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LOS ANGELES AND LONG BEACH HARBORS MODEL STUDY

Report 1

PROTOTYPE DATA ACQUISITION AND OBSERVATIONS

by

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This report describes the instrumentation, operation, calibration, and collected data of a 1-yr prototype wave, tide, and ship movement data acquisition program conducted by the U. S. Army Engineer Waterways Experiment Station and is the first of a series to be published under the general title "Los Angeles and Long Beach Harbors Model Study." This model study has four major objectives: (1) to determine incidence and severity of troublesome oscillations in the present harbor complex, (2) to investigate

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20. ABSTRACT (Continued).

tidal circulation characteristics of the present and proposed harbors, (3) to determine the optimum plan for future expansions to provide safe and economical berthing areas, and (4) to analyze the effect proposed expansions will have on existing harbors. The first two objectives require very accurate and reliable prototype data. From 1 June 1971 to 1 July 1972, wave data were obtained at 1-sec intervals from 13 wave gage stations at selected locations in the Los Angeles and Long Beach Harbors. Barometric pressure was monitored at the central receiving station onshore. In addition to wave data from pressure transducers, tidal height data were obtained from three float-type tide gages operated by the Los Angeles and Long Beach Port Authorities. For 15 stations in the harbors, tidal current measurements at three depths in the water column were collected at 1-hr intervals for a 25-hr observation period beginning at 0600 PDT on 5 March 1974. In conjunction with wave measurements, data on ship characteristics, mooring configurations, and ship motion (degree, type, and time of occurrence) were collected and tabulated for vessels berthed in the east channel and west basin of Los Angeles Harbor and in the southeast basin and east basin (slip 1) of Long Beach Harbor. The purpose of the prototype wave observation program was to obtain for a 1-yr period continuous, accurate, and reliable wave data to be used in hydraulic and possibly mathematical models and in evaluating surge conditions in the existing harbors. Ship movement and mooring configuration data were collected to allow correlation of adverse ship motions with prototype wave conditions. Tidal heights and currents were measured in the harbors area to provide data for physical hydraulic model verification and to aid in identifying potential circulation problems. Detailed descriptions of wave gages, recording equipment, operating procedures, and methods for checking and calculating calibration and submergence coefficients are presented for the wave data acquisition system. Relative and absolute accuracy analyses of the pressure-type wave sensors indicate accuracies of the water surface measurements to be $\pm$0.05 ft for transducer response and $\pm$0.1 ft for transducer submergence elevation. Acquisition procedures, data reduction, data editing, modes of permanent storage, and data quality and quantity are discussed in detail for each type of data collected during the prototype field survey of this model study.

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PREFACE

The Los Angeles and Long Beach Port Authorities plan to construct additional harbor basins and dredge deeper channels and harbor areas to meet growing future demands for additional ship mooring facilities. The Los Angeles and Long Beach Harbors model study was undertaken to investigate (a) incidence of harbor oscillations adverse to ship mooring, (b) tidal circulation characteristics of the existing harbor and proposed expansions, (c) optimum plan for future expansions, and (d) effects of future expansions on existing harbor conditions. This report, the first in a series to be published under the general title "Los Angeles and Long Beach Harbors Model Study," presents the results of a 1-yr prototype wave and tidal data acquisition program conducted by the U. S. Army Engineer Waterways Experiment Station (WES). These data, taken over a 1-yr period, will provide an accurate and reliable data base for use in evaluating and comparing surge and tidal circulation conditions before and after any new construction in the existing harbors.

Project administration, funding, and certain field support for the prototype data acquisition were provided by the U. S. Army Engineer District, Los Angeles (LAD), under project management of Messrs. J. Chapman and H. Converse, and under the general direction of Messrs. G. Fuquay, Chief of the Engineering Division, and C. H. Fisher, Chief of the Coastal Resources Branch. Mr. C. Hux provided diving services, and Mr. T. Nizinski assisted in collection and coding of ship data. COL R. J. Malley, CE, and COL J. V. Foley, CE, were District Engineers of LAD during the course of this study. Contract monitoring and general project administration for the U. S. Army Engineer Division, South Pacific, were provided by Messrs. O. T. Magoon and J. W. Gerhart.

Messrs. L. L. Whiteneck and B. N. Hoffmaster, Chief Harbor Engineers of the Ports of Los Angeles and Long Beach, respectively, and their staffs provided personnel assistance in collecting ship and tidal data. The Allan Hancock Foundation of the University of Southern California and the U. S. Coast Guard assisted WES in conducting the tidal surveys.

The study was conducted in the Hydraulics Laboratory of WES, under the general supervision of Messrs. H. B. Simmons and F. A. Herrmann, Chief and Assistant Chief, respectively, of the Hydraulics Laboratory, Mr. R. Y. Hudson and Dr. R. W. Whalin, former and present Chiefs, respectively, Wave Dynamics Division (WDD), and Mr. C. E. Chatham, Chief, Harbor Wave Action Branch. This report was prepared by Mr. E. B. Pickett, Chief, Hydraulic Analysis Division (HAD), Dr. D. L. Durham, WDD, and Mr. W. H. McAnally, Estuaries Division (ED). The prototype data collection program was coordinated by Mr. Pickett. Technical support was provided by the WES Instrumentation Services Division (ISD), under the general direction of Messrs. F. P. Hanes, Chief, ISD, L. M. Duke, Chief, Operations Branch (OB), and H. C. Greer, OB. Site management and coordination were under the supervision of SP5 S. H. Stern of HAD, SP5 T. M. Anderson of WDD, and SP5 J. W. Moran of WDD.

Tidal data collection and analyses were conducted under the general supervision of Mr. R. A. Sager, Chief, ED, and direct supervision of Messrs. G. M. Fisackerly, Chief, Harbor Entrance Branch (HEB), D. Crouse of HEB, and Mr. McAnally.

Wave data analyses were conducted under the general supervision of Mr. M. B. Boyd, Chief, Mathematical Hydraulics Division, and Dr. Durham. The analyses were conducted by Messrs. J. R. Houston and J. H. Thompson of WDD, with ship data analyses by Mr. L. G. Crosby of WDD.

Directors of WES during the prototype data collection and preparation and publication of this report were BG E. D. Peixotto, CE, and COL G. H. Hilt, CE. Technical Director was Mr. F. R. Brown.

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CONTENTS

CONVERSION FACTORS, U. S. CUSTOMARY TO METRIC (SI)
UNITS OF MEASUREMENT

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
inches	2.54	centimetres
feet	0.3048	metres
pounds (mass)	0.4535924	kilograms
pounds (force) per square inch	6894.757	pascals
pounds (mass) per cubic foot	16.01846	kilograms per cubic metre
feet per second	0.3048	metres per second
knots (international)	0.5144444	metres per second
Fahrenheit degrees	5/9	Celsius degrees or Kelvins*

* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula: $C = (5/9)(F - 32)$. To obtain Kelvin (K) readings, use: $K = (5/9)(F - 32) + 273.15$.

LOS ANGELES AND LONG BEACH HARBORS MODEL STUDY

PROTOTYPE DATA ACQUISITION AND OBSERVATIONS

PART I: INTRODUCTION

Purpose of Observations

1. The four major objectives of the Los Angeles and Long Beach Harbors model study are to:

a. Determine incidence and severity of troublesome oscillations in the present harbor complex.

b. Investigate tidal circulation characteristics of the present and proposed harbors.

c. Determine optimum plan for future expansions to provide safe and economical berthing areas.

d. Analyze effect proposed expansions will have on existing harbors.

2. A concise outline of the approach taken to achieve the first two objectives is as follows:

a. Acquire prototype wave data over a 1-yr period.

b. Record observations of ship motion.

c. Catalog ships using Los Angeles and Long Beach Harbors.

d. Conduct analytical investigations of moored ship response.

e. Perform extensive analyses of prototype wave data.

f. Attempt to correlate ship motion with wave height and frequency.

g. Collect prototype tidal height and current data to verify model tests of tidal circulation within the harbor complex.

All steps in this approach except step d require prototype data of three types: wave, tide, and ship movement.

3. The necessity for hydraulic model studies to achieve the last three objectives will be discussed extensively in future reports of this series. However, before such model studies can be performed, adequate prototype information (including reliable data on wave and current

conditions in the Los Angeles and Long Beach Harbors area) must be available to allow an understanding of existing conditions and problems in the present harbors and for use in various modeling efforts. Wave and current data are especially necessary for the longer period fluctuations due to tides, tsunamis, distant storms, or other causes. Wave or surge periods of 1/4 to 30 min are of particular significance in ship mooring problems.

4. The prototype wave observation program was undertaken by the U. S. Army Engineer Waterways Experiment Station (WES) to obtain for a 1-yr period continuous, accurate, and reliable wave data for use in hydraulic and possibly mathematical model studies and also in evaluating surge conditions in the existing harbors. Records of ship movement and mooring configurations were collected to allow correlations of adverse ship motions with prototype wave data. Tidal heights and currents in the harbors area were measured to provide data for physical hydraulic model verification and to aid in identifying potential circulation problems.

Scope of Report

5. This report is a description of the instrumentation, operations, calibrations, and available records of the prototype observations pertaining to waves, tides, currents, and ship movements in the Los Angeles and Long Beach Harbors during May 1971 through June 1972. Certain data not recorded in machine-usable form are included for record and reference uses.

Wave Measurement System Requirements

6. Locations and types of measurements and instruments were based on requirements for the hydraulic model, mathematical analyses, characteristics and availability of equipment, cost, recommendations of the Science Engineering Associates (SEA) study,[1] suggestions and recommendations of the Coastal Engineering Research Board (CERB),[2,3] and other

factors. Primary requisites for the prototype data acquisition system were as follows:

a. Accuracy necessary to measure the low amplitudes of 1/4- to 30-min-period waves within a broad spectrum of background fluctuations (from 5 sec to 25 hr with total amplitudes of tides and waves up to 20 ft*).

b. Ability to function properly for a long period of time (13 months).

c. Computer-compatible records of the voluminous data (604,800 points per week per gage for 1-sec sampling intervals).

Measurement Locations

7. The 13 wave gage station locations shown in Plate 1 were chosen to obtain measurements in known problem areas near the breakwater openings, in areas of principal ship mooring, and in areas which, according to results of WES and SEA[1] analyses, were expected to be antinodal. Station 2 was located near the mooring position of the Los Angeles supertanker facility. Stations 3, 3A, 4, and 10 were used to obtain data on wave energy near the outer breakwater openings. Station 12 had a surface-piercing-type gage, the measurements of which were compared with those of the gage at sta 11 (same location), which was one of the 12 pressure-type wave gages. Station 13 was used for barometric pressure correction of the absolute pressure-type wave gages. Three float-type tide gages (LA, LB-J, and LB-P) operated by the Los Angeles and Long Beach Port Authorities were available. Tidal heights also were extracted from many of the wave gage records. Details of each wave and tide measurement location are given in Appendix A. Velocities of tidal currents also were measured at 15 stations (see Plate 2).

8. Reported ship movement and mooring configurations were collected and tabulated for vessels berthed in the east channel and west basin of Los Angeles Harbor and the southeast basin and east basin

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* A table of factors for converting U. S. customary units of measurement to metric (SI) units is presented on page 6.

(slip 1) of Long Beach Harbor. These four basin areas (Plate 2) include those locations at which moored ships have historically experienced excessive movement.

Scope of Observations

Waves

9. In general, the wave sensors were in place and operational from 26 May 1971 to 29 June 1972; however, at some particular times during this period, any or possibly all of the sensors were temporarily out of service for tape change, calibration, repair, etc. A bar chart showing the periods during which each station was operational is presented in Plate 3. The records are 90.5 percent complete for the wave gages from initial operation of the stations to the end of the measuring period. About 4.2 percent of the total possible records were incomplete during sensor canister modifications in July-August 1971, 2.5 percent during the January-April 1972 outage of the deepwater sensor at sta 10, and 2.8 percent during various other outages.

Tides

10. During the observational period of the wave sensors, the three float-type tide gages (LA, LB-P, and LB-J) were operational much of the time, with the tide records 97, 93, and 54 percent complete for the LA, LB-P, and LB-J gages, respectively. In addition to the tidal elevation data provided by these three gages, data of this type can also be extracted from the wave records for each of the 12 pressure-type wave gage stations. For 15 stations (Plate 2) in the harbors, tidal current measurements (speed and azimuth) at three depths in the water column were taken at 1-hr intervals during a 25-hr observational period beginning at 0600 PDT on 5 March 1974. The current records for all stations were complete, with the following exceptions:

a. Fifty percent completion for sta 3G and 3I, due to workboat malfunction.

b. Eighty-five percent completion for all three stations of range 2, due to a workboat malfunction.

c. Minor time delays at a few stations because of interference from passing vessels.

Ships

11. In four berthing areas of the Los Angeles and Long Beach Harbors, data on ship characteristics, mooring configurations, and ship motion were collected to provide input to be used in accomplishing the first objective of the model study, i.e., determining incidence and severity of troublesome oscillations in the present harbor complex. These data were collected in conjunction with the prototype wave measurements. Ship information was collected from 1 March 1971 to 31 July 1972 for Los Angeles Harbor and 1 March to 31 December 1971 for Long Beach Harbor. Detailed information on ship characteristics and mooring configurations was collected for each moored ship that reported movement. Additional information on type, degree, and time of ship movement was collected at 4-hr intervals for the entire berthing period of the ship. The total number of 4-hr observation periods for which information was collected is 14,176, with 2,472 of these reporting some ship movement. The breakdown of these 4-hr observations with respect to the four berthing areas of interest is as follows:

Location	Total	Movement
Los Angeles		
East channel	3,696	2,306
West basin	2,734	21
	6,430	2,327
Long Beach		
East basin (slip 1)	1,495	3
Southeast basin	6,251	142
	7,746	145
Total	14,176	2,472

These data include observations taken during the longshoremen strikes of 1 July-6 October 1971 and 17 January-21 February 1972. For each of these berthing areas, the number of 4-hr observations for each month of the study is depicted graphically in Plates 4-7. Ship data were readily available throughout the study, except for the durations of the above-mentioned longshoremen strikes. No data were obtained in the berthing areas of Long Beach Harbor after 1 January 1972.

Other Observations

12. In compliance with recommendations of CERB,[2,3] fixed-position current meters were installed at the entrances of two basins (locations A and B on Plate 1), and portable, internal-chart-recording wave and current gages were procured for making local measurements during any occurrences of heavy surging or other phenomena of interest. Another survey of tidal currents in the harbor was conducted for a 25-hr period beginning at 0800 on 8 June. Measurements taken by the fixed-position current meters were interrupted frequently due to marine growth, sometimes within hours after clearing the meters. The threshold velocity of both the fixed and portable current meters was too large to obtain reliable information on the long-period waves of interest, except for potential periods of very high, low-frequency energy. There were no such extended (up to 1 day) periods of high energy during the 13-month measurement program. The data from the strip charts of the portable wave gages were of poor quality and could only be used for relatively large-amplitude, long-period waves. The data from these current meters, the portable gages, and the above-mentioned tidal current survey are questionable, due to sparse and limited record lengths and reduced quality. Therefore, these data were not reduced, analyzed, and reported in this study.

PART II: WAVE DATA ACQUISITION SYSTEM

Wave Gages

13. At 12 of the 13 wave gage stations, the sensors were Bell and Howell Model 4-460 digital pressure transducers in submerged mountings. Each underwater sensor transducer was mounted in a waterproof canister clamped to a mounting bracket, which was strapped as required to a piling or other stable underwater surface. Eleven of these sensors contained 25-psia transducers, and a 50-psia transducer was used in the deeper submergence at sta 10. Each sensor was equipped with remote-control valving to expose the sensor to atmospheric pressure supplied through a tube from the sensor's shore-mounted transmitter station. For each use of this atmospheric pressure check system, the tube was purged of any water by a short "blow down" from the shore end of the tube through a check valve at the sensor.

14. Details from the manufacturer's bulletin and procedures for quality control and acceptance tests for the pressure transducer are given in Appendix B,[4] and the underwater assembly is shown in Figure 1. (The performance accuracy statements in paragraph 1.2.3.1f of Appendix B were of particular importance, and the manufacturer's cooperation was excellent.) Custom-made, waterproof cables connected the submerged sensors to their above-water transmitter stations. The transmitter stations included the power supplies, pressure sensor digitizers (from FM signal), and audio-tone frequency-shift transmitters for data transmission. An interior view of the transmitter station is shown in Figure 2. The pressure sensor digitizer was shifted from its usual location in the transducer housing to the above-water transmitter station to provide easier access to the digitizer in the event of any necessary maintenance.

15. The pressure transducer canisters were initially fitted with stainless steel tops to serve as heat sinks for the purge valve solenoids. However, within a few weeks severe electrolysis corroded these tops, even though special effort had been made to select materials

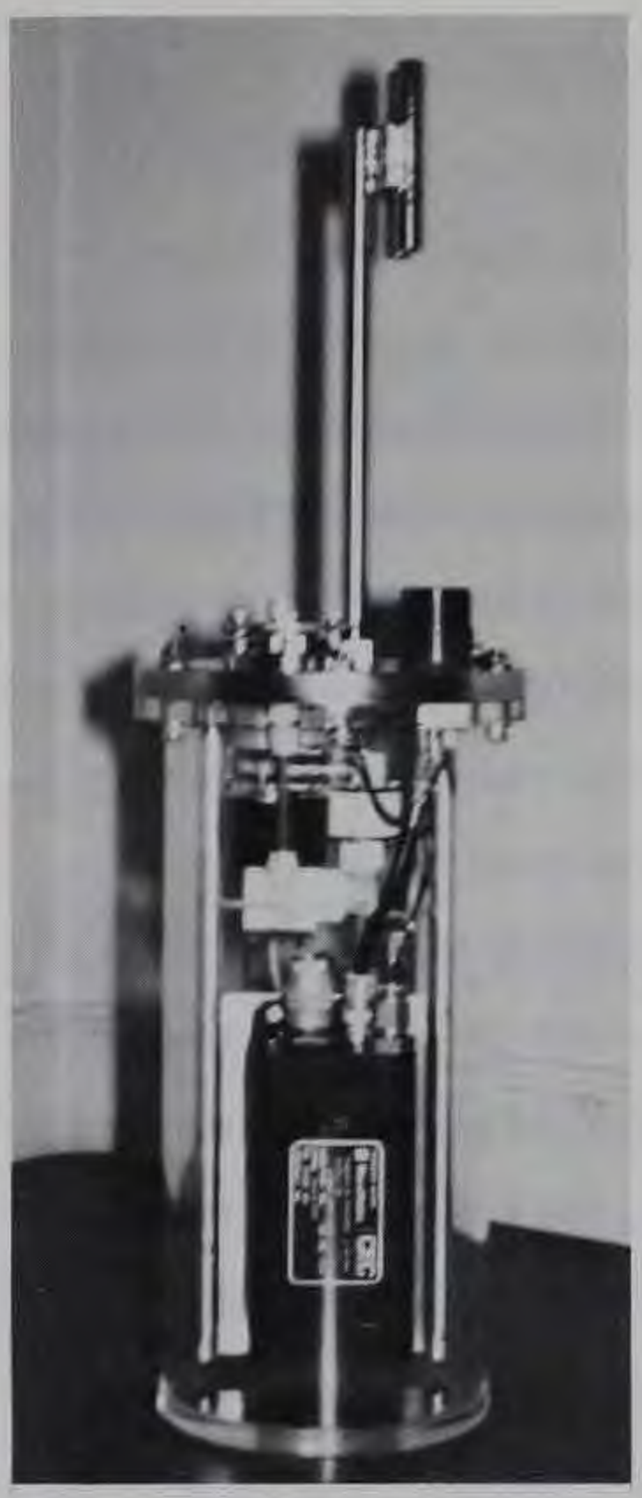

Figure 1. Submerged sensor canister (plastic, 6-in. diameter, and 15 in. high) containing pressure transducer (bottom) and atmospheric pressure check valves (top). Projection above canister is strain reliever for cable at connector

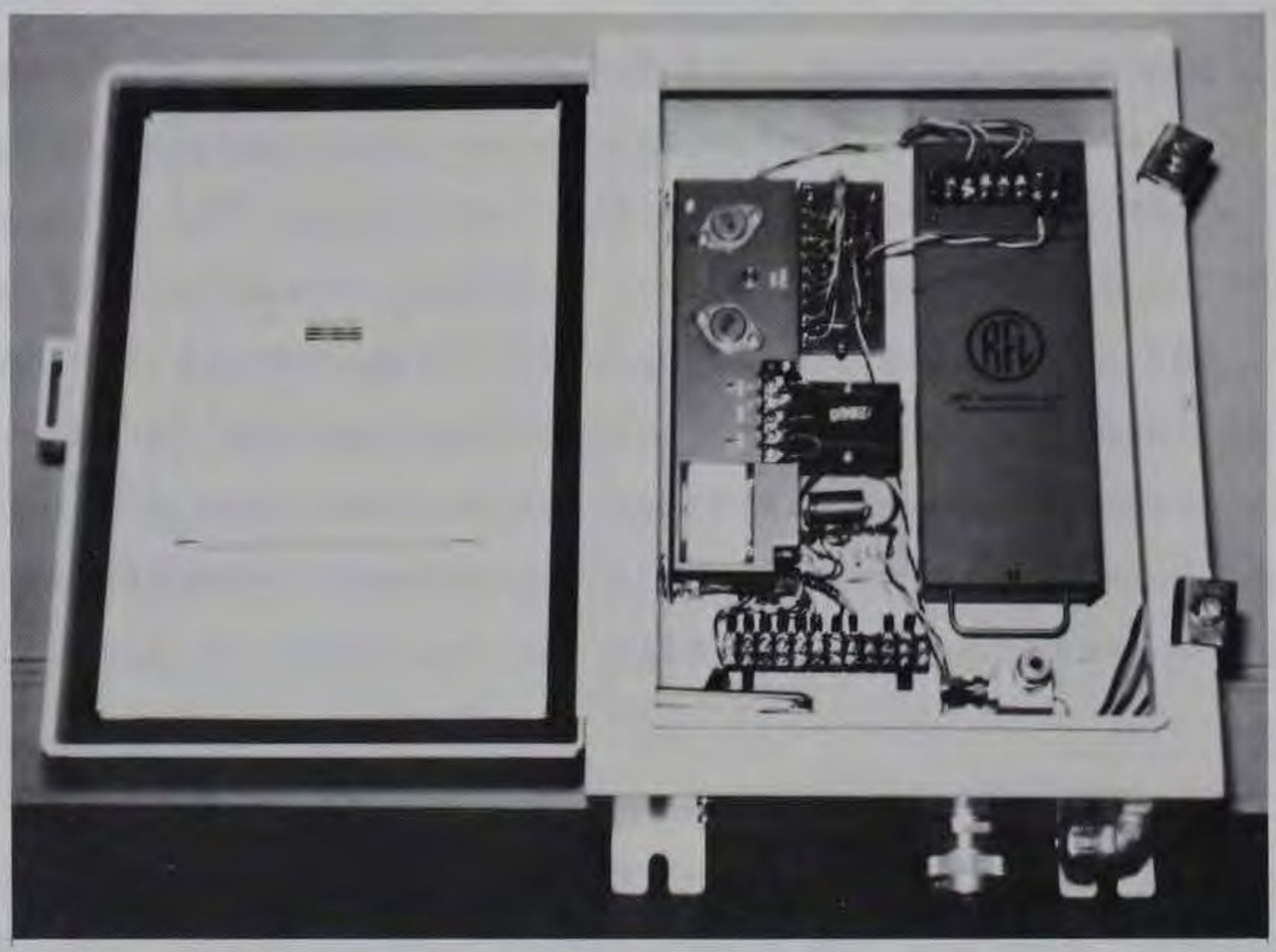

Figure 2. Shore-mounted transmitter station for wave pressure sensor. Power supply and digitizer on left, frequency-shift audio-tone transmitter on right, and connection for air line purge at lower right

compatible with the canisters. The replacement tops were made of the same plastic as that used in the canisters, and no additional problems of this nature were encountered. It was later concluded that the problem may have been crevice corrosion in the very thin space outside the gasket between the plastic cylinder and the stainless steel top.

16. The surface-piercing wave gage at sta 12 was a Baylor Wave Measuring System. This system consists of a 25-ft-long parallel-cable wave staff, a transducer, and an analog-to-digital converter with interfacing for an audio-tone frequency-shift transmitter similar to those used with the pressure sensors. It was mounted on an 8V-on-3H slope across the opening inside the four-pile dolphin used for the channel navigation light at the entrance to the Los Angeles Harbor main channel (see Figure A1 in Appendix A). Additional details of the Baylor gage are given in Appendix C.

Recording Equipment

17. Digital signals from the various sensors were transmitted to the central, data-receiver station (Figure 3) by leased, voice-grade telephone line or by radio, as indicated in the block diagram in Plate 8. Data were transmitted at approximately five pressure readings per second.

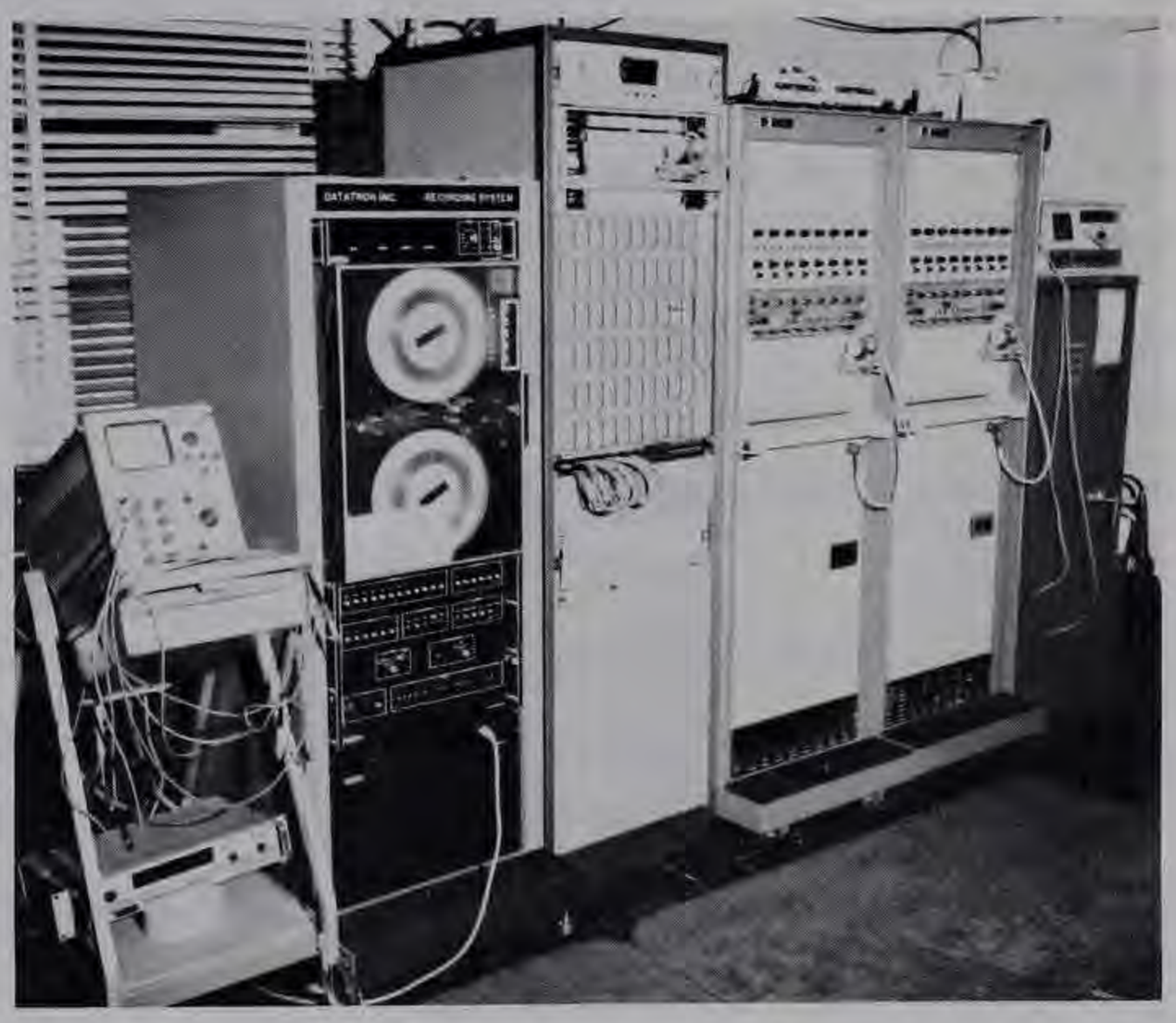

Figure 3. Central recording center. From left: diagnostic oscilloscope and digital voltmeter, magnetic tape recorder, data receiver units (with single-channel strip-chart recorder at top), two eight-channel strip-chart recorders, and communications radio (data and voice)

These data were received at the central receiver station with a high Q bandpass filter to reject noise and to demultiplex water elevation information on common carriers. The central-data receiver output for each data channel included a 12-bit natural binary output in parallel with a 12-lamp visual display and a 0-10 VDC analog signal.

18. The digital signals continuously updated the registers in a digital multiplexer which temporarily "locked" every second for recording on an incremental magnetic tape recorder. Details of the magnetic tape format are given in Appendix D.

19. The analog signals were recorded concurrently on multichannel strip charts (pressure styli) and sequentially at an expanded scale on a single-channel strip chart (pen stylus; 4 min per channel). Samples of the analog strip charts are shown in Plates 9 and 10. Comparisons of some of these analog records with records plotted from the recorded digital data are shown in Plate 11.

Operation Procedures

20. In general, most of the measurement system operation was automated and continuous, with periodic and other maintenance and supplementary observations (i.e., atmospheric pressure check, removal of marine growths (Figure 4), etc.) as appropriate. The recording center was manned daily from 0800 to 1630 in order to detect and correct any malfunctions with a minimum loss of records. Full-time attendance was impractical because of the near impossibility of accomplishing any remedial work outside of the working hours of the various organizations involved.

21. Pertinent operational information from the detailed Magnetic Tape Ledgers and Daily Narrative Logs is summarized in the graphical and tabular Magnetic Tape Recording Log in Appendix E. Users of the magnetic tapes should review this log at the times of interest to determine possible voids or errors in the records to be analyzed.

Figure 4. Typical marine growth on a transducer canister and cable after a few weeks submergence

PART III: SENSOR CALIBRATIONS

Calibration Equation

22. The data reduction equation for the pressure transducer wave measurements is*

$$Z_t = \frac{P}{\gamma_s} - Z_s - \left(\frac{P}{\gamma_s}\right)_{13} \quad (1)$$

where

Z_t = water-surface elevation, ft above mean lower low water (mllw)

P/γ_s = pressure transducer measurement, ft of seawater (see Equation 2)

Z_s = submergence of transducer, ft below mllw

$\left(P/\gamma_s\right)_{13}$ = atmospheric pressure at mllw, ft of seawater based on sta 13 data

Due to the depth-period attenuation present when wave readings are taken using a submerged pressure sensor, the recordings will require a correction factor to obtain a true wave-height reading. A procedure for making this correction is given in Appendix F.

Basic Calibrations

23. The basic calibration equation for the pressure transducers was established by the manufacturer by means of physical laboratory testing in a pressure tank accurate to ±0.01 percent full scale (see Appendix B). The equation for the Baylor gage was established at WES by electrically shorting between the two instrument cables at measured intervals (see Appendix C). In both cases, an equation of the following type was evaluated:

$$\frac{P}{\gamma_s} = Ax_c + B \quad (2)$$

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* For convenience, symbols and unusual abbreviations are listed and defined in the Notation (Appendix L).

where

P/γ_s = pressure (or water level) measured, ft of seawater

P = pressure, psi

γ_s = specific weight (64.0 pcf) of seawater at 15°C*

A = constant coefficient representing scale factor

x_c = transducer response in digital (numeric) form

B = constant coefficient representing a pressure (or water level) at zero count

The values of A and B for each transducer, based on the pretest calibrations, are as follows:

Transducer	A Feet of Seawater per Count	B Feet of Seawater
1008	0.03045	-6.439
1009	0.01532	-3.622
1010	0.01518	-3.219
1011	0.01529	-3.485
1012	0.01499	-2.796
1013	0.01526	-3.496
1014	0.01507	-3.007
1015	0.01507	-2.991
1016	0.01516	-3.199
1017	0.01527	-3.506
1018	0.01519	-3.350
1019	0.01515	-3.174
1020	0.01517	-3.209
Baylor	-0.00591	15.700

Additional factory calibrations of transducer 1013 and comparisons of the posttest with the pretest calibrations of the pressure transducers are given in Table 1.

24. The manufacturer investigated the dynamic response of the model 4-460 transducers as assembled in the field; for pneumatic tests, 15 msec was required for the transducer output to reach 90 percent of

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* The following conversions[5] corresponding to a temperature of 15°C are used throughout this report: 1 psi = 2.0415 in. of mercury = 2.25 ft of seawater. Also, for the barometer data: At 0°C, 1 psi = 2.0360 in. of mercury.

the final value following the application of a full range pressure step. This small response time, which would probably be even shorter if water had been used as the medium, is not significant as far as the prototype tests are concerned.

Submergence Considerations

25. For each of the submerged pressure transducers, the submergence calibration described is simply an evaluation of the depth Z_s below the San Pedro Bay mllw datum at which the transducer was located. It should be noted that evaluation of the wave-height spectrum at each station can generally be obtained from data based on Equation 2. However, the determination of absolute water-surface elevations, comparison of elevations at different times, and any water-surface differences between stations require data based on Equation 1, which includes barometric corrections (for the absolute pressure transducers) and transducer submergence (relative to a datum such as mllw). The value of the submergence was not the same for all stations, nor was it constant at any station for the complete test period. For example, whenever a transducer was removed for maintenance or modification, it was often not replaced precisely at the previous elevation. Unfortunately, direct field measurements of submergence were inconsistent and unreliable. The evaluation reported herein consists of three steps:

a. The barometric pressure data at sta 13 are compared with pressure records from a mechanical microbarograph and a mercury barometer.

b. The submergence of the transducer at sta 1 is determined using the LA tide gage record along with sta 13 data.

c. The submergences of sta 2-12 and 14 are determined using data from sta 1 and 13.

Basic Data for Calibrations

26. A set of 140 checkpoints was investigated, with each point at a time of slack water at various high or low tides throughout the 14 months of record (see dates in Plate 3 and Appendix E). The observed

and predicted tides and the barometric pressures for these points are listed in Appendix G, and a complete listing of all such data available from the test period is given in Appendix H. A histogram demonstrating the range and distribution of the predicted tide values is presented in Figure 5. The points were chosen such that:

a. A complete set of data (tide gage, analog barometer, and digital transducer values) was available for each point.

b. The entire 14-month test period was considered.

c. A representative sampling of high, low, and intermediate tide heights was included.

27. A mean digital count[6] for each operational station was obtained for each checkpoint. This average value pertains to the first 10-min block of data on the magnetic tape following the predicted time of the slack-water checkpoint. To obtain the average, all the data within the block for each station were considered. Since one block contains 10 min of data and since the sampling was at 1-sec intervals, a mean digital count for each station is based on 600 separate values. The mean digital counts are listed in Appendix G. (The corresponding sets of 600 data points for each mean value are omitted from this report for economic reasons since the nearly 1,100,000 values constitute a rather voluminous listing.)

Basic Assumptions for Submergence Calculations

28. The accuracy of the submergence calibrations for Z_s is highly dependent on two conditions: first, that the manufacturer's values for A and B in Equation 2 are correct and constant for the entire test period; and second, that the water surface throughout the harbor lies in a horizontal plane during times of slack water. The value of A (first condition) was roughly checked for every transducer used at each station by plotting transducer output (mean digital counts) against a calculated absolute pressure based on the microbarograph values plus observed tide heights for the checkpoints (plot scales: 1 in. = 100 counts and 1 in. = 1 ft). No significant contradictions to

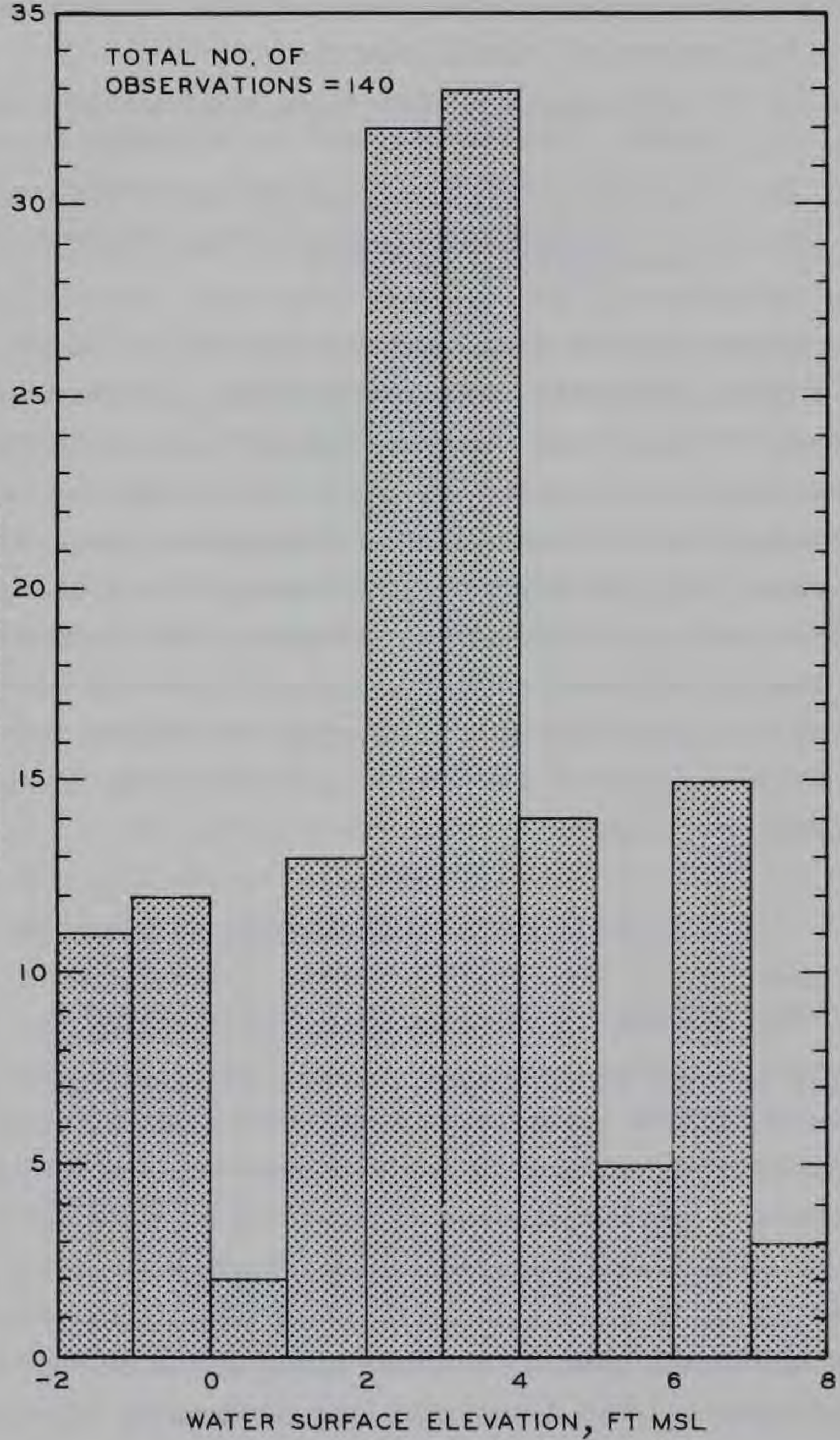

Figure 5. Histogram of predicted tide values used in checkpoint computations

this part of the first condition were detected. The value of B in Equation 2 must also be constant; however, a precise value is not required since measurement of a change in water-surface elevation and not actual zero datum of the transducer is the ultimate objective. The condition of the harbor water surface during slack water is discussed in detail in paragraphs 42-47.

Station 13 Barometric Pressure Calibration

29. Transducer 1013, which was used for nearly all the barometric pressure measurements, was recalibrated by the manufacturer twice during the test period to account for changes in the depth of protective oil over the sensing diaphragm. Comparisons of these calibrations with plots of corresponding microbarograph and transducer data for the checkpoints and some additional direct readings are given in Appendix G. The coefficients recommended for use in Equation 2 for this measurement are given in Table 2. An atmospheric pressure correction of +0.07 ft of seawater to account for the difference in elevation (about 60 ft) between the instrument and mllw is included in coefficient B for sta 13.

Station 1 Submergence

30. The sta 1 transducer signal was compared with a direct measurement of water-surface level at each checkpoint (LA tide gage near sta 1; see Plate 1). The manufacturer's values for A and B in Equation 2 were accepted as listed for transducers 1009 and 1019 in Table 1, and the value of Z_s (Table 2) varies due to apparent changes in the elevation of the transducer. Additional details of the submergence calculations are given in Appendix I. It should be noted that the individual LA tide gage readings may vary significantly from the true water-surface elevation, as indicated by the comparisons among 1/2-month averages of all the high and low readings for the three tide gages and the predicted tides (see Appendix H and paragraphs 42-47).

Stations 2-12 and 14 Submergence

31. Sta 2-12 and 14 were compared with sta 1, with water-surface elevations evaluated by means of Equations 1 and 2 and sta 13 data (see Appendix J). The values of A and $B - Z_s$ for these stations are listed in Table 2.

32. Although a daily log was maintained at the recording center (see Appendix E), not all changes (e.g., changes in the fluid pressure at sta 13) were noted at the precise times of occurrence. All coefficient changes described above and noted in Table 2 were at times when a persistent shift occurred between the mean digital count values for a series of checkpoints and the corresponding backup system values.

PART IV: ACCURACY ANALYSES OF WAVE SENSORS

Introduction

33. The purpose of these analyses is to consolidate information regarding the accuracy and interpretation of prototype water-surface levels in the Los Angeles and Long Beach Harbors as obtained during May 1971 through June 1972. This detailed study is for time-averaged water-surface levels throughout the harbor area during the period 0000, 8 June 1972, through 2400, 9 June 1972. The averaging period was to be no more than 30 min and the absolute accuracy was to be within ±0.1 ft. Questions were raised regarding the effects of geologic subsidence and uplift on the gage datum levels and the significance of the differences between actual and predicted tidal values.

34. In the paragraphs below the following are discussed: (a) relative accuracy of prototype measurements, (b) water-surface levels (8-9 June 1972), (c) absolute accuracies of prototype measurements, and (d) geodetic considerations of the Los Angeles-Long Beach mllw datum.

Relative Accuracy Considerations

35. The manufacturer's guaranteed system accuracy of ±0.25 percent full range corresponds to ±0.28 and ±0.14 ft of seawater for the 50- and 25-psia transducers, respectively. In addition to the system accuracy, meteorological phenomena (wind, air mass pressure) may cause the measured water-surface elevations at various stations to differ substantially at the same slack-water checkpoint. In order to roughly estimate the errors that might be expected in the data, the following two calculations were made:

a. The calculated level at sta 1 was compared with the levels observed at the LA tide gage (see plot in Appendix J).

b. The calculated levels at the other stations were compared with the level at sta 1 (see plot in Appendix J).

Station 1 relative
to the LA tide gage

36. Denoting each difference in water-surface levels (sta 1 minus LA tide gage reading) by ε_i, the following values apply to the 140 slack-water checkpoints (May 1971-June 1972):

a. $\frac{1}{140}\sum_{i=1}^{i=140} \varepsilon_i = 0.016$ (average error in submergence)

b. $\frac{1}{140}\sum_{i=1}^{i=140} |\varepsilon_i| = 0.103$ (average absolute difference)

c. $\sqrt{\frac{1}{140}\sum_{i=1}^{i=140} \varepsilon_i^2} = 0.125$ (RMS difference)

37. The values of ε_i for sta 1 are plotted in Appendix J; the large scatter is expected since the tide gage readings are relatively inaccurate (see paragraph 30). Since the tide gage and transducer are both located in the same section of San Pedro Bay, differences due to meteorological phenomena or current patterns in the harbor should not be significant. Therefore, a reasonable estimate of the error in the datum for sta 1 data is the above-mentioned RMS difference, i.e., ±0.12 ft.

Stations 2-12 and 14
relative to station 1

38. The average error in submergence and the RMS difference for these stations as compared with those for sta 1 are listed below. The number of applicable checkpoints varies since the durations and times of off-line periods are different.

Wave Station (versus sta 1)	Total Number of Checkpoints (N)	$\frac{1}{N}\sum_{i=1}^{i=N} \varepsilon_i$, ft	$\sqrt{\frac{1}{N}\sum_{i=1}^{i=N} \varepsilon_i^2}$, ft
2	118	0.001	0.052
3 and 3A	122	-0.002	0.092
4	119	0.004	0.067
5	129	-0.001	0.063

(Continued)

Wave Station (versus sta 1)	Total Number of Checkpoints (N)	$\frac{1}{N}\sum_{i=1}^{i=N}\varepsilon_i$, ft	$\sqrt{\frac{1}{N}\sum_{i=1}^{i=N}\varepsilon_i^2}$, ft
6	132	0.002	0.143
7	113	0.009	0.061
8	134	0.003	0.100
9	119	-0.005	0.148
10	69	-0.007	0.189
11	121	-0.003	0.043
12	130	0.007	0.334
14	41	0.007	0.076
LA tide station	140	0.016	0.125

39. The values of ε_i for sta 2 and 11, which are in the vicinity of sta 1, are shown in Appendix J. The small values of ε_i shown in these plots (along with the low RMS values listed above) indicate that the relative accuracies of the pressure transducer measurements are well within the manufacturer's specifications. A conservative error estimate, based on the RMS values of ε_i for sta 2 and 11, is $\pm$0.05 ft of water, i.e., $\pm$0.1 percent of full transducer range. Since the Baylor gage (sta 12) responds to wave phenomena not present in the pressure transducer data, the large RMS difference (0.334 ft) listed above is physically justifiable; however, this value includes all the system inaccuracies and is therefore an upper bound for an error estimate.

Water-Surface Levels (8-9 June 1972)

40. The water-surface levels (calculated from 10-min mean digital count values) during the period 1730 on 7 June to 0230 on 10 June are presented in Plate 12 and Appendix K. The 341 values for each record are plotted at the midpoint of each 10-min interval, and the data were reduced by means of Equations 1 and 2, using the coefficient values listed in Table 2 for that period. The rapid fluctuations in the sta 3A data at times of high tide were due to a system malfunction rather than to actual water-surface oscillations and are correctable in processing. The fluctuations in sta 9 data were due to water-surface oscillations in

the west basin, which were verified on one occasion by staff gage observations.

Absolute Accuracy (8-9 June 1972)

41. The relative errors described in the preceding paragraphs are not the absolute accuracy of the measurements; in other words, a question remains as to the accuracy of the calculations for the submergence Z_s of each transducer (paragraph 31). In order to evaluate the correctness of the calculated submergences, the following three conditions are considered in the paragraphs below:

a. Is the mean water level relative to a geodetic datum at LA gage (in a physical sense) equivalent to the mean water level throughout the bay area relative to the same geodetic datum?

b. Are sufficient samples (checkpoints) available for each submergence calculation so that differences due to local changes in meteorological conditions are insignificant?

c. Were the changes in the bathymetry of the bay sufficiently small or remote from the instrument locations so that differences due to subsidence, rebound, etc., are insignificant?

Water-Surface Variations

42. The mean sea level (msl) at any location is, in a physical sense, continuously variable. The variations in meteorological conditions over any time period (i.e., hourly, daily, seasonal, etc.) can cause substantial differences between observed and predicted water-surface levels. In addition, observed water-surface levels vary according to geographic location, particularly at locations with different coastline geometries. The reasons for and significance of these differences are discussed in References 7 and 8.

43. The possible variations in San Pedro Bay cannot be evaluated directly from the prototype checkpoint data; that is, any differences that might exist have already been lumped into the submergence term Z_s in Equation 1. Two comparisons can be made: first, the average

water-surface elevations above mllw of the LB-P and LB-J gages as well as the average predicted-tide elevations can be compared with the average for the LA tide gage for the checkpoints; and second, the water-surface levels can be computed at each station at times for which the water-surface elevation is known to be essentially plane (see Appendix H).

44. The tide gage comparisons for applicable checkpoints in the 14-month period are as follows:

Source of Data	No. of Checkpoints	Average Water-Surface Elevations Feet Above mllw		Difference, ft
		Source	LA gage	
Predicted tide[9]	125	2.854	2.854	0.000
LB-P tide gage	77*	2.817	2.986	-0.169
LB-J tide gage	62*	3.087	3.034	+0.053

* The LB-P and LB-J gages did not operate during the complete test period.

Although the basic data for these comparisons are relatively inaccurate ($\pm$0.1 ft at best; see also paragraph 30), the indications are that on the average a small difference exists in the checkpoint data (about 0.2 ft between gages LB-P and LB-J).

45. A comparison of tide gage and predicted-tide values for each high and low tide during June 1972 is provided in Appendix K. There is obviously a persistent fall in observed water-surface levels (increase of values of prediction minus observed data) in the harbor during the month that is not reflected in the predicted-tide values. In fact, during 8-9 June the observed values averaged in the order of 0.3 ft less than the predicted tide gage values, and the difference varied about 0.6 ft during the period 1-30 June.

46. On five occasions during 21-26 June 1972, the difference between lower high water and higher low water was less than 1.0 ft. Under these conditions, the flow through the harbor at higher low water had to be essentially zero, and the average water surface, barring local meteorological phenomena or slow surging, must have been essentially

plane. The submergences of the transducers were calculated (as in paragraph 31) for these five occasions; the results are compared with the previous submergence values in the following tabulation:

Station	June 1972 Average Submergence at Five Occasions Feet Below mllw	Change from Original (Table 2) ft	No. of Checkpoints in Original Calculation*
1	9.85	-0.06	25
2	10.06	-0.05	25
3A	17.67	-0.08	57
4	10.88	-0.01	60
5	7.57	-0.09	36
6	7.69	-0.17	23
7	6.16	-0.03	25
8	5.51	-0.20	60
9	4.78	-0.13	25
10	16.22	+0.01	55
11	9.55	-0.08	25
12	15.81	+0.31	60
14	13.02	-0.12	41

* Checkpoints for transducers then in place at the measuring stations.

47. The average change in the above tabulation (omitting the Baylor gage) is -0.08 ft, which is less than the 0.1-ft inaccuracy of the LA tide gage. The larger changes (at sta 6, 8, 9, and 14) are less than the expected amplitudes of the longer period oscillations not appearing on the tide gage records; consequently, the larger changes are possibly due to natural phenomena (slow surging, etc.) rather than to errors in the original submergence calculations (paragraph 31). Therefore, the suggested accuracies of the water-surface measurements (excluding the Baylor gage) for the wave observation period as based on the above-mentioned data for June 1972 are as follows:

a. Transducer response: ±0.05 ft

b. Transducer elevation: ±0.1 ft

Geodetic Considerations of the Los Angeles-Long Beach mllw Datum

48. The geodetic benchmark for the Los Angeles-Long Beach area is

termed TIDAL 8; this benchmark is apparently outside the regions in the bay area that commonly undergo geologic movement.[10] The elevation of mllw in San Pedro Bay was established[10] during the period 1919-42, and TIDAL 8 is referenced to this mllw datum. Local msl in the bay is generally taken to be 2.80 ft above mllw.[11] The location of TIDAL 8 is shown in Plate 1. Also shown are values of subsidence (negative) and rebound (positive) at eight locations in the bay. These values are taken from field survey data;[12] the changes occurred during the period August 1971-February 1972. Some of the rebound values (0.102 ft, for example) are large enough to present a measurable change in the submergence calculations. However, any such changes have been lumped into any other changes in the computed submergence.

PART V: WAVE, SHIP MOVEMENT, AND TIDE OBSERVATIONS

Introduction

49. The Los Angeles and Long Beach Harbors have a long history of long-period wave activity, which is well summarized in Reference 1. In the same reference, sparsely observed long-period wave energy was compared with theoretically calculated seiche periods of the outer harbor and certain slips and basins (Table 3). In view of this and other previous work, WES conducted an extensive data collection program in an attempt to better define the long-period energy occurring in various locations of the harbors and to correlate the occurrence of such long-period wave energy with adverse ship movement.

50. Since previous studies had shown certain berthing areas to be more susceptible to mooring difficulties, it was natural to investigate these areas to estimate the causes of such mooring problems. According to Reference 1, periods ranging from 15 sec to 90 min are found in the harbors. In the berthing areas more susceptible to mooring problems, there are noted observations and theoretical calculations of seiche periods ranging from 1 to 15 min. From theoretical consideration,[13-15] calculated moored ship responses show peaks in this same period band. Consequently, concurrent wave and ship mooring data for these berthing areas are essential in attempting to define acceptable energy levels for given periods, which in turn is a major factor in designing or modifying a harbor. Therefore, during the planning and initiation of the wave data collection program, it became apparent that moored ship movement information is required in any attempts to define energy levels above which adverse mooring motion occurred. In order to provide ship movement data for this portion of the study, a collection scheme was devised to observe subjectively and record ship movements during the wave data collection period.

51. In addition to correlation of wave energy with ship motion, prototype wave data are necessary to understand more about the energy in very long-period waves (15-90 min), which are discussed in Reference 1.

Harbor design or modification requires at least a knowledge, if not a complete understanding, of the occurrence of such phenomena. For example, very long-period waves may be important to some extent in maintaining acceptable circulation characteristics of a harbor. Thus, harbor modifications which change the energy levels at such wave periods must be carefully considered.

52. In addition to wave and ship movement information, tidal data were collected as partial fulfillment of the second objective of this study. Tidal elevations and currents were monitored at selected locations in the harbors to provide prototype tidal data for verification of physical hydraulic model tests of tidal circulation in the existing harbors and to assist in identifying potential or existing circulation problems in the harbors.

Wave Observations

General characteristics

53. To supplement and extend current knowledge of the wave climate in Los Angeles and Long Beach Harbors, WES undertook an extensive prototype data survey during the period June 1971 through June 1972. Water-surface elevations sampled at 1-sec intervals were collected from nine harbor and four breakwater locations at various times throughout the study. The characteristics of the data acquisition system are described in much detail in Part II, while specifics of the gage locations can be found in Part I. The wave data discussed below were collected exclusively from pressure cell gages.

54. Usable wave data are not available for all gages at all times during the survey for various reasons:

a. Certain gages were on line for only a portion of the survey, due to either location changes or instrumentation outages.

b. Periodically (about every 5-1/2 days), use of the system as a whole was interrupted from 0.5 to a maximum of 8 hr for magnetic tape and strip chart paper changes and servicing. Wave data lost during these times amount to less than 1 percent of the total collected during the study period.

c. At various times during otherwise normal operation, it was necessary to make calibration checks of a pressure cell or a strip chart recorder.

d. Occasionally, there were recording system errors resulting in either a parity error, a "hung" bit in the A/D conversion, or a clipped record due to data exceeding the pressure range. In general, these errors were found only when attempting to use the data.

The magnetic tape recording log in Appendix E tabulates the on and off times for each of the gages, the start and stop times for each of the magnetic tapes and correlated analog strip charts, and known system calibration checks (pressure cell or strip chart recorder) as well as known temporary instrumentation problems which may have affected wave data. However, the log may be incomplete since it does not contain information about parity errors, "hung" bits, and clipped data.

55. After allowing for the above-mentioned losses of data, there still exist more than one-third billion measurements of water-surface elevations with correlated time and spatial coordinates, which comprise the usable wave data.

Data storage

56. All original information is retained in both analog and digital forms on strip charts and magnetic tapes, respectively. These analog raw data on pressure-sensitive strip charts are stored in a metal storage cabinet in a controlled environment (Figure 6). Likewise, the digital raw data on magnetic tapes are stored in a metal, magnetic tape cabinet in a controlled environment (Figure 7). The strip chart and magnetic tape information is correlated in that the strip charts were changed each time the magnetic tapes were changed. Since there were 16 channels of information recorded, there are two eight-channel strip charts for each of 80 magnetic tapes. In addition, for each magnetic tape, there is one strip chart with an expanded scale and with data sequentially recorded from each channel for 4 min. Due to the vulnerability of the original pressure-sensitive strip charts, they are to be reproduced on microfilm for permanent storage. It is anticipated that as time and funds become available, the original digital data will be converted to engineering units in a demultiplexed form and stored on

Figure 6. Strip-chart analog wave data

Figure 7. Magnetic and digital wave data

magnetic tapes in a machine-independent format for more convenient use by interested parties.

57. The details of the magnetic tape format for the original data are summarized in Appendix D. It is apparent that data recovery requires substantial bit manipulation in the absence of a 12-bit machine. Furthermore, the demultiplexing of the data for more than a few records demands either large core or a high volume of input and output. These considerations generally lead to machine-dependent (site specific) programming to attain efficiency. The desire to avoid such a restriction prompted the above-mentioned proposal for permanent storage of the original digital data.

Scaling factors and corrections

58. Determination of the scale factors used in converting the original digital data to water-surface elevations relative to mllw is treated in detail in Part III. The actual implementation of the conversion scheme for use by digital computers at WES is described herein.

59. The digital count recorded by the submerged pressure cell is related to the total pressure upon it by

$$P_t = A'_c K_c + B'_c \tag{3}$$

where

P_t = total pressure, psi

A'_c = scale factor for a cell, psi per count

K_c = digital count recorded by a cell

B'_c = zero offset factor for a cell, psi

Furthermore,

$$P_t = P_b + P_s + P_{wt}$$

where

P_b = barometric pressure, psi

P_s = pressure due to water column between mllw and the depth of a cell, psi

P_{wt} = pressure due to the variable water column between the surface and mllw due to both waves and tides, psi

Therefore,

$$P_{wt} = P_t - P_b - P_s$$

Dividing each term by the specific weight of seawater yields the height of an equivalent column of seawater.

$$H_{wt} = H_t - H_b - H_s = \frac{P_t}{\gamma_s} - \frac{P_b}{\gamma_s} - \frac{P_s}{\gamma_s} \qquad (4)$$

where

$$H_t = A_c K_c + B_c$$

$$A_c = \frac{A'_c}{\gamma_s}$$

$$B_c = \frac{B'_c}{\gamma_s}$$

and particularly since the barometer is a pressure cell

$$H_b = A_b K_b + B_b$$

where

A_b = scale factor per count for barometer, feet of seawater

K_b = digital count recorded by barometer

B_b = zero offset factor for barometer, feet of seawater

$-H_s$ is simply the elevation of the pressure cell relative to mllw, i.e.

$$-H_s = REL$$

Substitution into Equation 4 yields

$$H_{wt} = A_c K_c + B_c - (A_b K_b + B_b) + REL$$

In practice, the data are scaled one record at a time; and since a record consists of only 10 min of data, the barometric pressure cell

counts are averaged over the 10-min period to minimize computations. Thus

$$\overline{H}_b = A_b \overline{K}_b + B_b$$

$$H_{wt} = A_c K_c + B_c - \overline{H}_b + REL \tag{5}$$

The final equation (Equation 5) is implemented in computational procedures, which will be further explained below.

