</u>	<u>Prior Survey</u>	<u>Lat(N)</u>	<u>Long(W)</u>
21WK	H-10283	38/02/17.5	122/08/43.5
Ledge	H-10283	38/02/35	122/09/51
18 Obstr (Sewer outfall)	H-10283	38/03/17	122/07/11
Dol (8)	H-10306	38/03/15	122/05/39.0
Tide Rips (note)	H-10283	38/02/21	122/08/17.5
Tide Rips (note)	H-10283	38/02/35	122/09/43
Mooring buoys (centered)	H-10283	38/02/10.5	122/07/17

In addition to the items listed above, several bottom samples and soundings from both H-10283 and H-10306 were transferred in color to the smooth sheet. The soundings were transferred to the smooth sheet in areas to support depth curves and/or to supplement areas not covered by the present survey.

With the transfer of the items listed above, survey H-10896 is adequate to supersede the prior surveys within the common area.

**N. ITEM INVESTIGATIONS**

AWOIS item (51227) is a charted submerged wreck that plots within the survey area. This item was verified during survey operations but no attempt was made to determine a least depth. This item originates from H-10283 and has been transferred in color to the present survey. The evaluator recommends retaining the charted 21 Wk. Additional information is found in the hydrographer's report, sections N and S.

**O. COMPARISON WITH CHART**

Survey H-10896 was compared with the following charts.

<u>Chart</u>	<u>Edition</u>	<u>Date</u>	<u>Scale</u>
18657	17th	July 3, 1999	1:10,000
18658	29 <sup>th</sup>	March 13, 1999	1:10,000

a. Hydrography

Charted hydrography originates with the previously discussed prior surveys which have been adequately addressed in section M of the evaluation report, and Corps of Engineer surveys conducted in 1997-98. Portions of prior surveys H-10283 and H-10306 have been superseded along Suisun Reach to Point Edith Crossing and along the limits of the charted disposal area from lighted buoy "7" to near Suisun Bay Channel Light "11". Present survey depths reflect a shoal bias and generally differ from 1-3 feet. The following items originating from miscellaneous sources were not adequately addressed during survey operations and should be retained on the chart.

<u>Item</u>	<u>Lat(N)</u>	<u>Long(W)</u>
Submerged pipeline area (centered)	38/02/00	122/08/48
Submerged cable area (centered)	38/02/30	122/07/18
Disposal area (from/to)	38/02/54	122/06/11
	38/03/48	122/04/00
4 ft rep 1994 (Note)	38/01/42	122/08/22

Except for the following, the sounding data obtained during the survey are consistent with the charted controlling depths for Suisun Point Reach, Bulls Head Channel, East Bulls Head Channel, and Point Edith Crossing Range. These federally maintained channels are subject to shoaling along the edges and the following depths are noted from the current survey.

<u>Depth</u>	<u>Lat(N)</u>	<u>Long(W)</u>
31 feet	38/03/23	122/04/28.5
31 feet	38/03/24	122/04/26.5
28 feet	38/03/29	122/04/18.5
30 feet	38/03/07	122/05/15.5
31 feet	38/03/06	122/05/18
32 feet	38/03/05	122/05/18
32 feet	38/03/04	122/05/09.5



40 feet	38/02/15	122/07/37
39 feet	38/02/13.5	122/07/36

Survey H-10896 is adequate to supersede charted hydrography within the common area except as noted above. In addition, the evaluator recognizes that more recent sounding information may be available from the Corps of Engineers and should be considered during the next chart update. Additional discussion can be found in the hydrographer's report, section N.

**b. Dangers To Navigation**

Two dangers to navigation were identified during survey operations. An additional thirty- three (33) potential dangers to navigation were identified during office processing at PHB. These dangers were reported to the USCG, NIMA, and N/CS261 on July 20, 1999, July 26, 1999 and June 6, 2000.

**P. ADEQUACY OF SURVEY**

Hydrography contained on survey H-10896 is adequate to:

- a. Delineate the bottom configuration, determine least depths, and draw the required depth curves;
- b. Reveal there are no significant discrepancies or anomalies requiring further investigation; and
- c. Show the survey was properly controlled and soundings are correctly plotted.

With the exception of the following, the hydrographic records and reports received for processing are adequate and conform to the requirements of the Hydrographic Manual, 4th Edition, revised through Change No. 3, the Hydrographic Survey Guidelines, the NOS Hydrographic Surveys Specifications and Deliverables, and the Statement of Work dated October 1, 1998.