60. It is well known that pressure associated with waves is attenuated as the depth of the submerged pressure cell increases. Thus, increasing the depth of submergence of the pressure cell acts as a low-pass filter in acquisition of wave data. The pressure response function for submerged pressure cells (assuming the cells themselves are perfect) is dependent upon the wave period, the depth of the cell, and the water depth at the cell location. No correction of subsurface pressure response was attempted in the scaling of raw data. However, in a future report dealing with spectral analysis of the data, the correction for submergence of pressure cells at specific gages will be covered in detail. General information as to the subsurface pressure response factor is presented in Appendix F.

Data reduction and editing

61. Obviously, the first step in any data analysis is to convert the data to a form acceptable to the user. WES has developed a program for preprocessing data from the original data tapes. It must be emphasized that although much of the program is standard Fortran, certain machine specific operations are used in reading the data tape and subsequent bit string manipulations. The program could be altered to be machine-independent at the cost of increasing run time on the WES computer.

62. Preprocessing data encompasses a wide range of operations and depends upon the operations to be used in the subsequent processing of data. Henceforth, preprocessing should be construed as recovery of data from storage media, performing any necessary data adjustments (such as

scaling, adding constants, etc.), editing the data, and storing the resulting data for future use. Other preprocessing functions might include trend removal and digital filtering, particularly if the subsequent processing is to be based on band-limited frequency analyses. These latter preprocessing functions will be considered in a future report in this series on wave data analyses.

63. The data preprocessing program developed at WES for use on the Los Angeles and Long Beach Harbors prototype data includes the following functions:

a. Recovering data from digital magnetic tapes.

b. Demultiplexing data.

c. Scaling data to water-surface elevations relative to mllw.

d. Editing data.

   (1) Removing spikes.

   (2) Discovering extended sequences of bad data.

      (a) Option 1--Do nothing to correct the sequence.

      (b) Option 2--Replace data with tide information only, with no attempt to reconstruct waves.

      (c) Option 3--Attempt data correction by filling the gap with information from before and after the gap.

e. Storing resultant data.

   (1) Option 1--On tape for future use.

   (2) Option 2--On high-speed peripherals for immediate analysis.

This program can operate either as a self-contained unit to generate information for future use or as an input routine for a data analysis program.

Ship Motion Observations

Study areas

64. Since observing completely and recording ship movements of all ships moored in the entire harbor complex during the study period would have made collecting and managing the data extremely difficult and

financially impossible, four areas were selected as study areas. In order to provide a basis for the selection, a survey was conducted of past histories of ship motion problems in various basins to determine which basins had the most problems and would most likely experience ship movement problems during the course of the study period. The four study areas selected by the U. S. Army Engineer District, Los Angeles (LAD), were the east channel and west basin berths in Los Angeles Harbor and the southeast and east basin (slip 1) berths in Long Beach Harbor.

Data collection form

65. Due to the fact that the wave data and ship movement observations would be collected for approximately 1 yr, a systematic means of collecting visual observations of mooring conditions rather than a measured system of observations was chosen to facilitate both data management and the economics of collection. This systematic means was provided by a standardized form, which was selected from several trial forms developed and used during the initial stages of the collection period. The form selected and used for the majority of the study period was designated Ship Movement and Surge Record, Form SPL 538 (Plate 13).

66. Form SPL 538 contained three basic blocks which provided space for information characterizing the moored ship and its movements. The first block provided space for several parameters identifying the ship, including its location and times of arrival and departure. The second block of information provided space for a description of the ship's mooring configuration, such as mooring line positions, physical characteristics of the lines, and types of strain under which the lines were initially placed. In the third block, visual observations of ship movements were recorded, for which purpose space was provided for four full days of berthing, with each day broken into six 4-hr observation periods. For each observation period, space was provided to record the time of the observed ship movement, the symbols describing the degree of movement (light, medium, or heavy), and the type of movement (longitudinal, transverse, vertical, fishtail, and/or roll).

67. Most of the terms used in the form are self-explanatory to

personnel versed in ship mooring terminology. Terms describing the degree of movement were selected to reflect the physical appearance of the mooring lines as the ship moved. The terms used to describe the type of movement were redefined from the six classical translation and rotation terms for ship motion to indicate in simple language the direction of the movement. The reason for using 4-hr observation periods was to reduce the total amount of data to be collected and was based on the postulation derived from past experiences that surging conditions in the basins of Los Angeles and Long Beach Harbors do not change rapidly. However, in case of severe strains accompanied by rapidly changing surging conditions, harbor personnel were prepared to make any necessary observations. A more detailed description of the form and its terms can be found in Report 2 of this series.[16]

68. During the periods from 1 March 1971 to 31 July 1972 for the Los Angeles Harbor study areas and 1 March 1971 to 31 December 1971 for the Long Beach Harbor study areas, the Ship Movement and Surge Record forms were distributed by LAD to harbor security personnel. During the course of patrolling their respective areas, security guards observed and recorded ship movements and maintained the record forms. While it was recognized that the selected method of collection contained degrees of subjectivity in terms of individual personnel using the forms, the security personnel were chosen for two reasons: (a) the security personnel were on duty 24 hr a day, and (b) having the same personnel constantly maintain the forms provided a more consistent bias than would a system in which personnel of each individual ship maintained the forms. Therefore, any interpretations based on the results of this method must consider such subjectivities.

69. Once the necessary information was recorded, the forms were periodically returned to LAD, where the data contained on the forms were assigned numerical coding and then transferred to computer cards. Also, LAD personnel built a separate card file containing information about the physical characteristics of each ship registered on a ship motion observation form. Once the study period ended, the two card files were combined and then forwarded to WES for computer sorting and analyses.

Computer sorting of ship motion records

70. Upon arrival of the card files at WES, the observation data were processed by a WES-developed program TAPEDT. Program TAPEDT scanned the card data, eliminated blank records, and stored the remaining data on magnetic tape. This provided an easier and safer means of data processing and also a more permanent means of data storage.

71. The data tape was first processed by a computer program MOOR, which was also developed by WES. Program MOOR scanned the data tape, extracted all information pertaining to mooring configurations, decoded the information, and provided a table output of the same. The data tape was then processed by program SURGE, which was initially developed by LAD and later modified by WES to include sorting parameters of degree, type, and time of movement. Program SURGE scanned the data tape, extracted all information pertaining to ship movement observations, and then used various sort parameters to produce tables containing all reported movements, tables containing different degrees of movement for any type, and tables of longitudinal movement. The above-mentioned tables were generated for each of the two harbors, and samples of those for Los Angeles Harbor are presented in Tables 4-9.

72. The above-mentioned collection and processing scheme is summarized in graphical form in Figure 8. A more detailed description of programs MOOR and SURGE and complete table outputs of the reported mooring configurations and ship movement observations can be found in Report 2 of this series.[16] The data obtained were subjected to various statistical analyses and summaries, the results of which will be presented in a future report of this series.

Tidal Observations

Tidal heights

73. Tidal heights were obtained from the wave gage measurements by the procedure described in paragraphs 27 and 40. The data so obtained for the period 7-10 June 1972 are presented in tabular form in

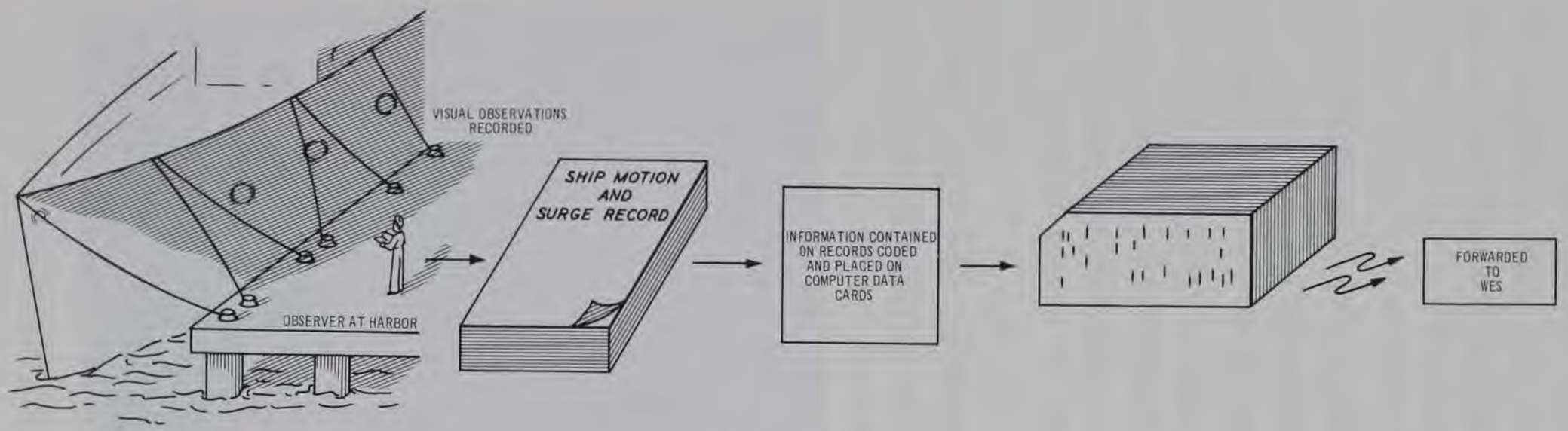

Figure 8. Data collection and sorting procedure

Appendix K. In addition, tidal height data were available from three float-type gages (LA, LB-J, and LB-P) operated by the Los Angeles and Long Beach Port Authorities. Appendix A and Plate 2 provide details of each tide gage location and Appendix H presents the observed tide levels at these gages.

Tidal currents

74. The tidal current survey was conducted by the WES, with assistance from the LAD, U. S. Coast Guard, Los Angeles and Long Beach Port Authorities, and the Allan Hancock Foundation of the University of Southern California. At 15 stations in the harbors, tidal currents were monitored for 3 depths in the water column at 1-hr intervals for a 25-hr period, beginning at 0600 PDT on 5 March 1974. Locations of these 15 stations are shown in Plate 2.

Equipment

75. The apparatus used for current measurement (see Figure 9) consists of a current meter, a direction indicator, and a 90-lb streamlined

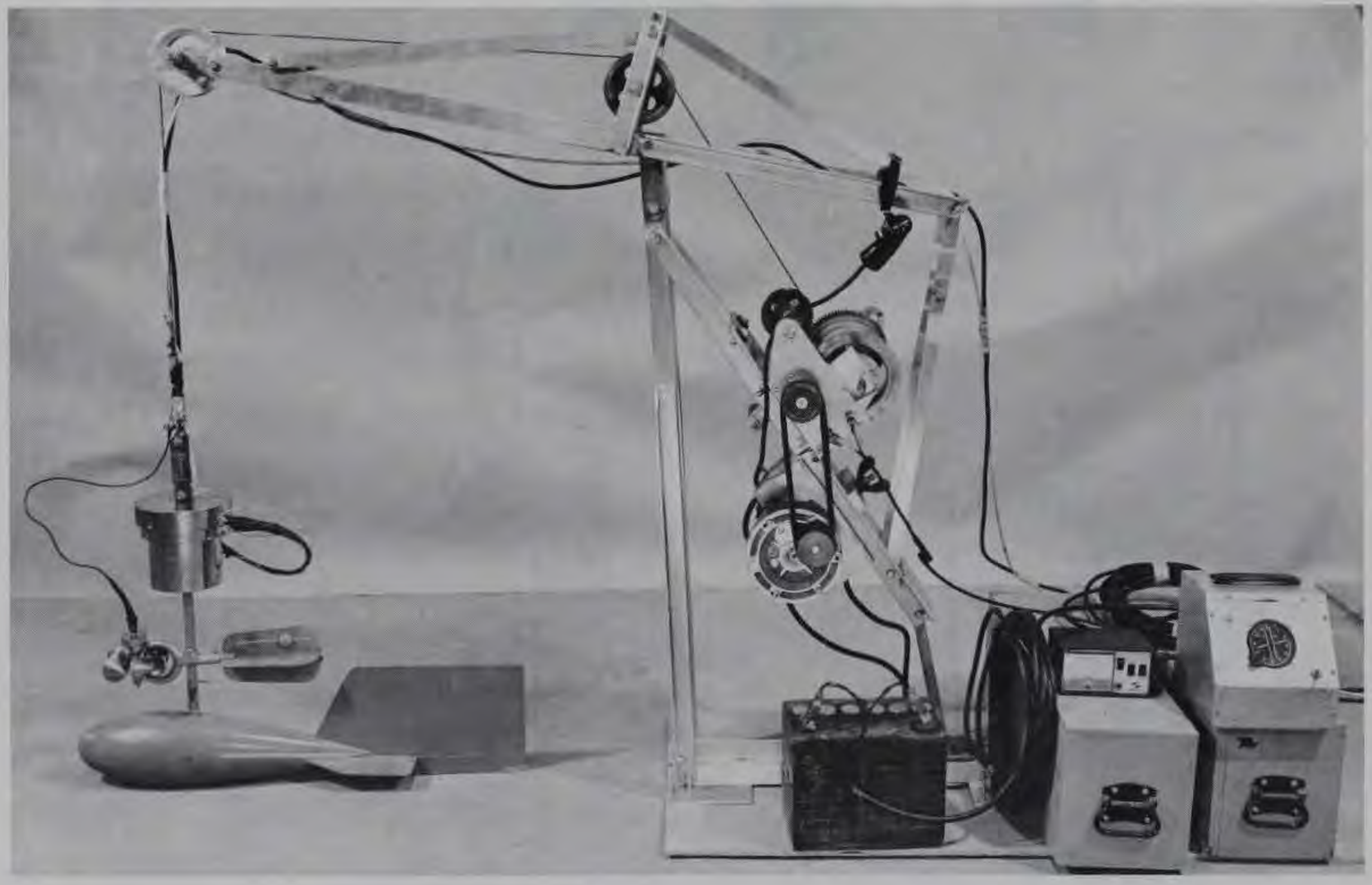

Figure 9. Instrumentation for monitoring tidal currents

weight, all suspended by a 3/16-in. wire rope from a support frame equipped with pulleys and a drum-type winch. The assembly is operated from a boat.

76. The current meter used in this survey was a direct reading Gurley Model 665. The sensing unit uses a vertical axis bucket wheel. Readout from the indicator is in feet per second, with minimum scale graduations of 0.2 fps. The meter displays linearity of ±5 percent from 0.2 to 7 fps, and error due to temperature change is approximately 0.05 percent per degree Fahrenheit deviation from 75°F. The threshold velocity is about 0.2 fps.

77. The direction indicator is a remote reading magnesyn compass designed by the WES such that it indicates the magnetic north azimuth of the direction from which the current is flowing. The readout device has a precision of ±2 deg, but accuracy is dependent upon the balance of the streamlined weight and the strength of current available to turn it. For currents greater than 0.5 fps, the accuracy is ±10 deg. For lower velocities, accuracy is reduced to ±25 deg, particularly when waves cause boat motion and when tidal currents slacken and turn.

78. The winch used to raise and lower the submerged unit operates an indicator that shows the depth of the unit below the water surface. This indicator is used to measure the total water depth and to position the current meter for each reading.

79. Wind measurements were taken with a Weather Measure Corporation Model W132 air meter, which is a hand-held instrument with direct readout.

Collection procedure

80. Each current measurement station was marked by a surface buoy tethered to a 200-lb scrap iron anchor. A flashing light on the buoys aided in locating them during night operations. One boat was assigned to each range, from which measurements were taken at three stations at about 1-hr intervals during the 25-hr survey. During measurements, the boat was tied to the marker buoy, with engines either idling or stopped.

81. The measurements were taken by tying the boat to the buoy, lowering the current meter assembly to the bottom, and recording the

water depth on the data recording sheet (Plate 14). The meter was then raised to 2 ft above the bottom, and current magnitude and direction were recorded. Weather conditions, vessel traffic, equipment malfunction, or other occurrences likely to affect the data were noted in the remarks column of the data sheet. The meter was then raised to half the water depth previously measured, and the procedure was repeated. Then the meter was raised to within 2 ft of the surface, and measurements were again taken.

Wind data

82. Wind velocity measurements were made at irregular intervals aboard a service boat that moved from range to range. Wind speed was measured with a hand-held anemometer at about 10 ft above the water surface, and the boat's compass was used to estimate wind direction.

Survey conditions

83. The tide of 5-6 March 1974 was a typical mixed tide of spring range. The diurnal range was 7.1 ft. Details of the tidal height measurements from the U. S. Coast and Geodetic Survey's LA gage will be presented in a future report of this series.

84. Water temperatures during the survey ranged from about 48 to 52°F. Wind speeds varied from calm to 5 knots during most of the day, except during a brief period when the afternoon onshore breeze reached 13 knots. Some light-to-medium wave chop occurred during the survey. Swell outside the breakwater was negligible. Data on wind velocity and wave regime during this survey will be noted in the future report mentioned in paragraph 83.

PART VI: SUMMARY OF RESULTS AND RECOMMENDATIONS

Summary of Results

85. The records collected at 1-sec intervals over the 13-month period for 13 wave gage locations (Plate 1) in the Los Angeles and Long Beach Harbors are complete for 90 percent of the stations' collective operation period (1 June 1971 to 1 July 1972). These data are recorded in digital form on magnetic tapes and in analog form on strip charts. Users of these pressure data from the magnetic tapes should carefully review the Magnetic Tape Recording Log (Appendix E) at times of interest to determine possible voids or errors in the data to be analyzed. From these pressure records, wave height data can be obtained quite reliably ($\pm$0.05 ft error) using Equation 5. Comparisons of absolute water-surface elevations with respect to time and/or location involve determination of the wave sensor elevation with somewhat less reliability ($\pm$0.1 ft error).

86. In conjunction with prototype wave measurements, data on ship characteristics, mooring configurations, and ship motion were collected for ships moored in four berthing areas of the Los Angeles and Long Beach Harbors. In addition to ship characteristics and mooring configurations, ship movement data (type, degree, and time of occurrence) were collected at 4-hr intervals for the entire berthing period of each ship in these four berthing areas. There are 14,176 4-hr observation periods for which ship movement information was collected. Ship movement of some type and degree is reported for 2,472 of the total 4-hr observation periods, with 2,327 of these occurring in Los Angeles berthing areas.

87. During the wave observation program, tidal height records were 97, 93, and 54 percent complete for the LA, LB-P, and LB-J float-type tide gages, respectively. In addition, tidal height data can be extracted from the wave records for each of the 13 pressure-type wave gage stations, and such information (Plate 12 and Appendix K) has been calculated for the period 1730 on 7 June to 0230 on 10 June 1972. For 15 stations (Plate 2) in the harbors, tidal velocity data at three depths in

the water column were obtained at 1-hr intervals from 0600 PDT on 5 March to 0700 PDT on 6 March 1974. On the average the current records for all stations were 93 percent complete.

88. The extensive prototype field study as documented in this report has successfully fulfilled the first three steps and last step in an approach, as outlined in paragraph 2, to achieve the first two of four major objectives (paragraph 1) of the Los Angeles and Long Beach Harbors model study. For these harbors, an excellent data base of wave, tide, and ship movement information has been established for future use in mathematical and physical hydraulic model studies.

Recommendations

89. For the wave sensors (pressure transducers), calibration and submergence coefficients could be recalculated by cross correlation techniques among the various wave sensors. This procedure, which would be independent of the (less reliable) data from the float-type tide gages, could be expected to improve the reliability of the absolute water-surface elevation data by a factor of two. "Real-time" calibration and record quality checks should be incorporated in future field operations to better insure continuous and reliable records. In addition to these "real-time" maintenance procedures, quasi "real-time" analyses of wave data would not only reduce the time lag between data collection and analyses but could assist in detecting equipment malfunctions. Underwater sensors should be mounted in a manner that would permit installation and retrieval without divers. Moving-element sensors (current meters) should be avoided for long-term data collection in marine environments conducive to rapid growth of marine organisms.

90. For future ship movement observation programs, additional and more specific data concerning mooring line configurations, such as exact length of each mooring line, precise position of attachment to ship and pier, and the initial tension in each line, would be beneficial for analytical studies of ship motion. For a few selected ships, direct measurement of ship motion (at least surge, sway, and roll) in addition to

the subjective categorizing of ship movement would help to reduce subjectivity of collective data and to provide quantitative ship movement data for correlation with measured wave energy.

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Table 1

Summary of Factory Calibrations of Pressure Transducers*

Transducer No.	Initial Calibration, 4-27-71: Count at 15 psia	Count per 10 psi	(A) Feet of Seawater per Count**	(B) Feet of Seawater at Zero Count	Final Calibration, 7-10-72: Count at 15 psia	Count per 10 psi	Error in Using Initial Calibration at Time of Final Calibration, ft Seawater: 15 psia	25 psia	Comparable 0.25 Percent Full Scale (FS) Error, ft Seawater
1008	1320	739	0.03045	-6.439	1313	735	-0.213†	-0.335††	0.28
1009	2440	1469	0.01532	-3.622	No response (possibly damaged in removal)				--
1010	2435	1482	0.01518	-3.219	No response (possibly damaged in removal)				--
1011	2436	1472	0.01529	-3.485	2440	1484	+0.061‡	+0.245‡‡	0.14
1012	2438	1501	0.01499	-2.796	2432	1481	-0.090	-0.390	0.14
1013	2440	1474	0.01526	-3.496	No calibration		--	--	--
1013	2381§	1466§	0.01535	-2.793	No calibration		--	--	--
1013	2402§§	1425§§	0.01579	-4.168	2397	1472	-0.079	+0.663	0.14
1014	2439	1493	0.01507	-3.007	2437	1487	-0.030	-0.121	0.14
1015	2438	1493	0.01507	-2.991	2444	1498	+0.090	-0.166	0.14
1016	2437	1484	0.01516	-3.199	2432	1476	-0.076	-0.197	0.14
1017	2439	1473	0.01527	-3.506	2434	1483	-0.076	+0.076	0.14
1018	2442	1481	0.01519	-3.350	2450	1487	+0.122	+0.213	0.14
1019	2437	1485	0.01515	-3.174	2448	1478	+0.167	+0.061	0.14
1020	2436	1483	0.01517	-3.209	No response (possibly damaged in removal)				--

* See Appendix B for basic data.

** At 15°C: 1 psi = 2.0415 in. Hg = 2.25 ft seawater.

† -0.457 ft at 35 psia for deepwater use.

†† -0.578 ft at 45 psia for deepwater use.

‡ Example calculation: $\frac{2440 - 2436}{147.2}$ 2.25 = +0.061 ft (higher than with final calibration).

‡‡ Example calculation: $\frac{(2440 + 1484) - (2436 + 1472)}{147.2}$ 2.25 = +0.245 ft (higher than with final calibration).

§ Extrapolated linearly from actual readings in factory recalibrations on 7-29-71.

§§ Extrapolated linearly from actual readings in factory recalibrations on 2-25-72.

Table 2

Wave Transducer Calibrations

$$Z_t = Ax_c + (B - Z_s) - \left(P/\gamma_s\right)_{13}$$

Z_t = water pressure above mllw, ft seawater

A = scale factor, ft seawater per digital count unit

x_c = transducer response, digital count units

B = pressure represented by zero count, ft seawater

Z_s = submergence of transducer below mllw, ft seawater

$\left(P/\gamma_s\right)_{13}$ = atmospheric pressure at mllw from station 13 data, ft seawater

Wave Sta No.	On-Line (Julian days)	Tide Reading No.	Transducer No.	Equation Coefficient A ft/unit	B ft	$B - Z_s$ ft	Z_s ft	Remarks (See Footnotes*)	Coefficients Used in Data Reduction and Appendix J Comparisons: Julian Day and Time From	To	$A \times 10^{-2}$	B	Z_s
01	146-196	001-018	1009	0.01532	-3.62	-12.01	8.39	--	150 (0000)	222 (1100)	1.532	-3.622	-8.4
	225-365	028-080	1019	0.01515	-3.17	-12.90	9.73	(1)	222 (1400)	End	1.515	-3.174	-9.8
	001-181	081-140	1019	0.01515	-3.17	-13.08	9.91	(2)					
02	155-207	004-022	1012	0.01499	-2.80	-12.72	9.92	--	150 (0000)	222 (1100)	1.499	-2.796	-9.8
	236-281	032-047	1014	0.01507	-3.01	-14.34	11.33	(1)	222 (1400)	281 (0800)	1.507	-3.007	-11.3
	300-365	054-080	1011	0.01529	-3.49	-14.88	11.39	(1)	281 (1015)	112 (1000)	1.529	-3.485	-11.4
	001-101	081-110	1011	0.01529	-3.49	-15.07	11.48	(2)					
	112-181	116-140	1011	0.01529	-3.49	-13.60	10.11	(3)	112 (1040)	End	1.529	-3.485	-10.1
03	195-222	018-027	1016	0.01516	-3.20	-7.85	4.65	--	150 (0000)	222 (1100)	1.516	-3.199	-4.7
	222-281	028-047	1011	0.01529	-3.49	-9.66	6.17	(1)	222 (1400)	281 (0800)	1.529	-3.485	-6.2
	300-012	048-083	1018	0.01519	-3.35	-9.57	6.22	(1)	281 (1015)	012 (1350)	1.519	-3.350	-6.2
03A	012-180	084-140	1018	0.01519	-3.35	-21.10	17.75	--	020 (0940)	End	1.519	-3.350	-17.8
04	195-222	018-027	1018	0.01519	-3.35	-12.57	9.22	--	150 (0000)	222 (1100)	1.519	-3.350	-9.2
	222-365	028-080	1009	0.01532	-3.62	-14.38	10.76	(1)	222 (1400)	End	1.532	-3.622	-10.8
	001-180	081-140	1009	0.01532	-3.62	-14.51	10.89	(2)					
05	153-188**	004-017	1011	0.01529	-3.49	-9.36	5.87	--	150 (0000)	222 (1100)	1.529	-3.485	-5.9
	188**-198**	018-020	1011	0.01529	-3.49	-9.31	5.82	(4)					
	198**-207	021-022	1011	0.01529	-3.49	-10.35	6.86	(4)					
	228-365	030-080	1015	0.01507	-2.99	-10.49	7.50	(1)	222 (1400)	End	1.507	-2.992	-7.6
	001-180	081-140	1015	0.01507	-2.99	-10.61	7.62	(2)					
06	152-198**	004-020	1019	0.01515	-3.17	-9.95	6.78	--	150 (0000)	222 (1100)	1.515	-3.174	-6.9
	198**-207	021-022	1019	0.01515	-3.17	-10.26	7.09	(4)					
	225-289**	028-050	1020	0.01517	-3.21	-11.50	8.29	(1)	222 (1400)	End	1.517	-3.209	-8.5
	289**-365	051-080	1020	0.01517	-3.21	-11.36	8.15	(4)					
	001-020**	081-085	1020	0.01517	-3.21	-11.48	8.27	(2)					
	020**-026**	086-088	1020	0.01517	-3.21	-12.62	9.31	(4)					
	026**-122**	089-115	1020	0.01517	-3.21	-12.45	9.24	(4)					
	122**-136**	116-117	1020	0.01517	-3.21	-11.45	8.24	(4)					
	136**-180**	118-140	1020	0.01517	-3.21	-11.07	7.86	(4)					
07	155-188	004-017	1020	0.01517	-3.21	-9.29	6.08	--	150 (0000)	222 (1100)	1.517	-3.209	-6.0
	188-206	018-022	1020	0.01517	-3.21	-9.10	5.89	(4)					
	242-365	033-030	1016	0.01516	-3.20	-10.75	7.55	(1)	222 (1400)	158 (0920)	1.516	-3.199	-7.9
	001-041	081-093	1016	0.01516	-3.20	-10.95	7.75	(2)					
	041-054	094-097	1016	0.01516	-3.20	-11.09	7.89	(4)					
	054-077	098-104	1016	0.01516	-3.20	-11.25	8.05	(4)					
	077-122	105-115	1016	0.01516	-3.20	-11.59	8.39	(4)					
	158-180	130-140	1016	0.01516	-3.20	-9.39	6.19	(3)	158 (0920)	End	1.516	-3.199	-6.2
08	147-178	001-014	1010	0.01518	-3.22	-7.15	3.93	--	150 (0000)	187 (0955)	1.518	-3.219	-3.9
	187-222	018-027	1017	0.01527	-3.51	-7.15	3.64	(1)	187 (0955)	222 (1100)	1.527	-3.506	-3.6
	222-281	028-056	1010	0.01518	-3.22	-8.61	5.39	(1)	222 (1400)	End	1.518	-3.219	-5.6
	281-365	057-080	1010	0.01518	-3.22	-8.78	5.56	(4)					
	001-180	081-140	1010	0.01518	-3.22	-8.93	5.71	(2)					
09	152-188	004-017	1014	0.01507	-3.01	-8.05	5.04	--	150 (0000)	222 (1100)	1.507	-3.007	-4.7
	188-209	018-022	1014	0.01507	-3.01	-7.42	4.41	(4)					
	236-021	032-064	1017	0.01527	-3.51	-9.94	6.43	(1)	222 (1400)	112 (1000)	1.527	-3.506	-6.3
	047-100	065-110	1017	0.01527	-3.51	-9.78	6.27	(3)					
	112-180	116-140	1017	0.01527	-3.51	-8.48	4.97	(3)	112 (1040)	End	1.527	-3.506	-5.0
10	197-222	021-027	1008	0.03046	-6.46	-52.19	45.73	--	150 (0000)	058 (0900)	3.046	-6.462	-45.8
	236-258	032-037	1008	0.03046	-6.46	-53.28	46.82	(3)					
	281-310	048-056	1008	0.03046	-6.46	-51.75	45.29	(3)					
	310-363	057-078	1008	0.03046	-6.46	-51.87	45.41	(4)					
	124-180	116-140	1008	0.03046	-6.46	-22.67	16.25	(3)	058 (1100)	End	3.046	-6.462	-16.3
11	146-195	001-017	1015	0.01507	-2.99	-10.81	7.82	--	150 (0000)	222 (1100)	1.057	-2.992	-7.8
	225-254	028-036	1012	0.01499	-2.80	-11.85	9.05	(1)	222 (1400)	End	1.499	-2.796	-9.3
	259-274	040-045	1012	0.01499	-2.80	-12.02	9.22	(4)					
	274-365	046-080	1012	0.01499	-2.80	-11.91	9.11	(4)					
	001-077	081-104	1012	0.01499	-2.80	-12.05	9.25	(2)					
	077-122	105-115	1012	0.01499	-2.80	-12.18	9.38	(4)					
	122-180	116-140	1012	0.01499	-2.80	-12.43	9.63	(4)					
12	146-365	001-080	--	0.005905		15.70		--	150 (0000)	End	-0.5905	15.7	--
	001-180	081-140	--	0.005905		15.70		(2)					
13	138-188	001-017	1013	0.01535	-3.57			--	150 (0000)	196 (0815)	1.535	-3.57	--
	190-020	018-085	1013	0.01535	-2.72			(5)	197 (0920)	020 (0940)	1.535	-2.72	--
	020-035	086-090	1008	0.03046	-6.46			(1)	020 (1110)	035 (1310)	3.046	-6.46	--
	035-181	091-140	1013	0.01535	-3.02			(1,5)	035 (1550)	End	1.535	-3.02	--
14	056-180	100-140	1014	0.01507	-3.01	-16.15	13.14	--	058 (1100)	End	1.507	-3.007	-13.1

* Explanations for change of coefficients: (1) change of transducer, (2) elevation of LA tide gage was changed on 005, with indeterminate effect on precision of reference datum and Z_s, (3) transducer remounted, (4) unexplained (possibly indeterminate leakage in calibration purge valve), and (5) transducer recalibrated.

** Estimated date about midway between preceding and following groups of tide readings.

Table 3

Oscillations of San Pedro Bay and the Outer Harbors:

Comparison of Theoretically Derived Periods with Those Derived from Wave Records*

Apparent Periods of Oscillation						
Theory	Measurement** (Authority† and Dates of Coverage of Data Analyzed)					
SEA (1968)	C&GS (1935-1936)	CIT (1943-1944)	WES (1945-1946)	MA (1960-1961)	U. of T. (1960-1961)	SEA (1930-1967)
1.26-133h	--	1.3h	--	--	--	1.2-1.4h
59.4-65.2	60	60	--	--	--	60-65
48.5-55.4	--	44-55	--	--	--	45.8-54.0
35.7-37.7	--	35-40	35	--	--	36.0-40.8
29.8-33.7	30	30-33	30	33.3	--	29.5-34.2
22.3-26.5	--	24-26	24-25	--	--	26.2-27.7
19.2-19.5	--	--	18-20	19.0	--	18.0-20.4
13.1-15.4	14	--	14-16	14.2-14.8	15.0-16.0	--
11.3-12.1	--	--	10-12	12.3	11.0-12.8	10.2-10.8
9.4	--	--	9-9.6	9.5	--	--
8.8	--	--	8.5	8.2-8.3	8.8	--
7.4-8.1	--	--	7-8	--	--	7.2-7.8
6.4	--	--	6.5	6.0-6.7	--	6.6
5.6	--	--	5.5-6.2	--	5.4	5.5-6.0
4.7-5.0	--	5	4.7-5.0	5.1	--	--
3.7-4.1	--	3.5-4.5	3.7-4.0	3.5-4.4	3.7	3.6-4.2
--	3	3	3.2	3.2	3.3	3.0-3.4
2.4-2.9	2.5	2-2.5	2-2.5	2.4-2.9	2.8	2.5-2.8
2.1-2.2	2	--	--	2.0-2.2	2.2	2.0-2.3
--	--	--	1.7-1.8	--	1.8	1.7-1.8
1.3-1.5	1.5	--	1.2-1.5	--	1.5	1.1-1.2
1.0	--	--	1.0	--	1.0	--
--	55s	--	45s	--	30-35s	35.9-46.0s
--	--	24s	--	--	20-22s	24.1-25.1s
--	16-20s	16s	--	--	--	16.7-20.0s
--	12s	14s	--	--	13s	12.1-14.3s
--	--	5-7s	--	--	--	6.3-10.9s

* From Reference 10.

** h and s denote hours and seconds, respectively; otherwise measurements are in minutes.

† Science Engineering Associates (SEA), Coast and Geodetic Survey (C&GS), California Institute of Technology (CIT), Marine Advisers, Inc. (MA), University of Texas (U. of T.), Waterways Experiment Station (WES).

Table 4

Mooring Line Configuration for Los Angeles Harbor Berths*

REC.	BERTH	SHIP NAME	POSITION	NUMBER	DIA.	MATERIAL	TIGHTNESS
293	58	VISHVA KIRTI	BOW	4	3	PLASTIC	SLACK
			BREAST FORE	1	2	MANILA	SLACK
			SPRING FORE	3	3	STEEL	SLACK
			SPRING AFT	2	3	PLASTIC	SLACK
			BREAST AFT	1	3	MANILA	SLACK
			STERN	3	3	PLASTIC	SLACK
294	58	VISHVA KIRTI	BOW	4	3	PLASTIC	SLACK
			BREAST FORE	1	2	MANILA	SLACK
			SPRING FORE	3	3	STEEL	SLACK
			SPRING AFT	2	3	PLASTIC	SLACK
			BREAST AFT	1	3	MANILA	SLACK
			STERN	3	3	PLASTIC	SLACK
295	58	VISHVA KIRTI	BOW	4	3	PLASTIC	SLACK
			BREAST FORE	1	2	MANILA	SLACK
			SPRING FORE	3	3	STEEL	SLACK
			SPRING AFT	2	3	PLASTIC	SLACK
			BREAST AFT	1	3	MANILA	SLACK
			STERN	3	3	PLASTIC	SLACK
297	54	ALEKSANDR VERMISHE	BOW	3	2	MANILA	TIGHT
			BREAST FORE	1	2	MANILA	SLACK
			SPRING FORE	2	1	STEEL	SLACK
			SPRING AFT	1	1	STEEL	SLACK
			BREAST AFT	2	2	MANILA	SLACK
			STERN	3	2	MANILA	SLACK
298	60	VISHVA MAYA	BOW	4	2	PLASTIC AND MANILA	SLACK
			BREAST FORE	1	2	MANILA	SLACK
			SPRING AFT	1	2	MANILA	SLACK
			BREAST AFT	1	2	MANILA	TIGHT
			STERN	3	2	MANILA	TIGHT
299	57	TAMAGAWA MARU	BOW	3	2	MANILA	SLACK
			SPRING FORE	2	2	MANILA	SLACK
			SPRING AFT	1	2	MANILA	SLACK
			BREAST AFT	2	2	MANILA	SLACK
			STERN	2	2	MANILA	SLACK
302	49	TOKO MARU	BOW	3	2	MANILA	TIGHT
			BREAST FORE	1	2	MANILA	TIGHT
			BREAST AFT	1	2	MANILA	TIGHT
			STERN	3	2	MANILA	TIGHT
303	137	PACIFIC NORTHWEST	BOW	4	3	PLASTIC	TIGHT
			SPRING FORE	2	3	STEEL AND PLASTIC	TIGHT
			SPRING AFT	1	3	PLASTIC	TIGHT
			BREAST AFT	1	3	PLASTIC	TIGHT
			STERN	2	3	PLASTIC	TIGHT
305	46	BENNINGTON	BOW	2	2	PLASTIC	TIGHT
			BREAST FORE	1	2	PLASTIC	TIGHT
			SPRING FORE	1	2	PLASTIC	TIGHT
			SPRING AFT	1	2	PLASTIC	SLACK
			BREAST AFT	1	2	PLASTIC	TIGHT
			STERN	2	2	PLASTIC	TIGHT
306	70	MEADOWBROOK	BOW	2	3	MANILA	TIGHT
			BREAST FORE	2	3	MANILA	TIGHT
			SPRING FORE	1	3	MANILA	TIGHT
			SPRING AFT	2	3	MANILA	TIGHT
			BREAST AFT	1	3	MANILA	SLACK
			STERN	1	3	MANILA	TIGHT
309	60	MILLICOMA	BOW	2	3	PLASTIC	SLACK
			BREAST FORE	1	3	PLASTIC	SLACK
			SPRING FORE	1	3	PLASTIC	SLACK
			SPRING AFT	2	3	MANILA	SLACK
			BREAST AFT	1	3	PLASTIC	SLACK
			STERN	2	3	PLASTIC	SLACK
311	46	SANSINENA	BOW	3	3	MANILA	TIGHT
			BREAST FORE	1	2	STEEL	TIGHT
			SPRING FORE	2	2	STEEL	TIGHT
			SPRING AFT	2	2	STEEL	TIGHT
			BREAST AFT	1	2	STEEL	TIGHT
			STERN	3	3	MANILA	TIGHT
313	46	AVILA	BOW	2	3	STEEL AND MANILA	TIGHT
			BREAST FORE	1	2	STEEL	TIGHT
			SPRING FORE	2	4	STEEL AND MANILA	TIGHT
			SPRING AFT	1	4	MANILA	TIGHT
			STERN	3	4	STEEL AND PLASTIC	SLACK

* Mooring configurations shown only for records reporting movement; records 1-277 omitted due to unusable data.

Table 5

Ship Movement Reports for Los Angeles Harbor Berths

REC.	MMDD	BERTH	SHIP NAME	DWT	L.	BEAM	DRAFT	TIME	DEGREE	TYPE	
293	326	58	VISHVA KIRTI	12970	505	64	30	08-12	LIGHT	VERTICAL	FISHTAIL
								20-24	LIGHT	LONG.	
293	327	58	VISHVA KIRTI	12970	505	64	30	04-08	LIGHT	SIDEWAYS	VERTICAL
								16-20	LIGHT	LONG.	SIDEWAYS
								20-24	LIGHT	LONG.	SIDEWAYS
294	328	58	VISHVA KIRTI	12970	505	64	30	04-08	LIGHT	SIDEWAYS	VERTICAL
								08-12	LIGHT	SIDEWAYS	VERTICAL
								16-20	LIGHT	SIDEWAYS	VERTICAL
								20-24	LIGHT	SIDEWAYS	VERTICAL
294	329	58	VISHVA KIRTI	12970	505	64	30	00-04	MEDIUM	FISHTAIL	VERTICAL
								04-08	LIGHT	FISHTAIL	
								08-12	LIGHT	SIDEWAYS	VERTICAL
								12-16	LIGHT	SIDEWAYS	VERTICAL
								16-20	LIGHT	FISHTAIL	
295	330	58	VISHVA KIRTI	12970	505	64	30	00-04	MEDIUM	FISHTAIL	VERTICAL
								04-08	LIGHT	FISHTAIL	VERTICAL
								08-12	LIGHT	FISHTAIL	VERTICAL
								12-16	MEDIUM	FISHTAIL	VERTICAL
								16-20	LIGHT	SIDEWAYS	FISHTAIL
								20-24	LIGHT	SIDEWAYS	FISHTAIL
295	331	58	VISHVA KIRTI	12970	505	64	30	00-04	MEDIUM	FISHTAIL	VERTICAL
								04-08	MEDIUM	FISHTAIL	VERTICAL
								16-20	MEDIUM	SIDEWAYS	FISHTAIL
								20-24	MEDIUM	FISHTAIL	VERTICAL
297	326	54	ALEKSANDR VERMISHE	14861	523	70	32	08-12	LIGHT	LONG.	ROLL
298	326	60	VISHVA MAYA	12379	505	64	30	08-12	LIGHT	VERTICAL	FISHTAIL
299	326	57	TAMAGAWA MARU	2522	290	41	18	08-12	LIGHT	VERTICAL	FISHTAIL
								16-20	LIGHT	FISHTAIL	
								20-24	LIGHT	FISHTAIL	
302	327	49	TOKO MARU	111469	843	131	52	08-12	LIGHT	VERTICAL	FISHTAIL
303	329	137	PACIFIC NORTHWEST	11750	501	63	30	08-12	LIGHT	ROLL	
305	329	46	BENNINGTON	17246	524	68	31	08-12	LIGHT	SIDEWAYS	LONG.
306	41	70	MEADOWBROOK	26110	607	80	34	00-04	LIGHT	SIDEWAYS	VERTICAL
								04-08	LIGHT	SIDEWAYS	VERTICAL
309	43	60	MILLICOMA	0	0	0	0	12-16	LIGHT	LONG.	SIDEWAYS
								16-20	LIGHT	LONG.	SIDEWAYS
311	45	46	SANSINENA	70630	810	104	47	00-04	LIGHT	FISHTAIL	
								04-08	LIGHT	FISHTAIL	
								08-12	LIGHT	FISHTAIL	
								12-16	LIGHT	FISHTAIL	
313	47	46	AVILA	17599	551	68	30	04-08	LIGHT	FISHTAIL	ROLL
								08-12	LIGHT	FISHTAIL	ROLL
								12-16	LIGHT	FISHTAIL	ROLL
								16-20	MEDIUM	SIDEWAYS	FISHTAIL
453	43	54	OVANEUS IUMANIAN	14861	523	70	32	16-20	LIGHT	LONG.	
								20-24	LIGHT	LONG.	
453	44	54	OVANEUS IUMANIAN	14861	523	70	32	16-20	LIGHT	FISHTAIL	
								20-24	LIGHT	FISHTAIL	
454	45	54	OVANEUS IUMANIAN	14861	523	70	32	00-04	LIGHT	FISHTAIL	
								04-08	LIGHT	FISHTAIL	
								08-12	LIGHT	SIDEWAYS	FISHTAIL
								12-16	LIGHT	FISHTAIL	
								16-20	LIGHT	LONG.	
454	46	54	OVANEUS IUMANIAN	14861	523	70	32	00-04	LIGHT	VERTICAL	FISHTAIL
								04-08	MEDIUM	VERTICAL	FISHTAIL
								08-12	MEDIUM	VERTICAL	FISHTAIL
								12-16	LIGHT	VERTICAL	FISHTAIL
								20-24	MEDIUM	SIDEWAYS	VERTICAL
455	47	54	OVANEUS IUMANIAN	14861	523	70	32	00-04	MEDIUM	VERTICAL	FISHTAIL
								04-08	LIGHT	VERTICAL	FISHTAIL
								08-12	LIGHT	VERTICAL	FISHTAIL
								12-16	LIGHT	VERTICAL	FISHTAIL
								20-24	LIGHT	VERTICAL	FISHTAIL
455	48	54	OVANEUS IUMANIAN	14861	523	70	32	00-04	MEDIUM	VERTICAL	FISHTAIL
								04-08	MEDIUM	VERTICAL	FISHTAIL
								08-12	MEDIUM	VERTICAL	FISHTAIL
								12-16	MEDIUM	VERTICAL	FISHTAIL
								16-20	MEDIUM	VERTICAL	FISHTAIL
								20-24	MEDIUM	VERTICAL	FISHTAIL

Table 6

Heavy Degree of Movement Reports for Los Angeles Harbor Berths

REG.	MMDD	BERTH	SHIP NAME	DWT	L.	BEAM	DRAFT	TIME	DEGREE	TYPE	
463	412	55	TONICHI MARU	3463	343	48	19	00-04	HEAVY	FISHTAIL	ROLL
464	413	55	TONICHI MARU	3463	343	48	19	00-04	HEAVY	VERTICAL	FISHTAIL
474	419	49	NEGO ENTERPRISE	15189	477	70	29	00-04	HEAVY	FISHTAIL	ROLL
518	519	49	STRYMON	28699	593	76	35	00-04	HEAVY	VERTICAL	FISHTAIL
								04-08	HEAVY	VERTICAL	FISHTAIL
518	520	49	STRYMON	28699	593	76	35	00-04	HEAVY	VERTICAL	FISHTAIL
522	519	59	STATE OF MADHYA PR	12669	501	66	29	00-04	HEAVY	VERTICAL	FISHTAIL
609	611	57	JALADURGA	12781	505	64	31	00-04	HEAVY	VERTICAL	FISHTAIL
612	6 8	58	JALADHIR	11756	509	64	30	20-24	HEAVY	SIDEWAYS	FISHTAIL
615	614	58	JALADHIR	11756	509	64	30	16-20	HEAVY	SIDEWAYS	
621	614	60	ALEKSANDR VERMISHE	14861	523	70	32	00-04	HEAVY	FISHTAIL	ROLL
625	613	55	SANTA ANITA	12319	494	70	29	00-04	HEAVY	FISHTAIL	ROLL
715	731	46	LOMPOC	16690	524	68	30	08-12	HEAVY	ROLL	
721	1017	49	MITO MARU	64317	735	106	42	00-04	HEAVY	FISHTAIL	ROLL
								04-08	HEAVY	FISHTAIL	ROLL
725	1017	59	VISHVA RAKSHA	11600	501	63	29	00-04	HEAVY	FISHTAIL	ROLL
745	1030	54	JALAJYTOI	16356	520	68	32	00-04	HEAVY	FISHTAIL	
755	1031	60	TOKO MARU	111469	843	131	52	00-04	HEAVY	ROLL	FISHTAIL
								04-08	HEAVY	ROLL	FISHTAIL
								08-12	HEAVY	SIDEWAYS	ROLL
								12-16	HEAVY	SIDEWAYS	ROLL
								16-20	HEAVY	SIDEWAYS	ROLL
755	11 1	60	TOKO MARU	111469	843	131	52	00-04	HEAVY	ROLL	FISHTAIL
765	1112	58	KENZAN MARU	1181	186	31	15	16-20	HEAVY	FISHTAIL	ROLL
771	1112	54	STATE OF MADHYA PR	12669	501	66	29	16-20	HEAVY	FISHTAIL	ROLL
783	1115	60	RYOZAN MARU NO 3	4245	301	47	20	16-20	HEAVY	FISHTAIL	ROLL
								20-24	HEAVY	FISHTAIL	ROLL
846	1115	59	VISHVA SIDDHI	12340	505	64	30	16-20	HEAVY	FISHTAIL	ROLL
								20-24	HEAVY	FISHTAIL	ROLL
853	1128	59	VISHVA SIDDHI	12340	505	64	30	00-04	HEAVY	FISHTAIL	ROLL
								04-08	HEAVY	FISHTAIL	ROLL
856	1128	54	STATE OF W BENGAL	13289	502	66	29	00-04	HEAVY	FISHTAIL	ROLL
								04-08	HEAVY	FISHTAIL	ROLL
856	1129	54	STATE OF W BENGAL	13289	502	66	29	00-04	HEAVY	VERTICAL	ROLL
857	1130	54	STATE OF W BENGAL	13289	502	66	29	00-04	HEAVY	VERTICAL	SIDEWAYS
								04-08	HEAVY	VERTICAL	SIDEWAYS
857	12 1	54	STATE OF W BENGAL	13289	502	66	29	00-04	HEAVY	VERTICAL	ROLL
								04-08	HEAVY	VERTICAL	ROLL
863	1128	55	JAPAN ELM	13921	461	76	28	00-04	HEAVY	FISHTAIL	ROLL
								04-08	HEAVY	FISHTAIL	ROLL
1018	1229	58	VISHVA NAYAK	9098	504	64	30	04-08	HEAVY	VERTICAL	FISHTAIL
								08-12	HEAVY	VERTICAL	FISHTAIL
1029	1226	55	SANTA ANA	12394	492	70	29	04-08	HEAVY	FISHTAIL	ROLL
								08-12	HEAVY	FISHTAIL	ROLL
1036	1226	53	OURANIA	6710	415	56	24	04-08	HEAVY	VERTICAL	FISHTAIL
								08-12	HEAVY	VERTICAL	FISHTAIL
								12-16	HEAVY	VERTICAL	FISHTAIL
1044	1227	59	VISHVA SEVA	12754	502	66	29	04-08	HEAVY	VERTICAL	FISHTAIL
								08-12	HEAVY	VERTICAL	FISHTAIL
								12-16	HEAVY	VERTICAL	FISHTAIL
1103	315	60	VISHVA TIRTH	12682	502	66	29	00-04	HEAVY	FISHTAIL	ROLL
1105	319	60	VISHVA TIRTH	12682	502	66	29	00-04	HEAVY	VERTICAL	ROLL
1105	320	60	VISHVA TIRTH	12682	502	66	29	00-04	HEAVY	FISHTAIL	ROLL

Table 7

Medium Degree of Movement Reports for Los Angeles Harbor Berths

REC.	MMDD	BERTH	SHIP NAME	DWT	L.	BEAM	DRAFT	TIME	DEGREE	TYPE	
294	329	5A	VISHVA KIRTI	12970	505	64	30	00-04	MEDIUM	FISHTAIL	VERTICAL
295	330	5A	VISHVA KIRTI	12970	505	64	30	00-04	MEDIUM	FISHTAIL	VERTICAL
								12-16	MEDIUM	FISHTAIL	VERTICAL
295	331	5A	VISHVA KIRTI	12970	505	64	30	00-04	MEDIUM	FISHTAIL	VERTICAL
								04-08	MEDIUM	FISHTAIL	VERTICAL
								16-20	MEDIUM	SIDEWAYS	FISHTAIL
								20-24	MEDIUM	FISHTAIL	VERTICAL
313	4 7	4A	AVILA	17599	551	68	30	16-20	MEDIUM	SIDEWAYS	FISHTAIL
454	4 6	5A	OVANEUS TUMANIAN	14861	523	70	32	04-08	MEDIUM	VERTICAL	FISHTAIL
								08-12	MEDIUM	VERTICAL	FISHTAIL
								20-24	MEDIUM	SIDEWAYS	VERTICAL
455	4 7	5A	OVANEUS TUMANIAN	14861	523	70	32	00-04	MEDIUM	VERTICAL	FISHTAIL
455	4 8	5A	OVANEUS TUMANIAN	14861	523	70	32	00-04	MEDIUM	VERTICAL	FISHTAIL
								04-08	MEDIUM	VERTICAL	FISHTAIL
								08-12	MEDIUM	VERTICAL	FISHTAIL
								12-16	MEDIUM	VERTICAL	FISHTAIL
								16-20	MEDIUM	VERTICAL	FISHTAIL
								20-24	MEDIUM	VERTICAL	FISHTAIL
460	4 8	4A	MONTPELIER VICTORY	35000	736	102	40	20-24	MEDIUM	SIDEWAYS	VERTICAL
463	410	5S	TONICHI MARU	3463	343	48	19	16-20	MEDIUM	SIDEWAYS	FISHTAIL
								20-24	MEDIUM	SIDEWAYS	FISHTAIL
463	412	5S	TONICHI MARU	3463	343	48	19	04-08	MEDIUM	FISHTAIL	ROLL
								08-12	MEDIUM	FISHTAIL	ROLL
								12-16	MEDIUM	FISHTAIL	ROLL
								20-24	MEDIUM	FISHTAIL	ROLL
464	413	5S	TONICHI MARU	3463	343	48	19	04-08	MEDIUM	VERTICAL	FISHTAIL
								16-20	MEDIUM	VERTICAL	FISHTAIL
468	414	4S	COUNTY CLARE	27600	600	75	35	00-04	MEDIUM	VERTICAL	FISHTAIL
468	415	4S	COUNTY CLARE	27600	600	75	35	00-04	MEDIUM	VERTICAL	FISHTAIL
469	417	4S	COUNTY CLARE	27600	600	75	35	16-20	MEDIUM	SIDEWAYS	VERTICAL
								20-24	MEDIUM	SIDEWAYS	VERTICAL
470	418	4S	COUNTY CLARE	27600	600	75	35	00-04	MEDIUM	FISHTAIL	ROLL
								04-08	MEDIUM	FISHTAIL	ROLL
								16-20	MEDIUM	VERTICAL	ROLL
476	420	5S	VISHVA VIKRAM	12900	505	64	30	00-04	MEDIUM	VERTICAL	FISHTAIL
								04-08	MEDIUM	LONG.	VERTICAL
								16-20	MEDIUM	SIDEWAYS	
477	422	5S	VISHVA VIKRAM	12900	505	64	30	00-04	MEDIUM	FISHTAIL	ROLL
								04-08	MEDIUM	FISHTAIL	ROLL
478	423	5S	VISHVA VIKRAM	12900	505	64	30	08-12	MEDIUM	SIDEWAYS	VERTICAL
478	424	5S	VISHVA VIKRAM	12900	505	64	30	00-04	MEDIUM	FISHTAIL	ROLL
								04-08	MEDIUM	ROLL	
								20-24	MEDIUM	SIDEWAYS	FISHTAIL
479	425	5S	VISHVA VIKRAM	12900	505	64	30	16-20	MEDIUM	VERTICAL	ROLL
479	426	5S	VISHVA VIKRAM	12900	505	64	30	00-04	MEDIUM	FISHTAIL	ROLL
								16-20	MEDIUM	FISHTAIL	ROLL
								20-24	MEDIUM	LONG.	SIDEWAYS
480	427	5S	VISHVA VIKRAM	12900	505	64	30	00-04	MEDIUM	FISHTAIL	ROLL
								12-16	MEDIUM	FISHTAIL	ROLL
								16-20	MEDIUM	FISHTAIL	ROLL
480	428	5S	VISHVA VIKRAM	12900	505	64	30	00-04	MEDIUM	VERTICAL	FISHTAIL
								08-12	MEDIUM	SIDEWAYS	
482	420	4S	OGISHIMA MARU	60962	755	108	39	00-04	MEDIUM	FISHTAIL	ROLL
488	423	5A	KONSTANTIN PAYSTOV	14200	525	69	32	20-24	MEDIUM	SIDEWAYS	FISHTAIL
489	425	5A	KONSTANTIN PAYSTOV	14200	525	69	32	00-04	MEDIUM	FISHTAIL	ROLL
489	426	5A	KONSTANTIN PAYSTOV	14200	525	69	32	00-04	MEDIUM	FISHTAIL	ROLL
490	427	5A	KONSTANTIN PAYSTOV	14200	525	69	32	00-04	MEDIUM	ROLL	
490	428	5A	KONSTANTIN PAYSTOV	14200	525	69	32	00-04	MEDIUM	FISHTAIL	ROLL

Table 8

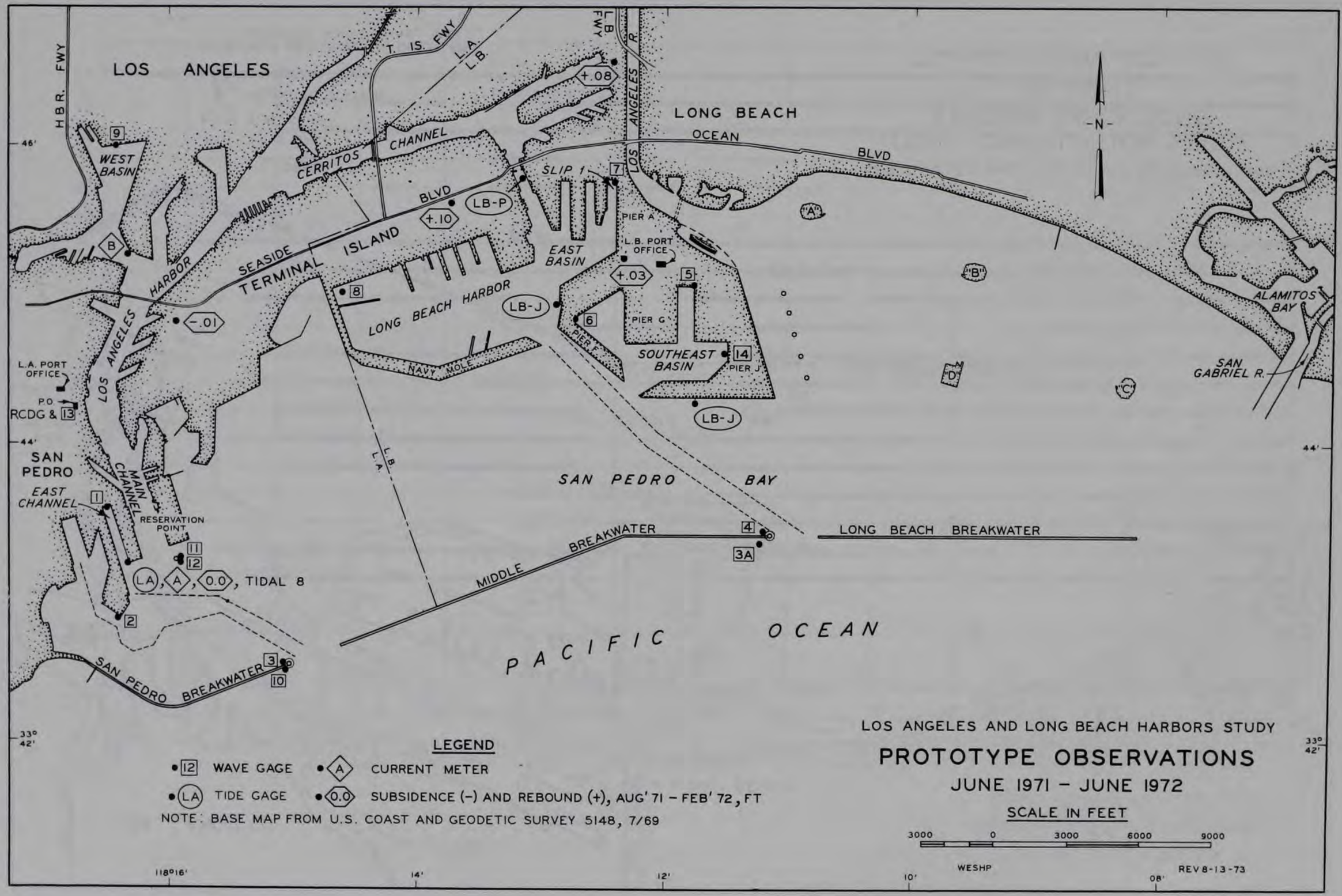
Light Degree of Movement Reports for Los Angeles Harbor Berths

REC.	MMDD	BERTH	SHIP NAME	DWT	L.	BEAM	DRAFT	TIME	DEGREE	TYPE	
293	326	5A	VISHVA KIRTI	12970	505	64	30	08-12	LIGHT	VERTICAL	FISHTAIL
								20-24	LIGHT	LONG.	
293	327	5A	VISHVA KIRTI	12970	505	64	30	04-08	LIGHT	SIDEWAYS	VERTICAL
								16-20	LIGHT	LONG.	SIDEWAYS
								20-24	LIGHT	LONG.	SIDEWAYS
294	328	5A	VISHVA KIRTI	12970	505	64	30	04-08	LIGHT	SIDEWAYS	VERTICAL
								08-12	LIGHT	SIDEWAYS	VERTICAL
								16-20	LIGHT	SIDEWAYS	VERTICAL
								20-24	LIGHT	SIDEWAYS	VERTICAL
294	329	5A	VISHVA KIRTI	12970	505	64	30	04-08	LIGHT	FISHTAIL	
								08-12	LIGHT	SIDEWAYS	VERTICAL
								12-16	LIGHT	SIDEWAYS	VERTICAL
								16-20	LIGHT	FISHTAIL	
295	330	5A	VISHVA KIRTI	12970	505	64	30	04-08	LIGHT	FISHTAIL	VERTICAL
								08-12	LIGHT	FISHTAIL	VERTICAL
								16-20	LIGHT	SIDEWAYS	FISHTAIL
								20-24	LIGHT	SIDEWAYS	FISHTAIL
297	326	5A	ALEKSANDR VERMISHE	14861	523	70	32	08-12	LIGHT	LONG.	ROLL
298	326	6N	VISHVA MAYA	12379	505	64	30	08-12	LIGHT	VERTICAL	FISHTAIL
299	326	5T	TAMAGAWA MARU	2522	290	41	18	08-12	LIGHT	VERTICAL	FISHTAIL
								16-20	LIGHT	FISHTAIL	
								20-24	LIGHT	FISHTAIL	
302	327	4G	TOKO MARU	111469	843	131	52	08-12	LIGHT	VERTICAL	FISHTAIL
303	329	13T	PACIFIC NORTHWEST	11750	501	63	30	08-12	LIGHT	ROLL	
305	329	4A	BENNINGTON	17246	524	68	31	08-12	LIGHT	SIDEWAYS	LONG.
306	41	7N	MEADOWBROOK	26110	607	80	34	00-04	LIGHT	SIDEWAYS	VERTICAL
								04-08	LIGHT	SIDEWAYS	VERTICAL
309	43	6N	MILLICOMA	0	0	0	0	12-16	LIGHT	LONG.	SIDEWAYS
								16-20	LIGHT	LONG.	SIDEWAYS
311	45	4A	SANSINENA	70630	810	104	47	00-04	LIGHT	FISHTAIL	
								04-08	LIGHT	FISHTAIL	
								08-12	LIGHT	FISHTAIL	
								12-16	LIGHT	FISHTAIL	
313	47	4A	AVILA	17599	551	68	30	04-08	LIGHT	FISHTAIL	ROLL
								08-12	LIGHT	FISHTAIL	ROLL
								12-16	LIGHT	FISHTAIL	ROLL
453	43	5A	OVANEUS TUMANIAN	14861	523	70	32	16-20	LIGHT	LONG.	
								20-24	LIGHT	LONG.	
453	44	5A	OVANEUS TUMANIAN	14861	523	70	32	16-20	LIGHT	FISHTAIL	
								20-24	LIGHT	FISHTAIL	
454	45	5A	OVANEUS TUMANIAN	14861	523	70	32	00-04	LIGHT	FISHTAIL	
								04-08	LIGHT	FISHTAIL	
								08-12	LIGHT	SIDEWAYS	FISHTAIL
								12-16	LIGHT	FISHTAIL	
								16-20	LIGHT	LONG.	
454	46	5A	OVANEUS TUMANIAN	14861	523	70	32	00-04	LIGHT	VERTICAL	FISHTAIL
								12-16	LIGHT	VERTICAL	FISHTAIL
455	47	5A	OVANEUS TUMANIAN	14861	523	70	32	04-08	LIGHT	VERTICAL	FISHTAIL
								08-12	LIGHT	VERTICAL	FISHTAIL
								12-16	LIGHT	VERTICAL	FISHTAIL
								20-24	LIGHT	VERTICAL	FISHTAIL
456	49	5A	OVANEUS TUMANIAN	14861	523	70	32	00-04	LIGHT	ROLL	
								04-08	LIGHT	ROLL	
								08-12	LIGHT	FISHTAIL	ROLL
								04-08	LIGHT	ROLL	
								08-12	LIGHT	FISHTAIL	ROLL
								12-16	LIGHT	FISHTAIL	ROLL
460	48	4A	MONTPELIER VICTORY	35000	736	102	40	04-08	LIGHT	ROLL	
								08-12	LIGHT	FISHTAIL	
								12-16	LIGHT	FISHTAIL	
								16-20	LIGHT	SIDEWAYS	FISHTAIL
460	49	4A	MONTPELIER VICTORY	35000	736	102	40	00-04	LIGHT	ROLL	
								04-08	LIGHT	ROLL	
461	49	6N	PIONEER VALLEY	0	0	0	0	08-12	LIGHT	FISHTAIL	ROLL
								12-16	LIGHT	FISHTAIL	ROLL

Table 9

Longitudinal Type of Movement Reports for Los Angeles Harbor Berths

REC.	MMDD	BERTH	SHIP NAME	DWT	L.	BEAM	DRAFT	TIME	DEGREE	TYPE	
293	326	58	VISHVA KIRTI	12970	505	64	30	20-24	LIGHT	LONG.	
293	327	58	VISHVA KIRTI	12970	505	64	30	16-20	LIGHT	LONG.	SIDEWAYS
								20-24	LIGHT	LONG.	SIDEWAYS
297	326	54	ALEKSANDR VERMISHE	14861	523	70	32	08-12	LIGHT	LONG.	ROLL
305	329	46	BENNINGTON	17246	524	68	31	08-12	LIGHT	SIDEWAYS	LONG.
309	4 3	60	MILLICOMA	0	0	0	0	12-16	LIGHT	LONG.	SIDEWAYS
								16-20	LIGHT	LONG.	SIDEWAYS
453	4 3	54	OVANEUS TUMANIAN	14861	523	70	32	16-20	LIGHT	LONG.	
								20-24	LIGHT	LONG.	
454	4 5	54	OVANEUS TUMANIAN	14861	523	70	32	16-20	LIGHT	LONG.	
476	419	59	VISHVA VIKRAM	12900	505	64	30	08-12	LIGHT	LONG.	SIDEWAYS
								12-16	LIGHT	LONG.	SIDEWAYS
								16-20	LIGHT	LONG.	SIDEWAYS
476	420	59	VISHVA VIKRAM	12900	505	64	30	04-08	MEDIUM	LONG.	VERTICAL
477	422	59	VISHVA VIKRAM	12900	505	64	30	20-24	LIGHT	LONG.	FISHTAIL
478	423	59	VISHVA VIKRAM	12900	505	64	30	04-08	LIGHT	LONG.	FISHTAIL
479	426	59	VISHVA VIKRAM	12900	505	64	30	20-24	MEDIUM	LONG.	SIDEWAYS
488	423	54	KONSTANTIN PAYSTOV	14200	525	69	32	04-08	LIGHT	LONG.	
512	5 9	46	MONTPELIER VICTORY	35000	736	102	40	08-12	LIGHT	LONG.	FISHTAIL
								12-16	LIGHT	LONG.	FISHTAIL
529	524	49	OGISHIMA MARU	60962	755	108	39	20-24	LIGHT	LONG.	SIDEWAYS
530	524	55	VISHVA VIKRAM	12900	505	64	30	20-24	LIGHT	LONG.	FISHTAIL
602	6 3	54	SULEYMAN STALSKIY	14113	523	70	32	08-12	LIGHT	LONG.	
								12-16	LIGHT	LONG.	
634	618	57	STATE OF MADHYA PR	12669	501	66	29	16-20	MEDIUM	LONG.	FISHTAIL
635	620	57	STATE OF MADHYA PR	12669	501	66	29	00-04	MEDIUM	LONG.	FISHTAIL
638	616	46	MONTPELIER VICTORY	35000	736	102	40	04-08	LIGHT	LONG.	FISHTAIL
651	623	49	AKTION	18750	583	70	30	00-04	MEDIUM	LONG.	FISHTAIL
711	725	60	AVILA	17599	551	68	30	08-12	LIGHT	LONG.	VERTICAL
								12-16	LIGHT	LONG.	
711	726	60	AVILA	17599	551	68	30	08-12	LIGHT	LONG.	VERTICAL
716	8 4	46	WORLD MOBILITY	87688	845	122	44	08-12	LIGHT	LONG.	ROLL
716	8 5	46	WORLD MOBILITY	87688	845	122	44	08-12	LIGHT	LONG.	VERTICAL
735	1018	46	LOMPOC	16690	524	68	30	00-04	LIGHT	LONG.	LONG.
743	1027	49	SANTA ROSA MARU	61110	735	105	42	00-04	LIGHT	LONG.	ROLL
753	1030	46	CITIES SERV VALLEY	41001	707	93	38	04-08	LIGHT	LONG.	
								20-24	LIGHT	LONG.	ROLL
757	1030	55	KENSHO MARU	13181	484	62	29	20-24	LIGHT	LONG.	FISHTAIL
763	11 7	58	KENZAN MARU	1181	186	31	15	20-24	LIGHT	LONG.	
767	11 3	54	STATE OF MADHYA PR	12669	501	66	29	16-20	LIGHT	LONG.	FISHTAIL
773	11 3	52	KOGAKU MARU	13658	500	63	30	16-20	LIGHT	LONG.	FISHTAIL
779	1111	52	FUZAN MARU	18099	477	71	28	16-20	MEDIUM	SIDEWAYS	LONG.
								20-24	MEDIUM	LONG.	FISHTAIL
782	1113	60	RYOZAN MARU NO.3	4245	301	47	20	16-20	MEDIUM	LONG.	SIDEWAYS
782	1114	60	RYOZAN MARU NO.3	4245	301	47	20	16-20	MEDIUM	LONG.	VERTICAL
846	1114	59	VISHVA SIDDHI	12340	505	64	30	16-20	LIGHT	LONG.	FISHTAIL
848	1119	59	VISHVA SIDDHI	12340	505	64	30	20-24	LIGHT	LONG.	
849	1120	59	VISHVA SIDDHI	12340	505	64	30	20-24	LIGHT	LONG.	



LEGEND

- ●12 WAVE GAGE
- ●A CURRENT METER
- ●LA TIDE GAGE
- ●0.0 SUBSIDENCE (-) AND REBOUND (+), AUG' 71 – FEB' 72, FT

NOTE: BASE MAP FROM U.S. COAST AND GEODETIC SURVEY 5148, 7/69

LOS ANGELES AND LONG BEACH HARBORS STUDY

PROTOTYPE OBSERVATIONS

JUNE 1971 – JUNE 1972

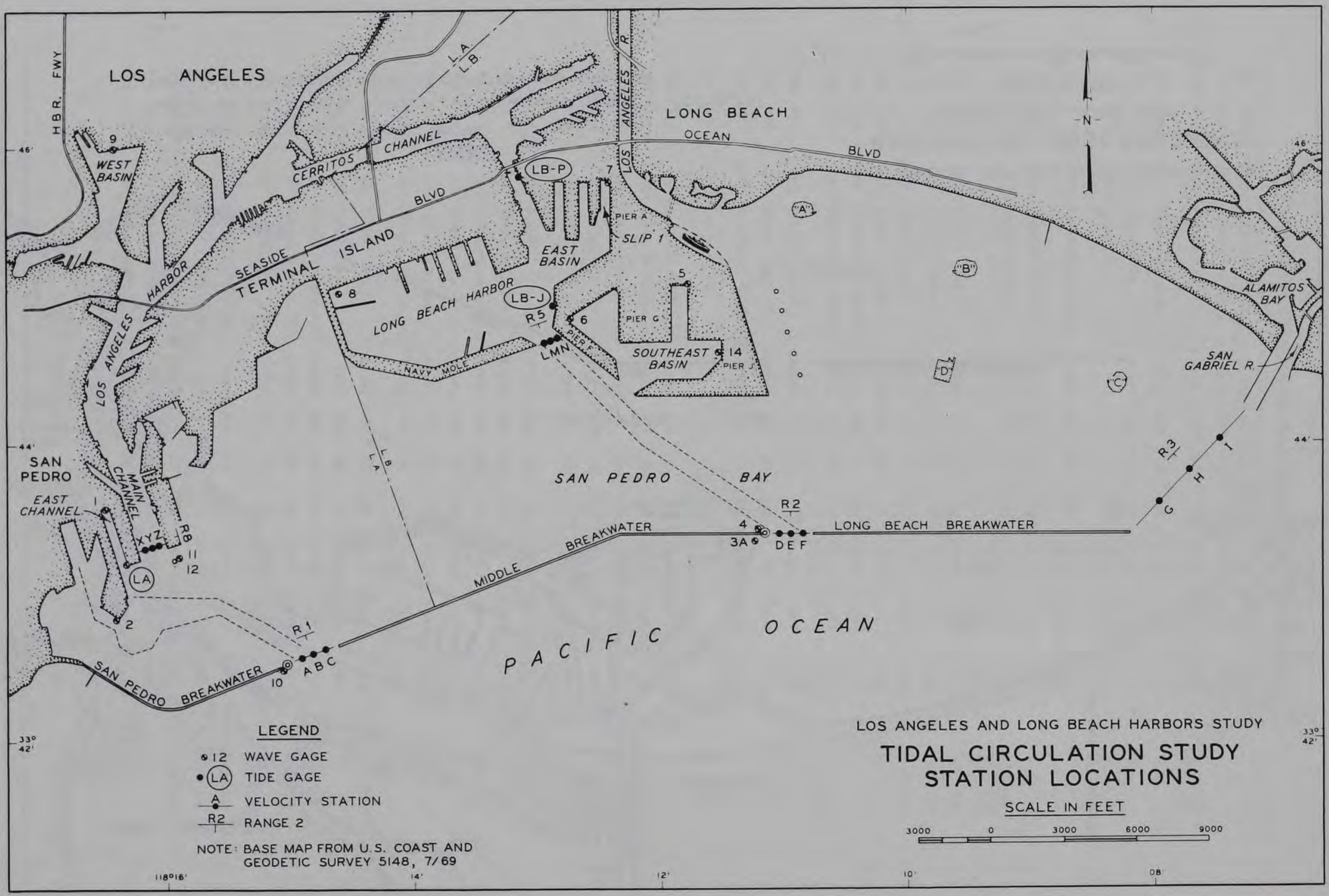
SCALE IN FEET

3000 0 3000 6000 9000

WESHP REV 8-13-73

PLATE 1

PLATE 2



LEGEND

- 12 WAVE GAGE
- (LA) TIDE GAGE
- A VELOCITY STATION
- R2 RANGE 2

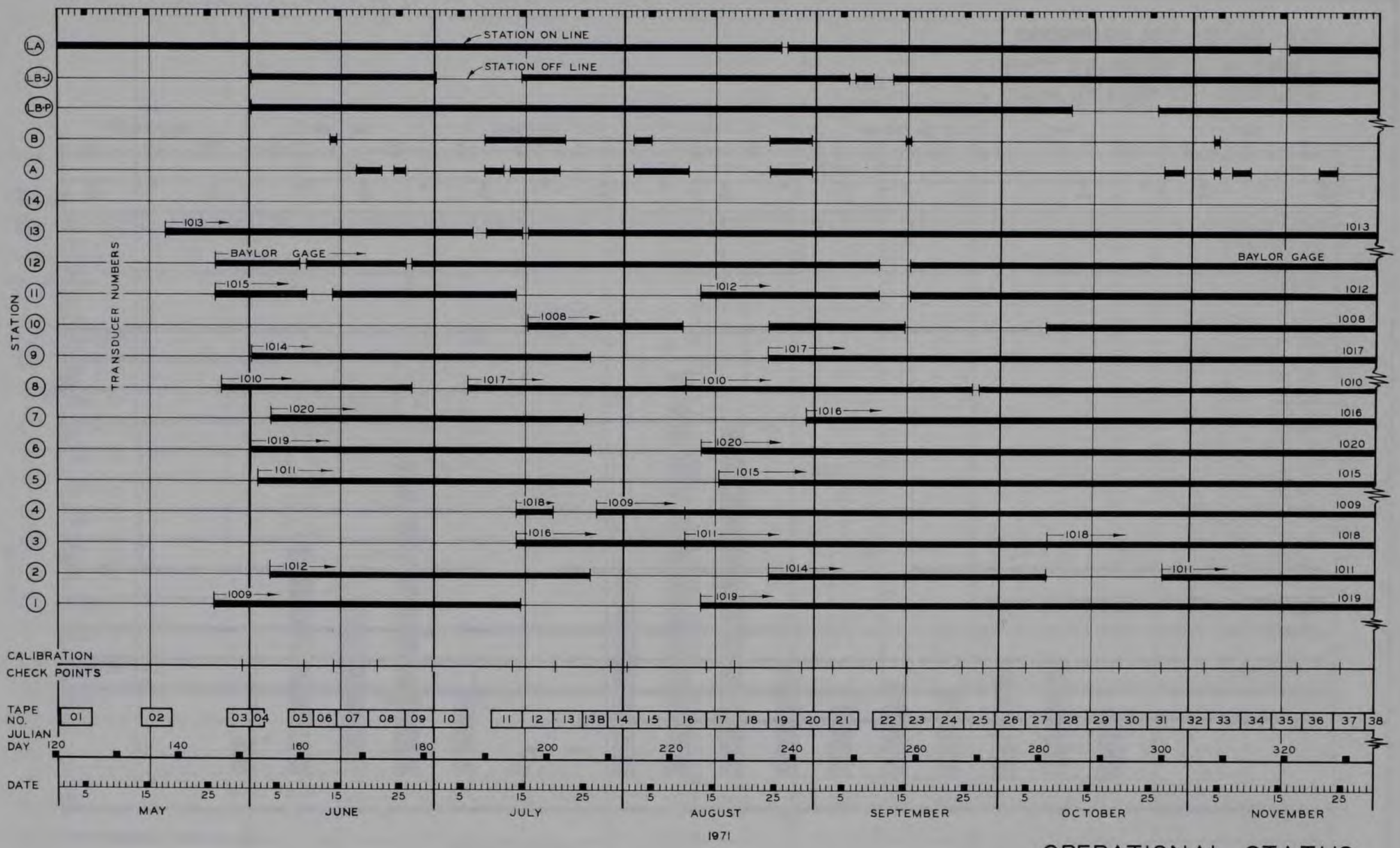
NOTE: BASE MAP FROM U.S. COAST AND GEODETIC SURVEY 5148, 7/69

LOS ANGELES AND LONG BEACH HARBORS STUDY

TIDAL CIRCULATION STUDY STATION LOCATIONS

SCALE IN FEET

3000 0 3000 6000 9000

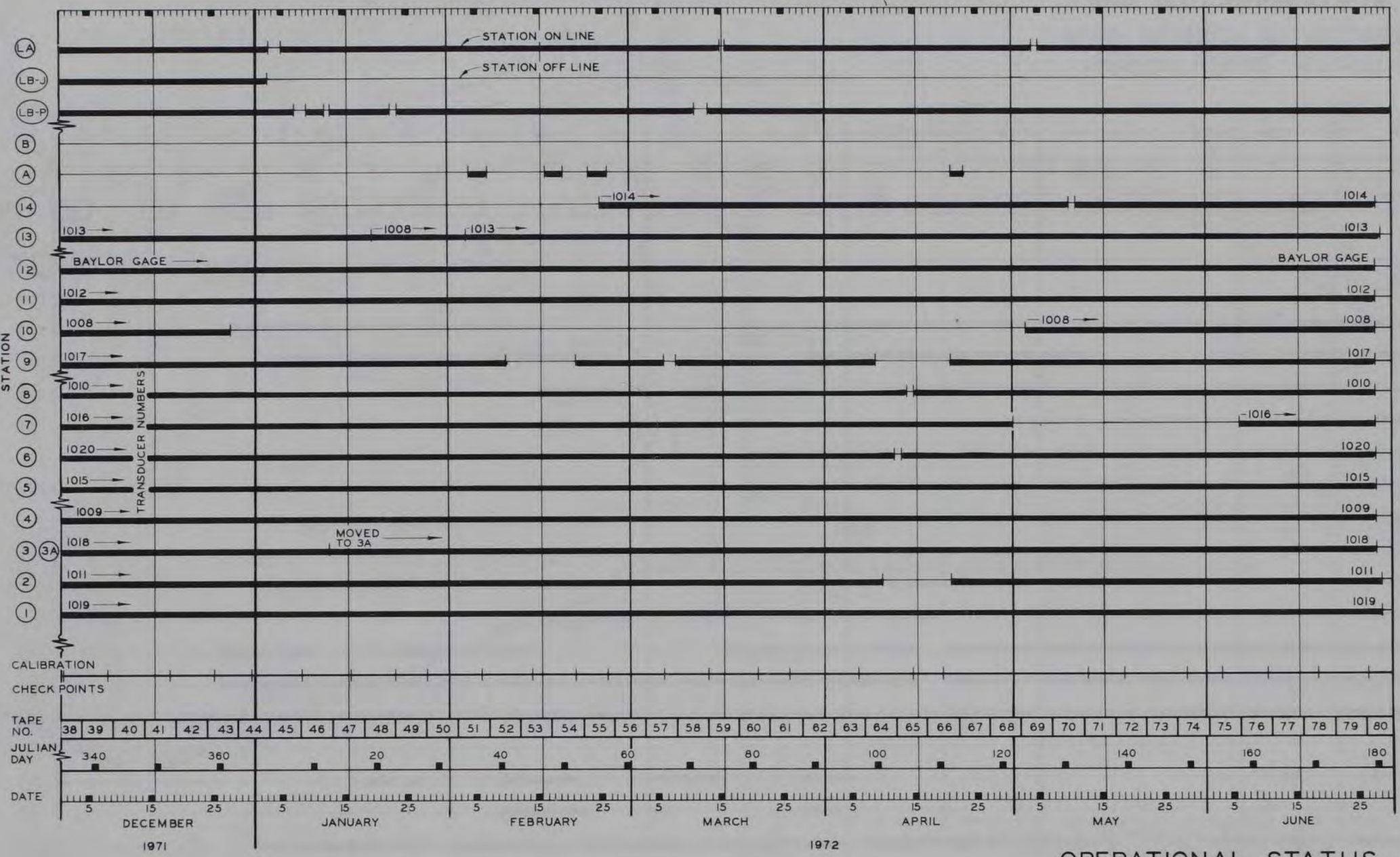


OPERATIONAL STATUS AND SENSOR PLACEMENT

MAY 1971 – NOVEMBER 1971

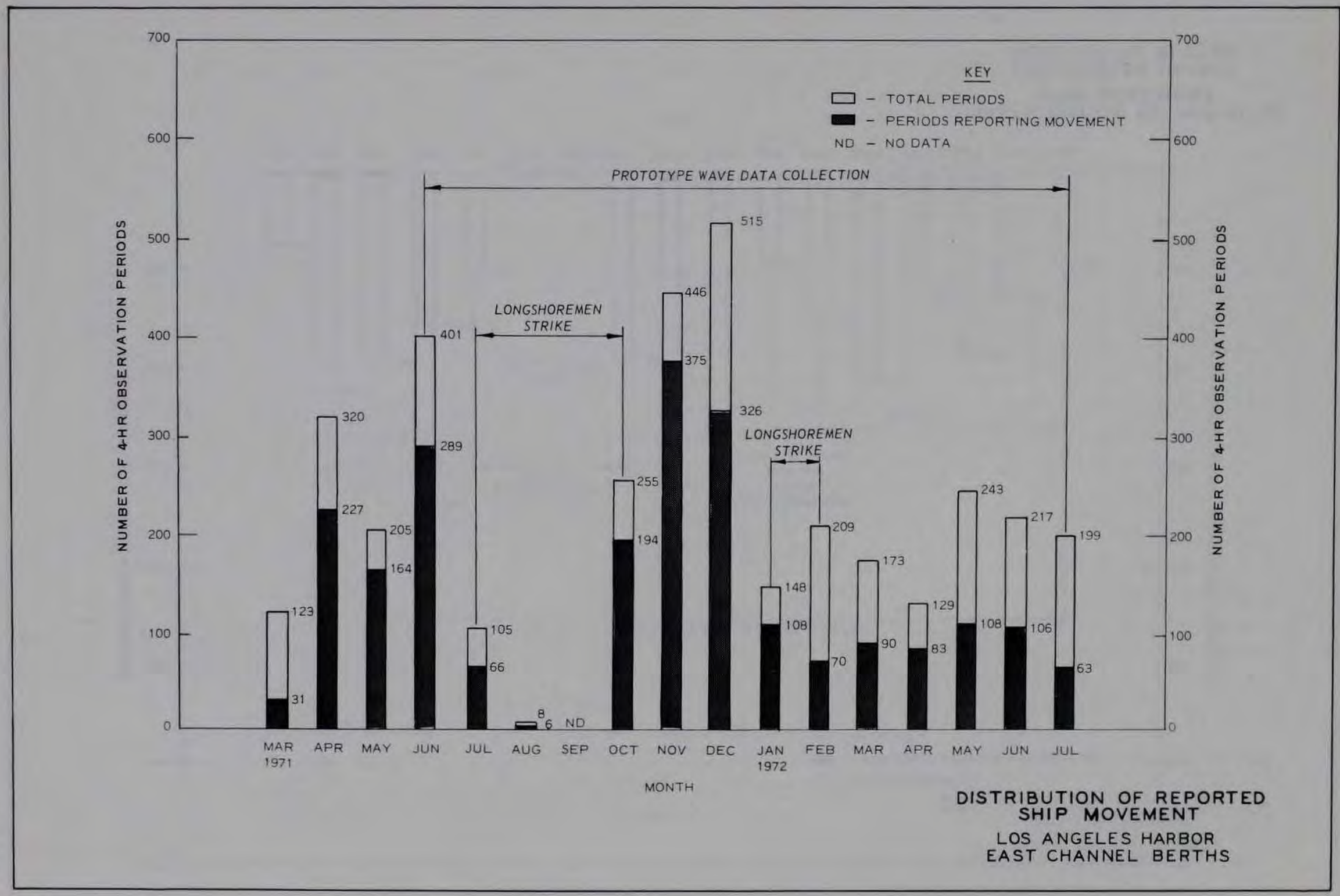
PLATE 3A

PLATE 3B



OPERATIONAL STATUS AND SENSOR PLACEMENT

DECEMBER 1971 – JUNE 1972

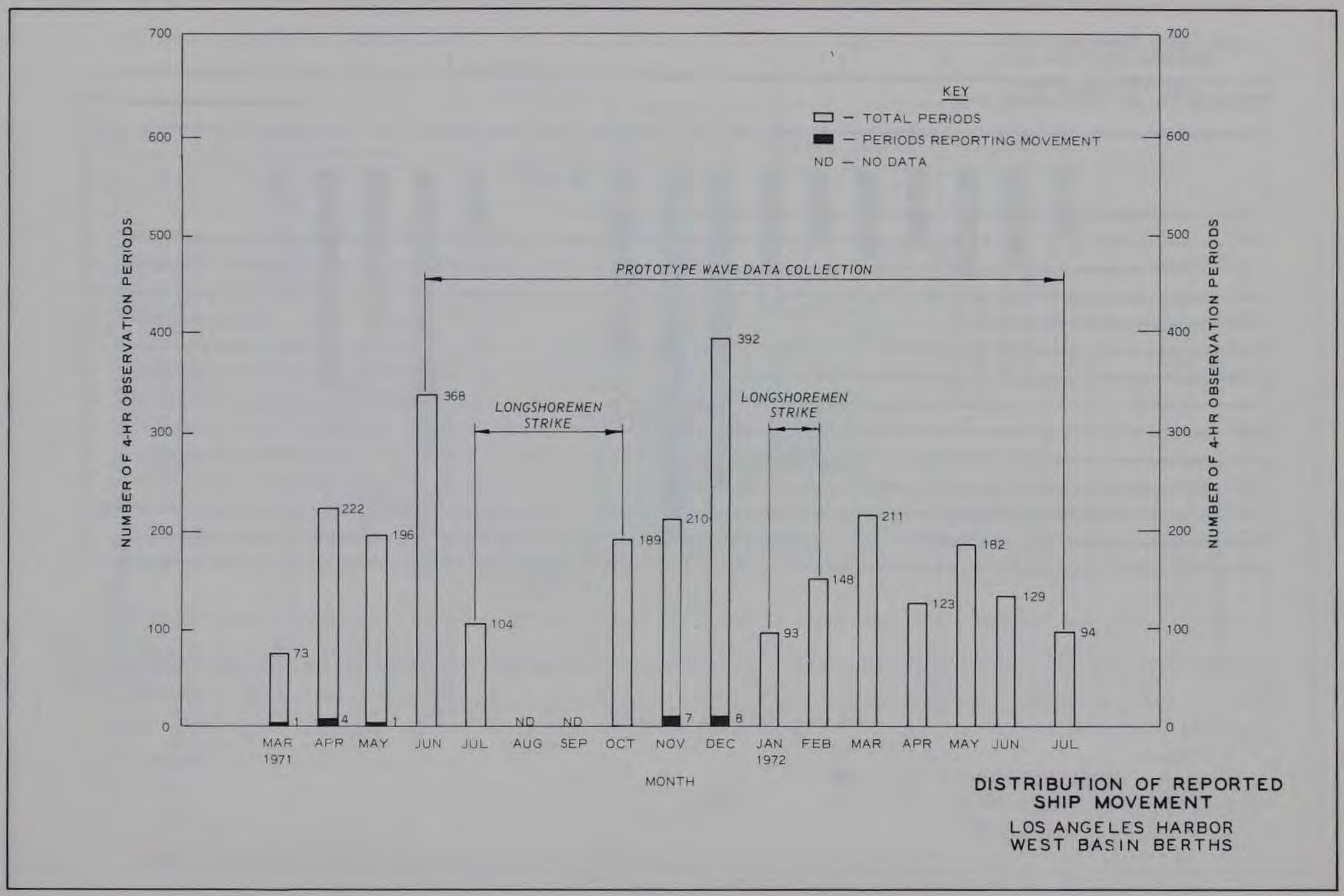


DISTRIBUTION OF REPORTED SHIP MOVEMENT

LOS ANGELES HARBOR
EAST CHANNEL BERTHS

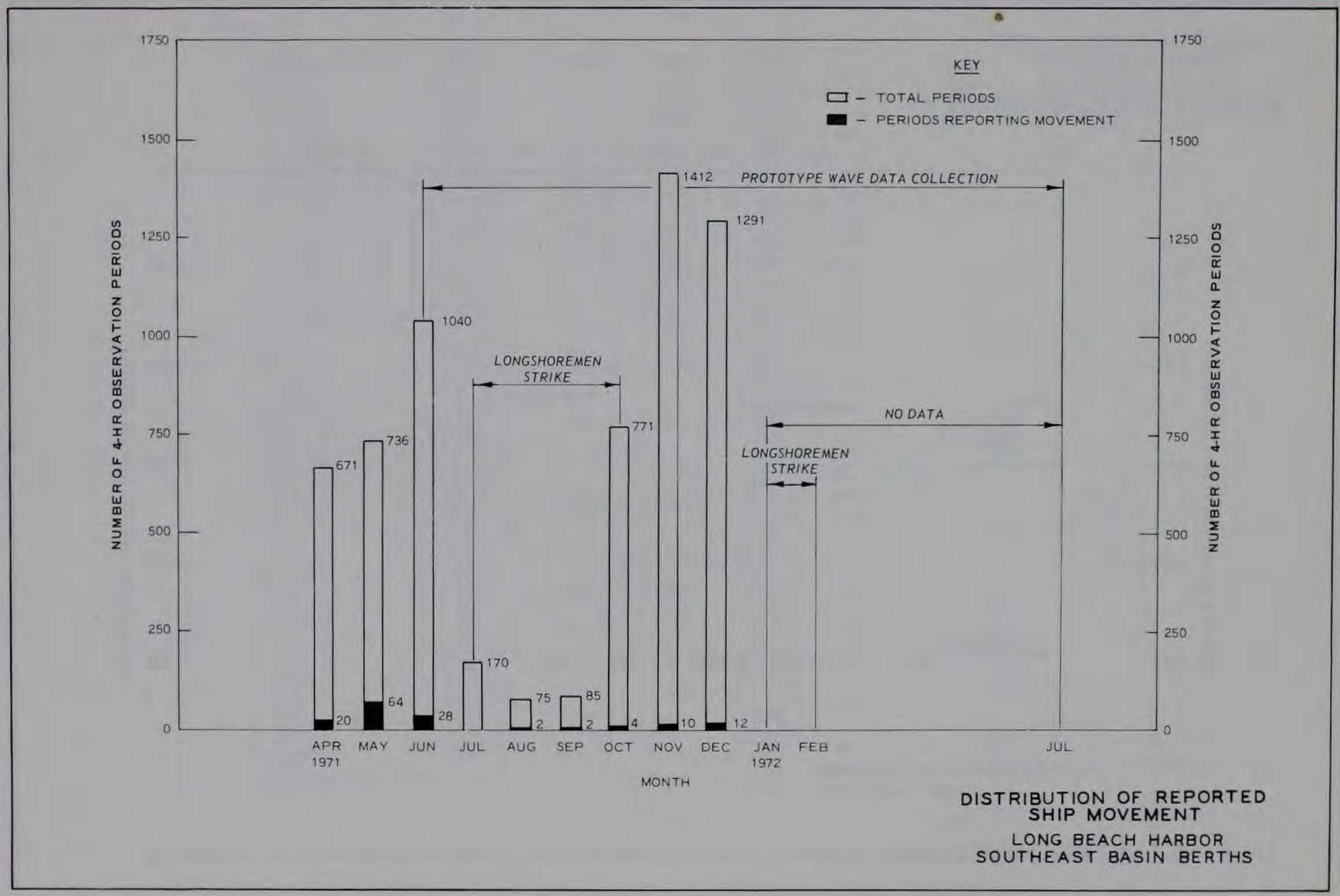
PLATE 4

PLATE 5



DISTRIBUTION OF REPORTED SHIP MOVEMENT

LOS ANGELES HARBOR
WEST BASIN BERTHS



DISTRIBUTION OF REPORTED SHIP MOVEMENT

LONG BEACH HARBOR
SOUTHEAST BASIN BERTHS

PLATE 6

4.0 QUALITY CONTROL EQUIPMENT LIST

Equipment used other than shown on this list shall be better than or equal to that listed.

Item	Equipment	Manufacturer	Model	Accuracy	Calibration Method
1a,b	Differential Voltmeters	Fluke	821A	0.01%	Against calibration stds
2	Counter/Timer	Monsanto	1020	$10^9 \pm$ 1 count	Against Calibration stds
3	Pressure Vessel	B & H	- -	- -	- - -
4	Pressure Transducer Force Balance	B & H	4-336	0.01%	Against 6-201 stds
5	Servo Amplifier	B & H	1-164		
6	Pressure Volume Regulator	B & H	360313-0100	- -	- - -

5.0 VISUAL INSPECTION

5.1 Clearness of Identification

5.1.1 Manufacturer Name

5.1.2 System Type Number

5.1.3 System Serial Number

5.1.4 Operating Manual

5.1.5 Wiring of Transmitter Stations

5.1.5.1 Wiring and plumbing of pressure sensor package

5.1.5.2 Wiring (component inner connecting) of the central station

5.2 Conformance to D.O.D.

5.2.1 General cleanliness and workmanship - scratches, marred finishes, etc.

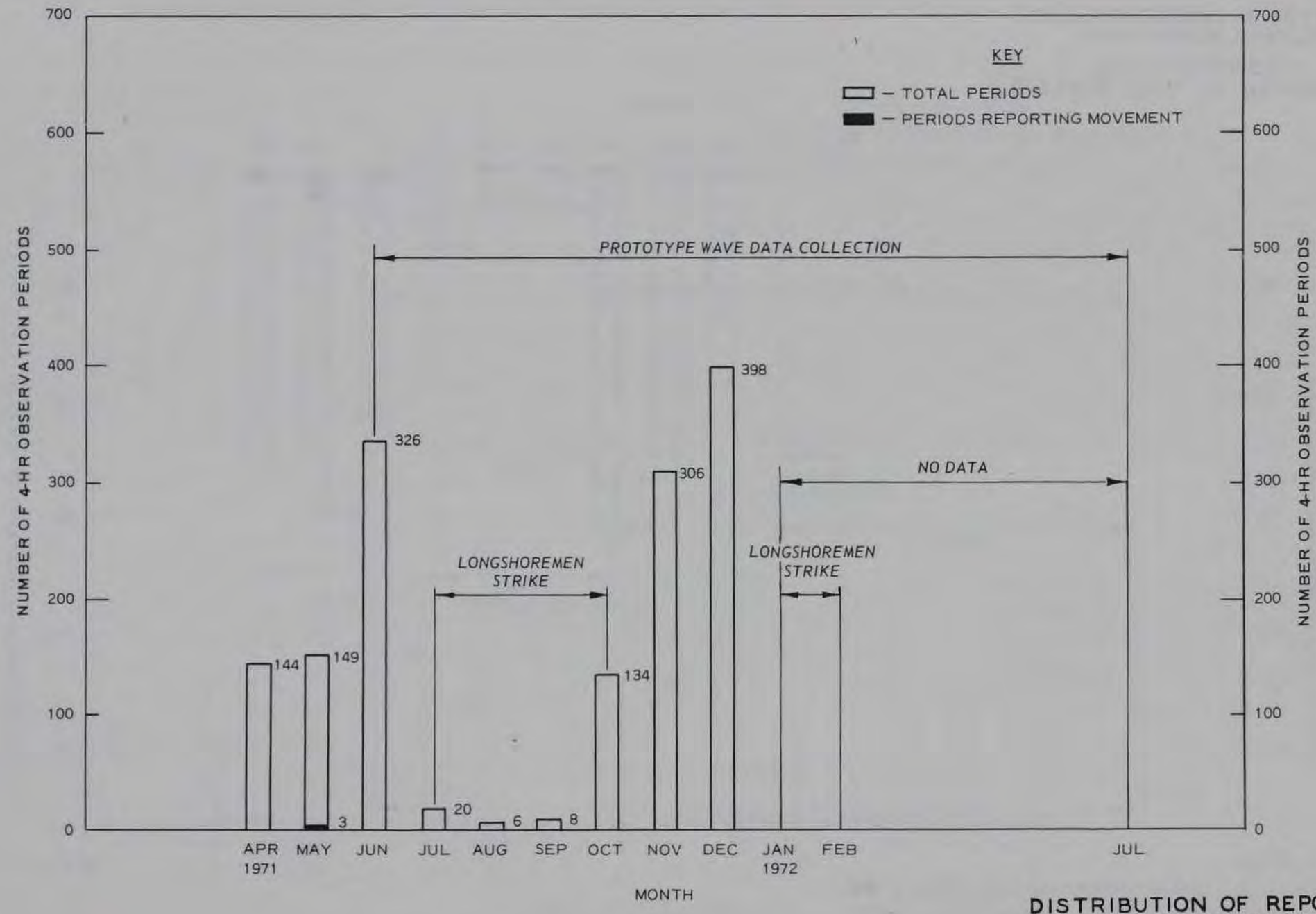
6.0 FINAL CLEAN UP

6.1 When the system has been accepted b y the customer and Bell & Howell Quality Assurance, it shall be cleaned of finger marks, dust, masking tape residue, etc., and made ready for shipment.

7.0 SHIPPING

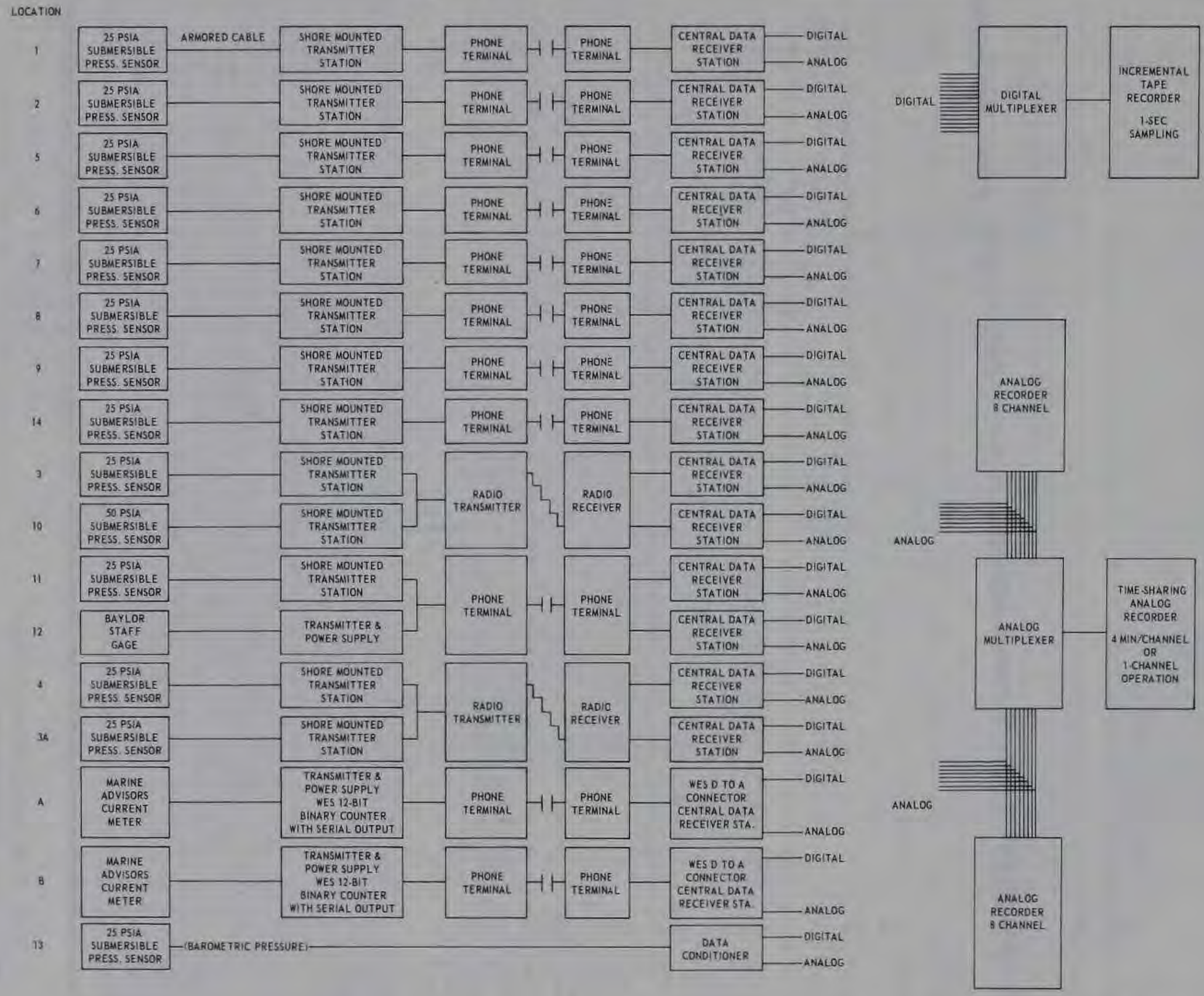
7.1 The system shall be taken to the shipping dock at Bell & Howell, after notification has been given the Army Corps of Engineers, to await their pick up. Each submersible pressure unit and transmitter station shall be placed in protective wrappings and placed in cartons. The central receiving station shall be free standing and padded only, for placement into the Van (to be provided by the customer).

PLATE 7



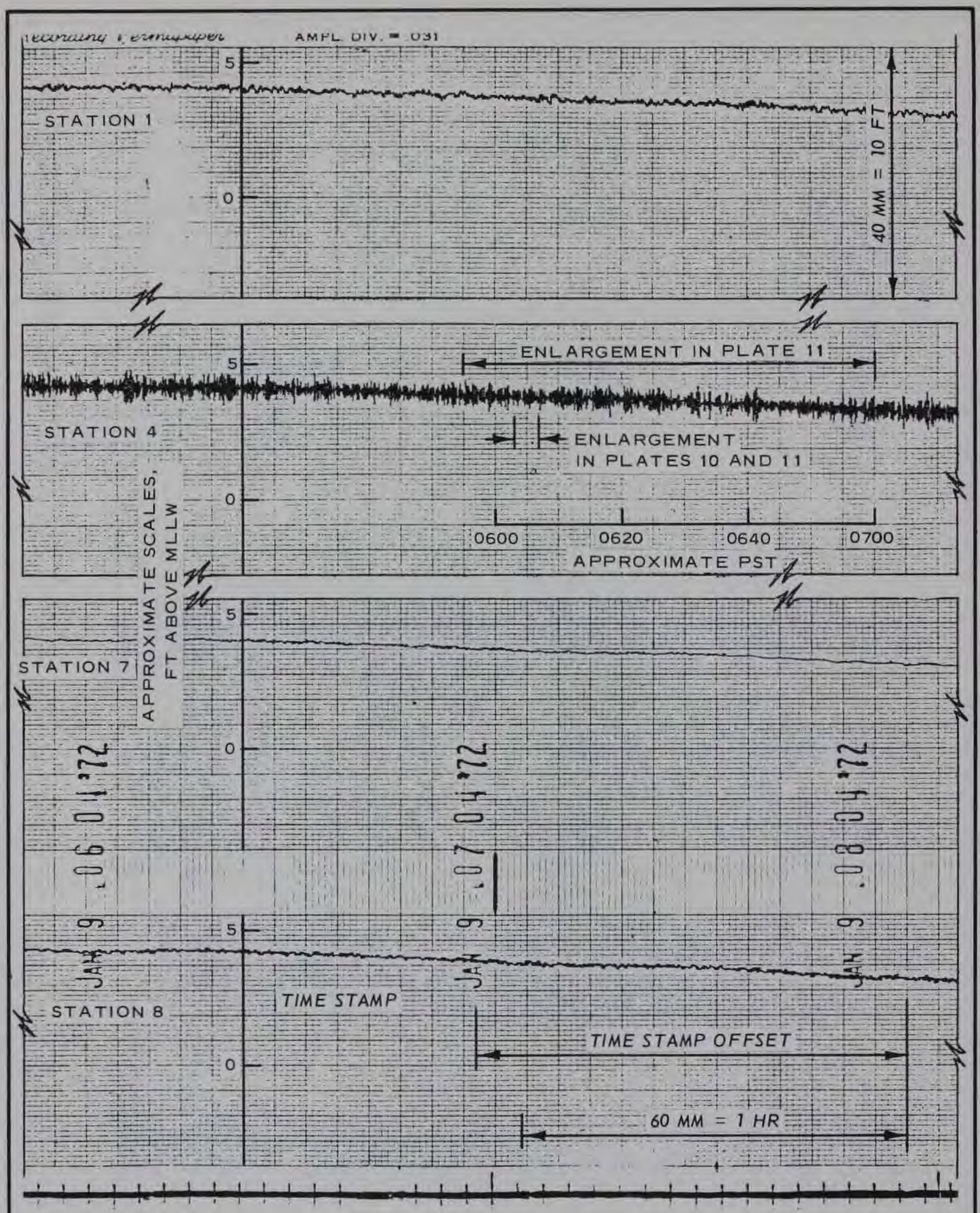
DISTRIBUTION OF REPORTED SHIP MOVEMENT

LONG BEACH HARBOR
EAST BASIN (SLIP 1) BERTHS



INSTRUMENTATION SCHEME

PLATE 8



NOTE: THESE ARE FULL-SCALE SEGMENTS OF RECORD; FULL HEIGHT OF EIGHT-RECORD CHART IS 403 MM.

TIME STAMP WAS OFFSET TO AVOID INTERFERENCE WITH RECORDING STYLUS.

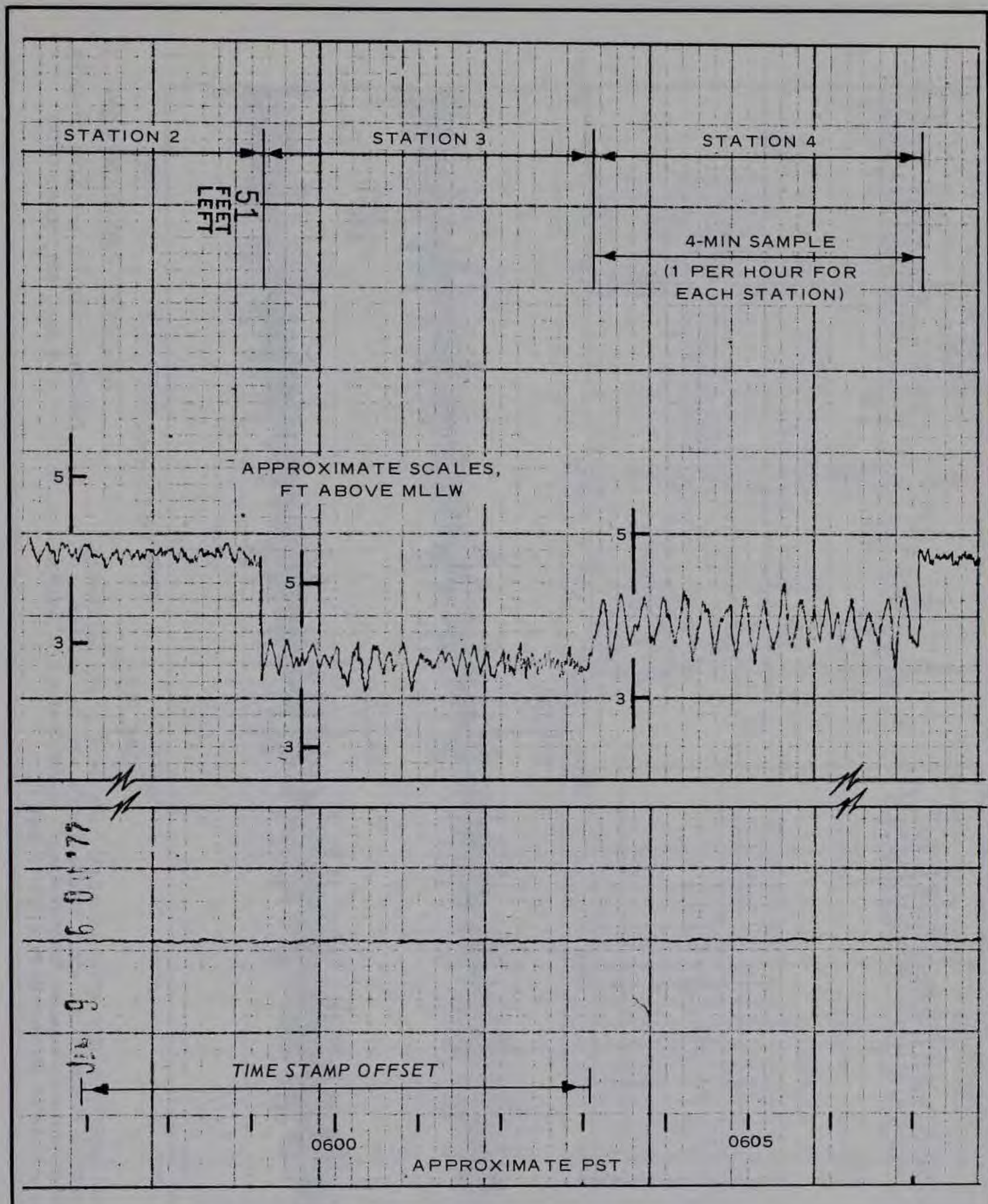
SAMPLE ANALOG STRIP CHART

SMALL SCALE PARALLEL RECORDS

9 JANUARY 1971, 0445-0715

(JULIAN DAY 009)

PLATE 9



NOTE: THESE ARE FULL-SIZE SEGMENTS OF RECORD; FULL HEIGHT OF CHART IS 10.95 IN.

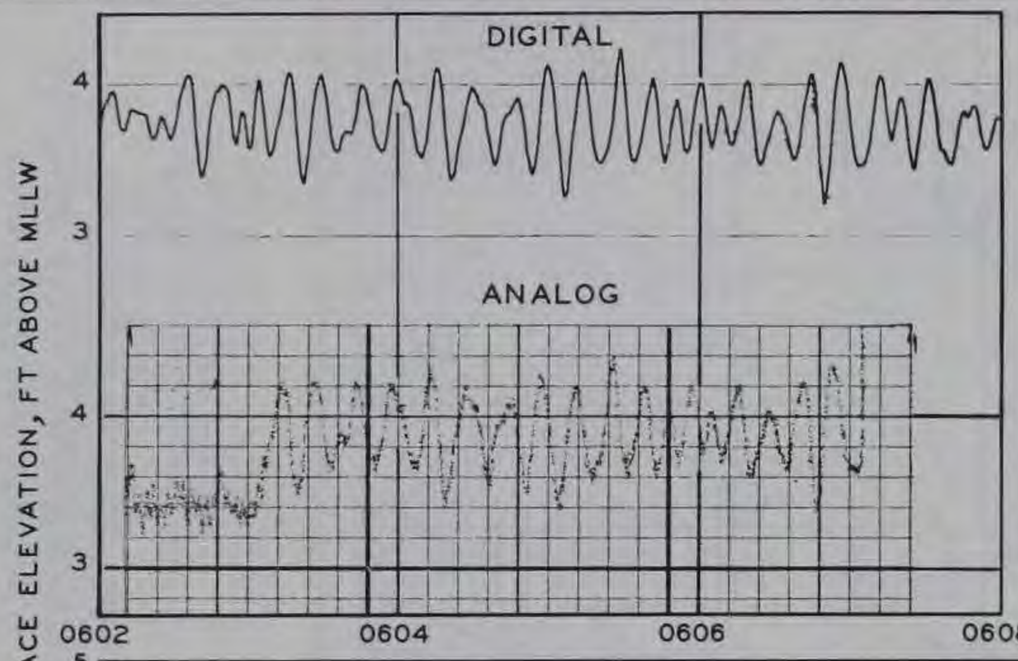
TIME STAMP WAS OFFSET TO AVOID INTERFERENCE WITH RECORDING STYLUS.