The preliminary smooth sheet as submitted by the contractor contained numerous errors with cartographic specifications and proper digital fonts as specified in the contract. These items were corrected at the Pacific Hydrographic Branch during office processing.

**Q. AIDS TO NAVIGATION**

Eight floating navigational buoys and seven fixed aids to navigation were located within the survey area and adequately serve the purpose intended. Several other fixed and floating aids to navigation fall in the proximity of the survey limits but were not addressed and should remain as charted. Additional information is found in the hydrographer's report, section P and the Detached Position Records that accompany this report.

Landmarks within the survey area were not addressed by the hydrographer and should be retained as charted.

**R. STATISTICS**

Statistics are adequately itemized in the hydrographer's report, section Q.

**S. MISCELLANEOUS**

Miscellaneous information is adequately discussed in the hydrographer's report, section R. No additional miscellaneous items were noted during office processing.


**T. RECOMMENDATIONS**

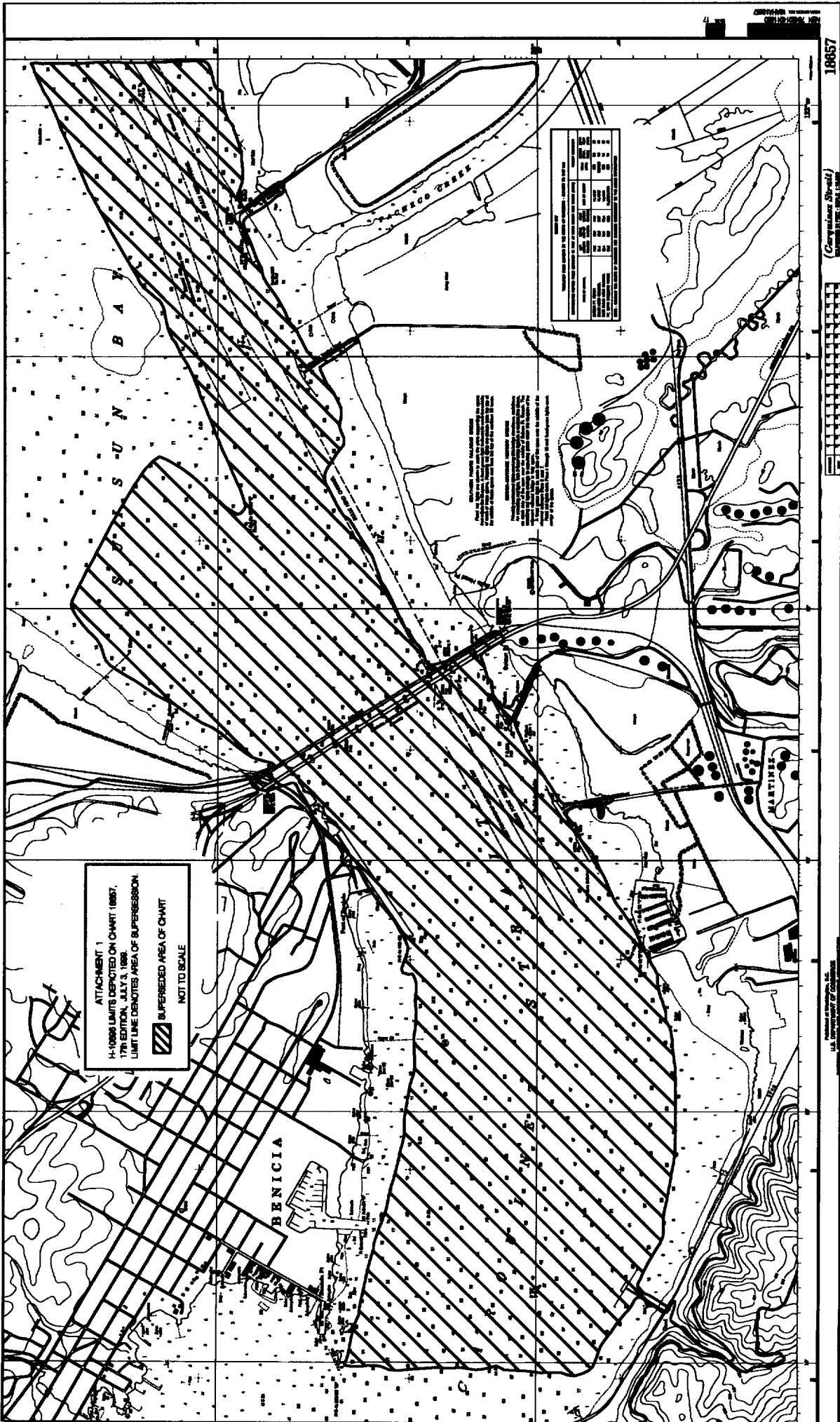
This is a good hydrographic survey. Additional information regarding recommendations is found in the hydrographer's report, section S.