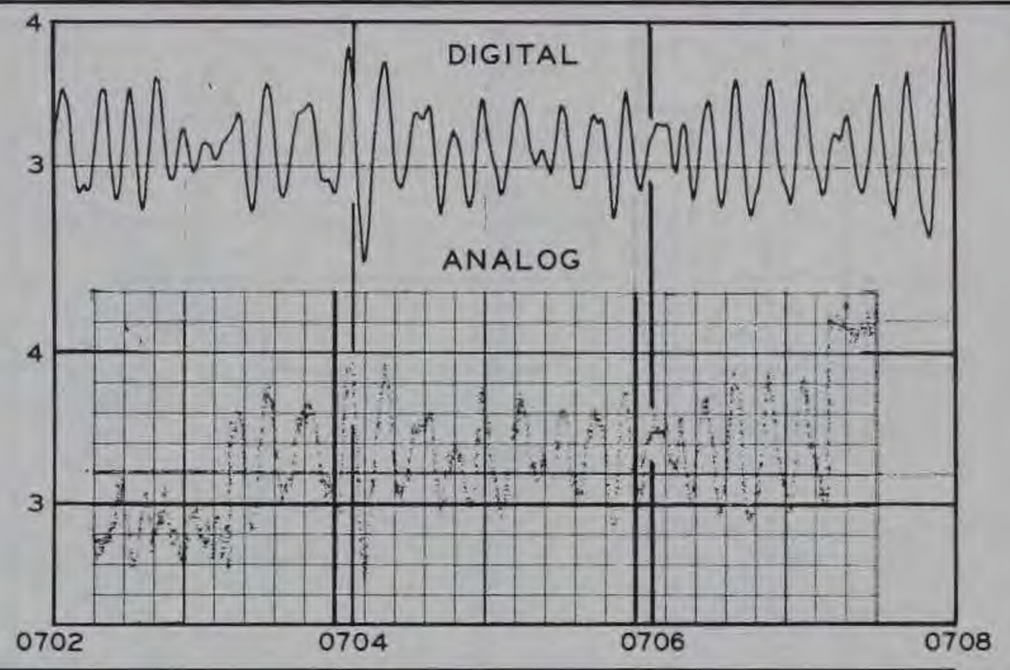
SAMPLE ANALOG STRIP CHART

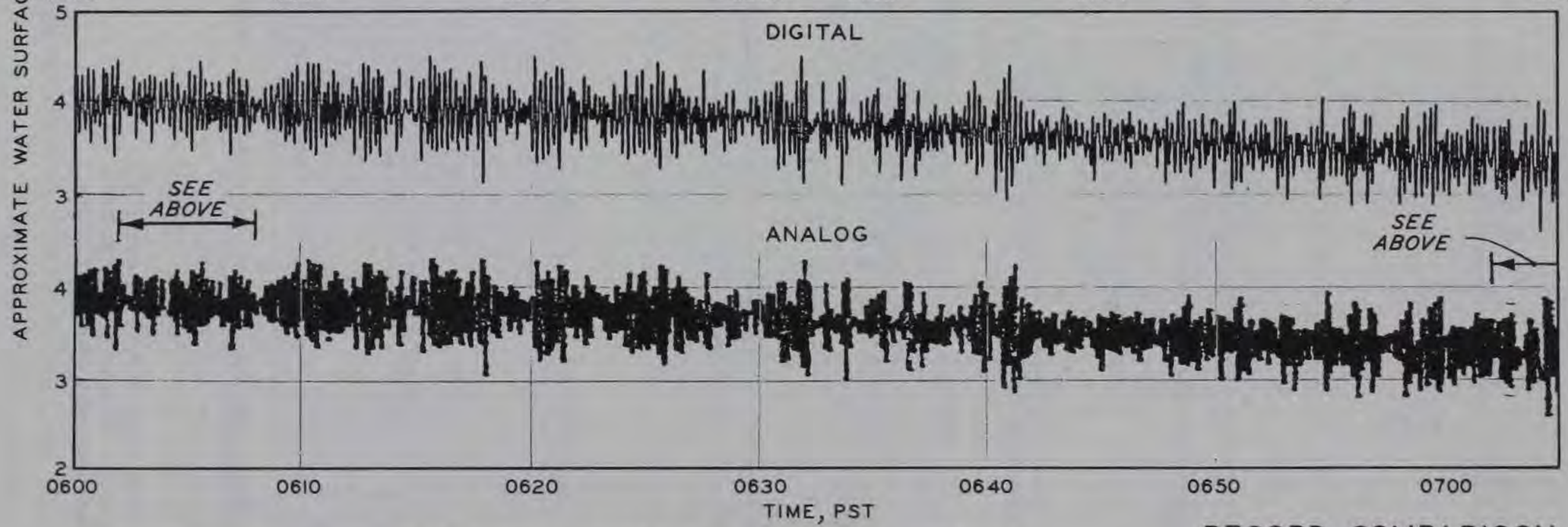
LARGER SCALE SEQUENTIAL RECORDS

9 JANUARY 1971, 0556 0607
(JULIAN DAY 009)

PLATE 11



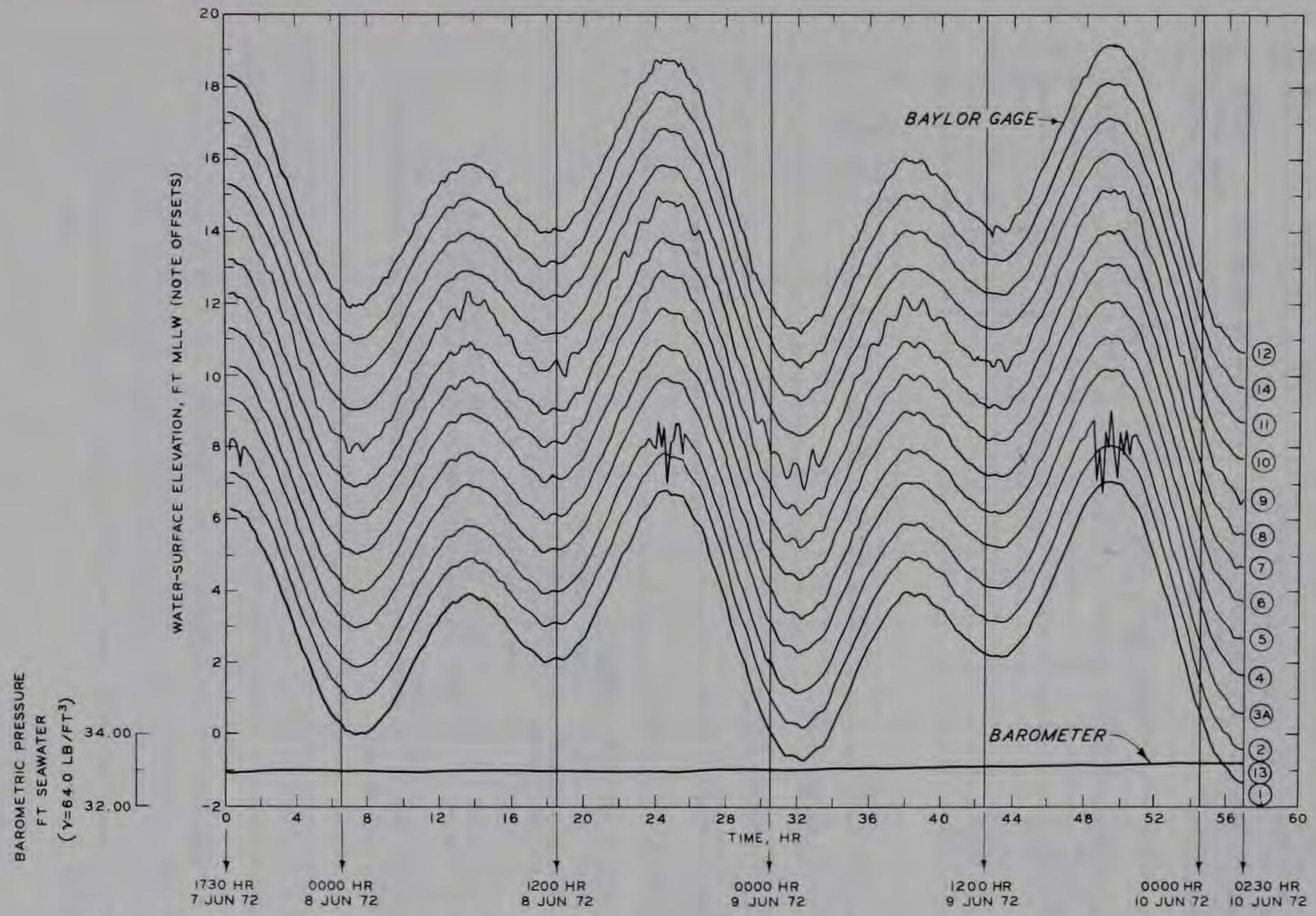




1. RECOMMENDED CALIBRATIONS USED WITH MAGNETIC TAPE DATA (1-SEC INTERVAL).
2. LA TIDE GAGE RECORDS FOR 8-10 JAN USED TO CALIBRATE ANALOG CHARTS.
3. RECORDS ARE FOR STATION 4; ANALOG "SEQUENTIAL " ABOVE, "PARALLEL" BELOW.
4. TRACES ARE FROM CHARTS SHOWN IN PLATES 10 AND 11.

RECORD COMPARISON

DIGITAL TAPE VS ANALOG CHARTS
9 JAN 1971, 0600 – 0705



NOTES: 1 PLOTTED POINTS ARE 10-MIN AVERAGE VALUES PLOTTED AT MIDPOINT OF THE TIME INTERVAL.

2 THE ORDINATE AXIS IS FOR STATION 1; THE REMAINING STATIONS ARE OFFSET IN EVEN 1-FT INTERVALS.

3 THE SEVERE OSCILLATIONS AT STATION 3A ARE PROBABLY DUE TO SYSTEM MALFUNCTIONS.

LOS ANGELES-LONG BEACH HARBOR

WATER SURFACE LEVELS

1730 HR ON 7 JUNE TO
0230 HR ON 10 JUNE 1972

PLATE 12

SHIP MOVEMENT & SURGE RECORD

SHEET ____ OF ____

AGENCY _____

BERTH _____ DATE (FIRST DAY) _____

SHIP NAME _____

DATE & TIME ARRIVED _____

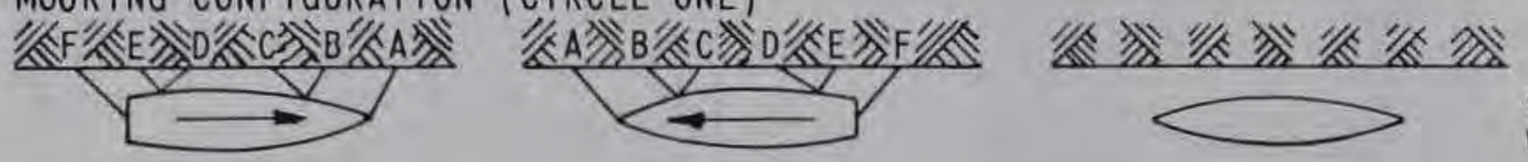
DATE & TIME DEPARTED _____

TYPE OF CARGO _____
(CIRCLE ONE)
1 CONTAINERS 3 WET BULK
2 BREAK BULK 4 DRY BULK

DRAFT _____ FT/M. FWD ____ FT/M. AFT

DRAFT _____ FT/M. FWD ____ FT/M. AFT

MOORING CONFIGURATION (CIRCLE ONE)



	LINES	1. TYPE, NO. & DIAM. (IN.) PLASTIC	MANILA	STEEL	OTHER	2. NOTE IF LINES ARE— SLACK	TIGHT	HEAVY STRAIN
FWD	A) BOW							
FWD	B) BREAST							
FWD	C) SPRING							
AFT	D) SPRING							
AFT	E) BREAST							
AFT	F) STERN							

SURGE RECORD		00-04	04-08	08-12	12-16	16-20	20-24
1ST DAY	TIME						
1ST DAY	SURGE & MOVEMENT SYMBOLS						
2ND DAY	TIME						
2ND DAY	SURGE & MOVEMENT SYMBOLS						
3RD DAY	TIME						
3RD DAY	SURGE & MOVEMENT SYMBOLS						
4TH DAY	TIME						
4TH DAY	SURGE & MOVEMENT SYMBOLS						

SURGE & MOVEMENT SYMBOLS:

DEGREE OF SURGE: L=LIGHT M=MEDIUM H=HEAVY

TYPE OF MOVEMENT (LIST MAIN TYPE FIRST):
A= LONGITUDINAL (FORE & AFT) B= TRANSVERSE (SIDEWAYS)
C= VERTICAL (UP & DOWN) D= FISHTAIL E= ROLL

CARGO HANDLING DELAYS DUE TO SURGE: CIRCLE ONE AND NOTE DATE & TIME
DIFFICULTIES: 1) NONE 2) SOME 3) CONSIDERABLE 4) STOPPED WORK

REMARKS: UNUSUAL CONDITIONS OR DIFFICULTIES OBSERVED: DAMAGE TO SHIP LINES, AND/OR WHARF, AND SEVERITY: SIGNIFICANT CHANGES IN MOORING CONFIGURATION: NOTE DATE & TIME:

_____

_____

_____

_____

SIGNATURES

1 ST DAY	2 ND DAY	3 RD DAY	4 TH DAY
0-8 _____	0-8 _____	0-8 _____	0-8 _____
8-16 _____	8-16 _____	8-16 _____	8-16 _____
16-24 _____	16-24 _____	16-24 _____	16-24 _____

SPL FORM FEB 71 538

SHIP MOVEMENT AND SURGE RECORD

PLATE 13

TIDAL DATA SHEET

Subject		Date	Page of Pages
Boat	Meter No.	Dir. Ind. No.	
Observers			
Range			

Sta No.	Military	Feet Below Surface		Current			Salinity			Air Temp	Remarks
				Dir Mag	Rev/Time	Velocity Ft/Sec	Sample No.	PPT	Temp		
		S									
		M									
		B									
		S									
		M									
		B									
		S									
		M									
		B									
		S									
		M									
		B									
		S									
		M									
		B									
		S									
		M									
		B									

WES Form No. 1999
Feb 1972

TIDAL DATA SHEET

APPENDIX A: STATION DETAILS

Inclosure 1: Station locations and bottom elevations (Table A1)
Inclosure 2: Station details and photographs (Figures A1-A4)

Table A1

Station Locations and Local Bottom Elevations*

Station No.	Latitude	Longitude	Port and Berth No.	Local Bottom ft Below mllw Elevation (0 = mllw)	No. of Figure Showing Station Details
1	33°43'34"	118°16'31"	LA 56	-19.4	A1
2	33°42'50"	118°16'24"	LA 47	-40.6	A1
3	33°42'31"	118°15'03"	--	-10.2**	A1
3A	33°43'23"	118°11'10"	--	-20.1**	A2
4	33°43'24"	118°11'10"	--	-13.2**	A2
5	33°45'03"	118°11'47"	LB 232	-24.7	A2
6	33°44'48"	118°12'43"	LB 207	-27.6	A3
7	33°45'47"	118°12'26"	LB 11	-9.4	A3
8	33°45'02"	118°14'39"	USN 8B	-5.0	A4
9	33°46'00"	118°16'25"	LA 137	-33.7	A4
10	33°42'28"	118°15'03"	--	-52.1**,†	A1
11	33°43'13"	118°15'58"	--	-23.0	A1
12	33°43'13"	118°15'58"	--	-23.0	A1
13	33°44'11"	118°16'47"	--	+63.2††	--
14	33°44'38"	118°11'31"	LB 242	-26.2	A2
LA	33°43'12"	118°16'19"	LA 60	--	A1
LB-J	33°45'02"	118°12'51"	LB 201	--	A3
LB-P	33°45'49"	118°13'08"	LB 36	--	A3
A	33°43'12"	118°16'19"	LA 60	--	A1
B	33°45'19"	118°16'21"	LA 149	--	A4

* See Plate 1 for general locations and Figures A1-A4 for location details.

** On sloping side of breakwater.

† Transducer elevation; use -21.3 after 3 May 1972 (Julian day 124).

†† Transducer elevation; use +58.7 before 28 June 1971 (Julian day 179).

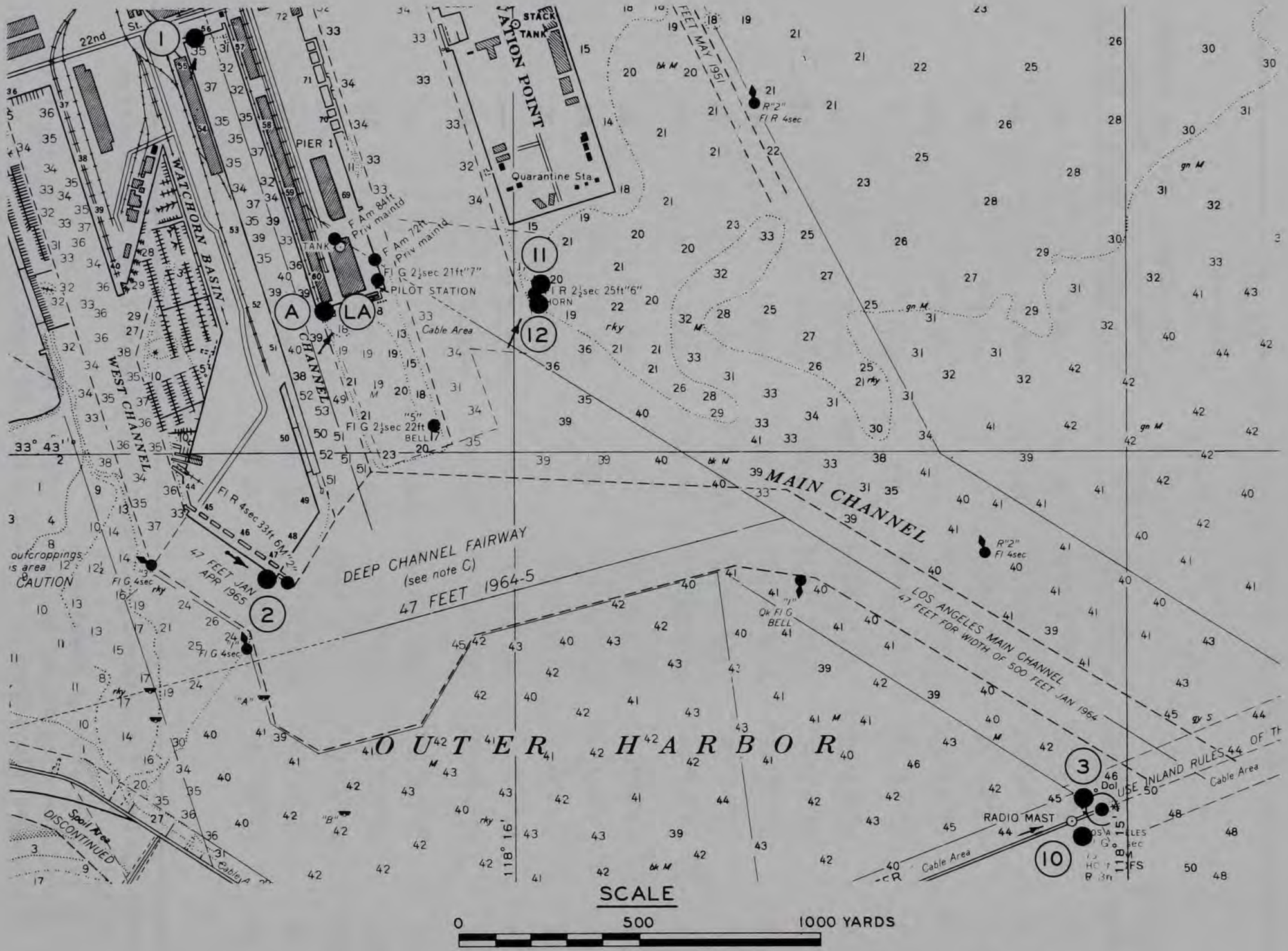


Figure A1a. Details from C&GS chart S147, 15th ed., Apr 14/69

Stations 11 and 12

Tide gage station LA
and station A

Station 2

Wave gage station 1

Wave gage stations 3 and 10

Figure Alb. Views of stations 1-3, 10-12, LA, and A as noted by arrows in Figure Ala.

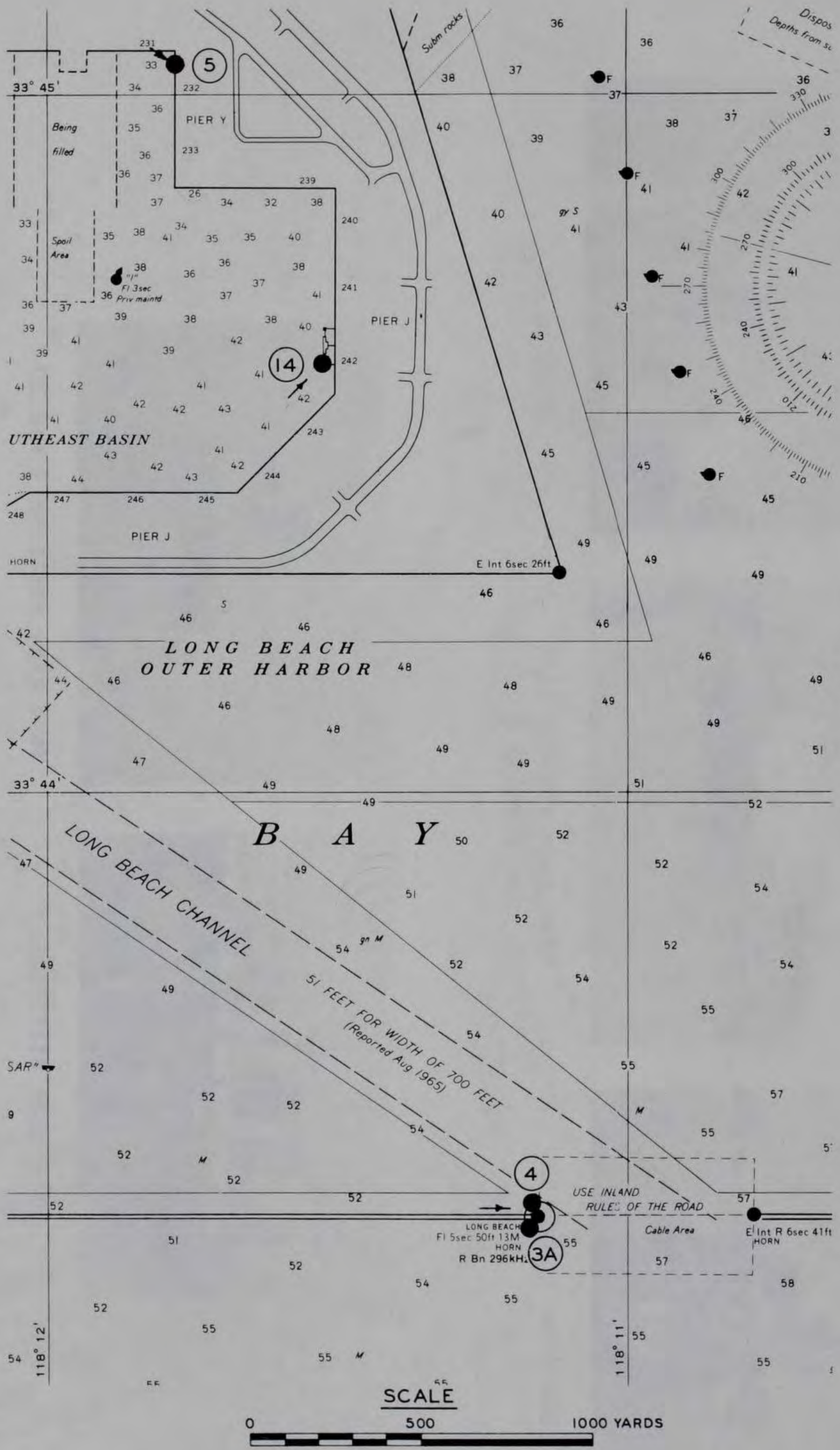


Figure A2a. Details from C&GS chart S147, 15th ed., Apr 14/69

Wave gage station 5

Wave gage station 14

Wave gage stations 3A and 4

Figure A2b. Views of stations 3A, 4, 5, and 14 as noted by arrows in Figure A2a

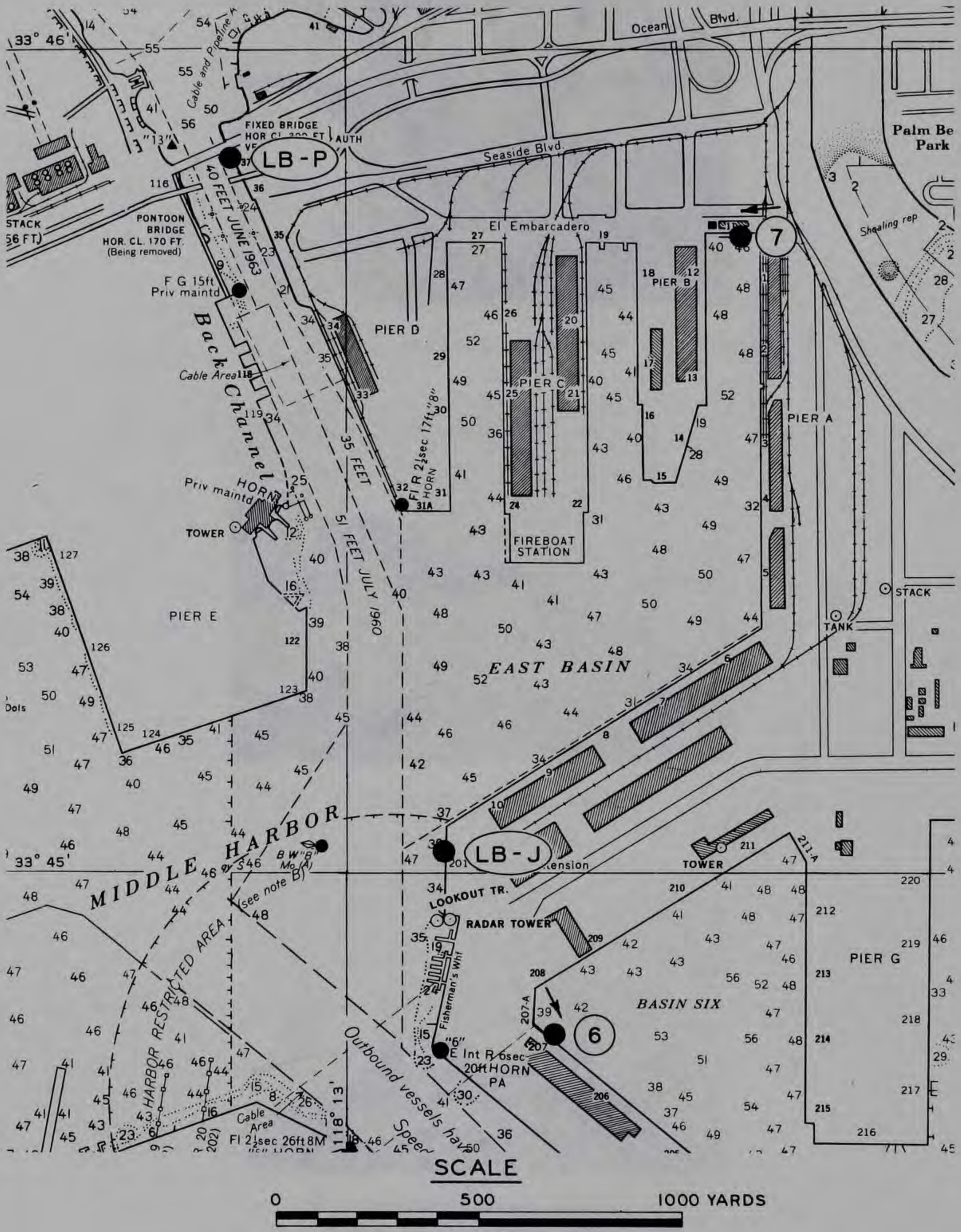


Figure A3a. Details from C&GS chart S147, 15th ed., Apr 14/69

Wave gage station 7

Wave gage station 6

Figure A3b. Views of stations 6 and 7 as noted by arrows in Figure A3a

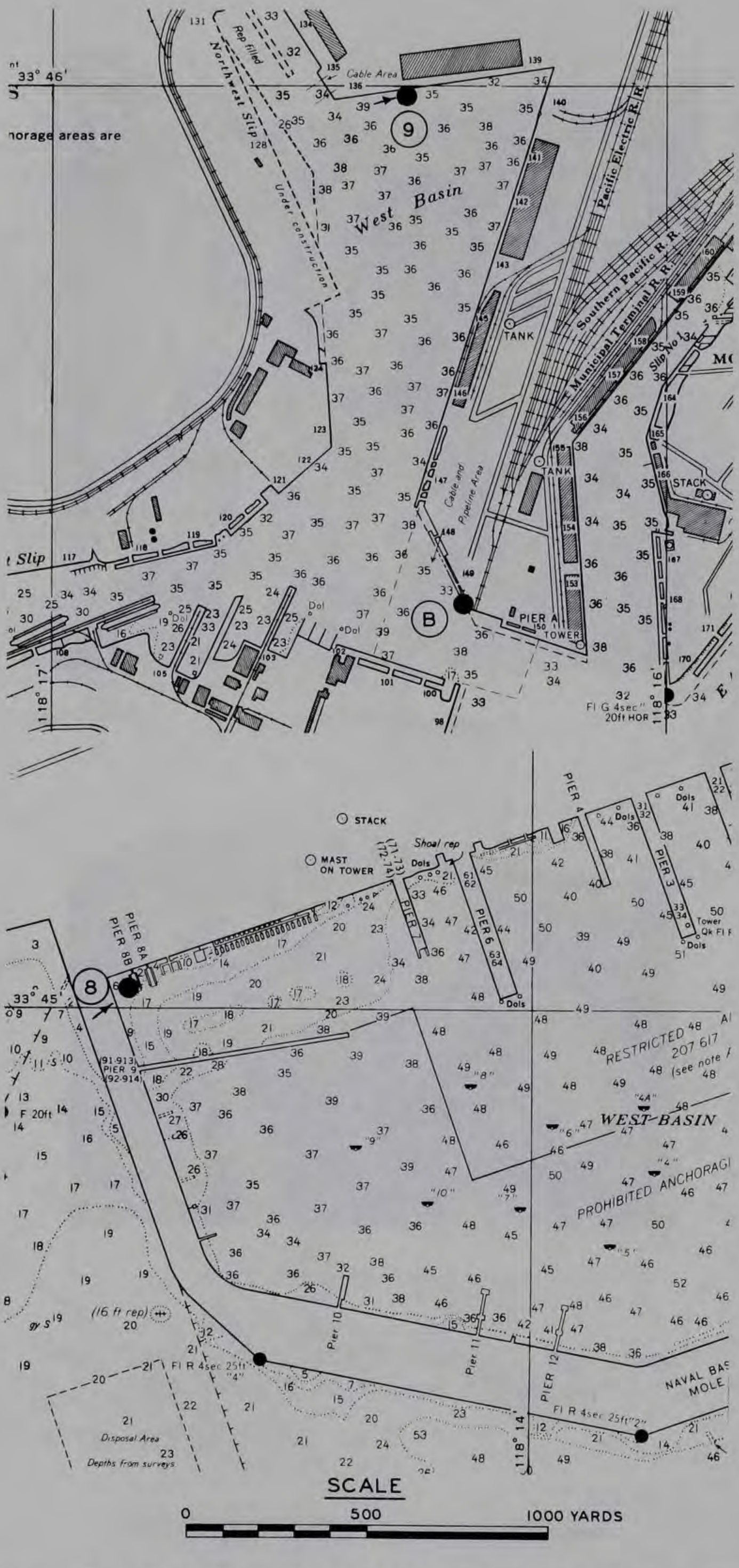


Figure A4a. Details from C&GS chart S147, 15th ed., Apr 14/69

Wave gage station 9

Current meter station B

Wave gage station 8

Figure A4b. Views of stations 8, 9, and B as noted by arrows in Figure A4a

APPENDIX B: PRESSURE TRANSDUCER DETAILS

Inclosure 1: Manufacturer's Bulletin 4460A/670
Inclosure 2: Quality Control and Acceptance Test Procedure
Inclosure 3: Factory Calibrations of Pressure Transducers
Inclosure 4: Summary of Factory Calibrations of Pressure Transducers (Table B1 and Figure B1)

TYPE 4-460 DIGITAL PRESSURE TRANSDUCER

FEATURES:

- Secondary Standard Accuracy— 0.05% or better
- Stable Output—extremely low zero and output drift
- Rugged—for mobile airborne use
- Dual capacitor pressure sensor— provides frequency output eliminating usual A-D converter errors

GENERAL

A high speed, high accuracy digital output pressure transducer is offered by Bell & Howell which employs a dual capacitor sensor as a means of generating a frequency. This frequency is applied to an integrated circuit counter and presented to a register for readout in any of the traditional digital formats. The 4-460 Digital Pressure Transducer is available with natural binary or BCD codes in serial or parallel output. Instruments are available in various pressure ranges as absolute, gage or differential pressure configurations.

The 4-460 Transducer offers these advantages:

- Completely self contained, including crystal controlled clock, programmer, counter and register.
- High accuracy and fast readout speeds.
- Precision pressure measurement in rugged environments over a wide temperature range.
- Computer compatible with inhibit control of the internal programmer.
- Output levels of logic "0" and "1" presented as zero and 5 volts dc.

APPLICATIONS

The inherent accuracy and ruggedness of this transducer makes it ideal for:

- Process control loops interfacing with computers
- Engine test stand pressure monitoring
- Wind tunnel data systems
- Airborne and mobile pressure monitoring systems
- Replacement for barometers
- Production line transfer standard in manufacturers and overhaul facilities

PRINCIPLES OF OPERATION

The pressure sensor consists of a flat diaphragm between two fixed insulated conductor plates which serve as capacitor elements. Bellows are used to isolate media from the capacitor circuits, and the sensor housing is evacuated to maintain constant dielectric for the capacitors. When the diaphragm is deflected by pressure, changes in each of the two capacitors occur — one increases while the other decreases. The capacitors control frequency of two VHF oscillators giving frequencies of F_1 and F_2. F_1 and F_2 are mixed and the difference frequency, $F_1 - F_2$ is extracted. $F_1 - F_2$ ranges from 0.25 to 7.5 MHz, zero to full scale pressure change. Although individual oscillator frequency changes are non-linear, the difference frequency output of the mixer is highly linear.

FM output from the mixer is digitized by an integrated circuit counter. To begin the cycle, the clock resets the counter to zero, then opens the count gate to admit the mixer output $F_1 - F_2$ to the counter. The count gate duration is one millisecond to provide proper scaling of a 13-bit system. (A 13-bit system gives a resolution of 0.013% full scale.) Shorter count gates are used for systems requiring less resolution, while longer count gates are used for systems requiring greater resolution. After the count gate closes, a transfer pulse from the clock sub-system loads the data from the counter into the register. Following the transfer pulse, a reset pulse restores the counter to zero and the cycle repeats.

For parallel output, the register stores the counter data. A number of wires equal to the number of bits is brought to the output. For serial output, the register is operated as a shift register and the data is clocked out on a single wire descending from the most significant bit (MSB) to the least significant bit (LSB). In either mode, the data transmitted is the most recent sample from the counter. Meanwhile, the counter is taking a new sample. The overall rate of data generated from the transducer is the same for either output format .

A heater with close temperature control of the pressure sensor is incorporated to minimize temperature error throughout the specified operation temperature range.

SPECIFICATIONS

Pressure Ranges: 0-10 psi to 0-200 psi absolute, gage or differential.

Standard Ranges: 10, 15, 30, 50, 75, 100, 150, 200.

Pressure Limits: Zero shift will be less than 0.02% FS or 1 count, whichever is greater when the following is applied:

10 — 100 psi ranges — 1.5X rated pressure.

Above 100 psi — 1.25X rated pressure.

Media: Pressure medium is in contact with 300 series stainless steel, teflon tubing, gold plated nickel bellows, and lead tin solder.

Combined Linearity and Hysteresis: ±0.05% FS ±1 count BSL

Repeatability: 0.02% FS ±1 count

Output Code: Natural binary—specify serial or parallel (BCD available as option)

Resolution: The number of bits output determines the resolution and word rate obtainable. The relationships are:

No. Bits	Resolution % F.S.	Bit Rate Kilobits/ Sec	Word Rate Word/Sec	Update Period Milli-seconds
10	0.1	62.5	6250	0.16
12	0.025	20.8	1700	0.58
13	0.013	11.4	870	1.15
14	0.007	6.25	500	2.0
15	0.0035	3.5	230	4.3
16	0.0018	1.7	120	8.0

End Points: Digital output at zero pressure input is 2.5% to 3.5% of FS. Digital output at full scale is 94% to 96% of digital count capacity.

Response Time: A full range step in pressure is followed by the electrical output to within 90% of final reading in less than 15 ms.

Output Logic Level and Impedance: Logical "O" is 0 to 0.4 Vdc, Logical "1" is 2.4 to 5 Vdc. Output impedance is 100 ohms. Standard TTL logic practices should be employed.

Input power: 28 Vdc ±4V; with heater 40 watts max.

Electrical isolation: 500 megohms at 45 Vdc.

Size: 2¾ inches x 2¾ inches x 6 inches max.

Weight: 2.2 lbs. max.

Environmental

Operating temperature: 0° to 165°F.

Thermal zero shift: 0.0007% / °F +1 count

Thermal sensitivity shift: 0.0005% / °F +1 count

Vibration: Sensitive axis vibration response: Maximum output error will not exceed values listed when transducer is vibrated to curve H of MIL-STD-810B (0.10 inches double amplitude 5 Hz to 14 Hz, 1 g peak 14 Hz to 23 Hz, 0.036 inches double amplitude 23 Hz to 74 Hz, 10 g peak 74 to 2 K Hz.)

PRESSURE RANGE	RESPONSE %FS	PRESSURE RANGE	RESPONSE %FS
10 psi	0.25	75 psi	0.13
15 psi	0.18	100 psi	0.13
30 psi	0.13	150 psi	0.10
50 psi	0.10	200 psi	0.08

Error due to vibration in other than the sensitive axis will be less than 50% of sensitive axis response.

Static Acceleration: Sensitive axis acceleration response is less than:

PRESSURE RANGE	RESPONSE %FS/G	PRESSURE RANGE	RESPONSE %FS/G
10 psi	0.15	75 psi	0.07
15 psi	0.12	100 psi	0.06
30 psi	0.07	150 psi	0.05
50 psi	0.05	20 psi	0.04

Shock: 100 g half sine wave pulse for 11 milliseconds will not cause zero or span shift of 0.04% FS or 2 counts, whichever is greater.

Humidity: Meets MIL-E-5272C Procedure 1.

Altitude: The transducer will perform to this specification at ambient pressure from 0 to 16 psia.

ORDERING INFORMATION

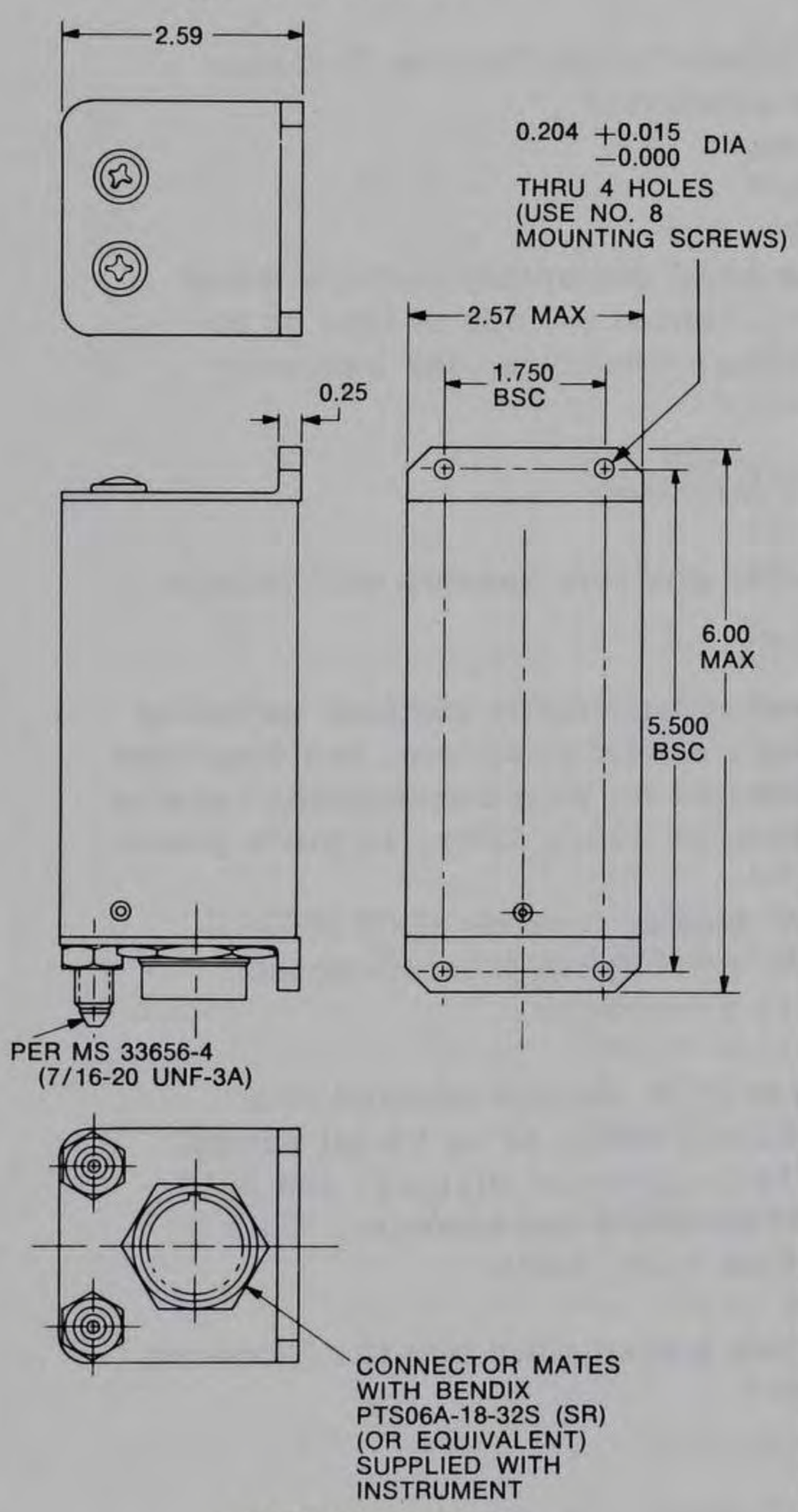
When ordering, specify Type 4-460-0001 Digital Pressure Transducer, natural binary or BCD, serial or parallel output code, number of bits (10 through 16, except 11), pressure range, and whether absolute, gage or differential transducers are desired.

Due to Bell & Howell's policy of continuing product improvement, specifications may be changed without notice. Consult your nearest Bell & Howell (Electronics & Instruments Group) sales office for price and confirmation.

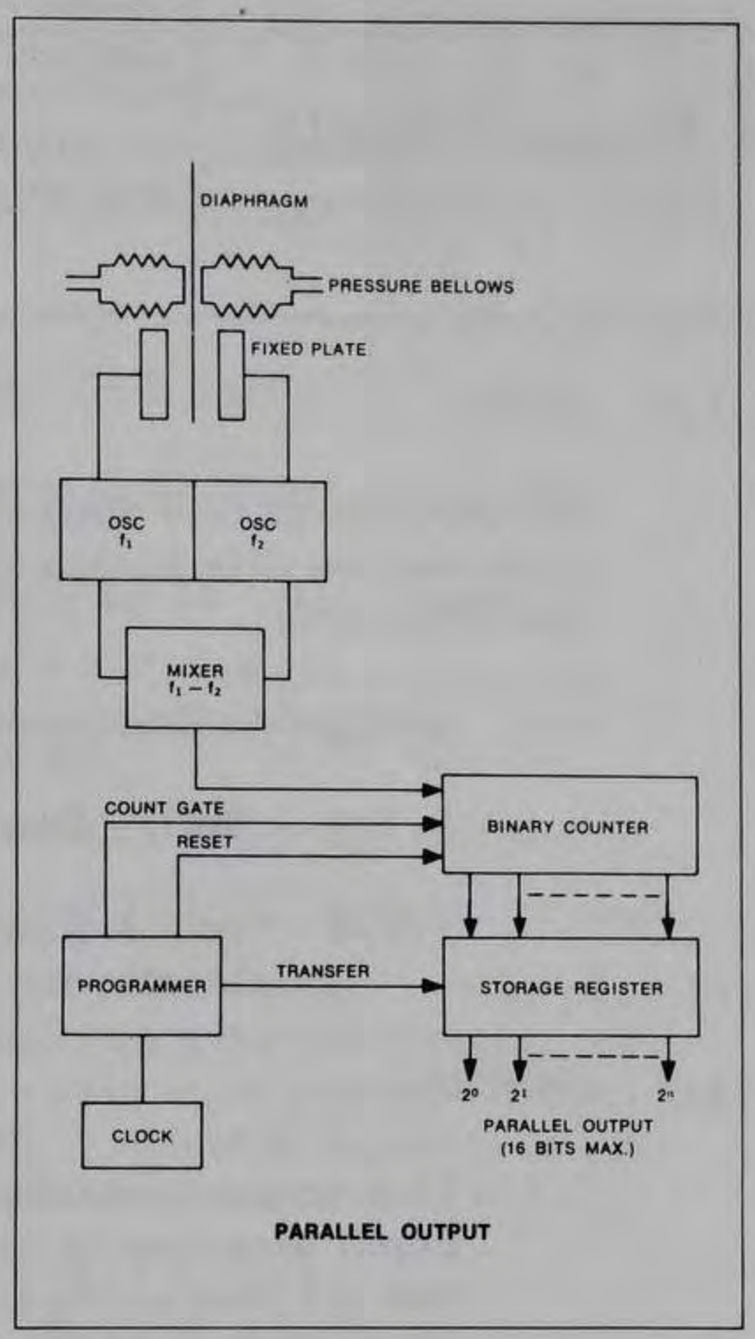
CONNECTOR PIN ASSIGNMENTS

A	1 LSB	PARALLEL OUTPUT (IF SPECIFIED)
B	2	
C	3	
D	4	
E	5	
F	6	
G	7	
H	8	
J	16 MSB	
K	15	
L	14	
M	13	
N	12	
P	11	
R	10	
S	9	
T	SERIAL OUTPUT (IF SPECIFIED)	
U	SIGNAL COMMON	
V	*	
W	*	
X	*	
Y	FM OUT	
Z	*	
a	*	
b	*	
c	(Vcc) (INTERNAL)	
d	*	
e	*	
f	*	
g	*	
h	+	28V POWER IN
j	−	

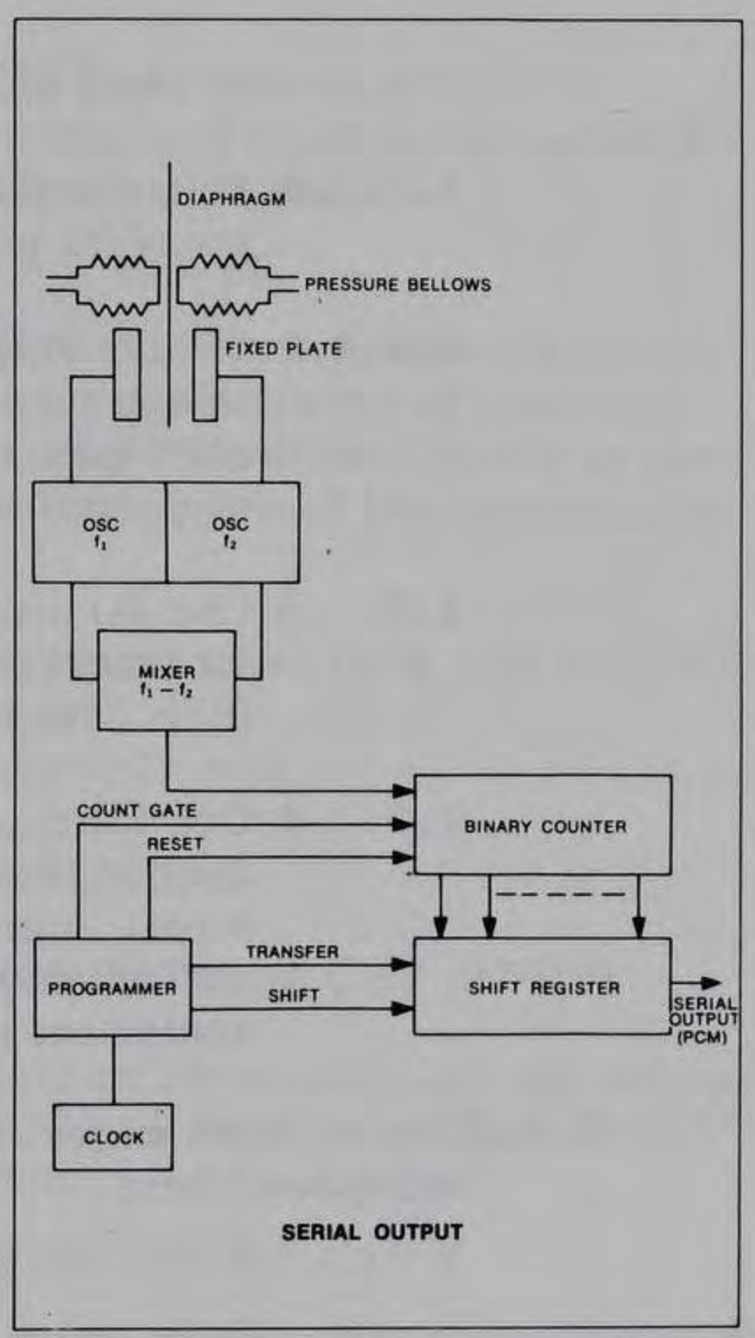
* CONTROL FUNCTIONS (SEE OPERATING MANUAL)



DIMENSIONAL OUTLINE



PARALLEL OUTPUT



SERIAL OUTPUT

Incl 1 (Sheet 3 of 3)

1.0 SCOPE

The purpose of this document is to outline the acceptance tests to be performed on this system to determine its conformance to the required specifications.

1.1 Applicable Documents

1.1.1 Bell & Howell Technical Specification 10-101-0415

1.1.2 Bell & Howell Dimensional Outline Drawing Pressure Monitoring System 10-101-0415

1.2 GENERAL

1.2.1 This pressure measuring system shall accurately measure water depth from remote locations for extended periods of time up to one (1) year using a digital pressure transducer and frequency shift data transmission system.

1.2.2 The system shall consist of the following:

1.2.2.1 Thirteen (13) submersible pressure sensors with reference pressure valving.

1.2.2.2 Twelve (12) shore-mounted transmitter stations including power supplies, pressure sensor digitizers, and frequency shift audio tone transmitters for data transmission capable of operation from commercial 115V, 60Hz, 15 watts power.

1.2.2.3 One (1) digital encoder display receiver (P/N 366583) for direct connection to a 0-25 psia pressure sensor (P/N 366557) for use as a barometer.

1.2.2.4 One (1) central receiver (P/N 366559) mounted at a central location. Electrical output to be 12-bit natural binary, parallel with 12-lamp visual display, and 0-10 VDC analog signals for driving a pen recorder. This equipment to operate from 115V, 60Hz.

1.2.3 The systems major components are broken down into the following subassemblies:

1.2.3.1 Pressure Sensor Package (P/N 366557)

Contains Digital Transducer (P/N 366656-0100)

a. Size - 6.5" diameter by 15" long, maximum

b. Submersible Depth - 100 feet (50 psia range)

c. Operating Temperature - 45° to 75° F

d. Input Power - Sensors: 5 VDC, 250 milliwatts

Solenoid Voltage: 12 VDC, approx. 10 watts

e. Output Signal - 0.25 to 7.5 MHz, 3 volts peak-to peak (minimum) into a 93 ohm coaxial cable RG62U. At 15 psia input pressure (which includes a four (4) inch head of H_2O) the output frequency shall be as follows:

25 psia range: 4298 ±7 KHz

50 psia range: 2324 ±7 KHz

f. Performance Accuracy

1. Combined Linearity and Hysteresis - ±0.05% FS BSL: between 15 psia and FS

2. Repeatability - 0.02% FS

3. Long Term Accuracy - Error shall not exceed 0.25% of initial calibration for at least one year as measured at the natural binary at the central station (exclusive of the transmission link).

1.2.3.2 Pressure Ranges (Digital Transducer (P/N 366656-0100)

Twelve (12) units will be 0-25 psia

One (1) unit will be 0-50 psia

1.2.3.3 Central Receiving Station Equipment (P/N 366559)

a. Size - The equipment is 10" rackmount, and occupies part of an EMCOR 11 rack (71" high x 25-1/2" deep x 21" wide).

b. Operating Temperature +45°F to+110°F

c. Input Power - 115 volts, 60 Hz commercial power at less than 200 watts

d. Input Signals - Voice grade telephone circuit with signal levels and signal-to-noise to be established jointly with the telephone company.

e. Output - 12-bit parrell, natural binary NRZ with a logic one of 5V and logic zero of OV, in accordance with standard TTL circuit practices, 0-10 VDC analogs, output load, 10K ohms minimum. Inhibit command from multiplexer shall be a logic one of =5V nominal.

1.2.3.4 The Station Includes the Following:

1.2.3.4.1 Fourteen (14) Bell & Howell Digital/Encoders Display units (P/N 366584) with 12-bit natural binary output and D/A Convertor for 0 -10 Voutput (includes two spares).

1.2.3.4.2 Fifteen (15) RFL HB24310 FS Receivers and fifteen (15) REL HB24315 SCHMITT Triggers for accepting tone signals over telephone voice grade circuits (includes one spare of each).

1.2.3.4.3 Two (2) Bell & Howell Digital Encoders/ Display units (P/N 366585) with 12-bit natural binary output.

1.2.3.4.4 Six (6) 11-Module Chassis RFL HB13517 for mounting the receivers. SCHMITT Triggers and Bell & Howell Encoder/Display modules.

12.3.4.5 Power Supplies, Terminations, and Inner Connections to provide an operating system, including unwired mating connectors for hookup to the data recording system and pen recorders.

.2.4 The input power shall be 115 volts, 60 Hz. Commercial power of less than 200 watts, the system shall be powered and allowed to stabilize at room temperature =77 ±5°F, and ambient attitude and humidity. Stabilization time shall be one (1) hour.

1.2.5 It shall be determined that as a completed system ready for final acceptance that each component part essential to the functioning of the complete system be installed and correct operation

verified before final acceptance tests are begun.

2.0 QUALITY CONTROL PROCESS

2.1 Linearity, Accuracy

2.1.1 The system shall have been stabilized and ready for functional tests to be performed.

2.1.2 Each of the submersible pressure sensor packages shall be prepared and sealed before submergance tests. All pressure and electrical connections shall be made also at this time.

2.1.2.1 The water test chamber shall be filled with water to a level which allows complete submergance of the pressure sensor package into the test vessel.

2.1.2.2 The test vessel shall be sealed and dogged completely water and pressure tight. With the pressure system normalized prepare to perform linearity and accuracy runs on the submerged digital transducer (channel by channel).

2.1.3 Read and record the frequency output of the system channel being monitored by use of the frequency counter, apply 15 psia to the test chamber, (pressurizing the water in the chamber shall allow water to be forced into the orifice on the plate of the submersible package leading to the transducer).

2.1.4 Read and record the output of the system channel while pressurizing the test vessel through ten (10) 20% incremental steps traversing to full scale and returning to 15 psia, for the 25 psia unit, i.e., 15, 17, 19, 21, 23, 25, 23, 21, 19, 17, 15 psia. The 50 psia unit shall be steps of 15, 22, 29, 36, 43, 50, 43, 36, 29, 22, 15 psia.

2.1.4.1 The value read and recorded shall be frequency in KHz.

2.1.4.2 The digitized read out on the Encoder/Display units which are 12-bit natural binary output shall be monitored by means of the patching "plug in" test board provided to monitor the indication of digitized output and shall be plugged into the respective information channel at the rear of the data conditioner for that channel. Plug J 1, 2, 3, etc., to determine if the lighted display on the patching "plug in" is identical to the lighted display on the data conditioner installed in the system. The counts displayed shall be read and recorded on the data sheet along side the frequency values obtained for each pressure step/channel.

Accomodations are made for analog D.C. voltage readings which shall also be recorded on the data sheet in a similar manner as the counts and frequencies are above.

2.1.4.3 The criteria read out for linearity and accuracy shall be the frequency read out obtained for each presssure step from the channel being monitored. The resolution of the frequency pick off is 0.01% for best accuracy determination.

The specification is ±0.05% FS (BSL) between 15 psia and full scale (for each channel).

2.1.4.4 The operation of the solenoid valve and check valve shall be checked as follows:

Step 1: Set the toggle switch in the transmitter box to the "operate" position

Step 2: Apply approximately 10 psig to the purge port, which will allow any accumulated water at the normally closed port of the solenoid valve through the check valve and into the test tank. After ten (10) seconds, remove the pressure, and vent the purge line to atmosphere.

Step 3: Place the toggle switch in the "calibrate" position, record this reading (atmospheric pressure).

Step 4: Return the switch to "operate". Apply approximately 25 psia to the test chamber.

Step 5: Operate the toggle switch to "calibrate" and back to "operate" at least three (3) times to force water into the purge line.

Step 6: Remove the 25 psia from the test chamber.

Step 7: Repeat steps 1 through 3 and compare the readings. The readings shall be comparable.

2.1.5 Before proceeding to the next channel, bleed off the pressure in the test vessel and carefully remove the lid. Remove the pressure and electrical connections from the submersible unit and gently remove the unit from the chamber.

2.2 Leak Check

2.2.1 After removing the submersible unit from the chamber, check it for any indication of water bubbles, droplets or condensation on any or within the interior portions of the transducer transparent housing. This test shall be performed on each pressure sensor package (13).

Specification: No leakage, no collection or buildup or condensation allowed.

NOTE: Prime areas to consider for leakage; sealing screws, relief valve, and transducer pressure port connection.

2.3 Completion Sequence of Tests

2.3.1 Proceed to the next channel and in turn all channels in the method described in the preceding paragraphs until data on each channel and in turn through the completed system is gathered. Compile data on the test data sheets incorporated in this acceptance test procedure.

3.0 CALCULATIONS

3.1 End Points

3.1.1.a. 0 pressure (15 psia) shall be approximately 4300 KHz for the 25 psia channel. This value varies with the water head in the test chamber.

b. 0 pressure (15 psia) shall be approximately 2324 KHz for the 50 psia channel.

3.1.2 Full scale shall be approximately 6900 KHz.

3.2 Linearity, Accuracy

3.2.1 Sample run is tabulated below: For a 0-25 psia range channel:

PSIA	Freq. Output	Freq. Theo.	Freq.
15	4296	4296	0
17	4810	4813	-3
19	5326	5329	-3
21	5843	5846	-3
23	6361	6362	-1
25	6879	6879	0
23	6361	6362	-1
21	5844	5846	-2
19	5327	5329	-2
17	4811	4813	-2
15	4296	4296	0

3.2.2 The combined linearity and hysteresis error is the maximum +, - output deviation of this curve from the ideal output described by a straight line connecting the zero and the full-scale pressure outputs divided by 2. It is expressed as a percent of FS.

Example: $\frac{3}{2 \times 6879} \times 100 = 0.022\%$ FS

4.0 QUALITY CONTROL EQUIPMENT LIST

Equipment used other than shown on this list shall be better than or equal to that listed.

Item	Equipment	Manufacturer	Model	Accuracy	Calibration Method
1a,b	Differential Voltmeters	Fluke	821A	0.01%	Against calibration stds
2	Counter/Timer	Monsanto	1020	$10^9 \pm$ 1 count	Against Calibration stds
3	Pressure Vessel	B & H	- -	- -	- - -
4	Pressure Transducer Force Balance	B & H	4-336	0.01%	Against 6-201 stds
5	Servo Amplifier	B & H	1-164		
6	Pressure Volume Regulator	B & H	360313-0100	- -	- - -

5.0 VISUAL INSPECTION

5.1 Clearness of Identification

5.1.1 Manufacturer Name

5.1.2 System Type Number

5.1.3 System Serial Number

5.1.4 Operating Manual

5.1.5 Wiring of Transmitter Stations

5.1.5.1 Wiring and plumbing of pressure sensor package

5.1.5.2 Wiring (component inner connecting) of the central station

5.2 Conformance to D.O.D.

5.2.1 General cleanliness and workmanship - scratches, marred finishes, etc.

6.0 FINAL CLEAN UP

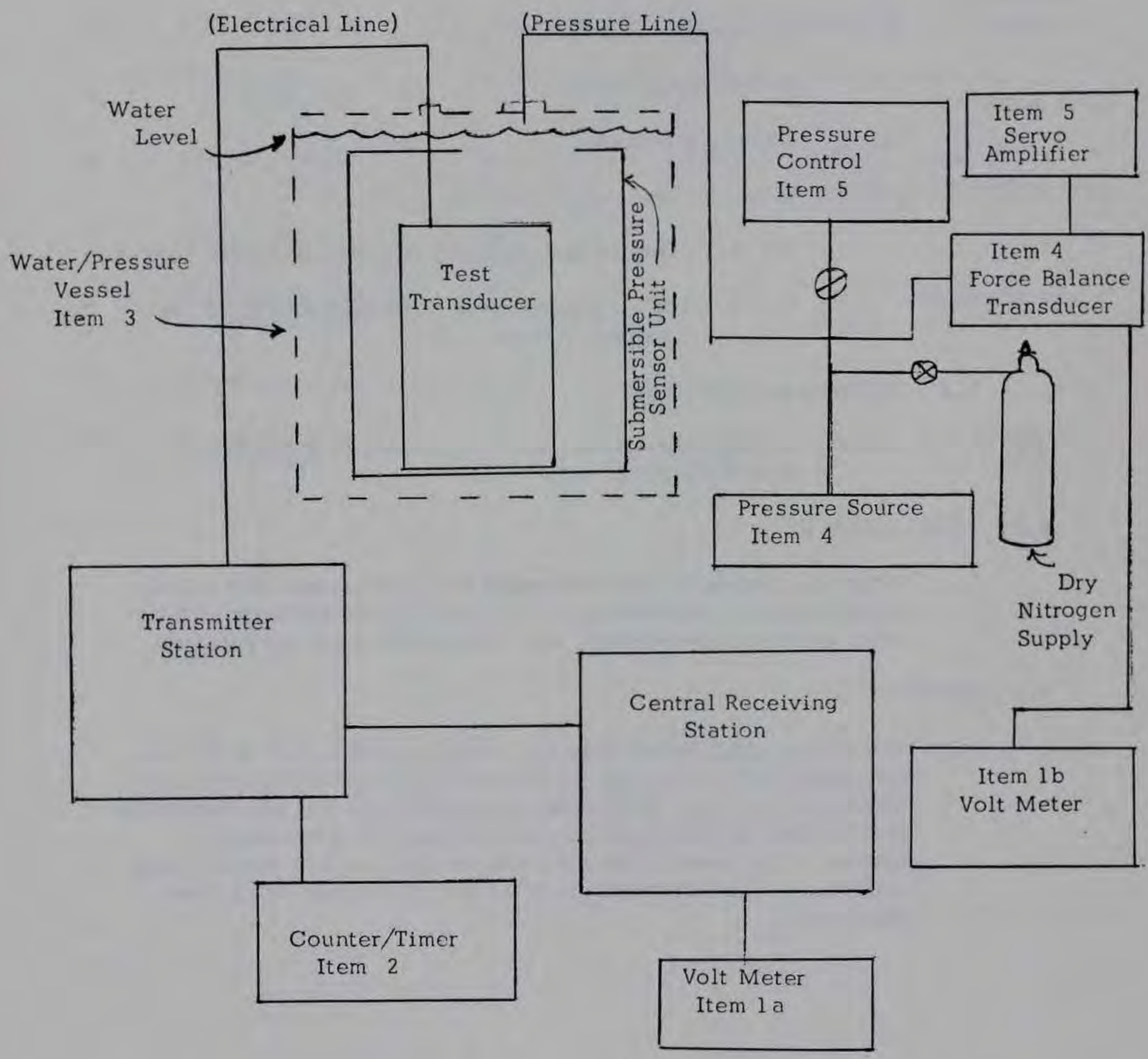
6.1 When the system has been accepted b y the customer and Bell & Howell Quality Assurance, it shall be cleaned of finger marks, dust, masking tape residue, etc., and made ready for shipment.

7.0 SHIPPING

7.1 The system shall be taken to the shipping dock at Bell & Howell, after notification has been given the Army Corps of Engineers, to await their pick up. Each submersible pressure unit and transmitter station shall be placed in protective wrappings and placed in cartons. The central receiving station shall be free standing and padded only, for placement into the Van (to be provided by the customer).

FIGURE 1

BLOCK DIAGRAM OF PRESSURE MONITORING
SYSTEM & TEST EQUIPMENT ITEMS



Incl 2 (Sheet 11 of 12)

QUALITY CONTROL ACCEPTANCE TEST SHEET

FOR THE

10-101-0415 PRESSURE MONITORING SYSTEM

Transducer S/N _____

Channel # _____ Pressure Range _____

% F.S.	Readings Counts	Analog	Freq	Theoretical Counts	Analog	Freq	Deviations Counts	Analog	Freq
(15 psia) 0									
20									
40									
60									
80									
100									
80									
60									
40									
20									
0									
SPAN									

Stamp

% deviation from BSL _____ % F.S. _____ Par. 2.1.4 ATP

Workmanship _____ _____

Conformance to D.O.D. _____ _____

Customer Representative _____

Bell & Howell Q.C. Representative _____

Date _____

Incl 2 (Sheet 12 of 12)

FACTORY CALIBRATIONS OF PRESSURE TRANSDUCERS

Transducer No. 1008; Cannister No. T 4326

Date & Temp.	Count	Applied Pressure, psia											10-psi Count
		15	17	19	21	23	25	23	21	19	17	15	
04-28-71 77°F	Actual	1321			1763		2059		1764			1321	738
	Linear	1321			1764		2059		1764			1321	
	Diff.	0			-1		0		0			0	
04-29-71 77°F	Actual	1321			1764		2059		1764			1321	738
	Linear	1321			1764		2059		1764			1321	
	Diff.	0			0		0		0			0	
05-03-71 80°F	Actual	1321			1763		2057		1763			1321	736
	Linear	1321			1763		2057		1763			1321	
	Diff.	0			0		0		0			0	
05-04-71 78°F	Actual	1320			1763		2058		1763			1320	738
	Linear	1320			1763		2058		1763			1320	
	Diff.	0			0		0		0			0	
05-05-71 76°F	Actual	1320			1763		2058		1763			1320	738
	Linear	1320			1763		2058		1763			1320	
	Diff.	0			0		0		0			0	
05-06-71 78°F	Actual	1320			1763		2058		1763			1320	738
	Linear	1320			1763		2058		1763			1320	
	Diff.	0			0		0		0			0	
05-10-71	Actual	1320			1763		2058		1763			1320	738
	Linear	1320			1763		2058		1763			1320	
	Diff.	0			0		0		0			0	
05-12-71	Actual	1320			1763		2058		1763			1320	738
	Linear	1320			1763		2058		1763			1320	
	Diff.	0			0		0		0			0	
05-17-71	Actual	1321			1763		2058		1763			1321	737
	Linear	1321			1763		2058		1763			1321	
	Diff.	0			0		0		0			0	
05-19-71	Actual	1322			1764		2059		1764			1323	737
	Linear	1322			1764		2059		1764			1322	
	Diff.	0			0		0		0			+1	
05-21-71	Actual	1322			1764		2058		1764			1321	736
	Linear	1322			1764		2058		1764			1322	
	Diff.	0			0		0		0			-1	
07-10-72	Actual	1313	1460	1606	1753	1901	2048						735
	Linear	1313	1460	1607	1754	1901	2048						
	Diff.	0	0	-1	-1	0	0						
		15	22	29	36	43	50	43	36	29	22	15	
04-27-71 77°F	Actual	1320	1836	2353	2870	3389	3905	3388	2870	2353	1836	1320*	739*
	Linear	1320	1837	2354	2871	3388	3905	3388	2871	2354	1837	1320	
	Diff.	0	-1	-1	-1	+1	0	0	-1	-1	-1	0	
07-20-72	Actual	1314	1829	2342	2856	3371	3886						735
	Linear	1314	1828	2342	3857	3371	3886						
	Diff.	0	+1	0	-1	0	0						

* Underlined values are those used in Table 1 of this report.

Incl 3 (Sheet 1 of 13)

FACTORY CALIBRATIONS OF PRESSURE TRANSDUCERS

Transducer No. 1009; Cannister No. T 4323

Date & Temp.	Count	Applied Pressure, psia											10-psi Count
		15	17	19	21	23	25	23	21	19	17	15	
04-26-71 77°F	Actual	2441	2734	3028			3909			3028		2441	1468
	Linear	2441	2735	3028			3909			3028		2441	
	Diff.	0	-1	0			0			0		0	
04-27-71 77°F	Actual	2440	2734	3027	3321	3615	3909	3616	3322	3027	2734	2440	1469
	Linear	2440	2734	3028	3321	3615	3909	3615	3321	3028	2734	2440	
	Diff.	0	0	-1	0	0	0	+1	+1	-1	0	0	
04-28-71 77°F	Actual	2440			3320		3909		3321			2440	1469
	Linear	2440			3321		3909		3321			2440	
	Diff.	0			-1		0		0			0	
04-29-71 77°F	Actual	2440			3321		3909		3321			2440	1469
	Linear	2440			3321		3909		3321			2440	
	Diff.	0			0		0		0			0	
05-03-71 80°F	Actual	2439			3319		3906		3320			2439	1467
	Linear	2439			3319		3906		3319			2439	
	Diff.	0			0		0		+1			0	
05-04-71 78°F	Actual	2438			3319		3907		3319			2438	1469
	Linear	2438			3319		3907		3319			2438	
	Diff.	0			0		0		0			0	
05-10-71	Actual	2440			3321		3909		3321			2440	1469
	Linear	2440			3321		3909		3321			2440	
	Diff.	0			0		0		0			0	
05-12-71	Actual	2438			3320		3907		3320			2439	1469
	Linear	2438			3319		3907		3319			2438	
	Diff.	0			+1		0		+1			+1	
05-17-71	Actual	2438			3319		3907		3319			2438	1469
	Linear	2438			3319		3907		3319			2438	
	Diff.	0			0		0		0			0	
05-19-71	Actual	2438			3321		3908		3321			2439	1470
	Linear	2438			3320		3908		3320			2438	
	Diff.	0			+1		0		+1			+1	
05-21-71	Actual	2436			3318		3906		3318			2437	1470
	Linear	2436			3318		3906		3318			2436	
	Diff.	0			0		0		0			+1	
	Actual												
	Linear												
	Diff.												
	Actual												
	Linear												
	Diff.												

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FACTORY CALIBRATIONS OF PRESSURE TRANSDUCERS

Transducer No. 1010; Cannister No. T 4317

Date & Temp.	Count	Applied Pressure, psia											10-psi Count
		15	17	19	21	23	25	23	21	19	17	15	
04-26-71 77°F	Actual	2436	2732	3027			3915			3027		243	1479
	Linear	2436	2732	3028			3915			3028		2436	
	Diff.	0	0	-1			0			-1		0	
04-27-71 77°F	Actual	2435	2731	3027	3323	3620	3917	3620	3324	3027	2732	2435	1482
	Linear	2435	2731	3028	3324	3621	3917	3621	3324	3028	2731	2435	
	Diff.	0	0	-1	-1	-1	0	-1	-	-1	+1	0	
04-28-71 77°F	Actual	2435			3323		3916		3323			2435	1481
	Linear	2435			3324		3916		3324			2435	
	Diff.	0			-1		0		-1			0	
05-03-71 80°F	Actual	2435			3322		3914		3322			2436	1479
	Linear	2435			3322		3914		3322			2435	
	Diff.	0			0		0		0			+1	
05-04-71 78°F	Actual	2436			3322		3916		3323			2436	1480
	Linear	2436			3324		3916		3324			2436	
	Diff.	0			-1		0		-1			0	
05-05-71 76°F	Actual	2435			3323		3915		3323			2435	1480
	Linear	2435			3323		3915		3323			2435	
	Diff.	0			0		0		0			0	
05-06-71 78°F	Actual	2435			3322		3915		3322			2435	1480
	Linear	2435			3323		3915		3323			2435	
	Diff.	0			-1		0		-1			0	
05-10-71	Actual	2434			3322		3915		3322			2434	1481
	Linear	2434			3323		3915		3323			2434	
	Diff.	0			-1		0		-1			0	
05-12-71	Actual	2432			3321		3914		3321			2433	1482
	Linear	2432			3321		3914		3321			2432	
	Diff.	0			0		0		0			+1	
05-17-71	Actual	2432			3320		3913		3321			2432	1481
	Linear	2432			3321		3913		3321			2432	
	Diff.	0			-1		0		0			0	
05-19-71	Actual	2433			3321		3914		3322			2435	1481
	Linear	2433			3322		3914		3322			2433	
	Diff.	0			-1		0		0			+2	
05-21-71	Actual	2433			3320		3914		3321			2433	1481
	Linear	2433			3322		3914		3322			2433	
	Diff.	0			-2		0		-1			0	
	Actual												
	Linear												
	Diff.												
	Actual												
	Linear												
	Diff.												

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FACTORY CALIBRATIONS OF PRESSURE TRANSDUCERS

Transducer No. 1011; Cannister No. T 4324

Date & Temp.	Count	Applied Pressure, psia											10-psi Count
		15	17	19	21	23	25	23	21	19	17	15	
04-26-71 77°F	Actual	2437	2731	3025			3907			3025		2437	1470
	Linear	2437	2731	3025			3907			3025		2437	
	Diff.	0	0	0			0			0		0	
04-27-71 77°F	Actual	2436	2731	3025	3319	3614	3908	3614	3319	3025	2731	2437	1472
	Linear	2436	2730	3025	3319	3614	3908	3614	3319	3025	2730	2436	
	Diff.	0	+1	0	0	0	0	0	0	0	+1	+1	
04-28-71 77°F	Actual	2436			3318		3907		3319			2436	1471
	Linear	2436			3319		3907		3319			2436	
	Diff.	0			-1		0		0			0	
04-29-71 77°F	Actual	2435			3319		3907		3319			2436	1472
	Linear	2435			3318		3907		3318			2435	
	Diff.	0			+1		0		+1			+1	
05-03-71 80°F	Actual	2434			3316		3905		3317			2434	1471
	Linear	2434			3317		3905		3317			2434	
	Diff.	0			-1		0		0			0	
05-04-71 78°F	Actual	2434			3317		3906		3317			2434	1472
	Linear	2434			3317		3906		3317			2434	
	Diff.	0			0		0		0			0	
05-05-71 76°F	Actual	2434			3317		3905		3317			2434	1471
	Linear	2434			3317		3905		3317			2434	
	Diff.	0			0		0		0			0	
05-06-71 78°F	Actual	2434			3316		3904		3316			2434	1470
	Linear	2434			3316		3904		3316			2434	
	Diff.	0			0		0		0			0	
05-12-71	Actual	2433			3316		3904		3316			2433	1471
	Linear	2433			3316		3904		3316			2433	
	Diff.	0			0		0		0			0	
05-17-71	Actual	2433			3315		3904		3315			2432	1471
	Linear	2433			3316		3904		3316			2433	
	Diff.	0			-1		0		-1			-1	
05-19-71	Actual	2432			3316		3903		3316			2432	1471
	Linear	2432			3315		3903		3315			2432	
	Diff.	0			+1		0		+1			0	
05-21-71	Actual	2431			3315		3903		3315			2431	1472
	Linear	2431			3314		3903		3314			2431	
	Diff.	0			+1		0		+1			0	
07-10-72	Actual	2440	2735	3035	3331	3628	3924						1484
	Linear	2440	2734	3034	3330	3627	3924						
	Diff.	0	+1	+1	+1	+1	0						
	Actual												
	Linear												
	Diff.												

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FACTORY CALIBRATIONS OF PRESSURE TRANSDUCERS

Transducer No. 1012; Cannister No. T 4318

Date & Temp.	Count	Applied Pressure, psia											10-psi Count
		15	17	19	21	23	25	23	21	19	17	15	
04-26-71	Actual	2433	2733	3032			3932			3032		2433	1499
77°F	Linear	2433	2733	3033			3932			3033		2433	
	Diff.	0	0	-1			0			-1		0	
04-27-71	Actual	2438	2738	3038	3338	3638	3939	3639	3338	3038	2738	2438	1501
77°F	Linear	2438	2738	3038	3339	3639	3939	3639	3339	3038	2738	2438	
	Diff.	0	0	0	-1	-1	0	0	-1	0	0	0	
04-28-71	Actual	2438			3337		3938		3338			2438	1500
77°F	Linear	2438			3338		3938		3338			2438	
	Diff.	0			0		0		0			0	
04-29-71	Actual	2438			3338		3938		3338			2438	1500
77°F	Linear	2438			3338		3938		3338			2438	
	Diff.	0			0		0		0			0	
05-03-71	Actual	2437			3335		3936		3336			2437	1499
80°F	Linear	2437			3336		3936		3336			2437	
	Diff.	0			-1		0		0			0	
05-04-71	Actual	2435			3335		3935		3335			2435	1500
78°F	Linear	2435			3335		3935		3335			2435	
	Diff.	0			0		0		0			0	
05-05-71	Actual	2435			3334		3934		3334			2435	1499
76°F	Linear	2435			3334		3934		3334			2435	
	Diff.	0			0		0		0			0	
05-06-71	Actual	2435			3334		3934		3334			2435	1499
78°F	Linear	2435			3334		3934		3334			2435	
	Diff.	0			0		0		0			0	
05-10-71	Actual	2432			3332		3932		3332			2432	1500
	Linear	2432			3332		3932		3332			2432	
	Diff.	0			0		0		0			0	
05-12-71	Actual	2240			3340		3940		3340			2440	1500
	Linear	2240			3340		3940		3340			2440	
	Diff.	0			0		0		0			0	
05-17-71	Actual	2438			3338		3938		3338			2438	1500
	Linear	2438			3338		3938		3338			2438	
	Diff.	0			0		0		0			0	
05-21-71	Actual	2434			3334		3935		3334			2434	1501
	Linear	2434			3335		3935		3335			2434	
	Diff.	0			-1		0		-1			0	
07-10-72	Actual	2432	2728	3023	3319	3616	3913						1481
	Linear	2432	2728	3024	3321	3617	3913						
	Diff.	0	0	-1	-2	-1	0						
	Actual												
	Linear												
	Diff.												

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FACTORY CALIBRATIONS OF PRESSURE TRANSDUCERS

Transducer No. 1013; Cannister No. T 4319

Date & Temp.	Count	Applied Pressure, psia											10-psi Count
		15	17	19	21	23	25	23	21	19	17	15	
04-26-71 77°F	Actual	2424	2718	3013			3899			3013		2424	1475
	Linear	2424	2719	3014			3899			3014		2424	
	Diff.	0	-1	-1			0			-1		0	
04-27-71 77°F	Actual	2440	2734	3028	3323	3618	3914	3618	3324	3029	2734	2440	1474
	Linear	2440	2735	3030	3324	3619	3914	3619	3324	3030	2735	2440	
	Diff.	0	-1	-2	-1	-1	0	-1	0	-1	-1	0	
04-28-71 77°F	Actual	2439			3324		3915		3324			2439	1476
	Linear	2439			3325		3915		3325			2439	
	Diff.	0			-1		0		-1			0	
04-29-71 77°F	Actual	2439			3323		3914		3324			2439	1475
	Linear	2439			3324		3914		3324			2439	
	Diff.	0			-1		0		0			0	
05-03-71 80°F	Actual	2437			3319		3910		3320			2437	1473
	Linear	2437			3321		3910		3321			2437	
	Diff.	0			-1		0		-1			0	
05-04-71 78°F	Actual	2437			3322		3913		3322			2437	1476
	Linear	2437			3323		3913		3323			2437	
	Diff.	0			-1		0		-1			0	
05-05-71 76°F	Actual	2436			3321		3912		3321			2436	1476
	Linear	2436			3322		3912		3320			2436	
	Diff.	0			-1		0		-1			0	
05-06-71 78°F	Actual	2436			3319		3910		3320			2436	1474
	Linear	2436			3320		3910		3320			2436	
	Diff.	0			-1		0		0			0	
05-10-71	Actual	2436			3321		3912		3320			2436	1476
	Linear	2436			3322		3912		3322			2436	
	Diff.	0			-1		0		-1			0	
05-12-71	Actual	2436			3320		3911		3320			2436	1475
	Linear	2436			3321		3911		3321			2436	
	Diff.	0			-1		0		-1			0	
05-17-71	Actual	2441			3324		3915		3325			2441	1474
	Linear	2441			3325		3915		3325			2441	
	Diff.	0			-1		0		0			0	
07-10-72	Actual	2397	2692	2986	3280	3569	3869						1472
	Linear	2397	2691	2986	3280	3575	3869						
	Diff.	0	+1	0	0	-6	0						

07-29-71	Applied Pressure (in. Hg @ 0 C)	31.5	28.5	
	Applied Pressure (psia)	15.4718	13.9983	
	Count	2450	2234	1466
02-25-72	Applied Pressure (in. Hg @ 0 C)	30.5	29.5	
	Applied Pressure (psia)	14.9807	14.4895	
	Count	2399	2329	1425

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FACTORY CALIBRATIONS OF PRESSURE TRANSDUCERS

Transducer No. 1014; Cannister No. T 4316

Date & Temp.	Count	Applied Pressure, psia											10-psi Count
		15	17	19	21	23	25	23	21	19	17	15	
04-26-71 77°F	Actual	2440	2737	3034			3930			3034		2440	1490
	Linear	2440	2738	3036			3930			3036		2440	
	Diff.	0	-1	-2			0			-2		0	
04-27-71 77°F	Actual	2439	2737	3035	3333	3631	3932	3632	3333	3035	2737	2439	1493
	Linear	2439	2738	3036	3335	3633	3932	3633	3335	3036	2738	2439	
	Diff.	0	-1	-1	-2	-2	0	-1	-2	-1	-1	0	
04-28-71 77°F	Actual	2439		3332		3931		3332				2439	1492
	Linear	2439		3335		3931		3334				2439	
	Diff.	0		-2		0		-2				0	
04-29-71 77°F	Actual	2438		3332		3931		3332				2438	1493
	Linear	2438		3334		3931		3334				2438	
	Diff.	0		-2		0		-2				0	
05-03-71 80°F	Actual	2437		3329		3927		3330				2438	1490
	Linear	2437		3331		3927		3331				2437	
	Diff.	0		-2		0		-1				-1	
05-04-71 78°F	Actual	2437		3327		3927		3328				2437	1490
	Linear	2437		3331		3927		3331				2437	
	Diff.	0		-4		0		-3				0	
05-05-71 76°F	Actual	2435		3328		3927		3328				2435	1492
	Linear	2435		3330		3927		3330				2435	
	Diff.	0		-2		0		-2				0	
05-06-71 78°F	Actual	2438		3329		3926		3329				2438	1488
	Linear	2438		3331		3926		3331				2438	
	Diff.	0		-2		0		-2				0	
05-10-71	Actual	2441		3330		3928		3331				2441	1487
	Linear	2441		3332		3928		3332				2441	
	Diff.	0		-2		0		-1				0	
05-12-71	Actual	2438		3331		3930		3331				2438	1492
	Linear	2438		3333		3930		3333				2438	
	Diff.	0		-2		0		-2				0	
05-17-71	Actual	2436		3329		3928		3330				2436	1492
	Linear	2436		3331		3928		3331				2436	
	Diff.	0		-2		0		-1				0	
05-19-71	Actual	2436		3328		3928		3329				2434	1492
	Linear	2436		3330		3928		3330				2436	
	Diff.	0		-2		0		-1				-2	
05-21-71	Actual	2435		3329		3928		3329				2435	1493
	Linear	2435		3331		3928		3331				2435	
	Diff.	0		-2		0		-2				0	
07-10-72	Actual	2437	2733	3031	3327	3625	3924						1487
	Linear	2437	2734	3032	3329	3627	3924						
	Diff.	0	-1	-1	-2	-2	0						

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FACTORY CALIBRATIONS OF PRESSURE TRANSDUCERS

Transducer No. 1015; Cannister No. T 4320

Date & Temp.	Count	Applied Pressure, psia											10-psi Count
		15	17	19	21	23	25	23	21	19	17	15	
04-27-71 77°F	Actual	2438	2735	3034	3332	3631	3931	3631	3333	3034	2736	2438	1493
	Linear	2438	2737	3035	3334	3632	3931	3632	3334	3035	2737	2438	
	Diff.	0	-2	-1	-2	-1	0	-1	-1	-1	-1	0	
04-29-71 77°F	Actual	2439			3331		3929		3331			2439	1490
	Linear	2439			3333		3929		3333			2439	
	Diff.	0			-2		0		-2			0	
05-03-71 80°F	Actual	2439			3331		3929		3332			2440	1490
	Linear	2439			3333		3929		3333			2439	
	Diff.	0			-2		0		-1			+1	
05-04-71 80°F	Actual	2436			3330		3928		3330			2436	1492
	Linear	2436			3331		3928		3331			2436	
	Diff.	0			-1		0		-1			0	
05-05-71 76°F	Actual	2436			3329		3928		3330			2436	1492
	Linear	2436			3331		3928		3331			2436	
	Diff.	0			-2		0		-1			0	
05-06-71 78°F	Actual	2436			3329		3928		3330			2436	1492
	Linear	2436			3331		3928		3331			2436	
	Diff.	0			-2		0		-1			0	
05-10-71	Actual	2434			3328		3927		3328			2434	1493
	Linear	2434			3330		3927		3330			2434	
	Diff.	0			-2		0		-2			0	
05-12-71	Actual	2434			3327		3926		3328			2434	1492
	Linear	2434			3329		3926		3329			2434	
	Diff.	0			-2		0		-1			0	
05-17-71	Actual	2432			3325		3924		3326			2432	1492
	Linear	2432			3327		3924		3327			2432	
	Diff.	0			-2		0		-1			0	
05-19-71	Actual	2431			3325		3924		3326			2432	1493
	Linear	2431			3327		3924		3327			2431	
	Diff.	0			-2		0		-1			+1	
05-21-71	Actual	2430			3324		3923		3325			2430	1493
	Linear	2430			3326		3923		3326			2430	
	Diff.	0			-2		0		-1			0	
07-10-72	Actual	2444	2739	3036	3334	3630	3928						1498
	Linear	2444	2741	3038	3335	3631	3928						
	Diff.	0	-2	-2	-1	-1	0						
	Actual												
	Linear												
	Diff.												
	Actual												
	Linear												
	Diff.												

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FACTORY CALIBRATIONS OF PRESSURE TRANSDUCERS

Transducer No. 1016; Cannister No. T 4315

Date & Temp.	Count	Applied Pressure, psia											10-psi Count
		15	17	19	21	23	25	23	21	19	17	15	
04-26-71 77°F	Actual	2437	2733	3029			3919			3029		2437	1482
	Linear	2437	2733	3030			3919			3030		2437	
	Diff.	0	0	-1			0			-1		0	
04-27-71 77°F	Actual	2437	2734	3030	3327	3624	3921	3624	3327	3030	2734	2437	1484
	Linear	2437	2734	3031	3327	3624	3921	3624	3327	3031	2734	2437	
	Diff.	0	0	-1	0	0	0	0	0	-1	0	0	
04-28-71 77°F	Actual	2437		3326		3920		3327				2437	1483
	Linear	2437		3327		3920		3327				2437	
	Diff.	0		-1		0		0				0	
04-29-71 77°F	Actual	2437		3327		3921		3327				2437	1484
	Linear	2437		3327		3921		3327				2437	
	Diff.	0		0		0		0				0	
05-05-71 78°F	Actual	2440		3330		3924		3330				2440	1484
	Linear	2440		3330		3924		3330				2440	
	Diff.	0		0		0		0				0	
05-06-71	Actual	2439		3329		3923		3329				2440	1484
	Linear	2439		3329		3923		3329				2439	
	Diff.	0		0		0		0				+1	
05-10-71	Actual	2438		3327		3921		3328				2438	1483
	Linear	2438		3328		3921		3328				2438	
	Diff.	0		-1		0		0				0	
05-12-71	Actual	2437		3326		3920		3327				2437	1483
	Linear	2437		3327		3920		3327				2437	
	Diff.	0		-1		0		0				0	
05-17-71	Actual	2436		3325		3919		3325				2436	1483
	Linear	2436		3326		3919		3326				2436	
	Diff.	0		-1		0		-1				0	
05-19-71	Actual	2434		3324		3921		3326				2436	1487
	Linear	2434		3326		3921		3326				2434	
	Diff.	0		-2		0		0				+2	
05-21-71	Actual	2434		3324		3918		3324				2434	1484
	Linear	2434		3324		3918		3324				2434	
	Diff.	0		0		0		0				0	
07-10-72	Actual	2432	2727	3021	3316	3612	3908						1476
	Linear	2432	2727	3022	3318	3613	3908						
	Diff.	0	0	-1	-2	-1	0						
	Actual												
	Linear												
	Diff.												
	Actual												
	Linear												
	Diff.												

FACTORY CALIBRATIONS OF PRESSURE TRANSDUCERS

Transducer No. 1017; Cannister No. T 4314

Date & Temp.	Count	Applied Pressure, psia 15	17	19	21	23	25	23	21	19	17	15	10-psi Count
04-26-71 77°F	Actual	2439	2734	3028			3911			3029		2440	1472
	Linear	2439	2733	3028			3911			3028		2439	
	Diff.	0	+1	0			0			+1		+1	
04-27-71 77°F	Actual	2439	2733	3028	3322	3617	3912	3618	3323	3028	2735	2439	1473
	Linear	2439	2733	3028	3323	3617	3912	3617	3323	3028	2734	2439	
	Diff.	0	-1	0	-1	0	0	+1	0	0	+1	0	
04-28-71 77°F	Actual	2440			3322		3910		3323			2440	1470
	Linear	2440			3322		3910		3322			2440	
	Diff.	0			0		0		+1			0	
04-29-71 77°F	Actual	2439			3323		3911		3324			2440	1472
	Linear	2439			3322		3911		3322			2439	
	Diff.	0			+1		0		+2			+1	
05-03-71 80°F	Actual	2441			3323		3911		3324			2441	1470
	Linear	2441			3323		3911		3323			2441	
	Diff.	0			0		0		+1			0	
05-04-71 78°F	Actual	2439			3322		3910		3323			2440	1471
	Linear	2439			3322		3910		3322			2439	
	Diff.	0			0		0		+1			+1	
05-05-71 76°F	Actual	2437			3321		3911		3322			2438	1474
	Linear	2437			3320		3911		3320			2437	
	Diff.	0			+1		0		+2			+1	
05-06-71 78°F	Actual	2438			3321		3910		3323			2439	1472
	Linear	2438			3321		3910		3321			2438	
	Diff.	0			0		0		+2			+1	
05-10-71	Actual	2436			3319		3908		3321			2437	1472
	Linear	2436			3319		3908		3319			2436	
	Diff.	0			0		0		+2			+1	
05-12-71	Actual	2436			3318		3906		3319			2436	1470
	Linear	2436			3318		3906		3318			2436	
	Diff.	0			0		0		+1			0	
07-10-72	Actual	2434	2730	3030	3321	3622	3917						1483
	Linear	2434	2731	3027	3324	3620	3917						
	Diff.	0	-1	+3	-3	+2	0						
	Actual												
	Linear												
	Diff.												
	Actual												
	Linear												
	Diff.												

Incl 3 (Sheet 10 of 13)

FACTORY CALIBRATIONS OF PRESSURE TRANSDUCERS

Transducer No. 1018; Cannister No. T 4321

Date & Temp.	Count	Applied Pressure, psia											10-psi Count
		15	17	19	21	23	25	23	21	19	17	15	
04-26-71 77°F	Actual	2432	2728	3023			3911			3023		2432	1479
	Linear	2432	2728	3024			3911			3024		2432	
	Diff.	0	0	-1			0			-1		0	
04-27-71 77°F	Actual	2442	2737	3033	3329	3626	3923	3626	3330	3033	2737	2441	1481
	Linear	2442	2738	3034	3331	3627	3923	3627	3331	3034	2738	2442	
	Diff.	0	-1	-1	-2	-1	0	-1	-1	-1	-1	-1	
04-28-71 77°F	Actual	2441		3330			3923		3330			2442	1482
	Linear	2441		3330			3923		3330			2441	
	Diff.											+1	
04-29-71 77°F	Actual	2441		3329			3923		3330			2441	1482
	Linear	2441		3330			3923		3330			2441	
	Diff.	0		-1			0		0			0	
05-03-71 80°F	Actual	2438		3325			3919		3326			2438	1481
	Linear	2438		3327			3319		3327			2438	
	Diff.	0		-2			0		-1			0	
05-04-71 78°F	Actual	2440		3328			3923		3328			2440	1483
	Linear	2440		3332			3923		3332			2440	
	Diff.	0		-4			0		-4			0	
05-05-71 76°F	Actual	2440		3327			3920		3327			2440	1480
	Linear	2440		3328			3920		3328			2440	
	Diff.	0		-1			0		-1			0	
05-06-71 78°F	Actual	2438		3325			3918		3326			2438	1480
	Linear	2438		3326			3918		3326			2438	
	Diff.	0		-1			0		0			0	
05-10-71	Actual	2438		3326			3920		3326			2438	1482
	Linear	2438		3327			3920		3327			2438	
	Diff.	0		-1			0		-1			0	
05-17-71	Actual	2437		3326			3920		3326			2437	1483
	Linear	2437		3327			3920		3327			2437	
	Diff.	0		-1			0		-1			0	
05-19-71	Actual	2437		3326			3920		3326			2437	1483
	Linear	2437		3327			3920		3327			2437	
	Diff.	0		-1			0		-1			0	
05-21-71	Actual	2437		3326			3920		3327			2437	1483
	Linear	2437		3327			3920		3327			2437	
	Diff.	0		-1			0		0			0	
07-10-72	Actual	2450	2745	3043	3339	3638	3937						1487
	Linear	2450	2747	3045	3342	3640	3937						
	Diff.	0	-2	-2	-3	-2	0						
	Actual												
	Linear												
	Diff.												

Incl 3 (Sheet 11 of 13)

FACTORY CALIBRATIONS OF PRESSURE TRANSDUCERS

Transducer No. 1019; Cannister No. T 4325

Date & Temp.	Count	Applied Pressure, psia											10-psi Count
		15	17	19	21	23	25	23	21	19	17	15	
04-26-71 77°F	Actual	2437	2733	3030			3922			3030		2437	1485
	Linear	2437	2734	3031			3922			3031		2437	
	Diff.	0	-1	-1			0			-1		0	
04-27-71 77°F	Actual	2437	2733	3030	3328	3625	3922	3625	3329	3030	2733	2437	1485
	Linear	2437	2734	3031	3328	3625	3922	3625	3328	3031	2734	2437	
	Diff.	0	-1	-1	0	0	0	0	+1	-1	-1	0	
04-28-71 77°F	Actual	2437			3327		3922		3328			2437	1485
	Linear	2437			3328		3922		3328			2437	
	Diff.	0			-1		0		0			0	
04-29-71 77°F	Actual	2436			3328		3922		3328			2436	1486
	Linear	2436			3328		3922		3328			2436	
	Diff.	0			0		0		0			0	
05-03-71 80°F	Actual	2435			3326		3919		3326			2435	1484
	Linear	2435			3325		3919		3325			2435	
	Diff.	0			+1		0		+1			0	
05-04-71 78°F	Actual	2435			3326		3919		3326			2435	1484
	Linear	2435			3325		3919		3325			2435	
	Diff.	0			+1		0		+1			0	
05-05-71 76°F	Actual	2435			3326		3920		3326			2435	1485
	Linear	2435			3326		3920		3326			2435	
	Diff.	0			0		0		0			0	
05-06-71 78°F	Actual	2435			3325		3919		3326			2435	1484
	Linear	2435			3325		3919		3325			2435	
	Diff.	0			0		0		+1			0	
05-10-71	Actual	2434			3324		3919		3325			2434	1485
	Linear	2434			3325		3919		3325			2434	
	Diff.	0			-1		0		0			0	
05-12-71	Actual	2433			3324		3918		3324			2433	1485
	Linear	2433			3324		3918		3324			2433	
	Diff.	0			0		0		0			0	
05-17-71	Actual	2440			3331		3924		3331			2440	1484
	Linear	2440			3330		3924		3330			2440	
	Diff.	0			+1		0		+1			0	
05-19-71	Actual	2440			3333		3925		3333			2443	1485
	Linear	2440			3331		3925		3331			2440	
	Diff.	0			+2		0		+2			+3	
05-21-71	Actual	2441			3331		3922		3331			2442	1481
	Linear	2441			3330		3922		3330			2441	
	Diff.	0			+1		0		+1			+1	
07-10-72	Actual	2448	2743	3037	3334	3630	3926						1478
	Linear	2448	2744	3039	3335	3630	3926						
	Diff.	0	-1	-2	-1	0	0						

Incl 3 (Sheet 12 of 13)

FACTORY CALIBRATIONS OF PRESSURE TRANSDUCERS

Transducer No. 1020; Cannister No. T 4322

Date & Temp.	Count	Applied Pressure, psia											10-psi Count
		15	17	19	21	23	25	23	21	19	17	15	
04-26-71 77°F	Actual	2437	2732	3028			3919			3029		2438	1482
	Linear	2437	2733	3030			3919			3030		2437	
	Diff.	0	-1	-2			0			-1		+1	
04-27-71 77°F	Actual	2436	2730	3027	3324	3621	3919	3621	3324	3027	2731	2435	1483
	Linear	2436	2733	3029	3326	3622	3919	3622	3326	3029	2733	2436	
	Diff.	0	-3	-2	-2	-1	0	-1	-2	-2	-2	-1	
04-28-71 77°F	Actual	2434			3322		3918		3323			2434	1484
	Linear	2434			3324		3918		3324			2434	
	Diff.	0			-2		0		-1			0	
04-29-71 77°F	Actual	2435			3322		3918		3323			2435	1483
	Linear	2435			3325		3918		3325			2435	
	Diff.	0			-3		0		-2			0	
05-03-71 80°F	Actual	2438			3323		3918		3325			2438	1480
	Linear	2438			3326		3918		3326			2438	
	Diff.	0			-3		0		-1			0	
05-04-71 78°F	Actual	2436			3323		3917		3324			2437	1481
	Linear	2436			3325		3917		3325			2436	
	Diff.	0			-2		0		-1			+1	
05-05-71 76°F	Actual	2436			3321		3916		3323			2437	1480
	Linear	2436			3324		3916		3324			2436	
	Diff.	0			-3		0		-1			+1	
05-06-71 78°F	Actual	2437			3321		3915		3324			2437	1478
	Linear	2437			3324		3915		3324			2437	
	Diff.	0			-3		0		0			0	
05-10-71	Actual	2433			3321		3916		3321			2433	1483
	Linear	2433			3323		3916		3323			2433	
	Diff.	0			-2		0		-2			0	
05-12-71	Actual	2432			3320		3915		3320			2432	1483
	Linear	2432			3322		3915		3322			2432	
	Diff.	0			-2		0		-2			0	
05-17-71	Actual	2430			3318		3913		3319			2431	1483
	Linear	2430			3320		3913		3320			2430	
	Diff.	0			-2		0		-1			+1	
05-19-71	Actual	2428			3319		3914		3319			2431	1486
	Linear	2428			3322		3914		3319			2428	
	Diff.	0			-3		0		-3			+3	
05-21-71	Actual	2434			3323		3919		3324			2435	1485
	Linear	2434			3325		3919		3325			2434	
	Diff.	0			-2		0		-1			+1	
	Actual												
	Linear												
	Diff.												

Incl 3 (Sheet 13 of 13)

Table B1

Summary of Factory Calibrations of Pressure Transducers*

Transducer No.	Initial Calibration, 4-27-71: Count at 15 psia	Count per 10 psi	(A) Feet of Seawater per Count**	(B) Feet of Seawater at Zero Count	Final Calibration, 7-10-72: Count at 15 psia	Count per 10 psi	Error in Using Initial Calibration at Time of Final Calibration, ft Seawater: 15 psia	25 psia	Comparable 0.25 Percent Full Scale (FS) Error, ft Seawater
1008	1320	739	0.03045	-6.439	1313	735	-0.213†	-0.335††	0.28
1009	2440	1469	0.01532	-3.622	No response (possibly damaged in removal)				--
1010	2435	1482	0.01518	-3.219	No response (possibly damaged in removal)				--
1011	2436	1472	0.01529	-3.485	2440	1484	+0.061‡	+0.245‡‡	0.14
1012	2438	1501	0.01499	-2.796	2432	1481	-0.090	-0.390	0.14
1013	2440	1474	0.01526	-3.496	No calibration		--	--	--
1013	2381§	1466§	0.01535	-2.793	No calibration		--	--	--
1013	2402§§	1425§§	0.01579	-4.168	2397	1472	-0.079	+0.663	0.14
1014	2439	1493	0.01507	-3.007	2437	1487	-0.030	-0.121	0.14
1015	2438	1493	0.01507	-2.991	2444	1498	+0.090	-0.166	0.14
1016	2437	1484	0.01516	-3.199	2432	1476	-0.076	-0.197	0.14
1017	2439	1473	0.01527	-3.506	2434	1483	-0.076	+0.076	0.14
1018	2442	1481	0.01519	-3.350	2450	1487	+0.122	+0.213	0.14
1019	2437	1485	0.01515	-3.174	2448	1478	+0.167	+0.061	0.14
1020	2436	1483	0.01517	-3.209	No response (possibly damaged in removal)				--

* See Appendix B for basic data.

** At 15°C: 1 psi = 2.0415 in. Hg = 2.25 ft seawater.

† -0.457 ft at 35 psia for deepwater use.

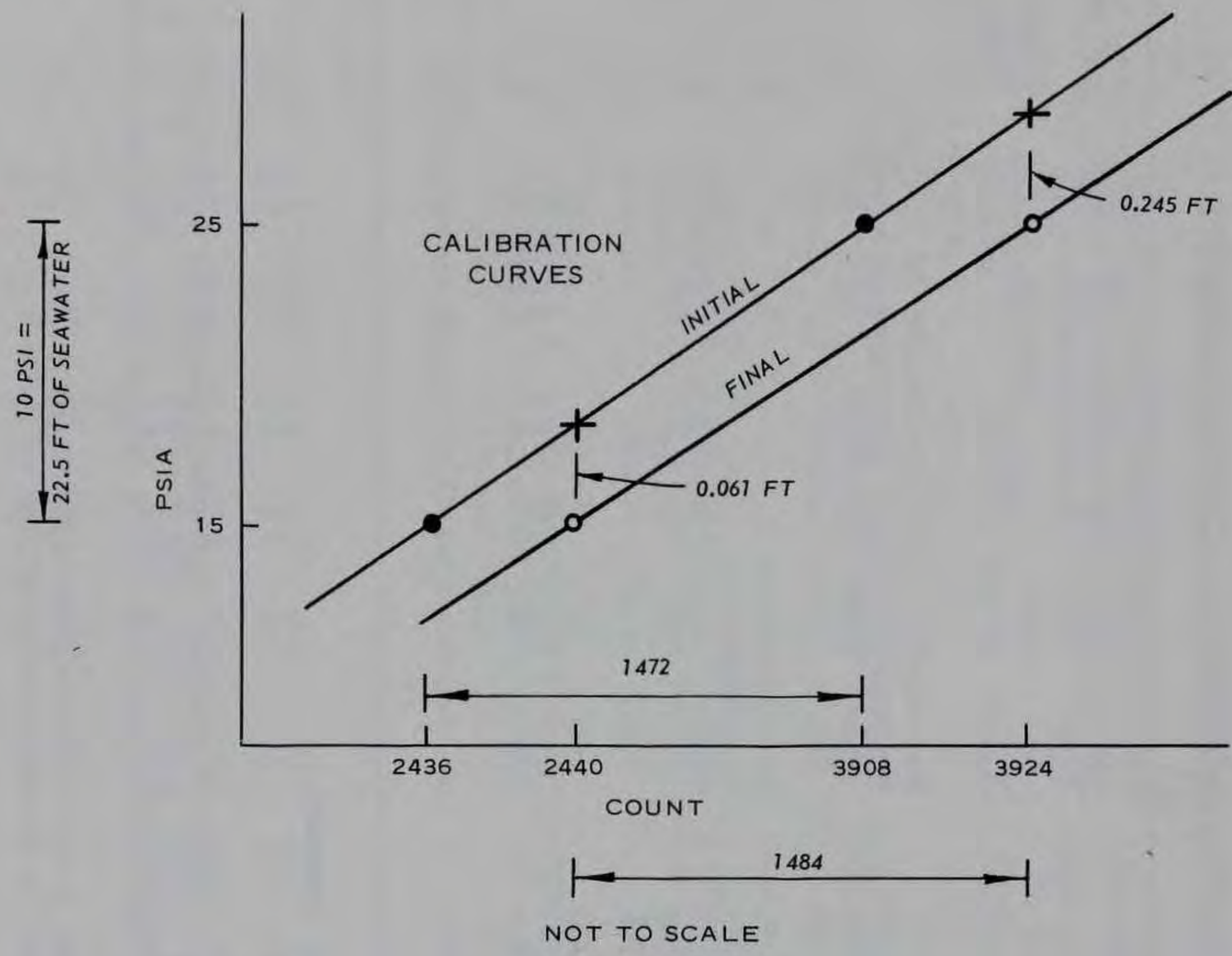
†† -0.578 ft at 45 psia for deepwater use.

‡ Example calculation: $\frac{(2440 - 2436)}{147.2} 2.25 = +0.061$ ft (higher than with final calibration). See Figure B1.

‡‡ Example calculation: $\frac{(2440 + 1484) - (2436 + 1472)}{147.2} 2.25 = +0.243$ ft (higher than with final calibration). See Figure B1.

§ Extrapolated linearly from actual readings in factory recalibrations on 7-29-71.

§§ Extrapolated linearly from actual readings in factory recalibrations on 2-25-72.



AT 15 PSIA:

$$\left(\frac{2440 - 2436}{1472/10}\right) 2.25 = +0.061 \text{ FT (HIGHER THAN WITH FINAL CALIBRATION)}$$

AT 25 PSIA:

$$\left(\frac{3924 - 3908}{1472/10}\right) 2.25 = +0.245 \text{ FT (HIGHER THAN WITH FINAL CALIBRATION)}$$

Figure B1. Example calculation of errors in using initial calibration at time of final calibration (transducer No. 1011)

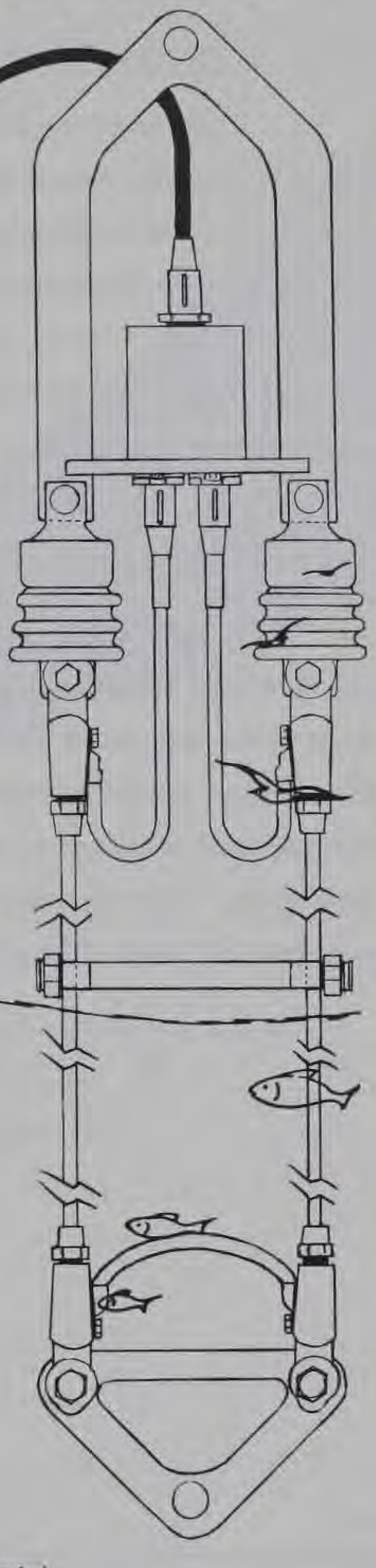
APPENDIX C: BAYLOR GAGE DETAILS

Inclosure 1: Manufacturer's Data Sheet WS702
Inclosure 2: WES Field Calibrations (Table C1)

BAYLOR

DATA SHEET WS702

WAVE PROFILE RECORDER SYSTEM



The Baylor Wave Profile Recorder System is a new development of Baylor research in the field of ruggedized oceanographic instrumentation. Built to satisfy the requirements of the offshore petroleum industry, the system is applicable to any severe ocean environment. The basic system consists of an extremely rugged wave staff, transducer element, and high-accuracy servo profile recorder.

The wave staff consists of two wire ropes held parallel by tension and spaced about 9" apart. Standard ½" stainless steel wire rope is original equipment, but field repairs using common plow steel wire ropes and conventional wire rope techniques may be made without significant loss in accuracy. The rugged simplicity and easy repair of the Baylor Wave Staff make this instrument suitable for the most severe and/or remote operations.

The transducer element, which electrically senses the length of wire rope above the water, has a sealed stainless steel housing to contain all solid-state components and is thermally insulated and temperature compensated for environmental stability. The sealed transducer will operate in any weather condition — even submerged. The transducer output is a direct current signal, compatible with direct meter readout, chart or other recording means. A switch, remotely controlled from the profile recorder, simulates maximum wave height at the transducer input terminals to allow a rapid, positive verification of calibration.

The wave profile recorder is an advanced design solid-state null balance recorder which faithfully records the wave profile versus time. The recorder cabinet contains an auxiliary meter, power supply, and calibration adjustments to make an attractive single cabinet unit.

Optional readout devices, wave-triggered high chart speeds, and custom design features are available upon request.

Designers, Manufacturers, and Service Contractors of Mechanical, Electrical and Hydraulic Components and Systems

SECTION 2

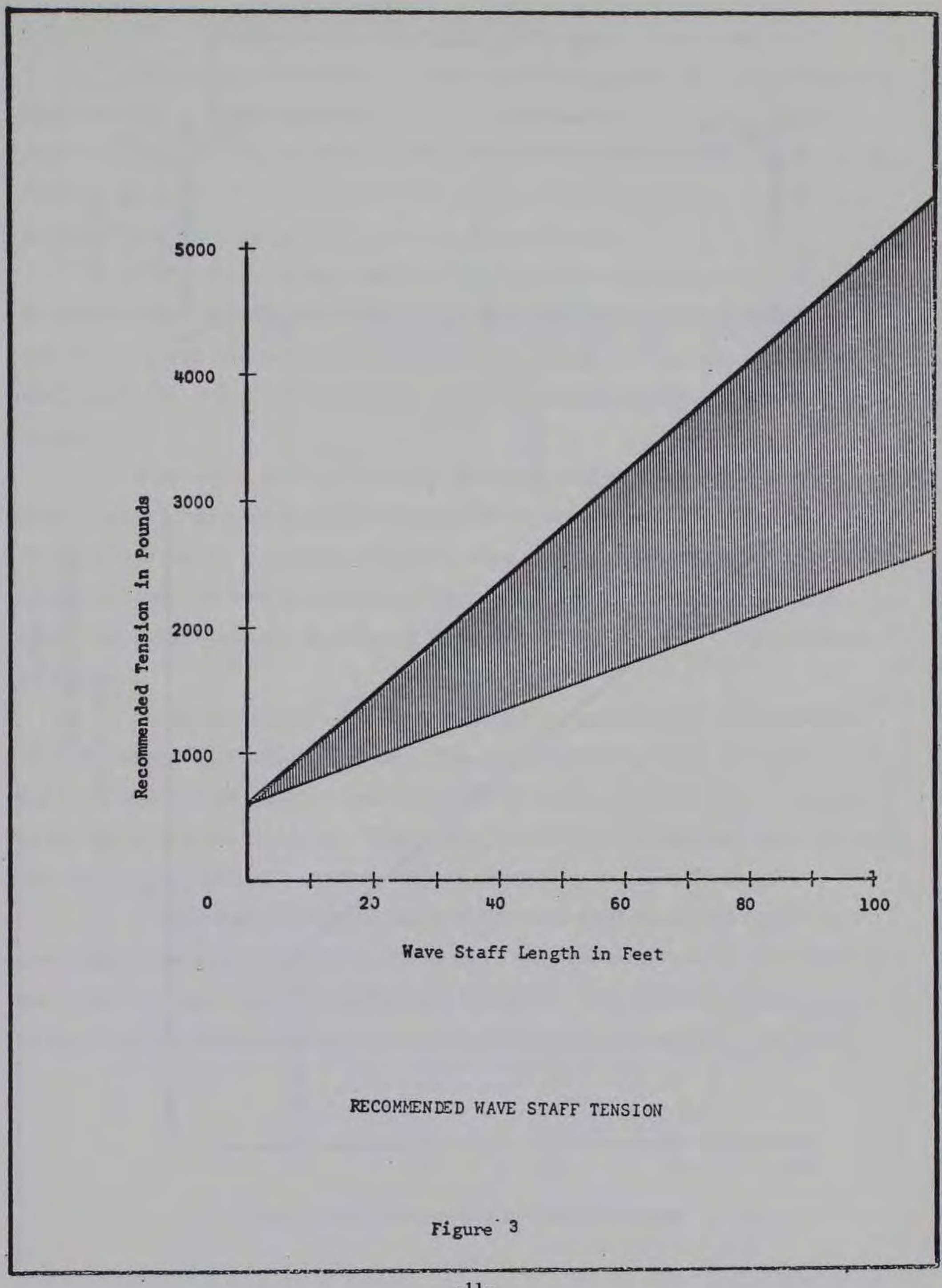
INSTALLATION

2.1 General Information

The wave staff is a pair of wire ropes held under tension to pierce the ocean surface at right angles with 1/3 to 1/2 of its length submerged below mean water level. The wave staff must be tensioned to withstand the forces of wind and wave . Recommended values of tension are from 1,000 lbs. for a 10 foot staff to 5,000 lbs. for a 100 foot staff as shown in Figure 3. Tensile strength of the wave staff is 20,000 lbs. as limited by the 10,000 lb. working strength of each of the two insulators.

2.2 Structural Clearance

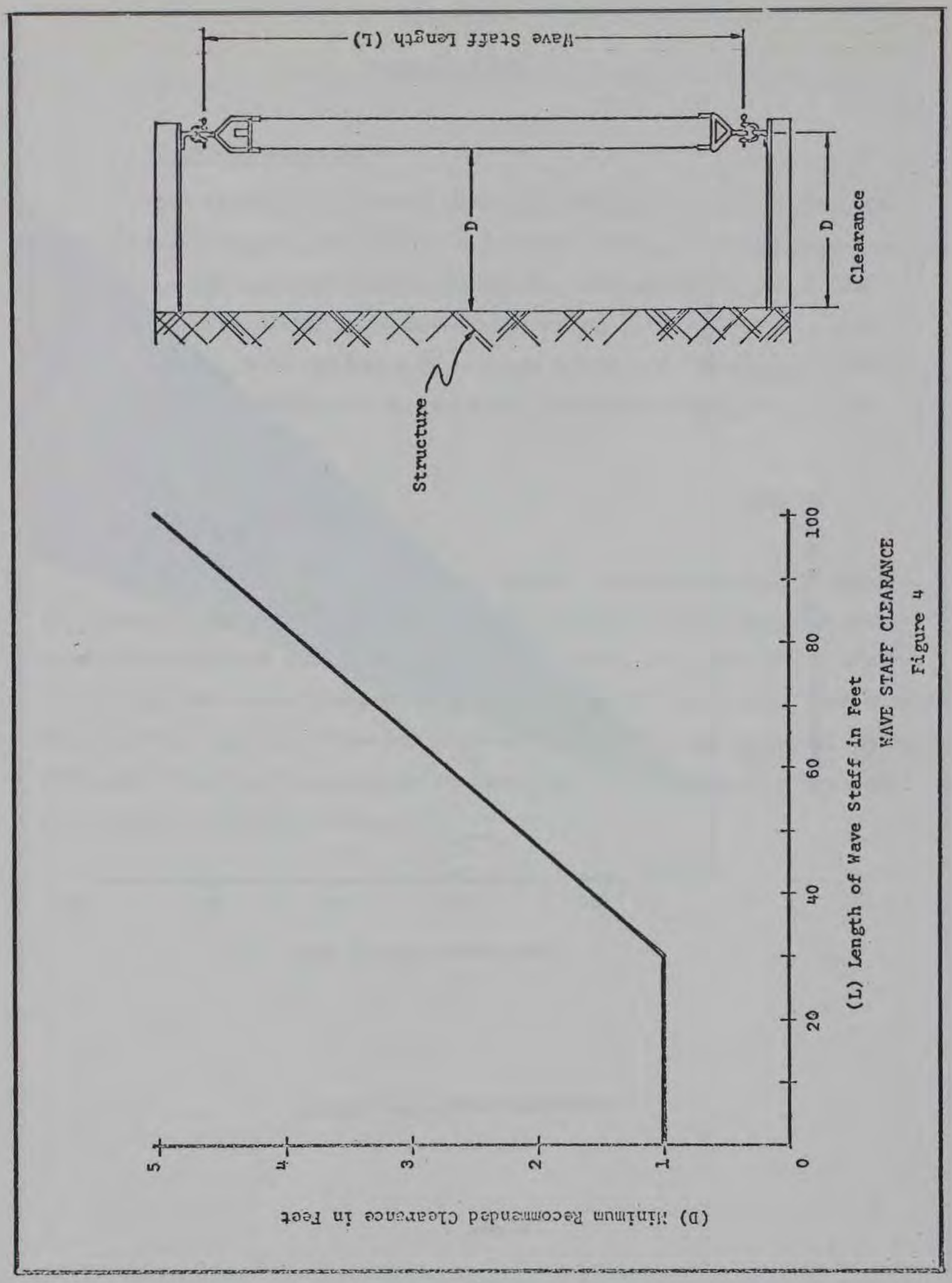
Provision must also be made so that the clearance between the supporting structure and the wave staff is appreciably greater than the anticipated movement of the wave staff when it is subjected to the forces of sea and wind as occur in a storm. Recommended minimum values of clearance are given in Figure 4, varying from a minimum of one foot for short wave staffs to five feet for a 100 foot wave staff. Note that this minimum recommended clearance should be observed over the full length of the wave staff.