H10896

**U. REFERRAL TO REPORTS**

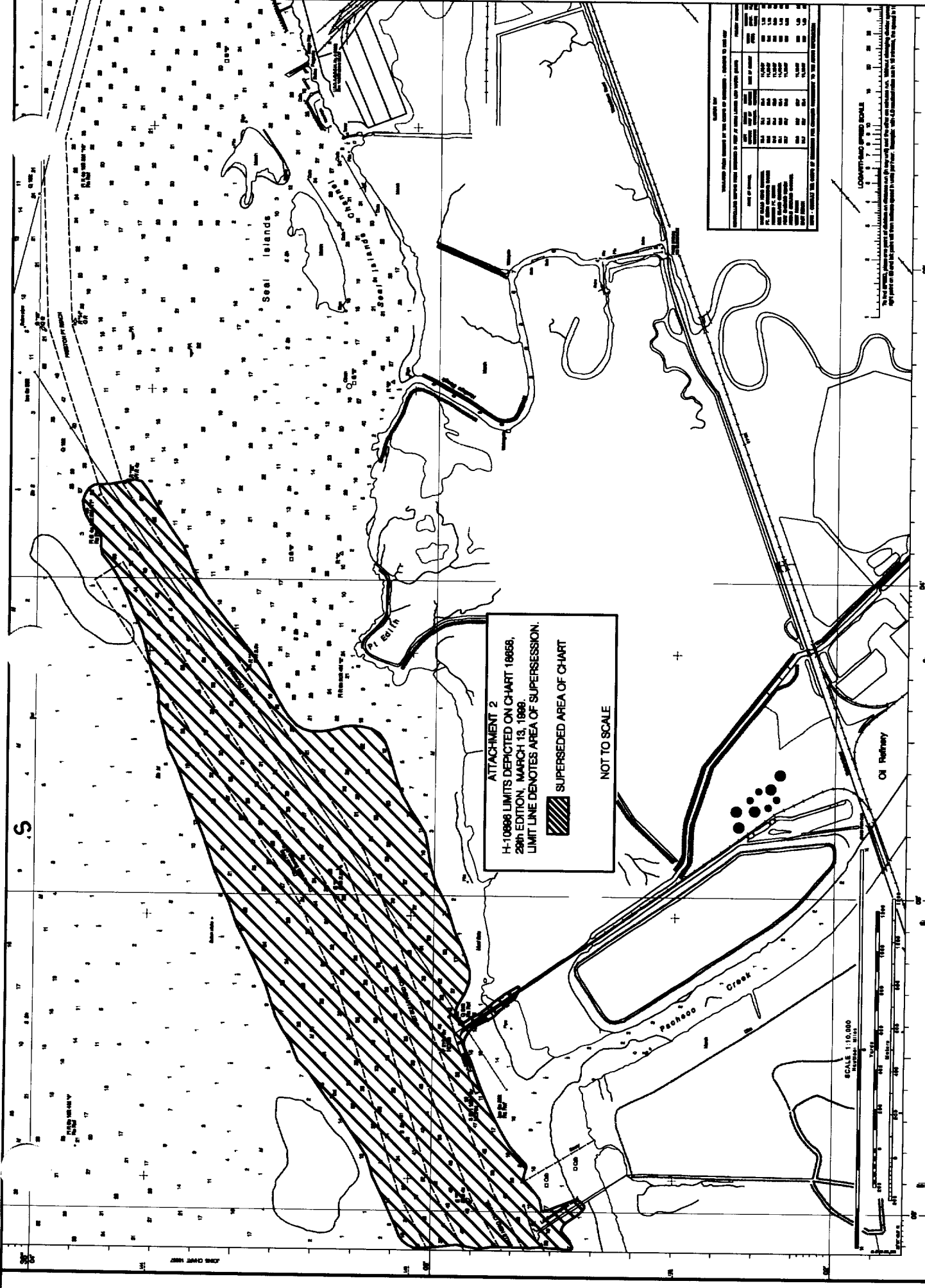
Referral to reports is adequately discussed in the hydrographer's report, section T.