RECOMMENDED WAVE STAFF TENSION

Figure 3

Incl 1 (Sheet 3 of 13)



WAVE STAFF CLEARANCE

Figure 4

Incl 1 (Sheet 4 of 13)

2.3.1 Typical Installation - Fixed Structures

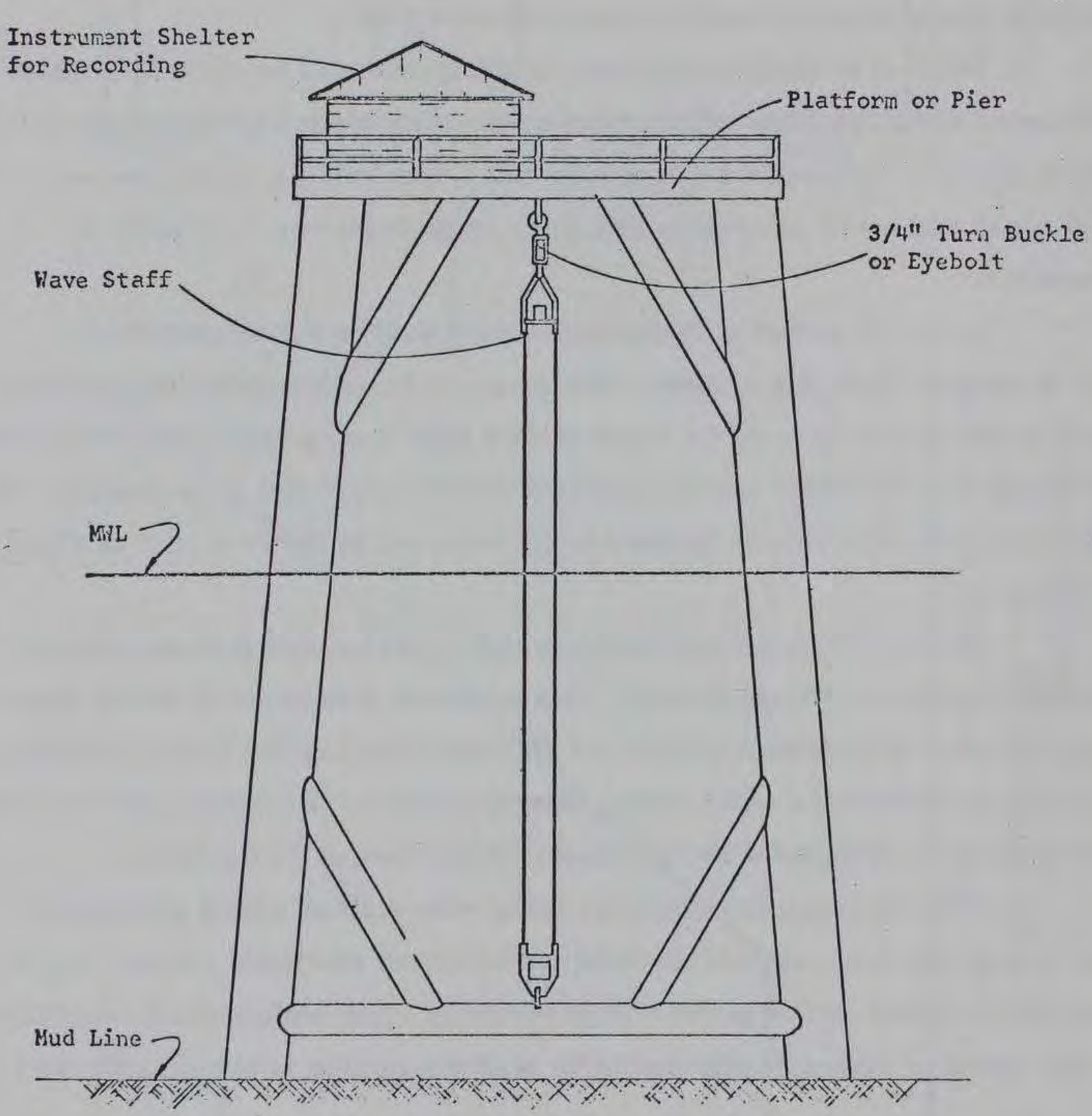
The simplest installation of the wave staff is made on a fixed structure such as a pier or offshore platform. In this installation, the lower end of the wave staff may be fixed to an underwater structural member and the upper end to another structural member above water as illustrated in Figure 5. A 3/4" turnbuckle or eye bolt may be used to tension the wave staff.

While it is desirable that the top of the wave staff be above the highest anticipated water level, the submersible construction of the wave staff transducer and its electrical connections do not make this a requirement. Also, the wave staff output will not be affected by salt spray on the transducer or electrical connectors.

A second method of installing the wave staff on a fixed platform or pier is made by providing an underwater sheave to the lower structural member. Through this sheave is passed a length of wire rope leading back to an above surface structural member where tensioning is provided by an eye bolt or turnbuckle. The other end of the wire rope is fastened to the lower end of the wave staff as shown in Figure 6.

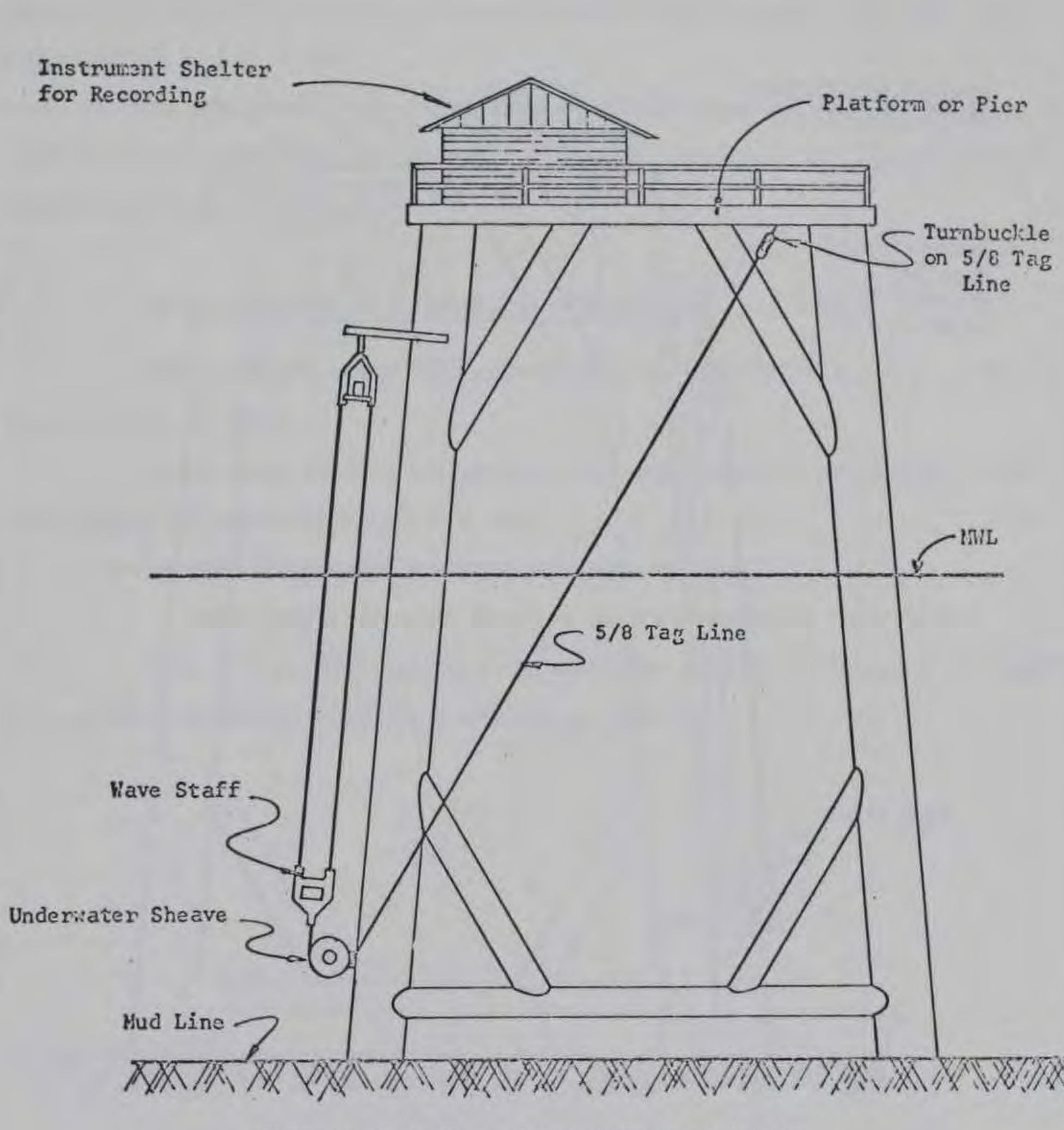
Notice in Figure 6 that the wave staff is replaceable from the surface when the underwater sheave is used. This method of installation is ideally suited for installation of the bottom sheave and 5/8" wire rope tag line when a platform is being constructed in a yard. Then, after the platform is erected, the wave staff may be installed from the surface without divers by use of the tag line.

A third method of installation of the wave staff on a fixed platform or pier is to prefabricate support brackets and a vertical structural member and install the wave staff on this prefabricated assembly. The prefabricated assembly is then bolted or otherwise fastened to the platform or pier as shown in Figure 7.



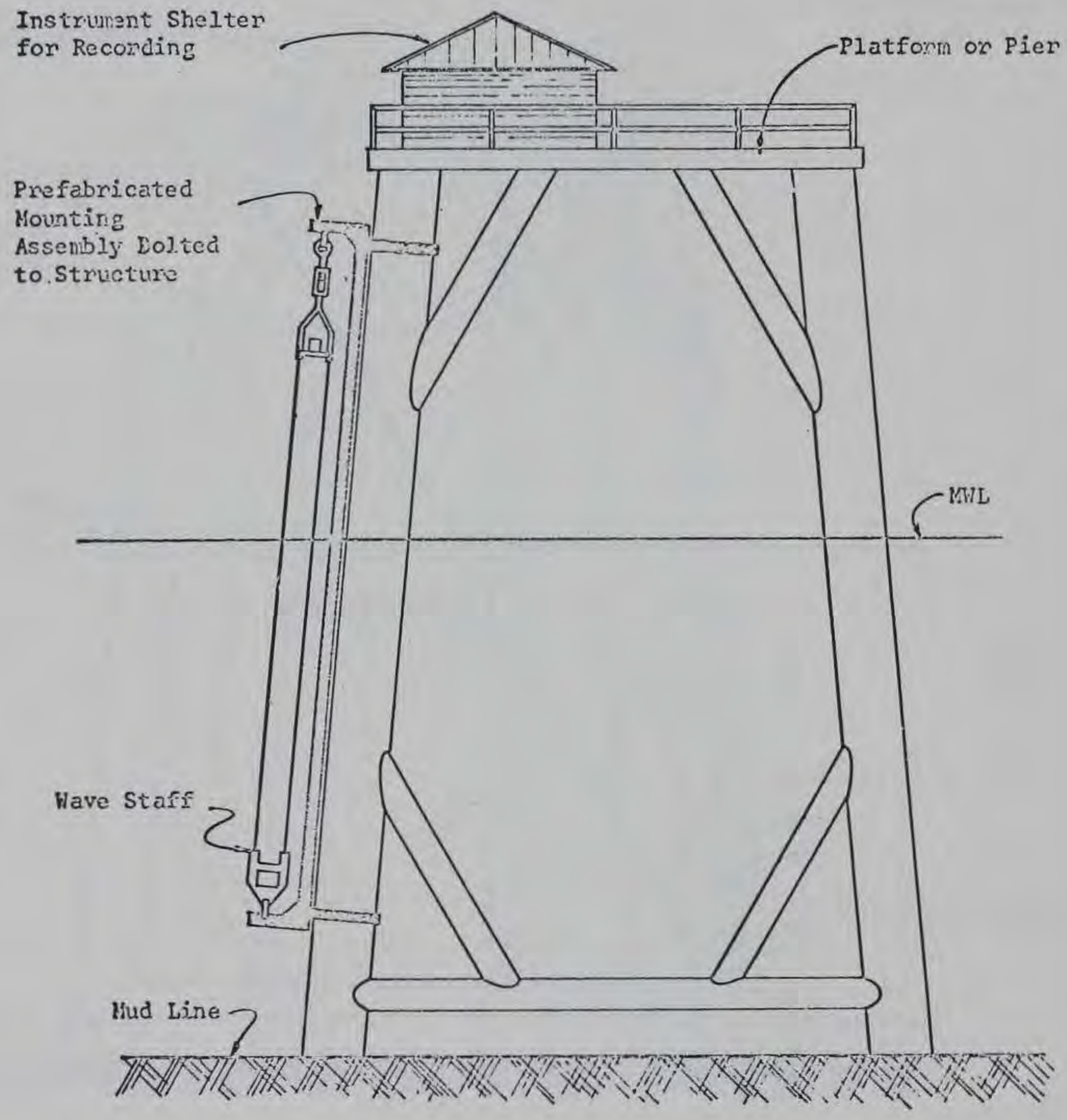
FIXED PLATFORM OR PIER INSTALLATION

Figure 5



UNDERWATER SHEAVE - FIXED PLATFORM MOUNTING

Figure 6



PREFABRICATED MOUNTING FOR PLATFORM OR PIER

Figure 7

Incl 1 (Sheet 8 of 13)

2.3.2 Movable Jack-Up Structure Installation - Open Legs

Installation of the wave staff on a movable jack-up structure is complicated by the fact that the water depth from one location to another may vary appreciably. On a rig with an open structure leg such as a LeTourneau drilling barge, the wave staff can often be installed within the protective confines of the leg as shown in Figure 8.

As in Figure 6, use of the sheave assemblies and 5/8" wire rope can be made to move a wave staff over a 200 foot span to accommodate varying water depths at different locations.

2.3.3 Jack-Up Structure Installation - Closed Leg

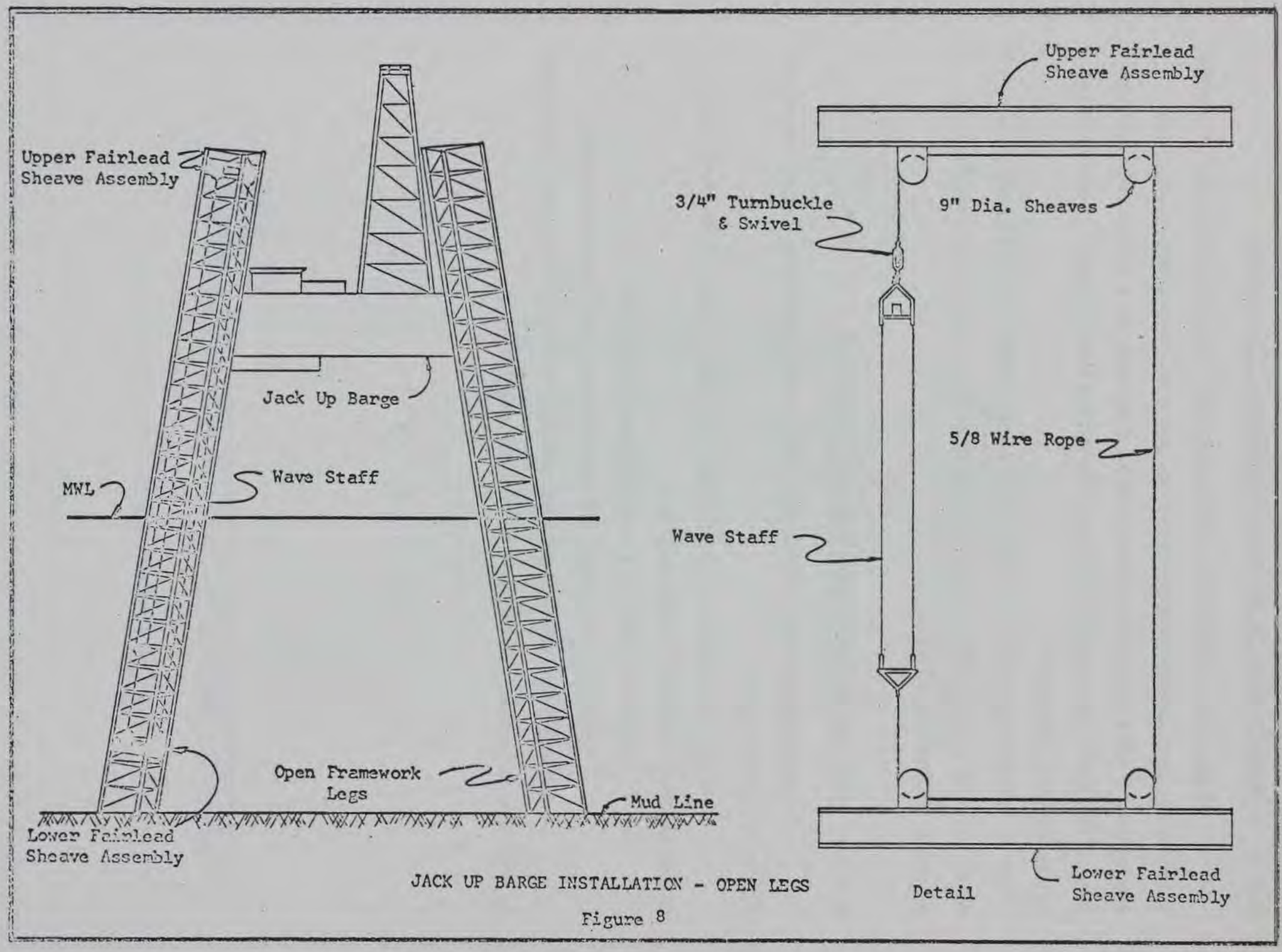
For a jack-up barge with closed legs, an installation similar to that of Figure 9 may be made.

As the wave staff is not vertical, the angle must be measured or estimated since the effective length will be:

Effective length = actual length x cosine $\ominus$

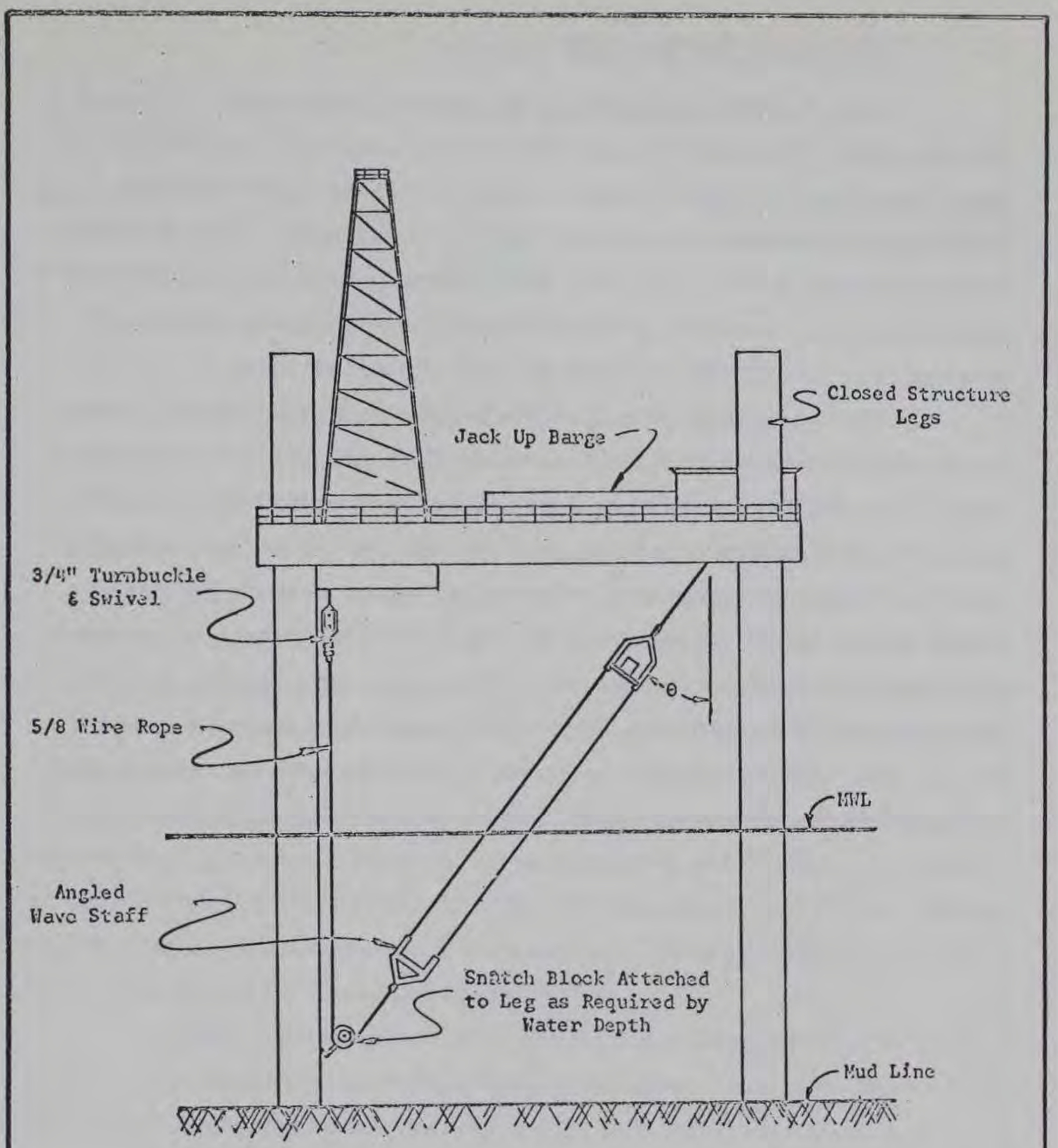
where $\ominus$ is the angle between the wave staff and the vertical.

After set-up, the recorder can easily be set to record true wave height by a simple adjustment covered in subsequent sections.



JACK UP BARGE INSTALLATION - OPEN LEGS

Figure 8



JACK UP BARGE INSTALLATION - CLOSED LEGS

Figure 9

Incl 1 (Sheet 11 of 13)

C11

2.4 Assembly of the Wave Staff

Dwg. D-10292 gives details of assembly of the wave staff. The wave staff may either be assembled on the deck prior to suspension, or vertically, in place. Note that 1 in. diameter holes are provided in the top spreader and lower spreader for customer's shackle, swivel, or turnbuckle. Plate thickness of these two parts is 1/2". Assembly of the insulators to the top spreader is by cotter-keyed pins. Assembly of the wire ropes to the insulators and bottom spreader is by conventional wire rope jaw ends with threaded pins.

The bottom shunt (Item 9) serves to make a positive electrical connection between the wire ropes so that the wave staff, in air, will yield an electrical output of minimum wave height. Spacers are necessary at intervals on the wire rope to maintain the wire rope spacing and prevent wind and sea from setting up vibrations in the rope assemblies. Table I gives spacer locations for various lengths of wave staff. The location of these spacers is not critical, and an extra spacer is included with each wave staff. It is strongly recommended, however, that the distance from the bottom shunt to each spacer be measured with an accurate steel tape and recorded so that the height of the calm sea, as estimated or measured from the nearest spacer, may be used to verify sea or wave height.

TABLE I

WAVE STAFF SPACER REQUIREMENTS

Wave Staff Length	Number Spacers Required	Install Spacers at Following Locations on Wave Staff
10	0	-- --
20	1	10 Feet
30	1	15 Feet
40	2	13 and 27 Feet
50	2	17 and 33 Feet
60	3	15, 30, and 45 Feet
70	3	17, 35, and 53 Feet
80	4	16, 32, 48, and 64 Feet
90	5	15, 30, 45, 60, and 75 Feet
100	5	16, 33, 50, 67, and 84 Feet

After the wave staff is assembled, make sure all connections are tight and secure, especially the electrical connections at top and bottom made with the #2 AWG electrical cables by 3/8" NC bolts. Bolt the transducer in place, and connect the lead-in cable assemblies to the transducer. Save all protective caps for future protection of the transducer connectors.

Install the wave staff assembly and tension as described in prior paragraphs. When tensioning, often the assembly will show a tendency to twist. A swivel is recommended so that the twist may be removed as the assembly is tensioned.

Table C1

Baylor Wave Rod Field Calibration (Binary Counts)

Ft H_2O	Run No. 1, 5-12-71				Run No. 2, 5-12-71				Run No. 3, 5-12-71				Run No. 4, 5-12-71			
	Observed	Linear	Deviation	Δ Deviation	Observed	Linear	Deviation	Δ Deviation	Observed	Linear	Deviation	Δ Deviation	Observed	Linear	Deviation	Δ Deviation
0	3701	3706	-5	--	3753	3757	-4	--	3751	3741	+10	--	3844	3843	+1	--
1	3551	3552	-1	4	3602	3601	+ 1	5	3601	3587	+14	4	3743	3691	+52	51
2	3406	3398	+8	9	3457	3445	+12	11	3444	3433	+11	3	3586	3539	+47	5
3	3231	3244	-13	21	3297	3289	+ 8	4	3283	3279	+4	7	3432	3387	+45	2
4	3073	3090	-17	4	3132	3133	-1	9	3127	3125	+2	2	3273	3234	+39	6
5	2910	2934	-24	7	2965	2977	-12	11	2958	2971	-13	15	3108	3082	+26	13
6	2755	2780	-25	1	2805	2821	-16	4	2796	2817	-21	8	2951	2930	+21	5
7	2590	2626	-36	11	2646	2665	-19	3	2636	2663	-27	6	2788	2777	+11	10
8	2435	2472	-37	1	2481	2509	-28	9	2478	2509	-31	4	2629	2625	+4	7
9	2277	2318	-41	4	2332	2353	-21	7	2324	2355	-31	0	2476	2473	+3	1
10	2122	2164	-42	1	2179	2197	-18	3	2158	2201	-43	12	2324	2320	+4	1
11	1960	2011	-51	9	2013	2041	-28	10	2000	2047	-47	4	2159	2168	-9	13
12	1801	1857	-56	5	1852	1885	-33	5	1842	1893	-51	4	1999	2016	-17	8
13	1647	1703	-56	0	1692	1729	-37	4	1682	1739	-57	6	1853	1864	-11	6
14	1487	1549	-62	6	1538	1573	-35	2	1528	1585	-57	0	1688	1711	-23	12
15	1335	1395	-60	2	1379	1417	-38	3	1376	1431	-55	2	1533	1559	-26	3
16	1176	1241	-35	25	1208	1261	-53	15	1220	1277	-57	2	1379	1407	-28	2
17	1044	1087	-43	8	1076	1105	-29	24	1075	1123	-48	9	1226	1254	-28	0
18	882	933	-51	8	925	949	-24	5	919	969	-50	2	1087	1102	-15	13
19	732	779	-47	4	780	793	-13	11	770	815	-45	5	932	949	-17	2
20	582	625	-43	4	625	637	-12	1	618	661	-43	2	778	797	-19	2
21	435	471	-36	7	476	481	-5	7	476	507	-31	12	630	645	-15	4
22	291	317	-26	10	337	325	+12	17	323	353	-30	1	490	493	-3	12
23	139	163	-24	2	187	169	+18	6	174	199	-25	5	336	340	-4	1
24	9	9	0	24	13	13	0	18	45	45	0	25	188	188	0	4
	$\frac{(+8)(100)}{3701}$		$\frac{(-62)(100)}{3701}$		$\frac{(+18)(100)}{3753}$		$\frac{(-53)(100)}{3753}$		$\frac{(+14)(100)}{3751}$		$\frac{(-57)(100)}{3751}$		$\frac{(+52)(100)}{3844}$		$\frac{(-28)(100)}{3844}$	
	= 0.22%		= 1.67%		= 0.48%		= 1.41%		= 0.37%		= 1.52%		= 1.35%		= 0.73%	

APPENDIX D: MAGNETIC TAPE FORMAT

APPENDIX D: MAGNETIC TAPE FORMAT

1. Each of the eighty 2400-ft-long magnetic tapes on which prototype measurements were recorded during June 1971 through June 1972 contains about 5 days' data divided into 6-hr-long files. Each file consists of 37 records, the first being a 16-character binary coded decimal (BCD) header of recording equipment constants followed by 36 records containing data. Each of these 10-min-long records has an initial 16-character BCD header of identification information and 600 scans at 1-sec intervals of data from up to 16 measurement channels. The data values are recorded in 12-bit binary data words sequentially multiplexed in two character spaces per data word.

2. The actual numbers of records per file, scans per record, and channels per scan may occasionally vary during system checks and changes in measuring equipment. All records were made in ODD parity. The tape format is shown graphically in Figure D1, for which several details are explained in the following paragraphs. The characters shown in the bit spaces are for convenient identification only; the actual "markings" are the absence or presence of a magnetized spot.

3. File Header (BCD). Items a-c set by manual switches.

a. Recorder Mode Code (L), usually "0."

0 = INTVL - causes selected number of input channels to be scanned repeatedly. Interval between each scan is determined by INTERVALOMETER switch positions.

1 = SINGLE - causes selected number of input channels to be scanned once each time START/STOP switch is set to START. Settings of INTERVALOMETER switches have no effect.

2 = TEST 1 - allows operator to record data one character at a time to compare contents of Datacoupler with recorded information. One character is recorded when STEP switch is pressed; following character is recorded when switch is released. Binary data contained in Datacoupler is that which appears at inputs when operator steps from header to data portion of format.

3 = TEST 2 - No recording occurs. Datacoupler continuously

displays binary data appearing at each input channel. Before input data can be displayed, operator must use STEP pushbutton to advance through header portion of format; STEP switch is also used to switch from one input channel to next.

b. Interval (III), usually "001" (for 1-sec interval).

(1) First space - time scale, usually "0."

0 = seconds

1 = minutes

2 = hours

(2) Second space - tens character, usually "0."

(3) Third space - units character, usually "1."

c. Scans per record (GGGG), usually "0599."

d. Data records per file (RR), usually "35."

e. Last channel in scan (EE), usually "15."

f. Three character spaces (---) to fill out header character to a multiple of four.

g. Parity check (P,L), built into system for monitoring equipment performance by checking ODD parity both across the tape (P) and longitudinally (L).

4. Record Header (BCD). Items a-c set by manual switches; items d-g controlled by digital clock.

a. Tape number (KK), varies from "01" to "80."

b. Channel being calibrated (CC), usually "19" if no channel is being calibrated, otherwise from "00" to "15," depending on number of tape channel for which system is being calibrated. Occasionally, the number was not set properly; see Magnetic Tape Recording Log for record of actual operations.

c. Year (YY), used "71" or "72."

d. Julian Day (DDD), varies from "001" to "365."

e. Hour (HH), varies from "00" to "23."

f. Minute (MM), varies from "00" to "59."

g. Second (SS), varies from "00" to "59."

h. One space (-), to fill out header character spaces to a multiple of four.

5. Data Scan (12-bit binary), usually "channel n" = "channel 16."

(Note that data channels 1-16 were recorded on tape channels 00-15 in sequence given on cover sheet of Magnetic Tape Recording Log.)

a. Most significant bit (B_M).

b. Binary bit (B).

c. Least significant bit (B_L).

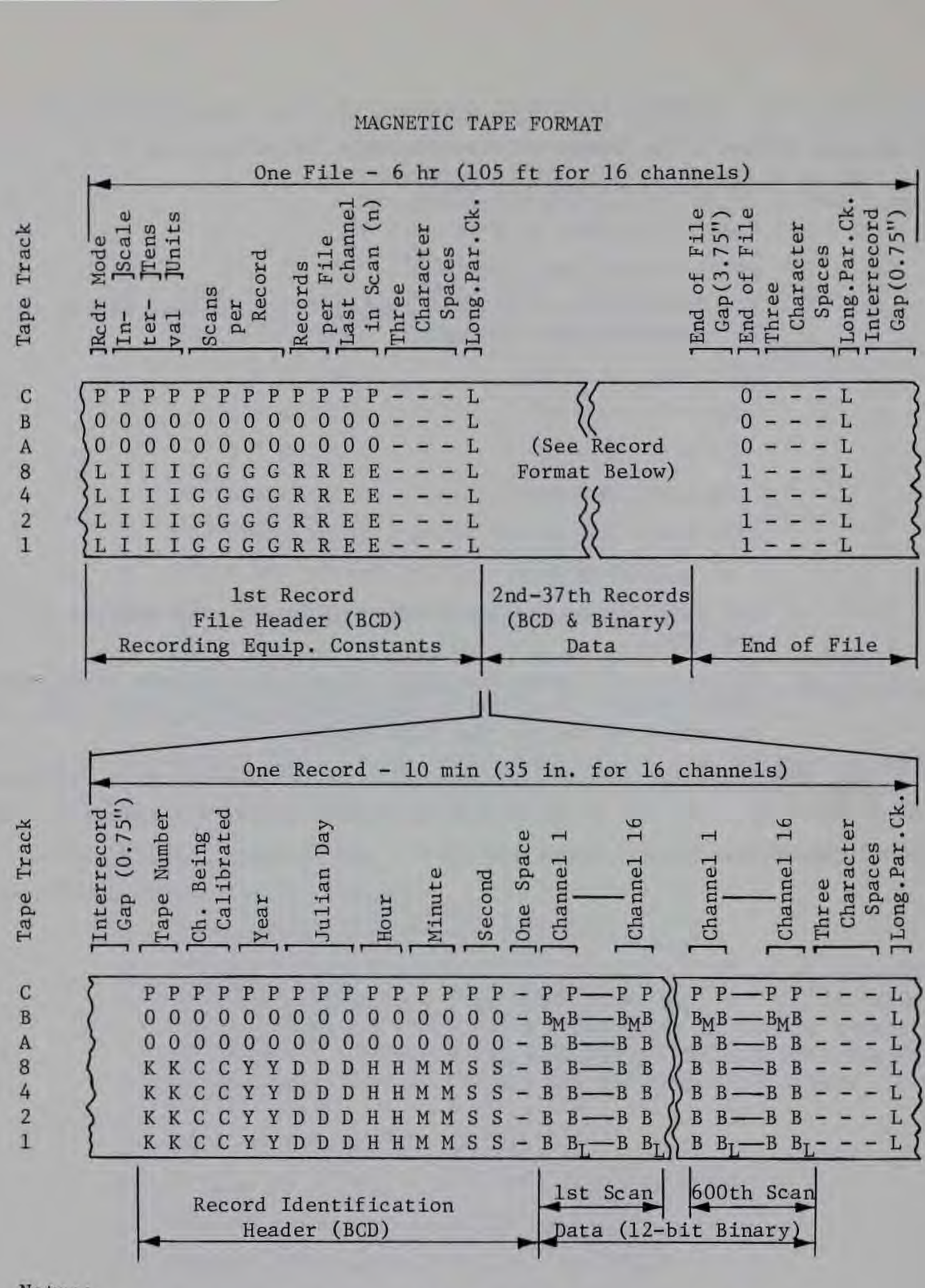
d. Equivalent values of bits representing decimal values of instrument output counts:

2048 = B_M B = 32
1024 = B B = 16
512 = B B = 8
256 = B B = 4
128 = B B = 2
64 = B B_L = 1

The total count for each data value can vary between 0 and 4095.

e. Following the last data scan of each record are three character spaces (---) and a longitudinal parity check (L), as described above for the file header.

6. End of file. The end of each file is identified by a 3.75-in. end-of-file gap, and end-of-file mark (1), three character spaces (---), and a longitudinal parity check (L).



Notes:

1. Tape recording density is 556 character spaces per inch.
2. Tape width is 0.50 in.
3. Format is compatible with any system using word length that is a multiple of 12 bits, using a minimum of bit string manipulation.
4. See accompanying text for detailed explanation.

Figure D1. Graphic presentation of magnetic tape format

APPENDIX E: MAGNETIC TAPE RECORDING LOG (MAY 1971-JUNE 1972)

APPENDIX E

May 1971 - June 1972

MAGNETIC TAPE RECORDING LOG

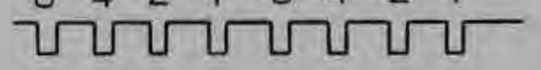
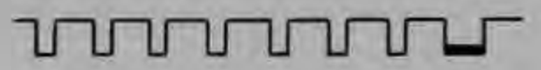
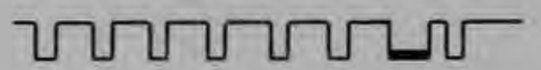
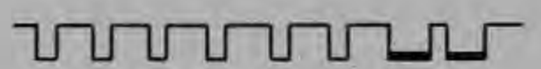
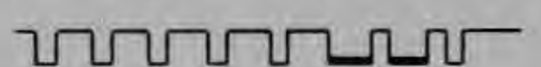
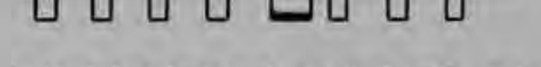
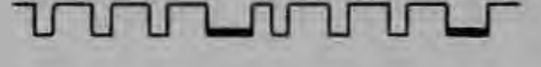
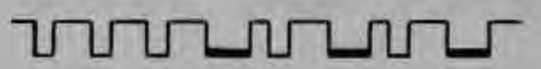
```
* * * * * * * * * * * * * * * * * * * * * * * * *
*                                               *
*                    CAUTION                    *
*                                               *
*   Users of the magnetic tapes should          *
*   review this log and the strip charts        *
*   at the times of interest to deter-          *
*   mine possible voids or errors in the        *
*   records to be analyzed.  This log           *
*   may not be all-inclusive.                   *
*                                               *
* * * * * * * * * * * * * * * * * * * * * * * * *
```

1. This graphical and tabular log was summarized from the Magnetic Tape Ledger and Daily Narrative Log and from inspection of the continuous strip charts, all recorded at the San Pedro field office during the observation period.

2. The graphs for each month show periods of no record by a solid horizontal line for the affected station, items of note for each station by tick mark on the day of occurrence, periods of record of each magnetic tape, Julian and calendar dates, and a few special events (clock error, current measurements, etc.).

3. The monthly tables (Inclosure 1) list the beginning and ending times for each tape and notes for the tick marks on the graphs. These notes indicate the transducer calibration checks, off and on times and off-on periods for various reasons given in the Comments, and other pertinent activities or observations. Other explanations are given in the footnotes of the first monthly table (May 1971).

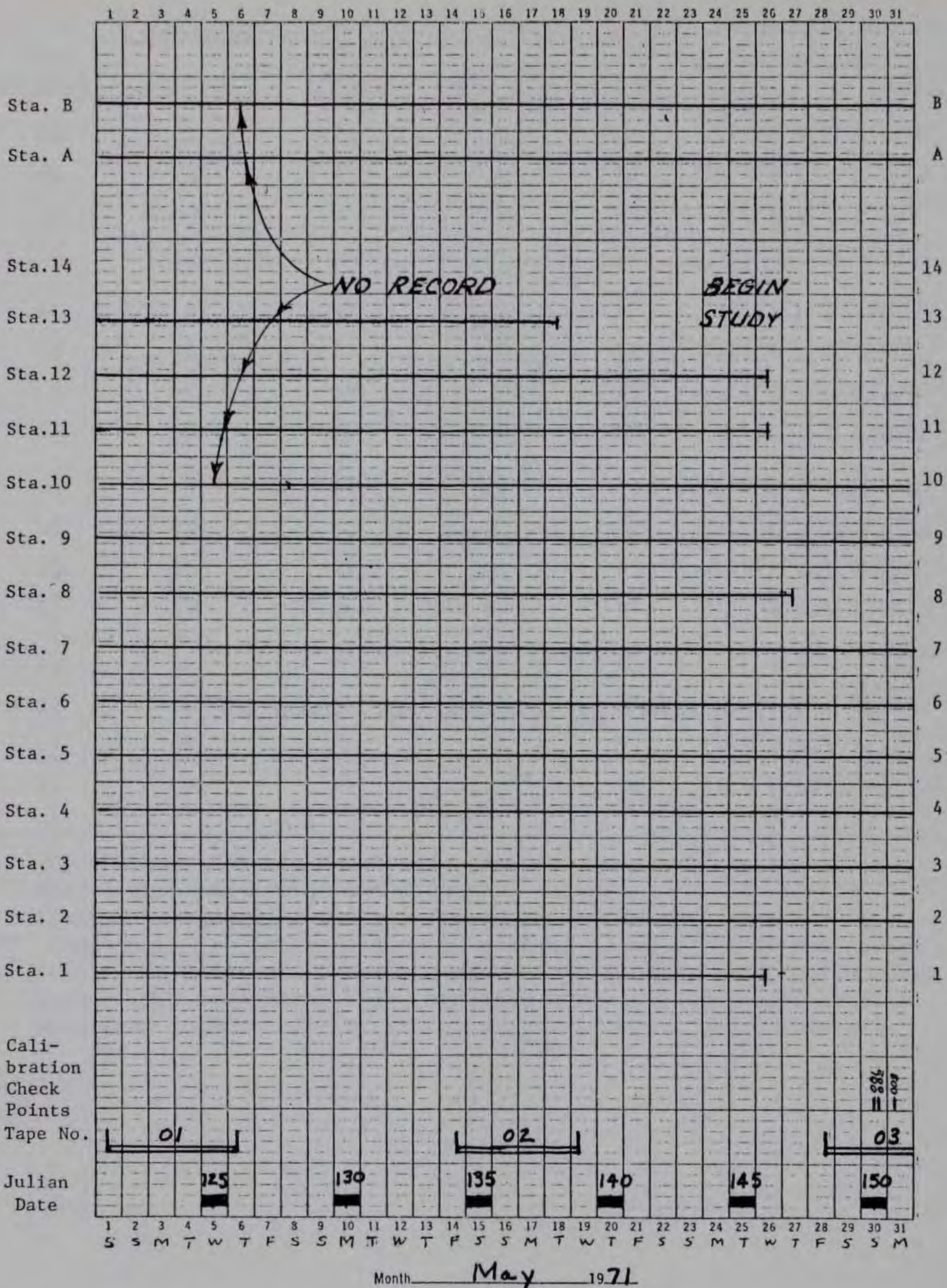
4. The corresponding magnetic tape channel, measurement station numbers, and strip chart recorder (SCR) trace numbers are as follows:

Tape Channel	1 Jun 1971-27 Feb 1972 Station	SCR Trace	27 Feb-29 Jun 1972 Station	SCR Trace*	Sequential Record Channel Code Tens Units (8 4 2 1 8 4 2 1)
00	1	A1	1	A1	
01	2	A2	2	A2	
02	3	A3	3	A3	
03	4	A4	4	A4	
04	5	A5	5	A5	
05	6	A6	6	A6	
06	7	A7	7	A7	
07	8	A8	8	A8	
08	9	B1	9	B1	
09	11	B3	11	B2	
10	10	B2	14	B3	
11	13	B4	10	B4	
12	12	B5	13	B5	
13	12**	--	A	B6	
14	A	B6	12	B7	
15	B	B7	12**	--	

* Exceptions to strip chart trace numbers are noted in log and on charts when one of the two 8-channel recorders was out of service (9-15 November, 24 January-3 February).

** Indicates a separate Station 12 reading "locked" at 15-sec intervals, held constant for each 1-sec record in the 15-sec period from 1 June 1971 to 3 March 1972, and then corrected to "lock" at each mid-1-sec interval for recording at the system's 1-sec interval.

Inclosure 1: Graphical and Tabular Log



Incl 1 (Sheet 1 of 28)

Date*	Time**	Tape No.	Stations Affected: Calibrate	Off-On†	Other	Comments††
May 1971						
01 121	0944 PDT	1		None on line		Begin tape (#316624)
06 126	0915 PDT	1				End tape
14 134	1515 PDT	2				Begin tape (#315842)
17 137	1244 PDT	|	12			
18 138	1257 PDT	|		13 on		
19 139	0755 PDT	2				End tape
26 146	--			1,11, 12 on		
27 147	--			8 on		
28 148	1458 PDT	3		"All" on		Begin tape (#316184)

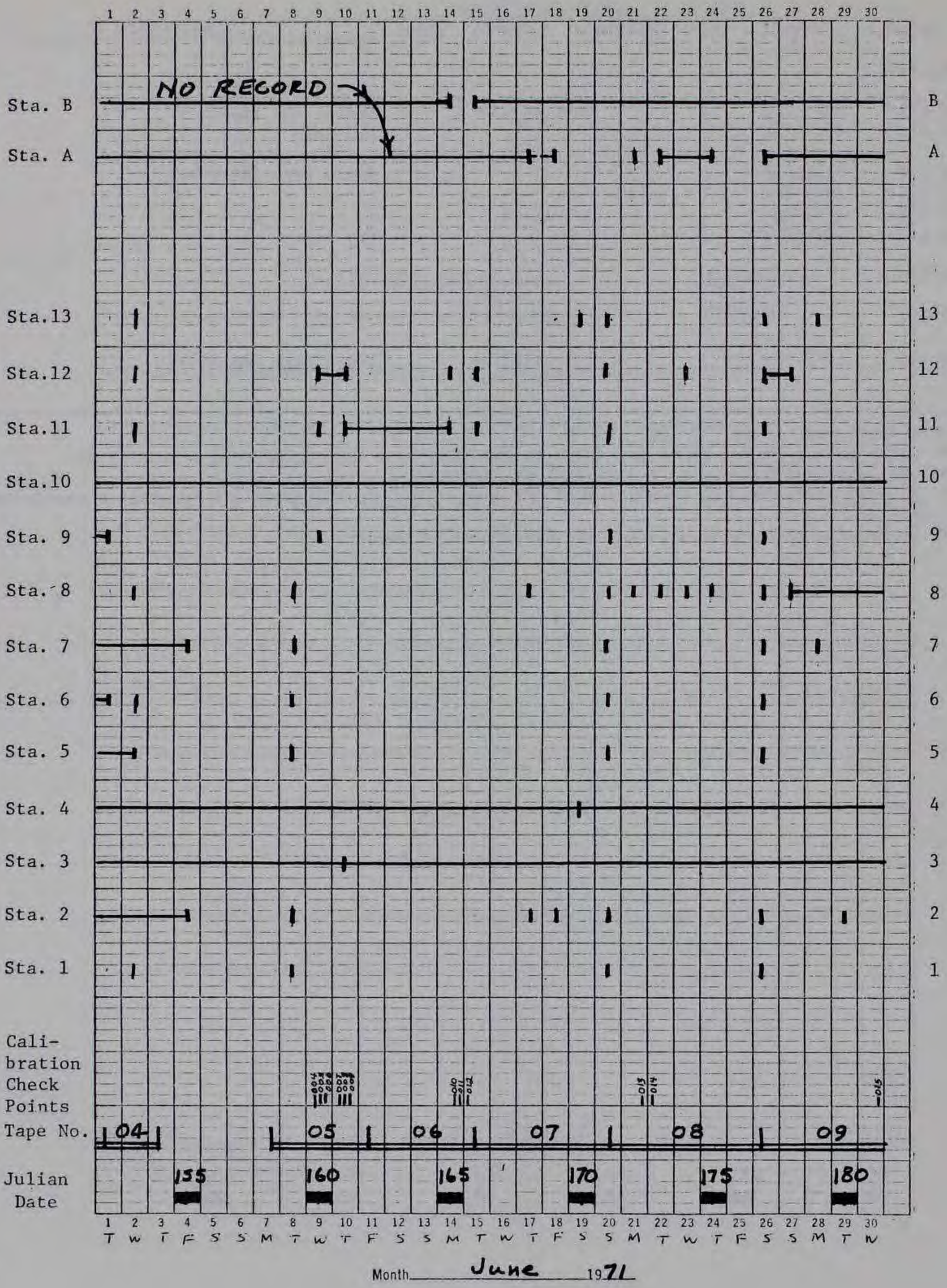
Notes applicable to all of log:

* Calendar and Julian dates are shown in the first and second columns, respectively.

** PST, except PDT prior to 7 June 1971 as labeled.

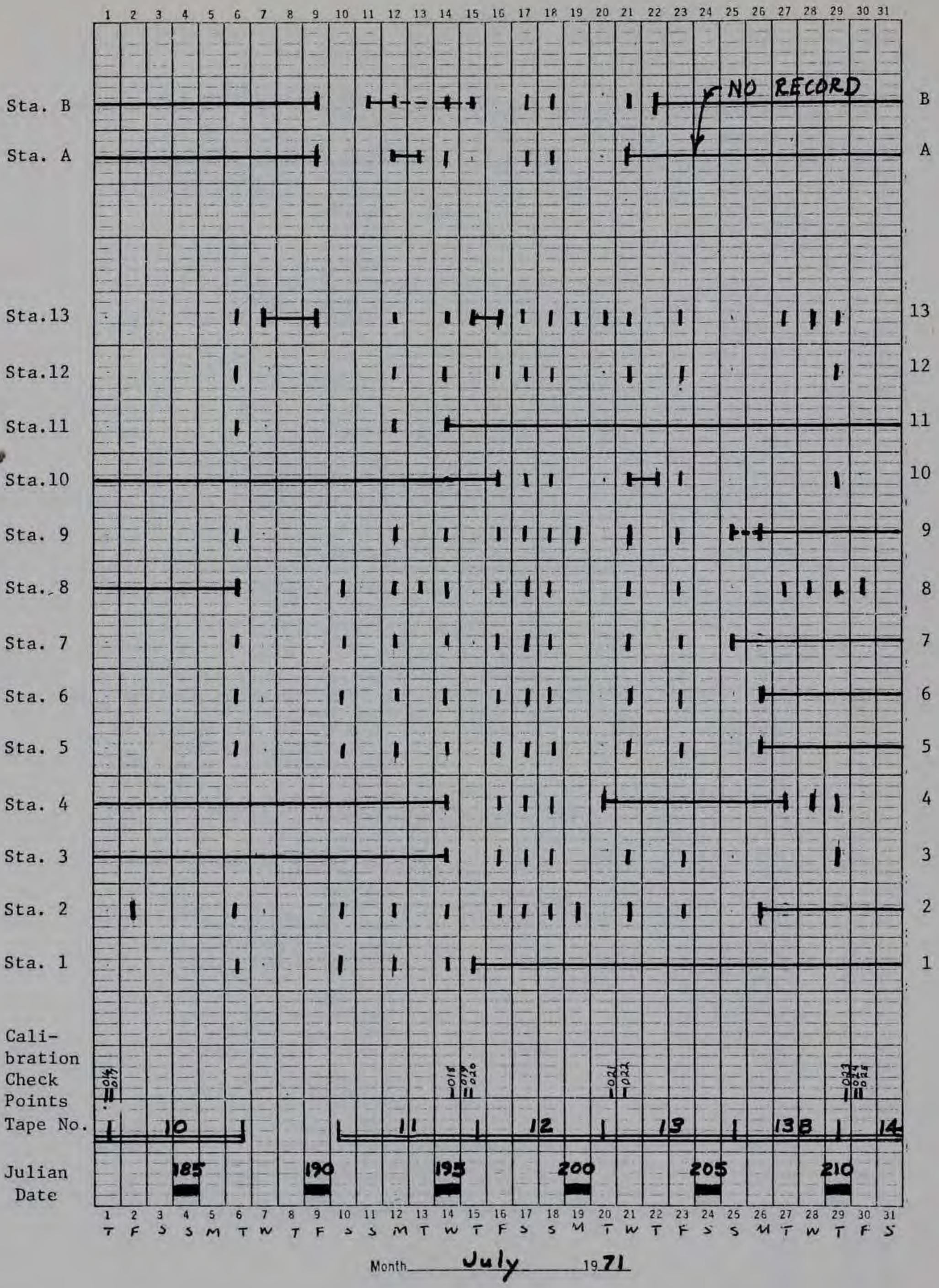
† All off indicates all channels went off line; "All" on indicates all operable channels went on line.

†† For *, **, etc., within table, see notes under Comments.



Incl 1 (Sheet 3 of 28)

Date	Time	Tape No.	Stations Affected: Calibrate	Off-On	Other	Comments
June 1971						
01 152	0701 PDT	3*		All off		End tape *Tapes 1-3 are fragmentary
01 152	1118 PDT	4		"All" on		Begin tape (#316182)
01 152	--	|		9 on		Installed transducer #1014
01 152	1330 PDT	|		6 on		Installed transducer #1019
02 153	1030 PDT	|		5 on		Installed transducer #1011
02 153	1420 PDT	|			All	Begin SCR
03 154	0803 PDT	4		All off		End tape
04 155	--	--			2,7	Installed #1012 and #1020, resp.
07 158	1446**	5		"All" on		Begin tape (#316187)
08 159	0924-0931	|	8			**PST for all times following
08 159	0942-0947	|	7			
08 159	0954-1003	|	6			
08 159	1005-1015	|	5			
08 159	1204-1215	|	1			
08 159	1221-1226	|	2			
09 160	0914-0921	|	11			
09 160	0929	|		12 off		
09 160	0925-1035	|			9	45-min surge verified visually
10 161	0935-1302	|			11,12	Irregular signal
10 161	1220-1450	|			3	Auxiliary barometer calibration on SCR
10 161	1302	|		12 on, 11 off		
11 162	0806	5		All off		End tape
11 162	0910	6		"All" on		Begin tape (#316232)
14 165	0940-1013	|		12		Power off
14 165	1120	|		11 on	12	Changed polarity of 12
14 165	1300	|		B on		
15 166	0230	|		B off		
15 166	0715	6		All off		End tape
15 166	0901	7		"All" on		Begin tape (#316181)
15 166	1048-1052	|		11,12	12	Power off; reversed leads on 12
17 168	0640-0900	|			8	Erratic trace (ship wake?)
17 168	1145	|			A	Begin erratic trace (unexplained)
17 168	1443	|			2	Shifted SCR trace 1 cm down
18 169	0700	|			2	Shifted SCR trace 1 cm up
18 169	1445	|			A	End erratic trace
18 169	1500	|			2	Shifted SCR trace 1 cm down
19 170	1245-1317	|	13,4			Auxiliary barometer on sta 4
20 171	1140-1421	|	13		All	SCR calibrations
20 171	1421	7		All off		End tape
20 171	1500	8		"All" on		Begin tape (#315906)
21 172	0732-0745	|			8	Unexplained oscillations
21 172	1215-1230	|			8	Unexplained oscillations
21 172	1330-1430	|	A,B			
22 173	0630-0645	|			8	Unexplained oscillations
22 173	0830-0920	|			8	Unexplained oscillations
22 173	0800-1000	|			A	Oscillation off scale
22 173	0945-1008	|		A		Change 4 & 8 bit circuit
22 173	1840	|		A off		
23 174	0800-1330	|			8	Erratic trace off scale
23 174	1240	|	12			
24 175	1020-1310	|		8		Power failure
24 175	1300	|		A on		
26 177	0100	|		A off		
26 177	0400?	8		All off		End tape (tape ran out)
26 177	0725	9		"All" on		Begin tape (#316188)
26 177	0725-0925	|	All			
26 177	1420	|		12 off		
27 178	0518	|		8 off		
27 178	0705	|		12 on		
28 179	0925-0928	|			7	Disturbed in check of 8
28 179	0928-1245	|			13	Moved from floor to wall
29 180	1500	|			2	Ship activity near 2



Incl 1 (Sheet 5 of 28)

Date	Time	Tape No.	Stations Affected: Calibrate	Off-On	Other	Comments
July 1971						
01 182	1415	9		All off		End tape
01 182	1434	10		"All" on		Begin tape (#316183)
02 183	0955-1000	|	2			
06 187	0955	|		8 on		Transducer #1010 off; #1017 on
06 187	1049	|			All	SCR's off for circuit modification
06 187	1504	10		All off		End tape
(06 187)	--	--			All	Magnetic tape off for equipment modification
(07 188)	1504	--				SCR's on
(09 190)	(0955)	--		(A on)		Magnetic tape off for equipment modification
(09 190)	(1105)	--		(B on)		Magnetic tape off for equipment modification
(10 191)	--	--				
(10 191)	0930	--			All	SCR's off
10 191	0950	11		"All" on		Begin tape (#316625); SCR-B on
10 191	1230	|			1,2,5,6,7,8	SCR-A on
11 192	0330	|		B off		
12 193	0130-0200	|			11	Slow surge, unexplained
12 193	0710-0715	|			9,11,12	SCR calibrations
12 193	0730	|		B on		Begin intermittent record
12 193	0940-0942	|	1			
12 193	1000-1002	|	2			
12 193	1040-1042	|	9			
12 193	1140-1144	|	7			
12 193	1200	|		A off		
12 193	1200-1203	|	6			
12 193	1220-1225	|	5			
12 193	1240-1415	|	7			
12 193	1300-1325	|	8			
12 193	1430-1443	|	1			
12 193	1445-1500	|		13		Changing microbarograph chart
12 193	2015-2030	|			11	Slow surge, unexplained (possible zero shift)
13 194	0440-1045	|		A on-off		
13 194	1320-1410	|			All	Chart recorder calibration affects tape
13 194	1400	|		A on		
13 194	2230-0130	|		8		Unexplained
14 195	0850	|		11 off		Removed transducer #1015
14 195	0920-1515	|		13		
14 195	1040	|		3 on		Installed transducer #1016
14 195	1040-1124	|			3	Tape channel indicator 03 instead of 02
14 195	1230	|		4 on		Installed transducer #1018
14 195	1530-1540	|		All		Checking 13
15 196	0355	|		1 off		(Removed transducer #1009 next day)
15 196	0815	|		13 off		
15 196	1420	|			B	End intermittent record
15 196	1420	11		All off		End tape
15 196	1500	12		"All" on		Begin tape (#316189)
16 197	0919	|		13 on		
16 197	1030-1040	|		All		Checking 13
16 197	1307	|		10 on		Installed transducer #1008
16 197	1345-1355	|			13	SCR calibrations
17 198	0829-0900	|			All	SCR calibrations
17 198	0945-1000	|	8			Could not purge
17 198	1010-1013	|	7			
17 198	1020-1024	|	6			
17 198	1030-1034	|	5			
17 198	1040-1050	|	8			Could not purge
17 198	1210	|			10	Noted high wave peak
18 199	0830-0910	|			All	SCR calibrations
19 200	0700	|			13	Transducer bumped
19 200	0850	|		13		Changing microbarograph chart
19 200	1210-1215	|	9			
19 200	1240-1243	|	2			
20 201	0850-0910	|			13	Transducer bumped
20 201	0920	|		4 off		Radio off line
20 201	1010	|			13	Transducer bumped
20 201	1300	12		All off		End tape
20 201	1330	13		"All" on		Begin tape (#316626); add 10 days to duties on SCR-B
21 202	0330	|		A off		
21 202	0810-0814	|	2			
21 202	0840-0843	|	9			
21 202	0920-0923	|	5			
21 202	0950-0955	|	6			
21 202	1010-1014	|	7			
21 202	1020-1550	|		13		
21 202	1030-1550	|		All		Magnetic tape off line
21 202	1325	|		10 off		
21 202	1330	|			3	SCR calibrations
22 203	0730	|		B off		
22 203	1455	|		10 on		
23 204	0950-1110	|			All	SCR calibrations
23 204	1328-1408	|			13	SCR calibrations
23 204	1340-1410	|			2	SCR calibrations
25 206	0900	|			9	Begin erratic fluctuation
25 206	1300	13		All off		End tape
25 206	1330	13 B		"All" on		Begin tape (#316531); add 10 days to duties on SCR-B
25 206	2100	|		7 off		Removed transducer #1020 next day
26 207	1030	|		9 off		Removed transducer #1014
26 207	1150	|		2 off		Removed transducer #1012
26 207	1330	|		5 off		Removed transducer #1011
26 207	1400	|		6 off		Removed transducer #1019
27 208	0430-0530	|		8		Unexplained
27 208	0706	|			13	Changing microbarograph chart
27 208	1235	|		4 on		
28 209	1020	|			13	Transducer bumped
28 209	1010-1150	|		8		Transmitter work
28 209	1245-1300	|		4		Power off
28 209	1345-1505	|		8		Transmitter work
28 209	1330-1445	|	13			Very linear
29 210	1100	13 B		All off		End tape (power off)
29 210	1230	14		"All" on		Begin tape (#316519); add 10 days to dates on SCR-B
30 211	1130-1150	|	8			

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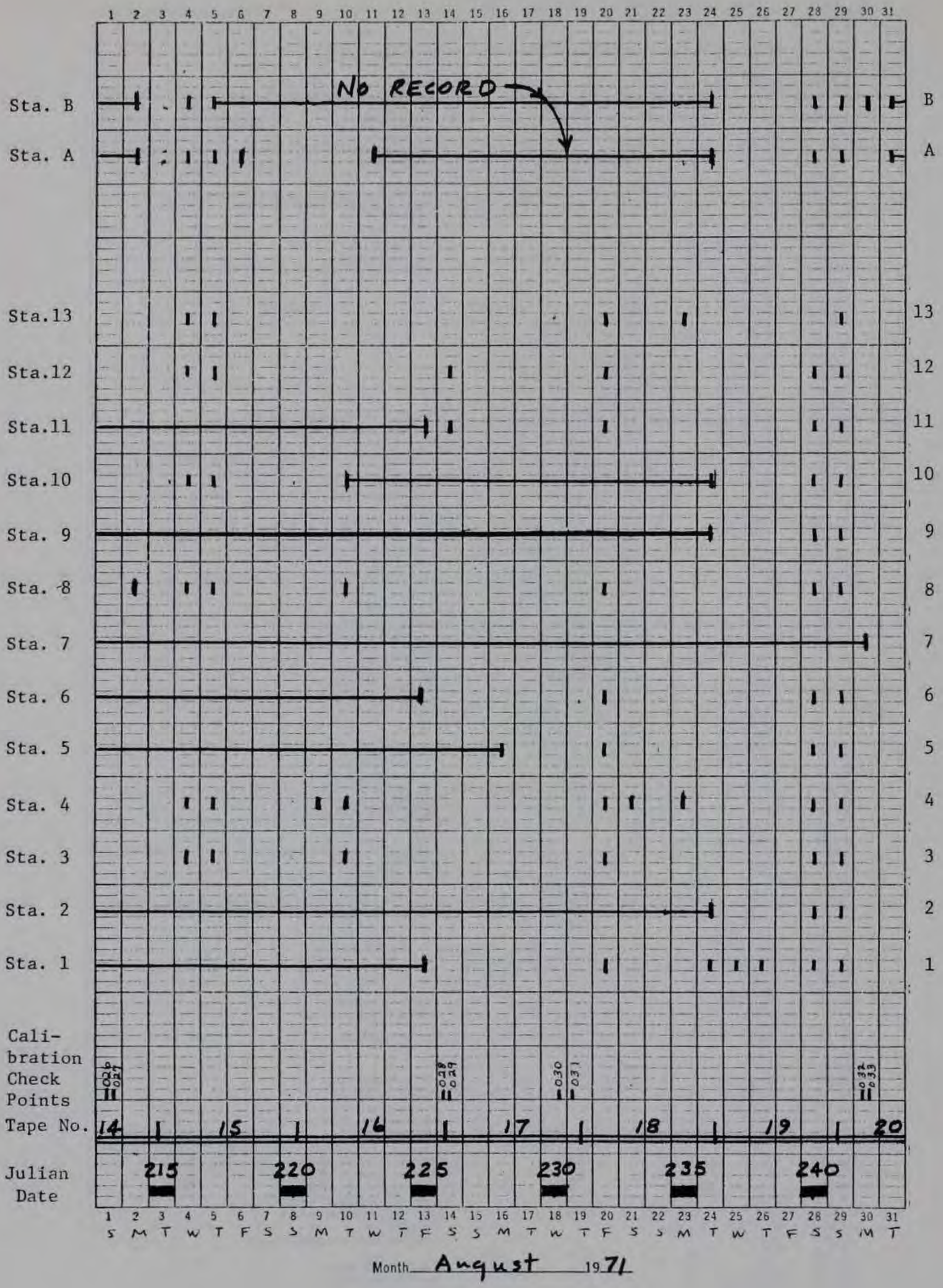
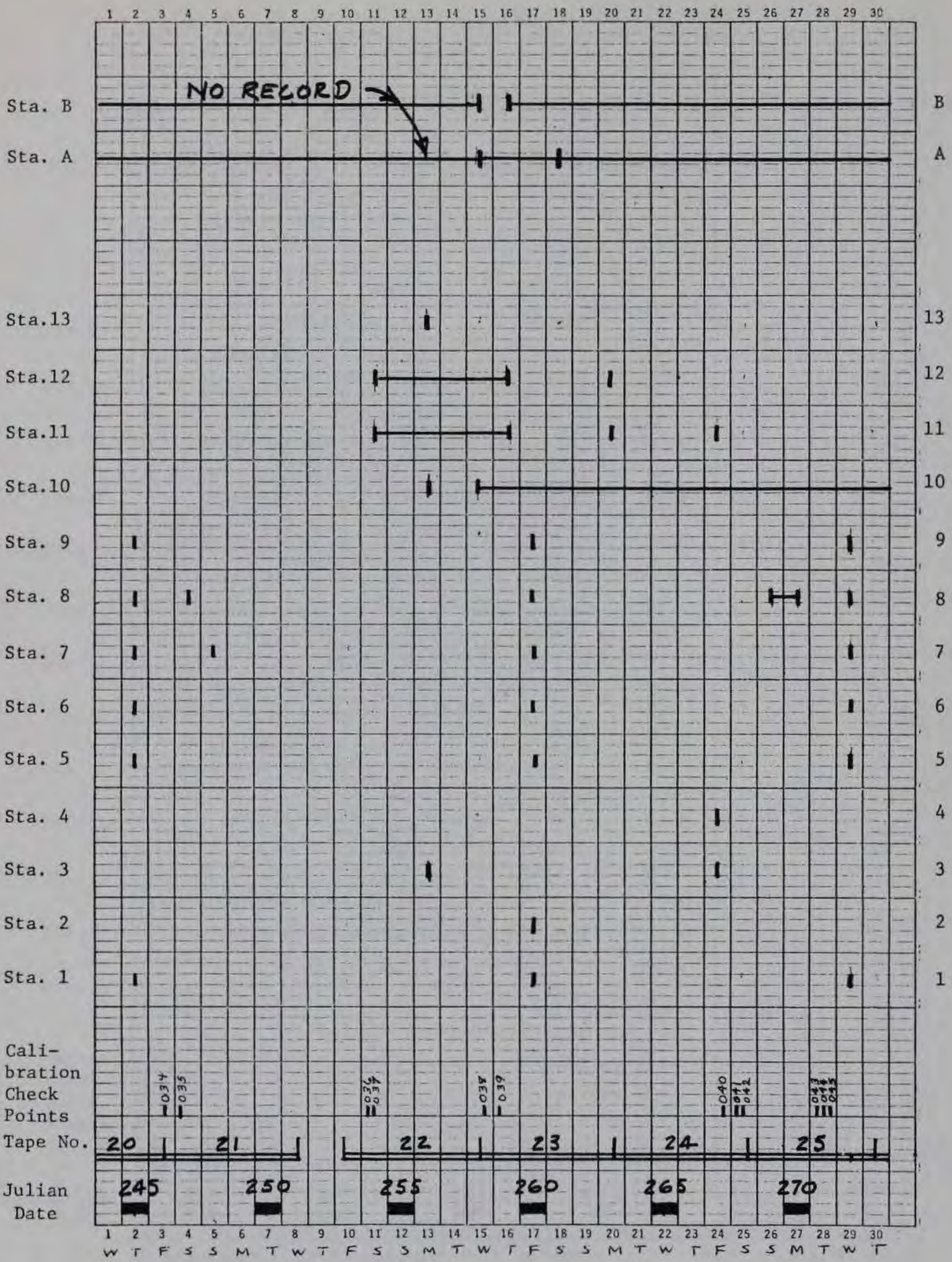


Incl 1 (Sheet 7 of 28)

Date	Time	Tape No.	Stations Affected: Calibrate	Off-On	Other	Comments
Aug 1971						
02 214	0845-0855		8			
02 214	0900			A on		Cleaned meter
02 214	0930			B on		Cleaned meter (intermittent)
03 215	0730	14		All off		End tape; installed air cond.
03 215	0930	15		"All" on		Begin tape (#316429)
04 216	1409			All		Momentary power loss
05 217	0148-?					Add 48 min to time on SCR-A
05 217	0752-0805			All		Momentary power loss
05 217	2300			B off		
06 218	1430			A		Momentary disconnect
08 220	1500	15		All off		End tape
08 220	1530	16		"All" on		Begin tape (#316423)
09 221	1210-1425				4	Oscillations off scale
10 222	0920-1115			3		Transducer #1016 off, #1011 on
10 222	1005			10 off		Removed tranducer #1008
10 222	1140-1250			4		Transducer #1018 off, #1009 on
10 222	1309-1354			8		Transducer #1017 off, #1010 on
11 223	2100			A off		
13 225	1100			6 on		Installed transducer #1020
13 225	1230			1 on		Installed transducer #1019
13 225	1350			11 on		Installed transducer #1012
14 226	0430?	16		All off		End tape (tape ran out)
14 226	0800	17*		"All"on		Begin tape (#316548); *log may be in - complete due to loss of strip charts
14 226	0830-1013			11,12		Severe oscillations
14 228	1015			5 on		Installed transducer #1015
19 231	1400	17		All off		End tape
19 231	1420	18		"All" on		Begin tape (#316547); add 10 days to dates on SCR-B from 0000 on 232 to 0900 on 236
20 232	0800-0820			All		Magnetic tape header check
21 233	0150			4		Begin intermittent spiking
23 235	0715-0750				13	Transducer disturbed
23 235	1420-1430			4		Checking circuits
24 236	1010			10 on		Reinstalled transducer #1008
24 236	1050			2 on		Installed transducer #1014
24 236	1050			A on		Cleaned meter
24 236	1120			B on		Cleaned meter
24 236	1210			9 on		Installed transducer #1017
24 236	1325-1340				1	Interruptions
24 236	1420	18		All off		End tape
24 236	1440	19*		"All" on		Begin tape (#316544); *log may be in- complete due to loss of strip charts
25 237	0810-0900			1		Circuit check
26 238	0910-0920			1		Circuit check
28 240	1120-1210		1			
28 240	1220-1230		2			
28 240	1230-1240		3			
28 240	1240-1250		4			
28 240	1250-1310		5			
28 240	1310-1320		6			
28 240	1320-1330		7			
28 240	1330-1340		8			
28 240	1340-1350		9			
28 240	1350-1400		11			
28 240	1400-1410		12			
28 240	1410-1420		10			
28 240	1420-1430		A			
28 240	1430-1440		B			
29 241	0800	19		All off		End tape
29 241	0820-0905	--			All	Work on tape system
29 241	0920	20*		"All" on		Begin tape (#317772); *log may be in- complete due to loss of strip charts
30 242	0855			7 on		Installed transducer #1016
30 242					B	Questionable operation
31 243	?			A off		
31 243	?			B off		



Month September 1971

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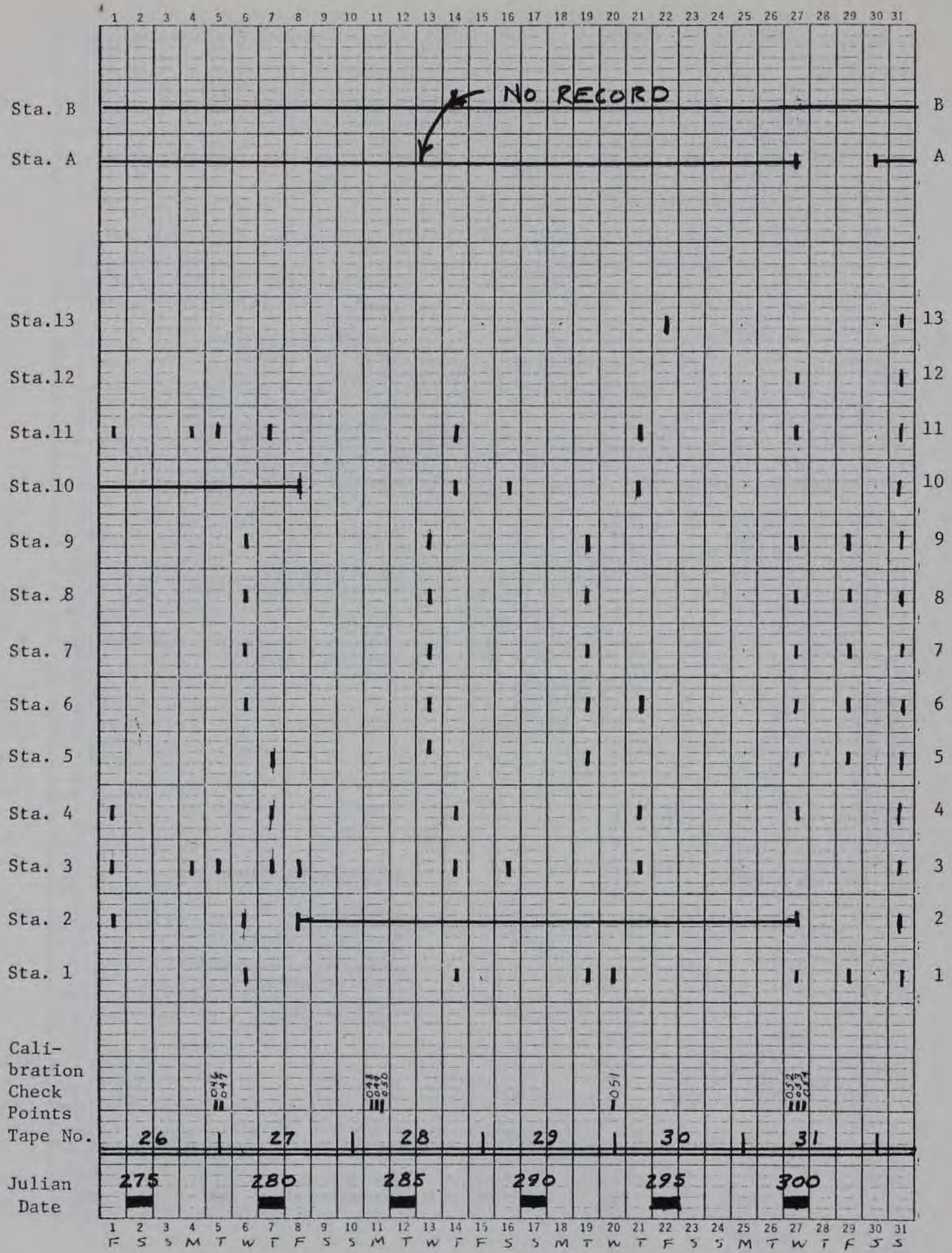
Date	Time	Tape No.	Stations Affected: Calibrate	Off-On	Other	Comments
Sep 1971						
02 245	0800	|			7	Unknown disturbances
02 245	0930-0940	|	9			
02 245	1000-1010	|	8			
02 245	1030-1040	|	7			
02 245	1040-1044	|	6			
02 245	1050-1054	|	5			
02 245	1420-1423	|	1			
02 245	1430-1440	|	2			
03 246	1410	20		All off		End tape
03 246	1430	21*		"All" on		Begin tape (#317771); *log may be incomplete due to loss of strip charts
04 247	? -0812	|		8		Power off
05 248	? -0700	|		7		Intermittently off
05 248	1200	|			7	Appears satisfactory
08 251	1450	21		All off		End tape
08 251	1450	--			All	Begin tape system repairs
10 253	0840	--			All	Complete tape system work
10 253	0840	22		"All" on		Begin tape (#317720)
11 254	0525	|		11, 12 off		Section of cable stolen
13 256	1020-1025	|	3			
13 256	1030-1035	|	10			No purge
13 256	1200-1240	|	13			
14 257	1345-1520	|			13	SCR calibrations
15 258	0900	|		10 off		Removed transducer #1008
15 258	1050	|		A on		
15 258	1100	22		All off		End tape
15 258	1120	23		"All" on		Begin tape (#317774)
15 258	1250	|		B on		
15 258	1455	|		A off		
16 259	0030	|		B off		
16 259	1245	|		11, 12 on		
17 260	1210-1220	|	9			
17 260	1230-1240	|	8			
17 260	1250-1255	|	7			
17 260	1300-1305	|	6			
17 260	1310-1320	|	5			
17 260	1330-1340	|	2			
17 260	1400-1410	|	1			
18 261	1000-0500	|			A	Erratic oscillations
20 263	0700-0710	|	11,12			
20 263	1430	23		All off		End tape
20 263	1450	24		"All" on		Begin tape (#317769)
21 264	2345	|			3	Unexplained disturbance
22 265	--	|			3	Irregular spiking
23 266	--	|			3	Irregular spiking
24 267	--	|			3	Irregular spiking
24 267	0850-0852	|	11			
24 267	0910-0913	|	3			
24 267	1040-1050	|	4			
25 268	1400	24		All off		End tape
25 268	1420	25		"All" on		Begin tape (#317775)
26 269	1615	|		8 off		Power off
27 270	1241	|		8 on		
27 270	--	|			3	Some spiking
29 272	0800-0808	|			11,12	SCR calibrations
29 272	1150-1156	|	1			
29 272	1210-1220	|	9			
29 272	1240-1248	|	8			
29 272	1320-1324	|	7			
29 272	1330-1339	|	6			
29 272	1350-1355	|	5			
30 273	1420	25		All off		End tape
30 273	1440	26		"All" on		Begin tape (#317717)



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Date	Time	Tape No.	Stations Affected: Calibrate	Off-On	Other	Comments
Oct 1971						
01 274	0800-0810		11			Slow return to operation
01 274	0820-0850		3			Slow return to operation
01 274	0850-0900		4			O. K.
01 274	0930-0950		2			Would not stay on atmospheric
04 277	--				3	Spiking
05 278	1319	26		All off		End tape
05 278	1340	27		"All" on		Begin tape (#317770)
05 278	--				3,11	Spiking
06 279	1150-1153		8			
06 279	1211-1212		7			
06 279	1230-1235		6			
06 279	1310-1320		9			
06 279	1330-1332		1			
06 279	1340-1344		2			Would not calibrate
07 280	0800-0815		11			Slow return to operation
07 280	0820-0840		3			Slow return to operation
07 280	0843-0845		4			
07 280	0900-0902		5			Slow return to operation
08 281	0815			3 off		Removed transducer #1011
08 281	0830			10 on		Reinstalled transducer #1008
08 281	0854-0940		10			
08 281	1015			3 on		Installed transducer #1018
08 281	1020-1030		3			
08 281	1115			2 off		Removed transducer #1014
08 281	1350-1356		10			
09 282	1200					SCR-A off; malfunction
10 283	1400	27		All off		End tape
10 283	1420	28		"All" on		Begin tape (#317719)
11 284	0850					SCR-A on, SCR-B off
12 285	0830					SCR-B on
13 286	1130-1135		9			
13 286	1210-1220		8			Solenoid sticky
13 286	1230-1233		7			
13 286	1240-1242		6			
13 286	1250-1252		5			
14 287	1130-1137		1			
14 287	1150-1153		11			Slow return to operation
14 287	1210-1215		3			
14 287	1220-1236		10			
14 287	1300-1309		4			
15 288	1330	28		All off		End tape
15 288	1350	29		"All" on		Begin tape (#316333)
16 289	0920-0930				3,10	SCR calibrations
19 292	1140-1145		1			Would not calibrate
19 292	1200-1206		9			
19 292	1220-1224		8			Slow return to operation
19 292	1242-1243		7			
19 292	1250-1252		6			Slow return to operation
19 292	1300-1303		5			
19 292	1303				5	Flag not removed
20 293	1200				5	Flag removed
20 293	1220-1224		1			Cleaned valve
20 293	1410	29		All off		End tape
20 293	1440	30		"All" on		Begin tape (#316455)
21 294	0150-0757			6		Power or phone line out
21 294	1150-1159		11			Slow return to operation
21 294	1210-1216		4			
21 294	1230-1240		10			
21 294	1240-1245		3			
21 294	1310-1320			4		Circuit check
22 295	0950-1120			13		Circuit modification
25 298	1100	30		All off		End tape
25 298	1120	31		"All" on		Begin tape (#316540)
27 300	0910			2 on		Installed transducer #1011
27 300	1105			A on		
27 300	1120-1126		11			Replaced inlet tube
27 300	--				4	3-ft waves
27 300	--				1,2,5-9 11,12	35 to 75 min surges
28 301	--				Several	Continued Surging
29 302	1230-1238		9			
29 302	1300-1304		8			
29 302	1330-1335		7			Unsatisfactory
29 302	1350-1352		6			
29 302	1400-1405		5			
29 302	1430-1447		1			
30 303	1420	31		All off		End tape
30 303	1440	32		"All" on		Begin tape (#316330)
30 303	1500?			A off		
31 304	0750-1010				All	SCR calibrations

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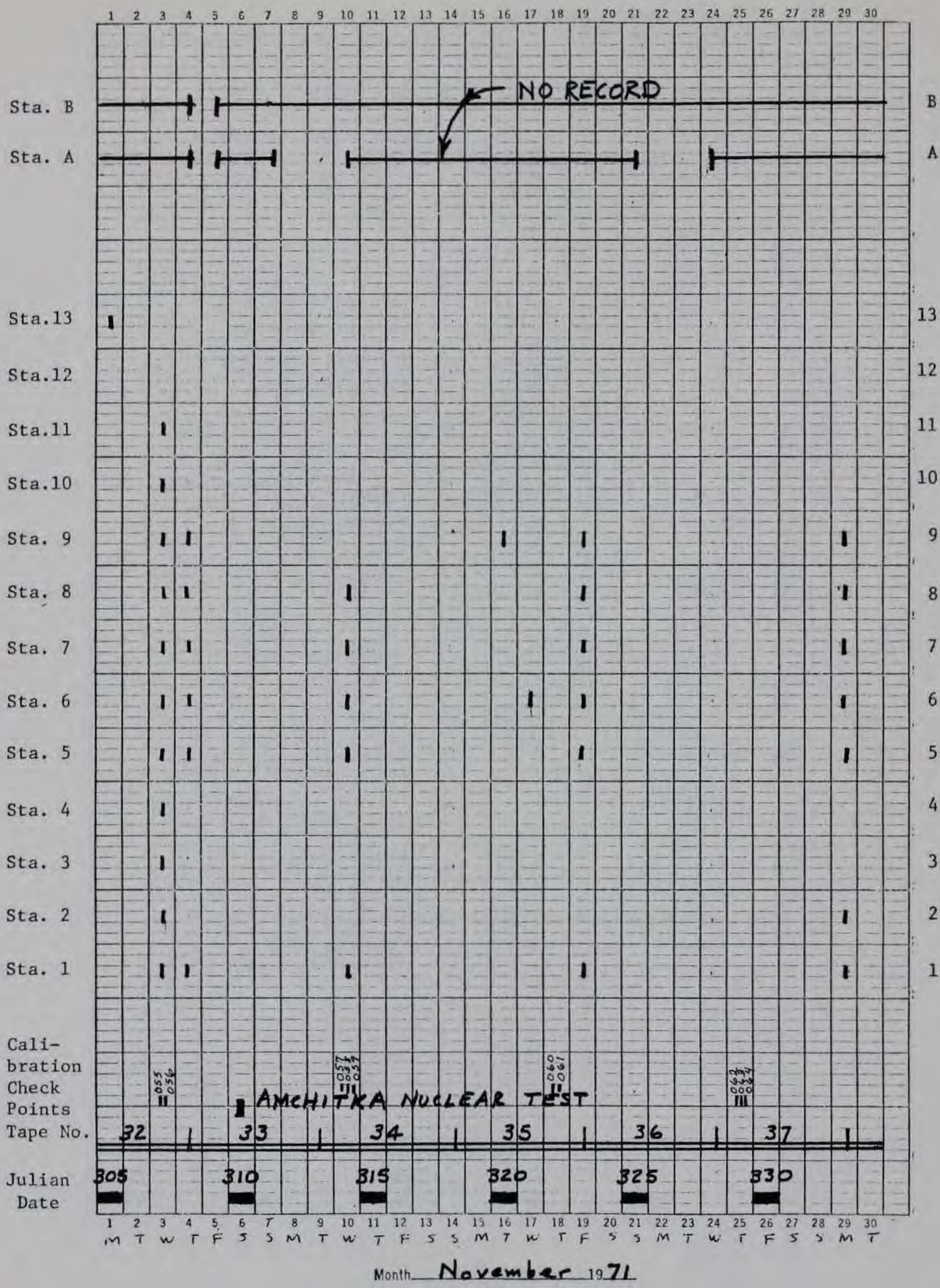

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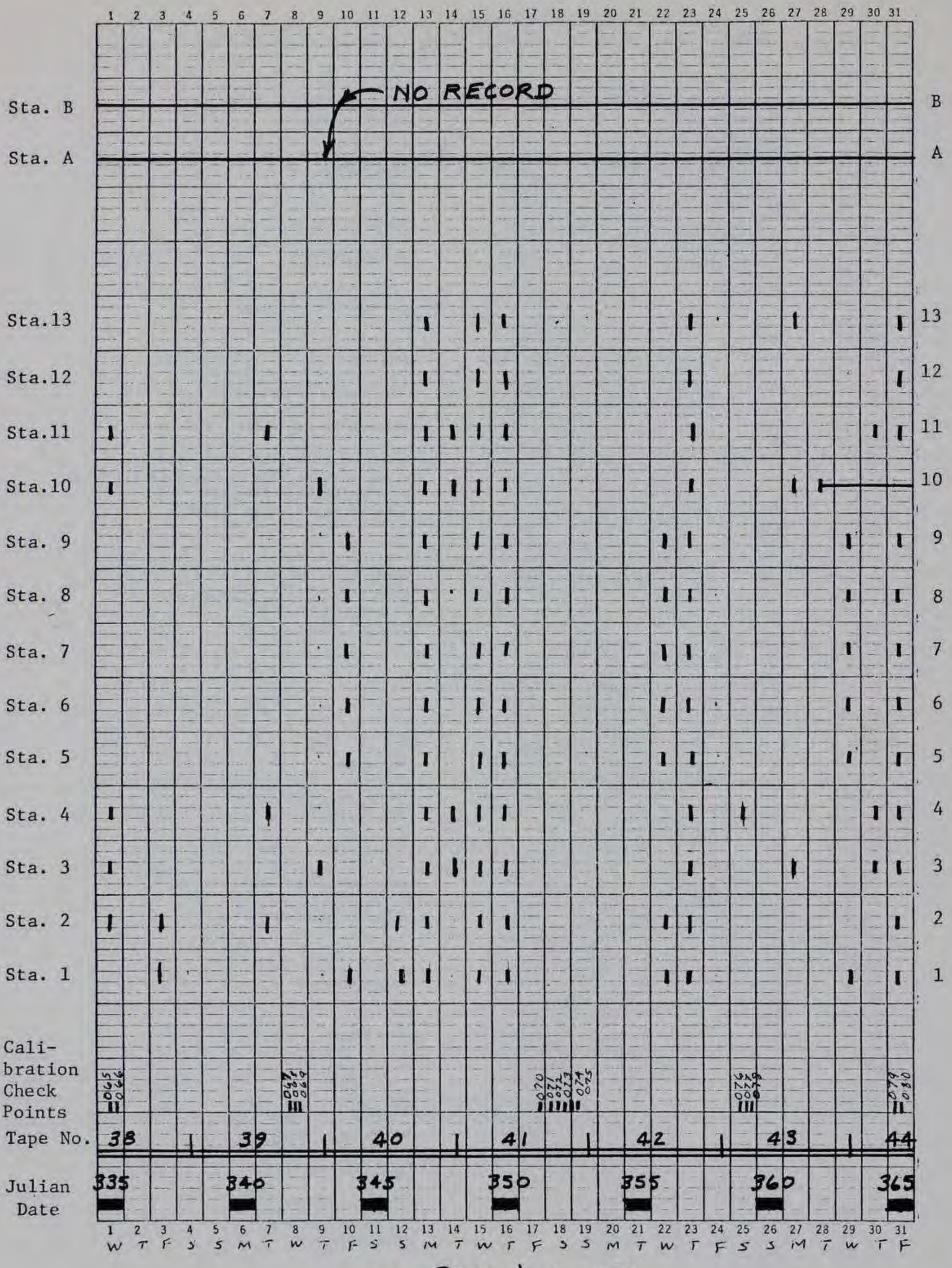
Date	Time	Tape No.	Stations Affected: Calibrate	Off-On	Other	Comments
Nov 1971						
01 305	0755-0800			13		Disturbed in chart change
03 307	0900-0904		1			Unsatisfactory
03 307	0910-0915		2			
03 307	0930-0940		9			
03 307	1000-1008		7			Unsatisfactory
03 307	1010-1017		6			
03 307	1020-1028		5			
03 307	1030-1048		8			Unsatisfactory
03 307	1230-1242		11			
03 307	1250-1255		3			Unsatisfactory
03 307	1300-1307		10			
03 307	1340-1347		4			
04 308	?				1,5-9	Cleaned intake tubes
04 308	1000			A on		
04 308	1050			B on		
04 308	1540	32		All off		End tape
04 308	1600	33		"All" on		Begin tape (#316543)
05 309	0640			A off		
05 309	1210					Channel marker flag to #33
05 309	1900			B off		
06 310	1400-2400					SCR's at fast chart speed to monitor any effects from Amchitka Island blast test; nothing detected
07 311	0840					Channel marker flag to #20
07 311	0930			A on		
09 313	1130	33		All off		End tape
09 313	1200	34		"All" on		Begin tape (#316541)
09 313	1330					SCR-A off; sta 1, 2, 5-10 on SCR-B until 319
09 313	1330-1450				All	SCR calibrations
10 314	1230-1235		1			
10 314	1300-1303		8			
10 314	1319-1324		7			
10 314	1330-1336		6			
10 314	1342-1347		5			
10 314	1401-1408		8			
10 314	?			A off		
14 318	1500	34		All off		End tape
14 318	1520	35		"All" on		Begin tape (#316218)
15 319	1250-1550				All	SCR calibrations
15 319	1500					SCR-A on
16 320	--				9	Considerable surge
16 320	1000-1330				All	SCR calibrations
17 321	0255-0925			6		Power or phone line out
17 321	0800-0810				2	SCR calibrations
17 321	0920-0925				2	SCR calibrations
19 323	0820-0830		1			
19 323	0850-0900		9			
19 323	0910-0915		8			
19 323	0930-0940		7			Unsatisfactory
19 323	0950-0953		6			
19 323	1000-1003		5			
19 323	1330	35		All off		End tape
19 323	1450	36		"All" on		Begin tape (#316114)
21 325	0300			A on		
24 328	1430	36		All off		End tape
24 328	1450	37		"All" on		Begin tape (#316311)
24 328	1900			A off		
25 329	0703				13	Adjusted SCR trace
29 333	1328-1336		1			
29 333	1340-1347		2			Unsatisfactory
29 333	1400-1406		9			
29 333	1419-1425		7			Unsatisfactory
29 333	1429-1433		6			
29 333	1439-1442		5			
29 333	1449-1456		8			
29 333	1540	37		All off		End tape
29 333	1600	38		"All" on		Begin tape (#316303)



Month December 1971

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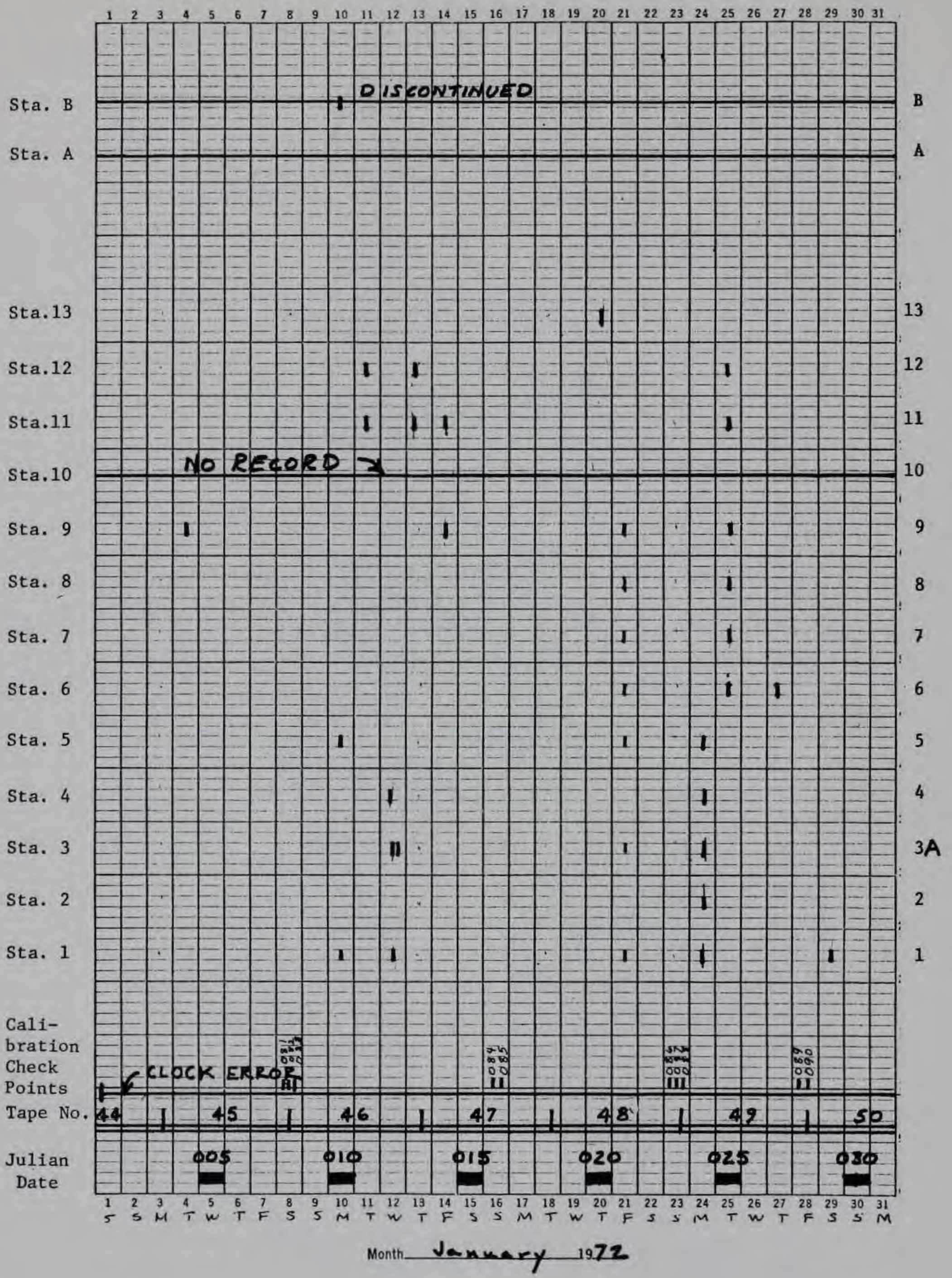
Date	Time	Tape No.	Stations Affected: Calibrate	Off-On	Other	Comments
Dec 1971						
01 335	1030-1040		11			O. K.
01 335	1050-1055		3			No response
01 335	1100-1105		10			No response
01 335	1130-1138		4			O. K.
01 335	2315-2400			2		Unexplained
03 337	0820-0830				1,2	SCR calibrations
04 338	?	38		All off		Tape stopped in night Repaired intervalometer card
04 338	1300	39		"All" on		Begin tape (#317415)
07 341	1059-1106		4			O. K.
07 341	1131-1136		11			Questionable
07 341	1315-1525			2		Unexplained
09 343	1220-1240		10,3			Unsatisfactory
09 343	1520	39		All off		End tape
09 343	1550	40		"All" on		Begin tape (#317416)
10 344	1300-1310		1			Unsatisfactory
10 344	1330-1340		9			Unsatisfactory
10 344	1350-1357		7			Questionable
10 344	1400-1405		6			O. K.
10 344	1410-1416		5			O. K.
10 344	1420-1433		8			Unsatisfactory
10 344	1518-1800			6		Unexplained
12 346	0820				2	SCR calibrations
12 346	0950-1000		1			Improved
13 347	1252-1259		1			O. K.
13 347	1309-1320			All		Tape No. 42 set in error
14 348	1010-1015		3			Unsatisfactory
14 348	1022-1025		11			O. K.
14 348	1030-1035		10			Unsatisfactory
14 348	1107-1115		4			O. K.
14 348	1341-1400		11			O. K.
14 348	1520	40		All off		End tape
14 348	1550	41		"All" on		Begin tape (#317417)
15 349	0530				Staff	Tsunami Alert
15 349	1430-1500				All	SCR calibrations
16 350	1143				13	Adjusted SCR trace
16 350	1230-1244		2			Questionable
16 350	1250-1259		1			O. K.
16 350	1310-1322		9			Unsatisfactory
16 350	1340-1349		8			Unsatisfactory
16 350	1430-1500				All	SCR calibrations
19 353	1610	41		All off		End tape
19 353	1630	42		"All" on		Begin tape (#317418)
22 356	--				1,5,6	Short period surge
22 356	--				2,7,8,9	Long period surge
22 356	1318-1324		1			O. K.
22 356	1330-1339		2			O. K.
22 356	1401-1410		9			O. K.
22 356	1425-1440		7			Unsatisfactory
22 356	1439-1450		6			O. K.
22 356	1500-1507		5			O. K.
22 356	1520-1535		8			O. K.
23 357	1130-1145		11			O. K.
23 357	1140-1235				All	SCR calibrations
23 357	1200-1220		3,10			Unsatisfactory
23 357	1236-1244		4			O. K.
23 357	1345-1754			5		Power failure
24 358	1520	42		All off		End tape; no file gap at end
24 358	1610	43		"All" on		Begin tape (#317419)
25 359	0640-0650				4	Unexplained oscillations
25 359	1005-1040				4	Unexplained oscillations
27 361	0755-0800				13	Adjusted SCR trace
27 361	0955-1225			10		Erratic signal after 1225
27 361	1143-1240			3	3	Testing; radio noise (to 364)
27 361	--				Several	Heavy swells
28 363	0200			10 off		Removed transducer #1008 on 014
29 363	1247-1256		1			O. K.
29 363	1316-1320		9			O. K.
29 363	1345-1350		7			Unsatisfactory
29 363	1350-1401		6			O. K.
29 363	1411-1413		5			O. K.
29 363	1438-1445		8			O. K.
29 363	1430	43		All off		End tape
29 363	1510	44		"All" on		Begin tape (#317414)
30 364	1005-1015			3		Repair to end noise
30 364	1049-1055		3			Unsatisfactory
30 364	119-1124		4			O. K.
30 364	1259-1305		11			O. K.
30 364	235959				All	Time skipped to 001 00 00 00
31 365	0900-0920			All		Reset to correct time



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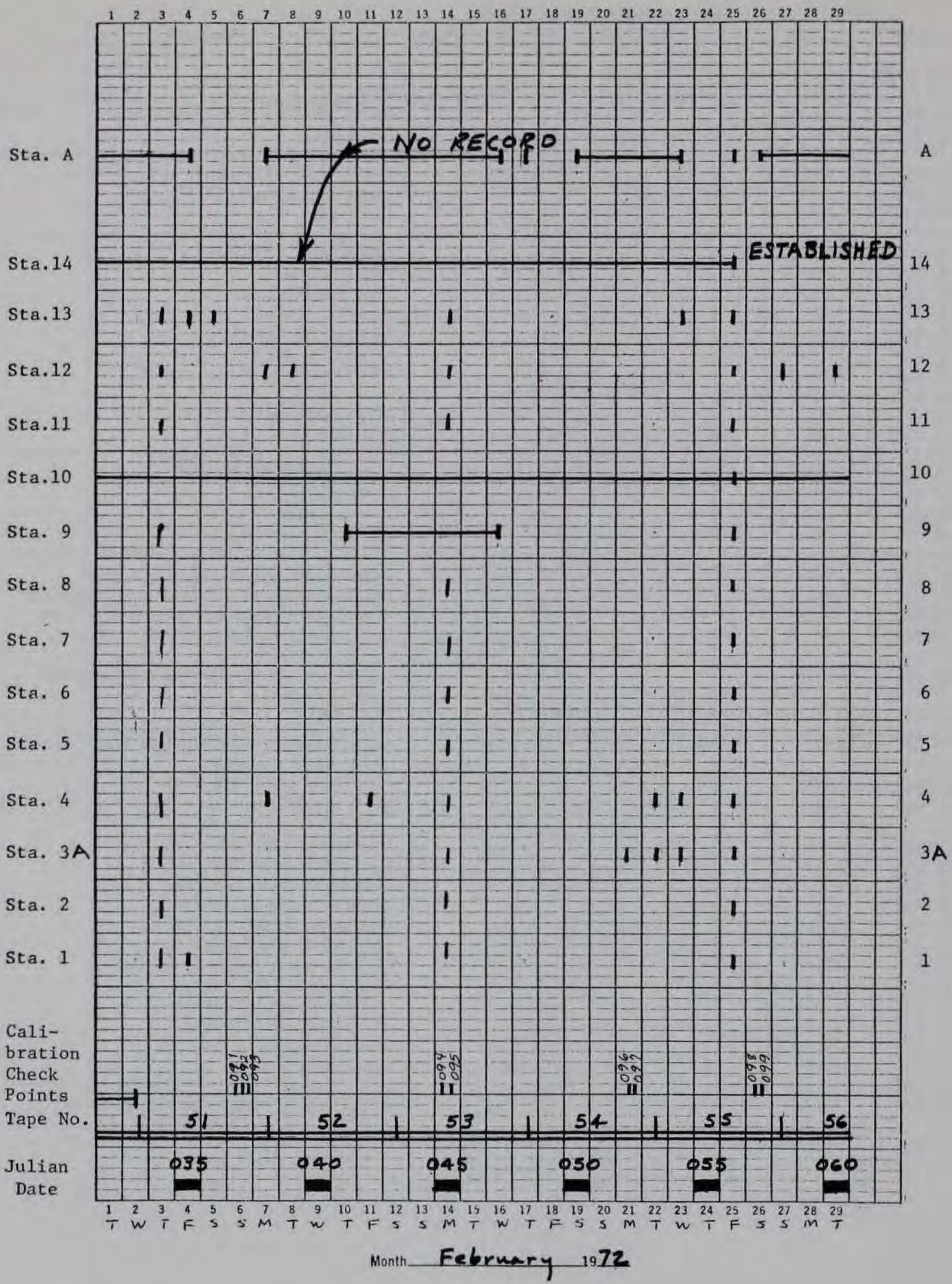
Date	Time	Tape No.	Stations Affected: Calibrate	Off-On	Other	Comments
Jan 1972						
01 001	--	|			All	Clock year on 1971 until 033
03 003	1530	44		All off		End tape
03 003	1550	45		"All" on		Begin tape (#317406)
04 004	2210	|			9	Began irregular trace
08 008	1100	45		All off		End tape
08 008	1120	46		"All" on		Begin tape (#317405)
10 010	1140	|		B off		Discontinued
10 010	1000-2400	|			1,5	Some oscillation
11 011	1235-1305	|			11,12	Erratic trace
12 012	0940-0944	|	1			Cleaned by diver
12 012	1000-1350	|		3-3A		Relocated to 3A
12 012	1210-1215	|		4		Affected by work on sta 3
12 012	1330-1333	|	4			
13 013	1310-1420	|		11,12		Corrected weak signal
13 013	1526	46		All off		End tape
13 013	1550	47		"All" on		Begin tape (#317404)
14 014	1025-1035	|	11			No response
14 014	1105-1115	|	9			No response
18 018	1530	47		All off		End tape
18 018	1550	48		"All" on		Begin tape (#317403)
19 019	0815	|				SCR chart speed changed to 2.5 mm/min
20 020	0942-1110	|		13		Transducer #1013 off, #1008 on
21 021	--	|			1,3A,5,6, 7,8,9	Surging, high waves at 3A
22 022	0930	|				SCR chart speed changed to 5 mm/min to end of tape
23 023	1600	48		All off		End tape
23 023	1630	49		"All" on		Begin tape (#316328); SCR chart speed set at 2.5 mm/min
24 024	0848	|				Oscillograph A off line
24 024	0900	|				1-3, 5-9 SCR-B; chart speed set at 5 mm/min
24 024	1440-1444	|		1		Equipment modification
24 024	1450-1453	|		2		Equipment modification
24 024	1500-1506	|		3A,4		Equipment modification
24 024	1510-1518	|		5		Equipment modification
25 025	0940-0942	|		6		Equipment modification
25 025	0950-0952	|		7		Equipment modification
25 025	0952	|			6,7	Interchanged channels on SCR-B
25 025	1020-1022	|		8		Equipment modification
25 025	1030-1032	|		9		Equipment modification
25 025	1110-1141	|		11,12		Equipment modification
27 027	1010-1110	|			6	90-sec oscillations
28 028	1500	49		All off		End tape
28 028	1520	50		"All" on		Begin tape (#316327); SCR-B chart speed set at 5 mm/min
29 029	0910-0950	|		1		O. K.



Month February 1972

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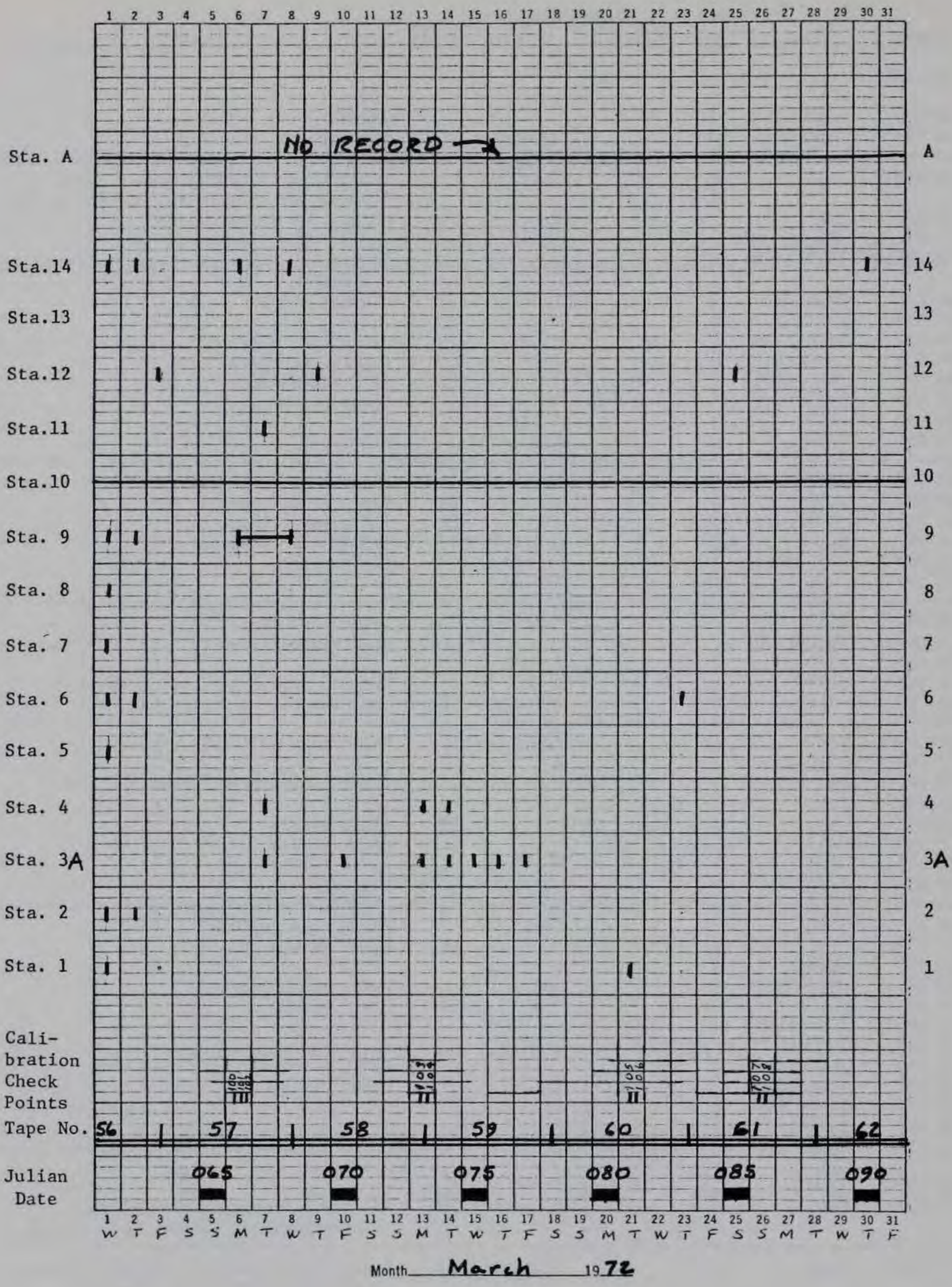
Date	Time	Tape No.	Stations Affected: Calibrate	Off-On	Other	Comments
Feb 1972						
02 033	1320-1350	|				Install oscillograph A
02 033	1550	50		All off		End tape (no file gap)
02 033	1610	51		"All" on		Begin tape (#316326); SCR-B chart speed set at 5 mm/min to 0813 on 034
02 033	1610	|			All	Clock year corrected to 1972
03 034	0813	|		13 off		
03 034	0813-1048	|			All	Correcting SCR-A; both SCR's set at 1 mm/min
04 035	0850-0930	|		1		Circuit check
04 035	1120	|		A on		
04 035	1310-1550	|		13 on		Transducer #1008 off, #1013 on
04 035	1420-1454	|		1		Electrical check
05 036	0800-0803	|			13	SCR calibrations
07 038	0425-0705	|		4		Unexplained
07 038	1200	|		A off		
07 038	1520	51		All off		End tape
07 038	1540	52		"All" on		Begin tape (#316329)
07 038	2200	|			12	Begin erratic trace
08 039	1900	|			12	End erratic trace
10 041	1428	|		9 off		Transducer floating
11 042	0455-0615	|		4		Unexplained
12 043	1400	52		All off		End tape
12 043	1420	53		"All" on		Begin tape (#316325)
14 045	0830-1100	|			All	SCR calibrations
16 047	1310	|		A on		
16 047	1540	|		9 on		Erratic trace; loose on bracket
17 048	1540	53		All off		End tape
17 048	1550	54		"All" on		Begin tape (#316125)
17 048	1720-0300	|		A		
18 049	0625	|			12	Begin intermittent erratic trace
19 050	1240	|		A off		
21 052	--	|			3A	Heavy swells
22 053	--	|			3A	Heavy swells
22 053	0945-1005	|		3A, 4		Power supply work
22 053	1520	54		All off		End tape
22 053	1540	55		"All" on		Begin tape (#316123)
22 053		|			3A	Heavy swells
23 054	0005	|		A on		
23 054	0910-1230	|		3A, 4		Power supply work
23 054		|			3A	Heavy swells
23 054	1010-1140	|	13			
25 056	1000-1020	|	13			
25 056	1020-1340	|			5	Erratic trace; phone line work
25 056	1024-1030	|		All		Power failure
25 056	1120-1150	|	1			
25 056	1350-1420	|	8			
25 056	1525	|		14 on		Installed transducer #1014 on sta B channel
26 057	1800	|		A off		
27 058	0900	55		All off	12*	End tape; *several intermittent irregularities through this record
27 058	1100	56		"All" on		Begin tape (#316324); revised channels (see introduction to this log)
29 060	1400-1500	|		12		Cleaned insulator and cables; ended erratic trace



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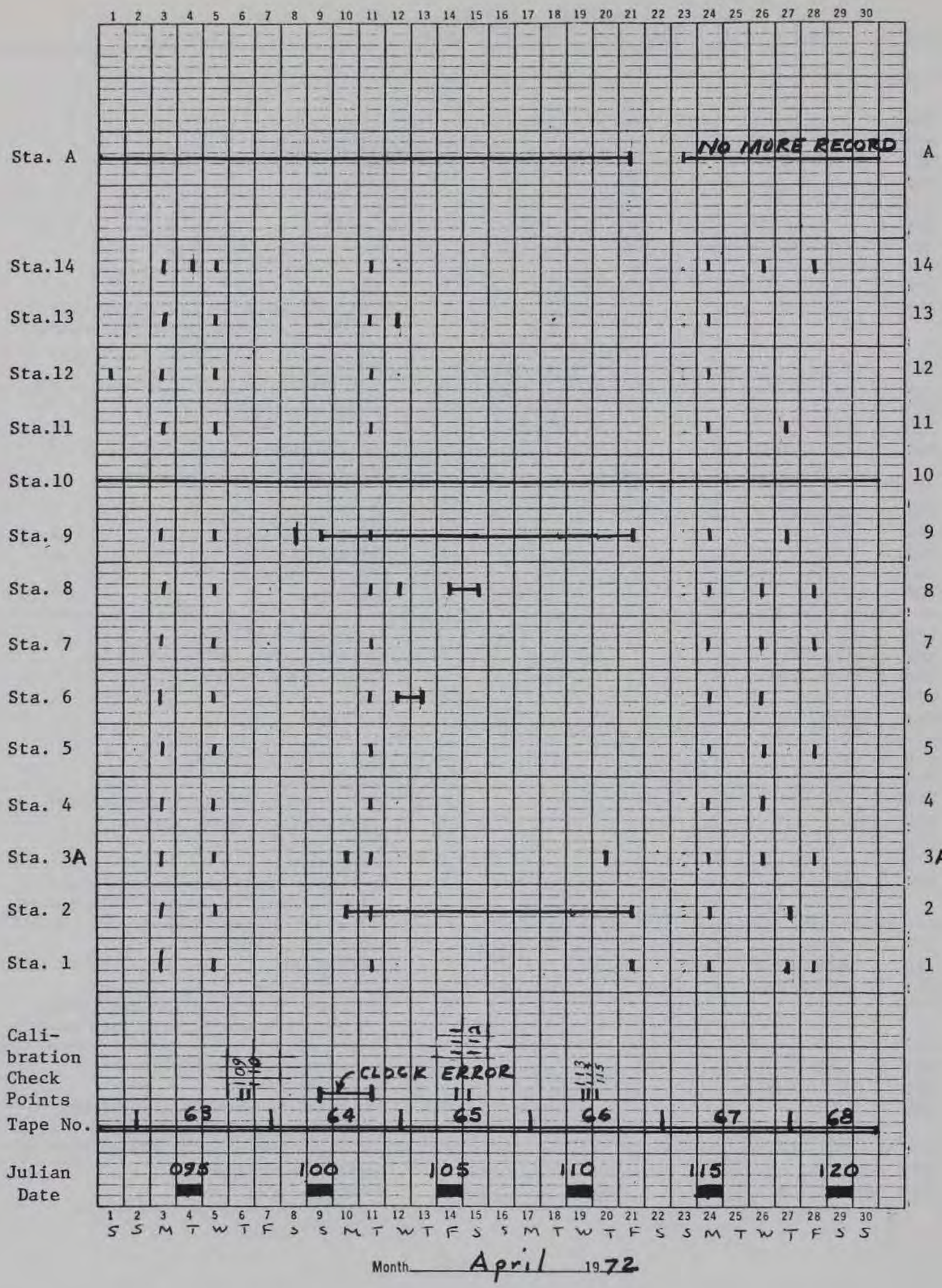
Date	Time	Tape No.	Stations Affected: Calibrate	Off-On	Other	Comments
Mar 1972						
01 061	1040-1100		14			
01 061	1110-1132		5			Unsatisfactory
01 061	1140-1200		7			Unsatisfactory
01 061	1250-1326		6			
01 061	1340-1357		8			
01 061	1410-1452		9			
01 061	1510-1525		1			
01 061	1530-1544		2			
02 062	1320-1350		2,6,9,14			
03 063	0940-1020			12		Equipment modification (corrected for mid-record reading on tape channel 15)
03 063	1400	56		All off		End tape
03 063	1440	57		"All" on		Begin tape (#317537)
06 066	1355			9 off		Phone line break
06 066	1350-1405			14		Unexplained
07 067	1040-1113		4			Questionable
07 067	1121-1128		3A			
07 067	1220-1235		11			
08 068	0915				14	SCR calibration
08 068	1015				9	SCR calibration
08 068	1020				A	SCR calibration
08 068	1410	57		All off		End tape
08 068	1430	58		"All" on		Begin tape (#317545)
08 068	1455			9 on		Erratic trace; replaced stylus
09 069	0925-1100			12		Circuit malfunction
10 070	--				3A	Heavy swell
13 073	1500	58		All off		End tape
13 073	1520	59		"All" on		Begin tape (#317536)
13 073	--				3A, 4	Heavy swell
14 074	--				3A, 4	Heavy swell; 3A may be overranged
15 075	--				3A	Heavy swell; 15-sec waves
16 076	--				3A	Heavy swell
17 077	--				3A	Heavy swell
18 078	1000	59		All off	9*	End tape; *continued intermittent irregularities through this record
18 078	1020	60		"All" on		Begin tape (#316321)
21 081	0940-1440			1		Unexplained
23 083	0845-1530				6	Erratic trace
23 083	1540	60		All off	9*	End tape; *continued intermittent irregularities through this record
23 083	1600	61		"All" on		Begin tape (#316248)
25 085	2120-0005			12		Unexplained
28 088	1530	61		All off	9*	End tape; *continued intermittent irregularities through this record
28 088	1540	62		"All" on		Begin tape (#317582)
30 090	1050-1250			14		Power line cut