  
Bruce A Olmstead  
Senior Cartographer



ATTACHMENT 1  
 H-10868 LIMITS DEPICTED ON CHART 10867,  
 17th EDITION, JULY 3, 1988.  
 LIMIT LINE DENOTES AREA OF SUPERSESSON.  
 [Hatched Box] SUPERSEDED AREA OF CHART  
 NOT TO SCALE

DEPTH	SYMBOL	DEPTH	SYMBOL
10	[Symbol]	10	[Symbol]
15	[Symbol]	15	[Symbol]
20	[Symbol]	20	[Symbol]
25	[Symbol]	25	[Symbol]
30	[Symbol]	30	[Symbol]
35	[Symbol]	35	[Symbol]
40	[Symbol]	40	[Symbol]
45	[Symbol]	45	[Symbol]
50	[Symbol]	50	[Symbol]
55	[Symbol]	55	[Symbol]
60	[Symbol]	60	[Symbol]
65	[Symbol]	65	[Symbol]
70	[Symbol]	70	[Symbol]
75	[Symbol]	75	[Symbol]
80	[Symbol]	80	[Symbol]
85	[Symbol]	85	[Symbol]
90	[Symbol]	90	[Symbol]
95	[Symbol]	95	[Symbol]
100	[Symbol]	100	[Symbol]




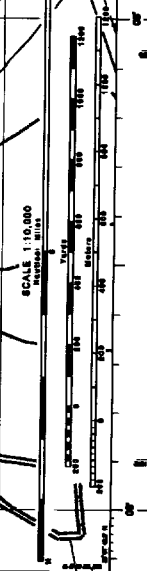
ATTACHMENT 2  
 H-10868 LIMITS DEPICTED ON CHART 18658,  
 20th EDITION, MARCH 13, 1998.  
 LIMIT LINE DENOTES AREA OF SUPPRESSION.  
 SUPERSEDED AREA OF CHART  
 NOT TO SCALE

TABLE 1  
 TIDE GAUGE DATA FOR THE COAST OF ALASKA - CONTINUED TO THE NEXT PAGE

STATION NO.	NAME	ELEVATION	TIDE GAUGE DATA	
			DATE	TIME
1001	ANCHORAGE	10	1998	01/01
1002	ANCHORAGE	10	1998	01/01
1003	ANCHORAGE	10	1998	01/01
1004	ANCHORAGE	10	1998	01/01
1005	ANCHORAGE	10	1998	01/01
1006	ANCHORAGE	10	1998	01/01
1007	ANCHORAGE	10	1998	01/01
1008	ANCHORAGE	10	1998	01/01
1009	ANCHORAGE	10	1998	01/01
1010	ANCHORAGE	10	1998	01/01



APPROVAL SHEET  
H-10896

Initial Approvals:

The completed survey has been inspected with regard to survey coverage, delineation of the depth curves, development of critical depths, cartographic symbolization, comparison with prior surveys and verification or disproval of charted data. The survey records and digital data comply with NOS requirements except where noted in the Evaluation Report.

*for* Charles R. Davis Date: 11/29/00  
Dennis J. Hill  
Chief, Cartographic Team  
Pacific Hydrographic Branch

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

James C. Gardner Date: 12-21-00  
James C. Gardner  
Commander, NOAA  
Chief, Pacific Hydrographic Branch

\*\*\*\*\*

Final Approval

Approved:

Samuel P. De Bow Jr. Date: Jan 29, 2001  
Samuel P. De Bow Jr.,  
Captain, NOAA  
Chief, Hydrographic Surveys Division

### MARINE CHART BRANCH

## RECORD OF APPLICATION TO CHARTS

FILE WITH DESCRIPTIVE REPORT OF SURVEY NO. H-10896

#### 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
18657	6/26/2000	Bruce A. Olden	<del>Full Part Before</del> After Marine Center Approval Signed Via
			Drawing No. Full application of soundings and features from smooth sheet.
18658	6/26/2000	Bruce A. Olden	<del>Full Part Before</del> After Marine Center Approval Signed Via
			Drawing No. Full application of soundings 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.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
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			Full Part Before After Marine Center Approval Signed Via
			Drawing No.