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Date	Time	Tape No.	Stations Affected: Calibrate	Off-On	Other	Comments
Apr 1972						
01 092	0920	1			12	Begin erratic trace
02 093	1100	62		All of	9*	End tape; *continued intermittent irregularities through this record
02 093	1120	63		"All" on		Begin tape (#317585)
03 094	0920-1210	|			All	SCR calibrations
04 095	0550-0835	|		14		Power off
05 096	1200-0600	|			All	Surging
07 098	1510	63		All off	9,12*	End tape; *continued intermittent irregularities through this record
07 098	1530	64		"All" on		Begin tape (#317553)
08 099	1225-1715	|		9		Unexplained
09 100	0000	|			All	Clock day at 200
09 100	1020-1030	|			All	Clock day corrected to 100
09 100	1020	|		9 off		Removed transducer #1017 on 103
09 100	1038	|			All	Clock day changed to 200
10 101	0955	|		2 off		Transducer floating
10 101	1120-1235	|		3A		Checking sta 2
11 102	0300-2400	|			All	Some surging
11 102	0820	|			All	Clock day corrected to 102
12 103	0950	|			13	SCR calibration
12 103	0950-1045	|			2	SCR calibration
12 103	0955-1135	|			10	SCR calibration
12 103	1200-1206	|		13		Checking sta 2 transducer
12 103	1500	64		All off	9,12*	End tape; *continued intermittent irregularities through this record
12 103	1520	65		"All" on		Begin tape (#317556)
12 103	1810	|		6 off		Power failure
13 104	0850	|		6 on		
14 105	2240	|		8 off		Power failure
15 106	1000	|		8 on		
17 108	1530	65		All off	12*	End tape
17 108	1540	66		"All" on		Begin tape (#317592)
20 111	1108-1120	|	3A			Questionable
21 112	1005	|		2 on		Reinstalled transducer #1011
21 112	1225	|		9 on		Reinstalled transducer #1017
21 112	1310	|		A on		Unidirectional record after 1520
21 112	1330-1353	|	1			Questionable
22 113	1620	66		All off		End tape
22 113	1640	67		"All" on		Begin tape (#317542)
23 114	0200	|		A off		
23 114	1200-1800	|		12		Erratic trace
24 115	1000-1520	|			All	SCR calibrations
26 117	1040-1045	|	7			Purge line inoperative
26 117	1049-1055	|	6			Questionable
26 117	1100-1115	|	5			Reasonable
26 117	1120-1125	|	14			Reasonable
26 117	1146-1156	|	8			Reasonable
26 117	1340-1351	|	3A			Reasonable
26 117	1352-1406	|	4			Reasonable
27 118	0920-0926	|	2			Reasonable
27 118	0940-1000	|	1			Unsatisfactory
27 118	1120-1136	|	9			Unsatisfactory
27 118	1250-1314	|	11			Unsatisfactory
27 118	1530	67		All off		End tape
27 118	1550	68		"All" on		Begin tape (#317555)
28 119	--	|			1,3A, 5,7, 8,14	Some surging; heavy swells at 3A

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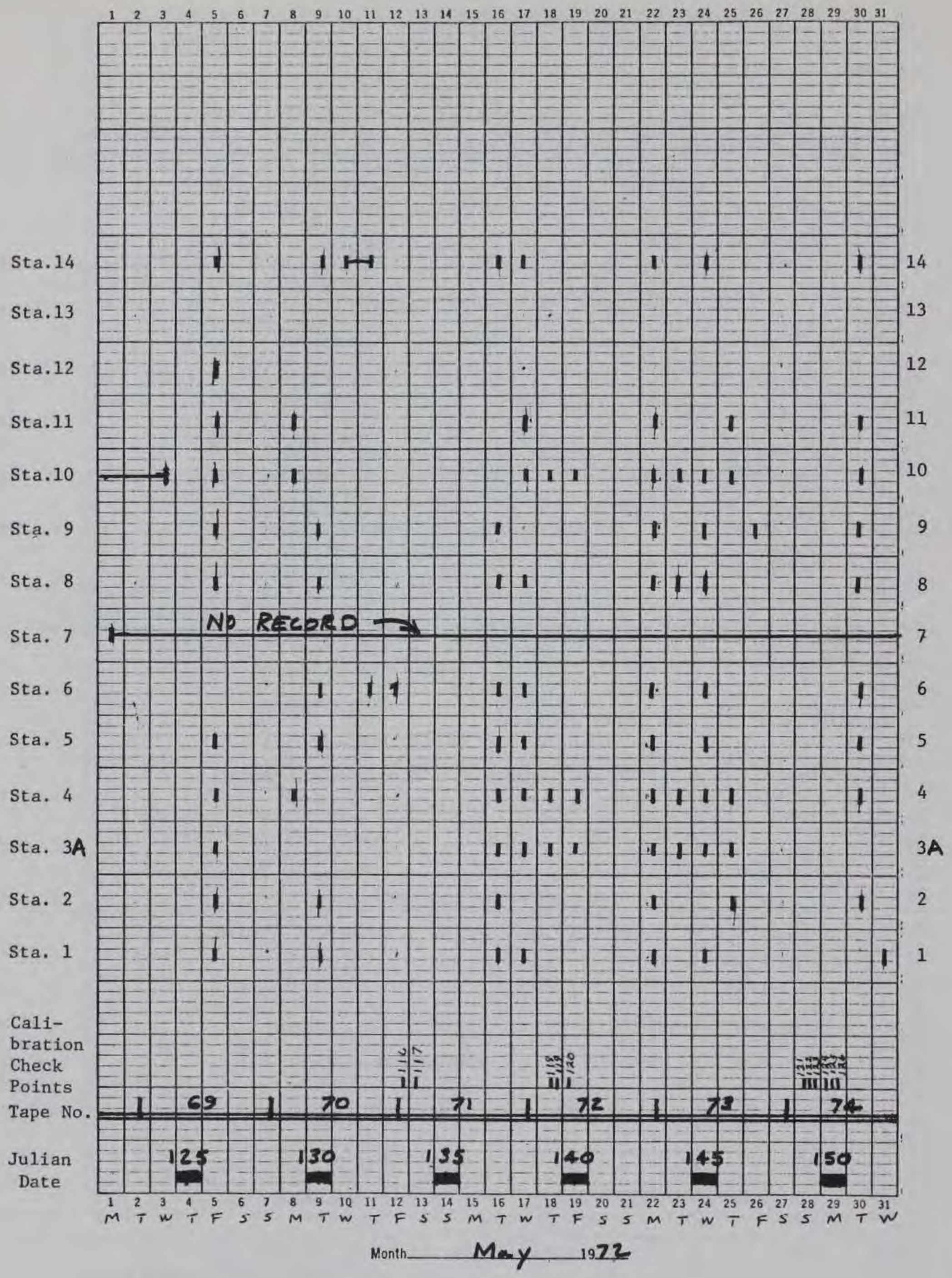

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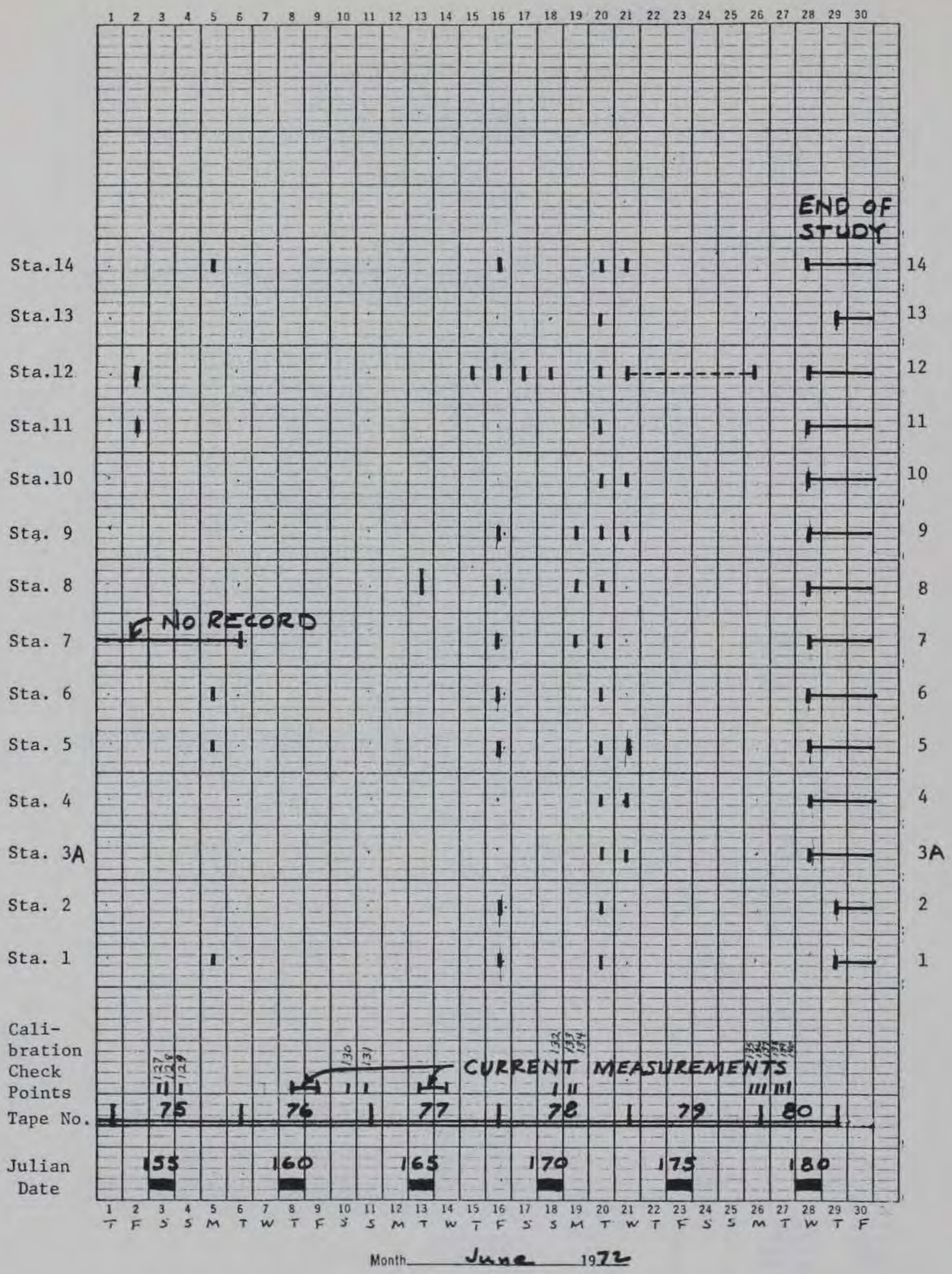
Date	Time	Tape No.	Stations Affected: Calibrate	Off-On	Other	Comments
May 1972						
01 122	1240	1		7 off		Removed transducer #1016 on 124
02 123	1430	68		All off	12*	End tape; *continued intermittent irregularities through this record
02 123	1520	69		"All" on		Begin tape (#317787) No lead header
03 124	1450			10 on		Installed transducer #1008
05 126	0810-0830			11,12		Power failure
05 126	0850-0855		3A			Check valve inoperative
05 126	0900-0915		4			
05 126	0940-0955		10			
05 126	1020-1040		11			Check valve inoperative
05 126	1230-1255		1			Unsatisfactory
05 126	1300-1305		2			
05 126	1322-1325		9			Unsatisfactory
05 126	1407-1420		8			
05 126	1429-1435		14			
05 126	1439-1450		5			
07 128	1650	69		All off	12*	End tape; *continued intermittent irregularities through this record
07 128	1700	70		"All" on		Begin tape (#317913)
08 129	1020-1028		10			
08 129	1130-1134		4			
08 129	1410-1420		11			Unsatisfactory
09 130	0810-0817		1			Unsatisfactory
09 130	0840-0843		2			
09 130	0920-0942		9			Unsatisfactory
09 103	1000-1006		8			
09 130	1120-1125		6			Could not purge
09 130	1130-1138		5			
09 130	1150-1223		14			
10 131	1200			14 off		Phone line cut
11 132	0701			14 on		
11 132	1020-1030		6			Could not purge
12 133	0900-1000			6		Cable work
12 133	1430	70		All off	12*	End tape; *continued intermittent irregularities through this record
12 133	1450	71		"All" on		Begin tape (#317781)
16 137	1158-1205		9			Unsatisfactory
16 137	1228-1234		8			
16 137	1250-1255		6			Unsatisfactory
16 137	1300-1306		5			
16 137	1309-1311		14			
16 137	1340-1345		1			
16 137	1400-1407		2			
16 137	--				3A,4	Heavy swells
17 138	0930-0935		10			
17 138	0950-1000		11			Unsatisfactory
17 138	1020-1030		4			
17 138	1030-1035		3A			Could not purge
17 138	--				3A,4	Heavy swells
17 138	--				1,5,6 8,14	Low level surging
17 138	1430	71		All off	12*	End tape; *continued intermittent irregularities through this record
17 138	1510	72		"All" on		Begin tape (#317782)
18 139	--				3A,4,10	Heavy swells
19 140	--				3A,4,10	Heavy swells
22 143	0730-0735		2			
22 143	0750-0755		1			Unsatisfactory
22 143	0810-0815		11			Unsatisfactory
22 143	0830-0835		10			
22 143	0900-0908		4			
22 143	0910-0915		3A			Could not purge
22 143	1020-1023		5			
22 143	1040-1042		14			
22 143	1100-1105		6			Could not purge
22 143	1130-1134		8			
22 143	1240-1245		9			Unsatisfactory
22 143	1430	72		All off	12*	End tape; *continued intermittent irregularities through this record
22 143	1440	73		"All" on		Begin tape (#317912)
23 144	0520-1400			8		Power failure
23 144	--				3A,4,10	Heavy swells
24 145	1130-1135		1			Unsatisfactory
24 145	1210-1215		9			Could not purge
24 145	1240-1244		8			
24 145	1300-1305		6			Could not purge
24 145	1320-1327		5			
24 145	1335-1339		14			
24 145	--				3A,4,10	Heavy swells
25 146	0950-0959		2			
25 146	1010-1018		10			
25 146	1030-1035		11			Could not purge
25 146	1120-1125		4			Could not purge
25 146	--				3A,4,10	Heavy swells
26 147	0230-1420				9	Erratic trace
27 148	1740	73		All off	12*	End tape; *continued intermittent irregularities through the record
27 148	1800	74		"All" on		Begin tape (#317786)
30 151	0900-0902		2			
30 151	0910-0923		11			Unsatisfactory
30 151	0940-0950		10			Unsatisfactory
30 151	1020-1025		4			Unsatisfactory
30 151	1050-1059		14			
30 151	1200-1205		6			Could not purge
30 151	1400-1405		9			Could not purge
30 151	1420-1423		8			
30 151	1450-1455		5			SCR trace shift after calibration
31 152	0910-0915		1			Could not purge



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Date	Time	Tape No.	Stations Affected: Calibrate	Off-On	Other	Comments
Jun 1972						
01 153	1430	74		All off	9,12*	End tape; *continued intermittent irregularities through this record
01 153	1440	75		"All" on		Begin tape (#317909)
02 154	0925-0940	|		11,12		Power off
05 157	1500-1700	|			1,5, 6,14	Some surging
06 158	0920	|		7 on		Installed transducer #1016
06 158	1430	75		All off	9,12*	End tape; *continued intermittent irregularities through this record
06 158	1500	76		"All" on		Start tape (#317785)
08 160	0800	|				Begin current measurements (WES)
09 161	1230	|				End current measurements
11 163	0900	76		All off		End tape
11 163	0920	77		"All" on		Start tape (#317784)
13 165	0705-1255	|		8		Unexplained
13 165	0715	|				Begin current drogue study
14 166	0845	|				End drogue study (Hancock Fdn.)
16 168	0750-0755	|	1			Purge unsatisfactory
16 168	0800-0805	|	2			
16 168	0830-0835	|	9			Purge unsatisfactory
16 168	0850-0853	|	8			
16 168	0910-0916	|	7			Unsatisfactory
16 168	0920-0925	|	6			Purge unsatisfactory
16 168	0930-0938	|	5			
16 168	0950-0953	|	14			
16 168	1030	77		All off	9,12*	End tape; *continued intermittent irregularities through this record
16 168	1230	78		"All" on		Start tape (#317783)
17 169	--	|			12	Intermittent irregularities
18 170	--	|			12	Intermittent irregularities
19 171	0000-1200	|			7,8,9	Surging, 1-hr period
20 172	0600-2400	|			All	Moderate waves and surging
21 173	0830-0913	|		5		Electronics check
21 173	--	|			3A,4, 10	Heavy swells
21 173	--	|			5,9, 14	Surge activity
21 173	1430	78		All off	9,12*	End tape; *continued intermittent irregularities through this record
21 173	1450	79		"All" on		Begin tape (#317858)
26 178	1430	|		All off	9,12*	End tape; *continued intermittent irregularities through this record
26 178	1450	80		"All" on		Begin tape (#317798)
28 180	0815	|		8 off		End of study
28 180	0900	|		3A,4,5, 7 off		End of study
28 180	1015	|		6 off		End of study
28 180	1020	|		10 off		End of study
28 180	1045	|		11,12 off		End of study
28 180	1155	|		14 off		End of study
28 180	1312	|		9 off		End of study
29 181	1133	|		1,2 off		End of study
29 181	1300	|		13 off		End of study
29 181	1300	80		All off	9,12*	End tape; *continued intermittent irregularities through this record

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APPENDIX F: WAVE MEASUREMENTS WITH SUBMERGED PRESSURE SENSORS

Inclosure 1: Excerpts from CERC Technical Memorandum No. 30, December 1969

Excerpts from
CERC WAVE GAGES by Leo C. Williams
(CERC Technical Memorandum No. 30, December 1969)

Section V. PRESSURE-SENSITIVE GAGE

1. Theory of Operation of Pressure-Sensitive Gage

The pressure-sensitive wave gage operates on the principle that when a wave crest passes a given point there will be an increase in water depth, and with an increase in the height of the water column there will be an increase in the pressure at the bottom of the column.

While a wave crest is not exactly equivalent to closed water column, the change in water level related to a wave crest or trough will cause a pressure change at the ocean bottom. If a pressure-sensitive device is placed near the ocean bottom, it will sense the pressure change caused by the wave.

The signal from the pressure-sensitive device may be carried to a shore location over an electrical cable, and recorded on a paper-strip chart or magnetic tape recorder. Since the signal at the recorder is produced by the wave crest and trough, it is directly related to the wave.

The pressure change produced by a wave train of constant amplitude and constant period will decrease as the pressure sensor is placed deeper and deeper in the water. If the wave period is made shorter, the pressure from the same wave height will also be reduced at a constant water depth. Ratios for conditions of pressure, depth, wave height and wave period have been established, and may be used to correct the recordings from a pressure-sensitive wave gage to provide a usable measurement of wave conditions.

Ripples and small sharp surface changes will be filtered out of the wave record due to the pressure-period attenuation outlined above. This filtering will influence the wave spectra analysis so that there will be apparent differences when comparing spectra data taken at the same time and location with both pressure and staff gages.

The change in tide at locations where pressure wave gages are used must be known. The increased water depth due to tide is, in effect, an increase in water depth, which must be used in correcting the wave record.

For these reasons a pressure-sensitive gage is not an ideal device for gathering true data on waves. This gage is recommended only for those locations where the installation of a step-resistant staff-type gage is impracticable due to the cost of a mounting structure or where a mounting structure would cause a navigational hazard.

2. Pressure-Sensitive Gages

Due to the depth-period attenuation present when wave recordings are taken using a pressure sensor placed near the ocean bottom, the recordings will require a correction factor to obtain a true wave-height reading.

To obtain the true wave-height data (significant height and significant period), use the following procedure:

a) Determine the significant height and period outlined in the method for step-resistance gages.

b) Using the significant period, refer to Figure 63 and find the line representing this wave period.

c) Determine the water depth at the time the recording was taken.

d) Intersect the water depth and wave period on the period curve.

e) Read the K (response) factor below the point of intersection.

f) Divide the significant height (found in a) above) by the K factor to obtain a corrected wave height.

The curves apply only to a wave gage mounted on the ocean bottom. If the gage is mounted near the surface, additional curves will be required. Data for preparing these curves (K factor) are available on page D2 and Tables D-1 and D-2 of CERC Technical Report No. 4, "Shore Protection. Planning and Design," 3rd Edition, 1966.

(See also page C3 and Tables C-1 and C-2 of SHORE PROTECTION MANUAL, Vol. 3, U. S. Army Coastal Engineering Research Center, 1973.)

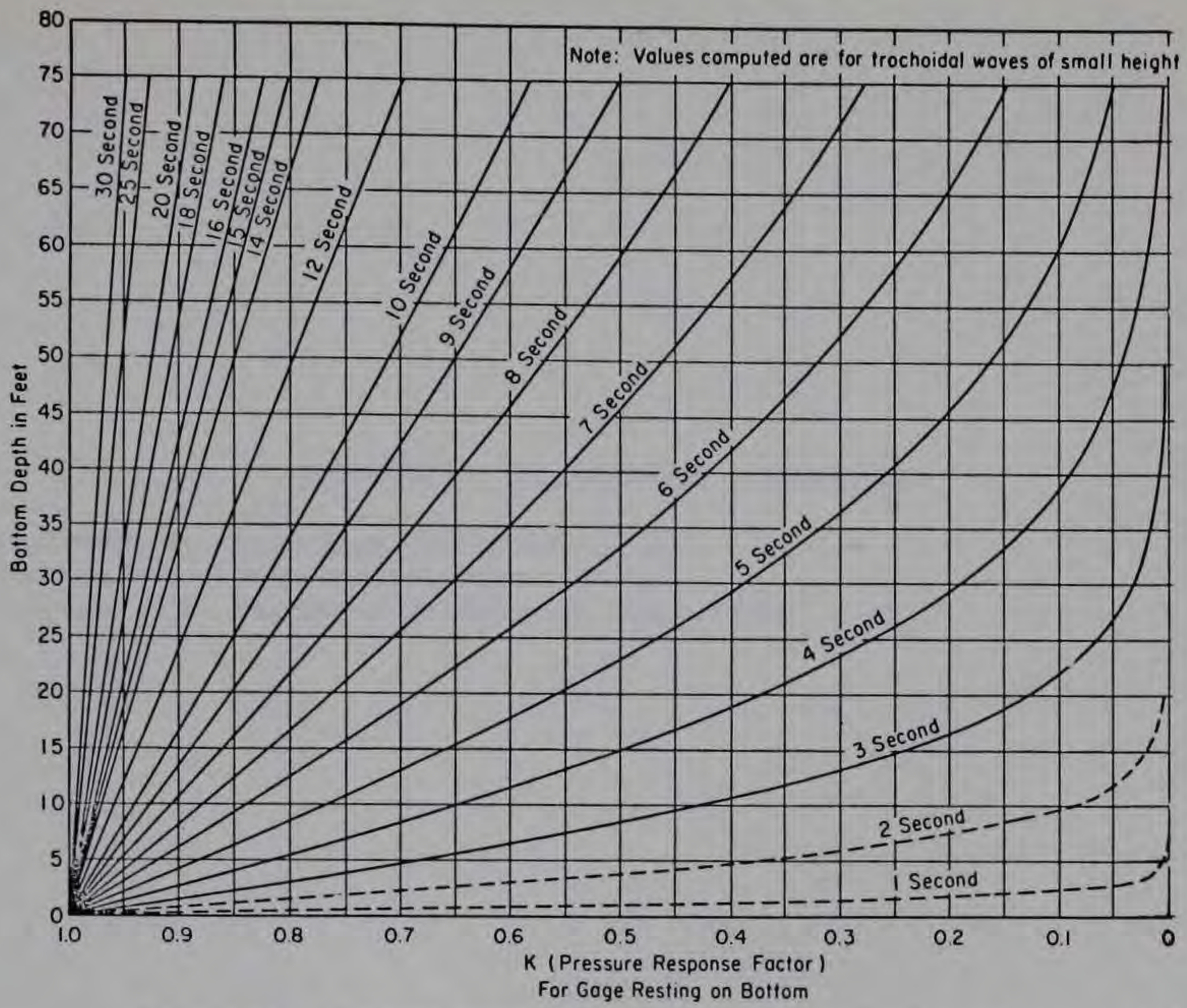


Figure 63. Pressure response curves for various depths and wave periods.

Incl 1 (Sheet 3 of 3)

APPENDIX G: SUBMERGENCE CALIBRATIONS

Inclosure 1: Tide Gage Checkpoint Data
Inclosure 2: Mean-Digital-Count Values
Inclosure 3: Barometer Calibration Comparisons

Note: Barometer data include +0.02 in. Hg correction noted in introduction to Appendix H.

Tide Gage Checkpoint Data

Line No.	ID No.	Rank	Tape No.	Julian Yr	Julian Day	Hr	Min	Barometer in. Hg	Tide Table LA	Observed Tide Gage Reading, ft* LA	LB-P	LB-J
00001	60	98	3	71	150	15	30	0.00	3.9	3.9	0.0	0.0
00002	70	63	3	71	150	20	36	0.00	2.8	2.8	0.0	0.0
00003	80	99	3	71	151	1	42	0.00	3.9	3.8	0.0	0.0
00004	90	87	5	71	160	10	24	29.93	3.4	3.5	3.4	3.5
00005	100	45	5	71	160	14	30	29.92	2.4	2.3	2.3	2.3
00006	110	125	5	71	160	20	48	29.92	6.2	6.3	6.2	6.2
00007	120	12	5	71	161	4	24	29.89	-1.0	-1.0	-1.0	-1.0
00008	130	91	5	71	161	11	6	29.92	3.5	3.5	3.4	3.5
00009	140	50	5	71	161	15	12	29.92	2.5	2.3	2.4	2.4
00010	150	111	6	71	165	14	24	0.00	4.3	4.5	4.3	4.3
00011	160	46	6	71	165	19	48	0.00	2.4	2.4	2.3	2.4
00012	170	108	6	71	166	1	12	0.00	4.2	4.5	4.4	4.4
00013	180	134	8	71	172	19	36	0.00	6.7	6.8	6.7	6.7
00014	190	5	8	71	173	3	6	0.00	-1.4	-1.4	-1.4	-1.4
00015	200	36	9	71	181	22	24	0.00	1.9	1.9	1.8	2.0
00016	210	68	9	71	182	3	42	0.00	2.9	3.0	2.8	3.0
00017	220	37	9	71	182	8	54	0.00	1.9	2.1	1.9	2.0
00018	230	28	11	71	195	21	6	29.84	1.4	1.4	1.4	0.0
00019	260	82	11	71	196	2	42	29.80	3.3	3.7	3.4	0.0
00020	270	32	11	71	196	8	6	29.87	1.6	1.8	1.6	0.0
00021	280	133	13	71	201	19	30	29.86	6.6	6.8	6.6	6.7
00022	290	10	13	71	202	2	54	29.86	-1.1	-.8	-1.1	-1.0
00023	300	38	14	71	210	21	24	29.94	1.9	2.0	1.8	1.9
00024	310	58	14	71	211	3	0	29.91	2.7	2.8	2.5	2.7
00025	320	47	14	71	211	7	0	29.94	2.4	2.5	2.2	2.3
00026	330	74	14	71	213	7	18	29.86	3.1	0.0	3.0	3.2
00027	340	71	14	71	213	9	24	29.86	3.0	3.2	2.9	3.0
00028	370	78	16	71	226	5	24	29.86	3.2	3.3	3.1	3.2
00029	380	69	17	71	226	8	42	29.95	2.9	2.9	2.8	2.9
00030	390	127	17	71	230	19	30	29.86	6.3	6.5	6.1	6.3
00031	400	19	17	71	231	2	30	29.86	-.6	-.5	-.6	-.5
00032	410	88	20	71	242	7	18	29.87	3.4	3.5	3.2	3.4
00033	420	83	20	71	242	9	24	29.80	3.3	3.0	3.1	0.0
00034	430	131	21	71	246	19	36	29.78	6.5	6.7	6.6	6.7
00035	440	16	21	71	247	2	24	29.82	-.7	-.8	-.8	-.7
00036	450	79	22	71	254	3	48	29.80	3.2	3.4	3.3	0.0
00037	460	72	22	71	254	6	48	29.80	3.0	3.0	3.1	0.0
00038	470	119	23	71	258	18	36	29.75	5.7	5.9	5.8	6.1
00039	480	23	23	71	259	1	30	29.81	-.1	0.1	0.1	0.3
00040	490	26	24	71	267	18	18	29.86	1.2	0.7	0.8	1.0
00041	500	73	24	71	268	0	36	29.87	3.0	2.9	2.8	3.2
00042	510	59	24	71	268	3	54	29.86	2.7	2.4	2.4	2.7
00043	520	96	25	71	271	6	30	29.87	3.7	3.4	3.3	3.7
00044	530	89	25	71	271	9	36	29.91	3.4	3.1	3.1	3.4
00045	540	116	25	71	271	15	36	29.84	4.8	4.7	4.6	4.9
00046	550	135	26	71	278	9	0	29.57	6.7	7.0	6.8	7.1
00047	560	17	27	71	278	15	42	29.89	-.7	-.5	-.7	-.5
00048	570	100	28	71	284	5	18	29.85	3.9	4.3	4.0	4.4
00049	580	84	28	71	284	9	18	29.87	3.3	3.6	3.4	3.7
00050	590	117	28	71	284	15	6	29.77	4.9	5.2	4.9	5.3

(Continued)

* A zero value in any of the last four columns means that no reading is available at that location at the required time. The LA "observed" readings have been adjusted to a gage zero at mllw.

Tide Gage Checkpoint Data (Continued)

Line No.	ID No.	Rank	Tape No.	Julian Yr.	Julian Day	Hr	Min	Barometer in. Hg	Tide Table LA	Observed Tide Gage Reading, ft LA	LB-P	LB-J
00051	610	24	30	71	293	15	42	29.94	0.1	0.1	0.1	0.2
00052	620	101	31	71	300	5	12	29.95	3.9	3.8	3.7	4.1
00053	630	85	31	71	300	9	36	29.95	3.3	3.2	3.0	3.3
00054	640	114	31	71	300	14	54	29.88	4.5	4.6	4.4	4.7
00055	650	139	32	71	307	8	30	30.12	7.1	6.9	6.9	7.1
00056	660	6	32	71	307	15	36	30.02	-1.4	-1.6	-1.6	-1.4
00057	670	113	34	71	314	5	0	30.11	4.4	4.4	4.2	4.5
00058	680	60	34	71	314	10	30	30.13	2.7	2.4	2.3	2.5
00059	690	109	34	71	314	15	48	30.05	4.2	4.1	3.9	4.2
00060	700	123	35	71	322	8	18	30.08	6.1	6.0	5.8	6.1
00061	710	21	35	71	322	15	36	29.98	-.4	-.6	-.7	-.4
00062	720	110	37	71	329	3	48	30.06	4.2	4.1	3.8	4.2
00063	730	64	37	71	329	9	6	30.16	2.8	2.3	2.2	2.6
00064	740	105	37	71	329	14	18	30.12	4.1	4.0	3.7	4.1
00065	750	140	38	71	335	7	30	30.01	7.1	7.5	6.8	7.2
00066	760	3	38	71	335	14	42	30.02	-1.6	-1.6	-1.8	-1.5
00067	770	106	39	71	342	2	54	30.06	4.1	3.9	3.6	0.0
00068	780	70	39	71	342	8	0	30.13	2.9	2.3	2.1	0.0
00069	790	107	39	71	342	13	12	30.13	4.1	3.6	3.3	0.0
00070	800	93	41	71	351	22	6	30.08	3.6	3.6	3.2	3.6
00071	810	51	41	71	352	2	18	30.01	2.5	2.4	2.1	2.5
00072	820	128	41	71	352	8	36	30.04	6.3	6.3	6.0	6.4
00073	830	13	41	71	352	16	6	30.03	-.9	-1.1	-1.3	-1.0
00074	840	94	41	71	352	22	48	30.09	3.6	3.5	3.2	3.6
00075	850	52	41	71	353	2	54	30.10	2.5	2.2	1.9	2.3
00076	860	29	43	71	359	10	6	30.02	1.4	1.7	0.0	0.0
00077	870	80	43	71	359	15	42	29.92	3.2	3.7	0.0	0.0
00078	880	30	43	71	359	21	12	29.95	1.5	1.6	0.0	0.0
00079	890	137	44	72	365	8	0	30.03	6.9	7.2	6.8	0.0
00080	900	4	44	72	365	15	24	29.97	-1.6	-1.5	-1.8	0.0
00081	910	34	45	72	8	10	9	30.12	1.8	1.8	0.0	0.0
00082	920	61	46	72	8	15	28	30.05	2.7	2.6	0.0	0.0
00083	930	39	46	72	8	20	13	30.10	2.0	1.8	0.0	0.0
00084	940	129	47	72	16	8	27	30.06	6.4	6.5	6.3	0.0
00085	950	9	47	72	16	15	42	29.98	-1.2	-1.3	-1.4	0.0
00086	960	25	48	72	23	9	50	30.11	0.9	0.9	0.0	0.0
00087	970	65	48	72	23	15	55	30.02	2.8	2.6	0.0	0.0
00088	980	40	49	72	23	20	14	30.01	2.1	2.0	0.0	0.0
00089	990	132	49	72	28	7	17	30.23	6.5	6.3	6.0	0.0
00090	1000	7	49	72	28	14	32	30.10	-1.4	-1.5	-1.8	0.0
00091	1010	33	51	72	37	8	56	30.23	1.7	1.5	0.0	0.0
00092	1020	48	51	72	37	14	21	30.19	2.4	2.3	0.0	0.0
00093	1030	41	51	72	37	18	6	30.17	2.2	1.9	0.0	0.0
00094	1040	126	53	72	45	8	21	29.99	6.2	6.5	0.0	0.0
00095	1050	11	53	72	45	15	9	30.00	-1.1	-1.1	0.0	0.0
00096	1060	62	54	72	52	16	43	30.09	2.7	2.7	0.0	0.0
00097	1070	53	54	72	52	19	41	30.13	2.5	2.5	0.0	0.0
00098	1080	122	55	72	57	7	11	30.03	5.9	5.9	0.0	0.0
00099	1090	14	55	72	57	14	10	30.01	-.9	-1.1	0.0	0.0
00100	1100	27	57	72	66	7	43	30.05	1.2	1.2	0.0	0.0

(Continued)

Tide Gage Checkpoint Data (Concluded)

Line No.	ID No.	Rank	Tape No.	Julian Yr.	Julian Day	Hr	Min	Barometer in. Hg	Tide Table LA	Observed Tide Gage Reading, ft* LA	LB-P	LB-J
00101	1110	42	57	72	66	14	15	30.02	2.3	2.3	0.0	0.0
00102	1120	43	57	72	66	16	21	30.02	2.3	2.2	0.0	0.0
00103	1130	120	58	72	73	7	24	30.04	5.7	5.9	0.0	0.0
00104	1140	18	58	72	73	14	0	30.01	-.7	-.9	0.0	0.0
00105	1150	75	60	72	81	16	46	29.92	3.1	3.4	0.0	0.0
00106	1160	66	60	72	81	20	3	29.94	2.8	2.9	0.0	0.0
00107	1170	118	61	72	86	7	2	29.86	5.1	5.4	0.0	0.0
00108	1180	22	61	72	86	13	33	29.87	-.3	-.1	0.0	0.0
00109	1190	81	63	72	97	18	10	30.00	3.2	3.3	0.0	0.0
00110	1200	76	63	72	97	20	54	30.02	3.1	3.0	0.0	0.0
00111	1220	130	65	72	105	21	11	30.02	6.4	6.5	0.0	0.0
00112	1230	8	65	72	106	4	10	30.04	-1.4	-1.4	0.0	0.0
00113	1240	92	66	72	110	16	6	30.02	3.5	3.2	0.0	0.0
00114	1250	67	66	72	110	20	20	30.08	2.6	2.5	0.0	0.0
00115	1260	115	66	72	111	2	16	30.10	4.5	4.3	0.0	0.0
00116	1320	136	71	72	133	20	5	29.92	6.8	6.9	0.0	0.0
00117	1330	1	71	72	134	3	16	29.91	-1.8	-1.9	0.0	0.0
00118	1340	102	72	72	139	15	13	29.78	3.9	4.1	0.0	0.0
00119	1350	56	72	72	139	20	4	29.75	2.6	2.7	0.0	0.0
00120	1360	112	72	72	140	1	39	29.76	4.3	4.6	0.0	0.0
00121	1370	90	74	72	149	10	9	29.90	3.4	3.4	0.0	0.0
00122	1380	44	74	72	149	14	18	29.84	2.3	2.2	0.0	0.0
00123	1390	121	74	72	149	20	41	29.83	5.8	5.9	0.0	0.0
00124	1400	20	74	72	150	4	12	29.84	-.6	-.8	0.0	0.0
00125	1410	86	74	72	150	10	52	29.90	3.3	3.4	0.0	0.0
00126	1420	49	74	72	150	14	51	29.79	2.4	2.4	0.0	0.0
00127	1430	104	75	72	155	14	54	29.87	4.0	0.0	0.0	0.0
00128	1440	57	75	72	155	20	7	29.85	2.6	0.0	0.0	0.0
00129	1450	103	75	72	156	1	28	29.88	3.9	0.0	0.0	0.0
00130	1460	138	76	72	162	19	49	29.90	7.0	0.0	0.0	0.0
00131	1470	2	76	72	163	3	11	29.86	-1.8	0.0	0.0	0.0
00132	1480	35	78	72	170	22	23	29.86	1.8	0.0	0.0	0.0
00133	1490	77	78	72	171	3	46	29.80	3.1	0.0	0.0	0.0
00134	1500	31	78	72	171	9	22	0.00	1.5	0.0	0.0	0.0
00135	1510	95	79	72	178	9	58	0.00	3.6	0.0	0.0	0.0
00136	1520	54	79	72	178	14	11	0.00	2.5	0.0	0.0	0.0
00137	1530	124	80	72	178	20	29	0.00	6.1	0.0	0.0	0.0
00138	1540	15	80	72	179	3	56	0.00	-.8	0.0	0.0	0.0
00139	1550	97	80	72	179	10	33	0.00	3.7	0.0	0.0	0.0
00140	1560	55	80	72	179	14	46	0.00	2.5	0.0	0.0	0.0

Incl 1 (Sheet 3 of 3)

Checkpoint Data Mean-Digital-Count Values

Line No.	ID No.	Time Hr	Time Min	Station* 1	2	3	4	5	6	7	8	9	10	11	12	13	14
00001	60	16	38	3178.8	0.0(1)	0.0	0.0	0.0	0.0	0.0	2883.4	0.0	0.0	0.0	2076.1	2391.0	0.0
00002	70	21	38	3135.8	0.0	0.0	0.0	0.0	0.0	0.0	2846.4	0.0	0.0	0.0	2192.3	2394.0	0.0
00003	80	2	48	3184.8	0.0	0.0	0.0	0.0	0.0	0.0	2893.1	0.0	0.0	0.0	2060.6	2392.8	0.0
00004	90	10	26	3174.9	3289.6	0.0	0.0	3014.2	3070.5	3025.4	2887.1	2969.8	0.0	3147.1	0.0	2391.8	0.0
00005	100	14	36	3096.8	3211.6	0.0	0.0	2938.1	2994.1	2943.2	2804.0	2867.9	0.0	3069.9	0.0	2390.0	0.0
00006	110	20	56	3354.6	3474.0	0.0	0.0	3194.8	3253.0	3201.5	3064.8	3150.7	0.0	3332.1	0.0	2392.0	0.0
00007	120	4	26	2881.9	2992.1	0.0	0.0	2722.9	2779.7	2730.5	2589.8	2660.4	0.0	2850.5	0.0	2381.0	0.0
00008	130	11	6	3177.7	3293.6	0.0	0.0	3017.5	3073.5	3020.9	2883.7	2966.0	0.0	**	2018.8	2391.7	0.0
00009	140	15	16	3098.2	3213.8	0.0	0.0	2940.1	2997.3	2944.8	2805.0	2870.0	0.0	**	2282.7	2389.7	0.0
00010	150	14	30	3220.5	3337.9	0.0	0.0	3059.7	3116.1	3070.6	**	3003.3	0.0	3195.4	**	2380.0	0.0
00011	160	19	50	3094.9	3211.4	0.0	0.0	2935.8	2993.4	2945.2	2802.3	2875.7	0.0	3070.7	**	2381.0	0.0
00012	170	1	20	3229.5	3346.4	0.0	0.0	3068.1	3123.9	3077.2	2937.8	3023.6	0.0	3204.5	**	2381.9	0.0
00013	180	19	40	3387.0	3506.8	0.0	0.0	3217.4	3280.3	3237.8	3094.8	3186.1	0.0	3364.7	1530.1	2386.0	0.0
00014	190	3	10	2856.9	2965.9	0.0	0.0	2689.5	2753.0	2708.6	2563.1	2634.9	0.0	2823.5	2901.3	2386.0	0.0
00015	200	22	25	3077.0	3186.4	0.0	0.0	2904.9	2977.0	2933.1	0.0	2873.9	0.0	3046.5	2316.4	2382.0	0.0
00016	210	3	45	3135.6	3246.9	0.0	0.0	2961.1	3032.1	2986.9	0.0	2928.2	0.0	3105.5	2155.5	2380.2	0.0
00017	220	8	55	3079.5	3189.9	0.0	0.0	2907.7	2979.3	2933.5	0.0	2860.5	0.0	3049.0	2312.4	2384.0	0.0
00018	250	21	10	2996.6	3147.2	2807.1	3112.8	2883.7	2951.8	2890.4	2742.7	2808.3	**	0.0	2378.8	†	0.0
00019	260	2	50	3121.9	3271.5	2927.9	3233.5	3000.8	3069.7	3006.0	2856.3	2935.5	**	0.0	2044.8	†	0.0
00020	270	8	10	†	3161.0	2819.8	3125.7	2894.6	2962.6	2901.6	2752.4	2819.6	**	0.0	2354.8	†	0.0
00021	280	19	30	†	3490.4	3146.2	0.0	3283.5	3307.4	3233.3	3083.6	3136.9	**	0.0	1511.1	†	0.0
00022	290	3	0	†	2982.3	2642.5	0.0	2789.0	2806.0	2732.5	2583.6	2621.6	2771.2	0.0	2798.6	†	0.0
00023	300	21	30	†	0.0	2833.3	3138.5	0.0	0.0	0.0	2775.2	0.0	2865.8	0.0	2321.7	2334.4	0.0
00024	310	3	0	†	0.0	2880.9	3183.0	0.0	0.0	0.0	2823.0	0.0	2888.5	0.0	2187.9	2333.0	0.0
00025	320	7	0	†	0.0	2867.8	3170.2	0.0	0.0	0.0	2812.8	0.0	2882.9	0.0	2246.2	2335.0	0.0
00026	330	7	20	†	0.0	2911.4	3218.4	0.0	0.0	0.0	2850.9	0.0	2904.4	0.0	2118.3	2329.3	0.0
00027	340	9	30	†	0.0	2906.8	3209.1	0.0	0.0	0.0	2845.4	0.0	2901.9	0.0	2116.5	2327.3	0.0
00028	370	5	29	3250.0	0.0	3009.5	3315.1	0.0	3156.8	0.0	2962.9	0.0	0.0	3220.1	2107.4	2333.8	0.0
00029	380	8	50	3230.0	0.0	2991.1	3296.2	0.0	3138.3	0.0	2943.2	0.0	0.0	0.0	1565.1	2335.9	0.0
00030	390	19	30	3452.2	0.0	3209.4	3510.8	3311.0	3358.2	0.0	3160.2	0.0	0.0	3418.9	1587.6	2331.0	0.0
00031	400	2	30	3001.0	0.0	2760.6	3060.8	2859.4	2902.9	0.0	2706.9	0.0	0.0	2965.2	2745.8	2329.7	0.0
00032	410	7	20	3262.4	3373.2	3020.6	3320.4	3121.9	3166.2	0.0	2969.1	3052.4	2948.5	3225.7	2103.9	2334.0	0.0
00033	420	9	30	3257.2	3367.2	3016.8	3316.2	3115.8	3159.7	3114.6	2959.6	3041.8	2945.4	3220.0	2106.0	2335.0	0.0
00034	430	19	40	3471.1	3584.6	3229.8	3531.6	3332.6	3377.0	3330.4	3170.6	3253.5	3050.4	3436.8	1527.6	2326.0	0.0
00035	440	2	30	2995.6	3103.6	2753.9	3053.6	2852.6	2898.5	2847.0	0.0	2788.3	2812.3	2959.9	2757.9	2327.0	0.0
00036	450	3	50	3261.0	3372.4	3016.0	3317.8	3117.2	3164.9	3124.1	2961.7	3050.9	2947.5	3235.9	2068.8	2325.0	0.0
00037	460	6	50	3244.7	3356.2	3004.3	3303.6	3101.8	3148.7	3103.5	2942.0	3021.9	2940.8	0.0	0.0	2326.1	0.0
00038	470	18	40	3410.0	3527.6	3170.3	3473.6	3274.9	3321.4	3275.2	3114.3	3203.5	0.0	0.0	0.0	2323.0	0.0
00039	480	1	30	3045.0	3155.3	2809.8	3103.4	2902.3	2947.4	2902.6	2740.7	2842.8	0.0	0.0	0.0	2326.4	0.0
00040	490	18	20	3097.0	3208.6	2860.8	3160.9	2959.7	3001.7	2955.9	2797.3	2879.7	0.0	3071.9	2513.1	2338.6	0.0

(Continued)

* A zero value in any of the "station" columns indicates that meaningful mean-digital-count data are not available; the transducer or data channel may have been inoperable, or the 10-min mean may include erroneous data (due to, for example, a calibration check infringing into the 10-min interval).

** Erroneous data due to, for example, a calibration check extending into the 10-min interval.

† These data channels were not operating during the period indicated. Values for station 1 are reconstructed from station 3 data; values for station 13 are reconstructed from the analog barometer record.

Checkpoint Data Mean-Digital-Count Values (Continued)

Line No.	ID No.	Time Hr	Time Min	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14
00041	500	0	40	3233.6	3345.4	2993.1	3296.4	3095.7	3139.7	3096.1	2940.7	3011.7	0.0	3208.7	2155.6	2340.4	0.0
00042	510	4	0	3209.7	3320.6	2967.8	3269.0	3066.2	3110.6	3065.0	2909.1	2989.1	0.0	3184.7	2215.3	2340.0	0.0
00043	520	6	30	3264.4	3375.5	3020.9	3324.1	3121.8	3166.9	3119.7	2962.9	3050.2	0.0	3238.8	2070.1	2342.0	0.0
00044	530	9	40	3259.9	3371.4	3020.2	3318.9	**	3262.3	3115.0	2958.1	3047.1	0.0	3234.6	2092.6	2344.0	0.0
00045	540	15	40	3339.5	3453.9	3103.9	3403.8	3203.6	3244.6	3197.6	3040.1	3124.9	0.0	3313.8	1878.3	2337.6	0.0
00046	550	9	0	3498.0	3611.4	3250.4	3554.8	3353.6	3398.5	3352.1	3206.8	3281.7	2965.0	3469.8	1534.3	2347.8	0.0
00047	560	15	50	3001.9	3111.3	2761.4	3063.0	2863.9	2906.5	2862.7	2717.3	2785.1	0.0	2974.0	2800.8	2341.0	0.0
00048	570	5	20	3305.0	0.0	3077.7	3369.6	3165.3	3209.0	3162.4	3016.0	3077.8	2920.7	3272.5	1971.4	2336.8	0.0
00049	580	9	20	3270.4	0.0	3039.6	3330.6	3127.6	3172.3	3126.3	2981.0	3048.6	2901.1	3240.3	2077.3	2338.0	0.0
00050	590	15	10	3363.6	0.0	3135.3	3429.6	3227.7	3271.7	3222.0	3073.8	3138.6	2949.3	3333.9	1836.2	2332.0	0.0
00051	610	15	50	3050.8	0.0	2821.2	3112.5	2910.4	2946.7	2906.3	2761.4	2822.9	2792.8	3020.3	2649.0	2344.0	0.0
00052	620	5	20	3297.1	0.0	3068.8	3358.3	3154.4	3192.7	3152.2	3008.0	3075.5	2914.8	3265.8	1998.6	2337.8	0.0
00053	630	9	40	3254.5	3352.9	3026.1	3314.7	3111.3	3148.2	3105.2	2961.1	3036.5	2893.9	3224.0	2115.1	2337.7	0.0
00054	640	15	0	3337.5	3436.5	3111.4	3397.8	3198.0	3234.6	3193.7	3049.6	3113.3	2936.0	3306.6	1877.5	2332.0	0.0
00055	650	8	30	3509.8	3609.2	3283.4	3566.9	3364.5	3402.2	3362.0	3213.9	3296.0	3021.9	3479.5	1513.2	2350.5	0.0
00056	660	15	40	2947.6	3046.1	2715.4	3003.7	2805.5	2843.5	2805.0	2668.4	2722.1	2740.1	2915.3	2965.1	2343.0	0.0
00057	670	5	0	3340.1	3441.0	3113.7	3396.2	3196.0	3234.6	3194.9	3057.6	3121.4	2938.5	3308.7	1911.4	2350.0	0.0
00058	680	10	30	3216.3	3318.2	2991.7	3278.0	3072.0	3109.9	3068.2	2930.4	2993.2	2879.7	3186.8	2240.8	2351.5	0.0
00059	690	15	50	3317.7	3417.6	3088.7	3375.7	3172.8	3208.3	3177.0	3041.8	3106.8	2926.6	3285.7	1966.2	2345.1	0.0
00060	700	8	20	3444.7	3545.4	3218.9	3504.1	3303.2	3341.8	3304.1	3171.1	3225.5	2991.4	3413.5	1629.4	2346.0	0.0
00061	710	15	40	3011.1	3111.2	2782.4	3072.2	2868.1	2902.3	2863.5	2728.6	2795.1	2776.6	2978.1	2748.4	2341.0	0.0
00062	720	3	50	3314.0	3414.9	3088.4	3374.5	3169.2	3205.0	3168.0	3035.9	3086.4	2927.5	3280.8	1968.0	2350.0	0.0
00063	730	9	10	3216.7	3317.6	2990.9	3280.1	3071.8	3108.8	3068.1	2935.6	2995.5	2879.8	3185.2	2245.1	2352.8	0.0
00064	740	14	20	3310.5	3412.2	3084.0	3370.5	3166.1	3202.1	3166.1	3033.9	3095.8	2925.2	3278.6	1992.8	2349.9	0.0
00065	750	7	30	3513.8	3614.6	3289.0	3572.1	3369.2	3405.3	3364.3	3233.6	3287.9	3026.0	3482.2	1446.7	2342.3	0.0
00066	760	14	50	2940.3	3040.3	2711.3	3006.3	2804.2	2840.1	2797.4	2665.0	2699.0	2742.6	2906.9	2958.7	2342.0	0.0
00067	770	3	0	3300.7	3402.4	3076.6	3360.7	3154.1	3193.2	3153.9	3023.1	3065.6	2921.2	3267.6	1989.1	2349.5	0.0
00068	780	8	0	3208.2	3309.0	2986.0	3271.1	3066.2	3102.7	3064.7	2932.6	2974.6	2878.4	3175.5	2257.1	2355.0	0.0
00069	790	13	20	3288.7	3390.1	3064.2	3349.3	3145.2	3183.2	3145.7	3013.4	3061.4	2916.2	3256.6	2041.4	2355.6	0.0
00070	800	22	10	3282.2	3382.3	3056.8	3341.3	3136.8	3173.5	3140.6	3006.6	3061.7	2911.3	3258.7	2059.0	2345.8	0.0
00071	810	2	20	3202.0	3304.3	2979.0	3265.2	3060.6	3096.2	3059.2	2926.4	2967.1	2874.8	3169.7	2256.1	2341.0	0.0
00072	820	8	40	3459.5	3560.3	3237.0	3520.8	3314.4	3351.9	3313.4	3180.4	3241.1	3001.4	3426.3	1593.1	2344.0	0.0
00073	830	16	10	2980.0	3080.2	2751.6	3039.6	2835.9	2871.3	2833.7	2699.6	2760.4	2762.8	2946.8	2840.4	2342.7	0.0
00074	840	22	50	3280.0	3381.6	3054.8	3338.3	3135.6	3171.7	3134.7	3001.4	3055.0	2910.4	3247.3	2067.4	2347.1	0.0
00075	850	3	0	3198.9	3301.0	2974.4	3257.6	3053.2	3088.3	3053.0	2919.4	2978.0	2872.2	3167.5	2281.2	2347.5	0.0
00076	860	10	10	3157.7	3258.8	2933.1	0.0	3014.4	3049.9	3015.9	2882.7	2921.8	2851.7	3125.4	2387.5	2340.5	0.0
00077	870	15	50	3267.1	3367.4	3041.3	3325.6	3119.9	3157.2	3118.9	2984.6	3035.6	2903.0	3233.9	2073.4	2332.5	0.0
00078	880	21	20	3150.8	3252.3	2925.0	3210.4	3009.2	3044.5	3010.7	2876.7	2913.1	2847.0	3118.8	2385.5	2336.0	0.0
00079	890	8	0	3510.3	3611.5	3289.8	3570.7	3367.3	3403.5	3365.4	3232.4	3269.1	0.0	3477.7	1443.0	2343.5	0.0
00080	900	15	30	2964.3	3062.3	2732.6	3020.4	2816.8	2854.0	2819.7	2685.6	2737.1	0.0	2928.3	2883.5	2344.8	0.0

(Continued)

** Erroneous data due to, for example, a calibration check extending into the 10-min interval.

Checkpoint Data Mean-Digital-Count Values (Continued)

Line No.	ID No.	Time Hr	Time Min	Station* 1	2	3	4	5	6	7	8	9	10	11	12	13	14
00081	910	10	10	3182.6	3284.7	2959.2	3245.6	3037.8	3073.7	3035.5	2902.0	2930.9	0.0	3151.0	2299.5	2347.0	0.0
00082	920	15	30	3228.3	3329.7	3001.4	3286.4	3062.7	3118.5	3084.7	2950.7	2982.6	0.0	3196.3	2165.1	2343.0	0.0
00083	930	20	20	3186.8	3288.1	2961.4	3247.4	3042.2	3078.3	3044.8	2910.8	2914.7	0.0	3155.0	2286.0	2346.9	0.0
00084	940	8	30	3483.0	3583.3	4005.9	3543.0	3338.2	3374.6	3340.6	3206.7	3243.9	0.0	3450.5	1530.7	2345.0	0.0
00085	950	15	50	2972.2	3072.1	3491.9	3033.9	2827.3	2864.6	2827.7	2693.7	2717.2	0.0	2938.9	2852.9	2338.0	0.0
00086	960	9	50	3121.7	3222.7	3641.9	3182.7	2975.2	3092.7	2975.8	2840.7	2902.7	0.0	3089.5	2452.7	1301.0	0.0
00087	970	15	50	3224.7	3325.9	3743.5	3284.7	3081.6	3184.4	3083.5	2949.1	2943.7	0.0	3192.8	2175.3	1297.0	0.0
00088	980	20	20	3186.3	3287.6	3705.3	3246.2	3042.3	3145.6	3043.1	2908.7	2954.1	0.0	3154.6	2273.4	1297.0	0.0
00089	990	7	20	3473.5	3574.1	3996.4	3533.5	3329.4	3427.6	3332.8	3198.5	3224.8	0.0	3436.7	1555.1	1305.1	0.0
00090	1000	14	40	2954.5	3053.1	3473.5	3015.4	2809.8	2911.4	2813.0	2677.7	2705.4	0.0	2916.2	2902.0	1300.0	0.0
00091	1010	9	0	3177.3	3278.5	3698.2	3238.0	3033.6	3133.9	3037.7	2905.7	2931.5	0.0	3141.9	2347.2	2377.1	0.0
00092	1020	14	30	3211.3	3311.4	3732.1	3272.0	3067.2	3165.9	3070.6	2936.6	2984.1	0.0	3175.6	2256.9	2374.0	0.0
00093	1030	18	10	3201.1	3301.3	3720.9	3261.3	3058.8	3157.6	3064.4	2932.1	2955.8	0.0	3165.3	2269.0	2373.0	0.0
00094	1040	8	30	3465.5	3575.9	3997.9	3535.8	3331.6	3428.5	3339.5	3205.5	0.0	0.0	3439.4	1523.1	2359.9	0.0
00095	1050	15	10	2979.2	3077.5	3495.9	3038.0	2833.1	2934.1	2841.5	2707.6	0.0	0.0	2941.7	2811.9	2358.3	0.0
00096	1060	16	50	3227.5	3327.1	3747.0	3288.7	3086.2	3185.3	3097.5	2961.5	2980.4	0.0	3194.0	2187.6	2365.8	0.0
00097	1070	19	50	3224.1	3323.9	3739.8	3283.4	3078.1	3177.9	3089.1	2952.4	2982.5	0.0	3190.9	2200.9	2369.1	0.0
00098	1080	7	20	3435.1	3535.0	3958.6	3497.1	3292.0	3388.4	3313.5	3169.5	3184.5	0.0	3401.2	1625.2	2361.3	0.0
00099	1090	14	10	2987.2	3085.5	3503.8	3045.6	2840.8	2940.8	2860.2	2714.2	2753.4	0.0	2953.2	2795.5	2360.3	0.0
00100	1100	7	50	3117.5	3233.4	3651.5	3193.2	2988.2	3086.4	3021.6	2861.0	2873.8	0.0	3102.3	2415.7	2365.0	3353.6
00101	1110	14	20	3180.4	3300.3	3720.1	3261.3	3057.7	3155.0	3088.8	2928.0	0.0	0.0	3169.4	2240.4	2360.5	3422.9
00102	1120	16	30	3175.6	3296.4	3717.1	3258.5	3051.9	3151.1	3085.7	2924.3	0.0	0.0	3165.8	2248.9	2360.0	3419.7
00103	1130	7	30	3404.4	3534.2	3932.1	3495.0	3291.3	3386.3	3325.3	3161.7	3205.9	0.0	3402.2	1636.4	2363.0	3659.9
00104	1140	14	0	2980.8	3095.9	3493.1	3056.3	2849.8	2950.6	2885.7	2720.2	2763.1	0.0	2962.7	2775.9	2359.4	3214.3
00105	1150	16	50	3228.8	3361.6	3774.0	3320.9	3120.0	3213.6	3157.4	2989.3	2983.1	0.0	3233.9	2070.7	2352.1	3485.7
00106	1160	20	10	3213.8	3345.4	3759.5	3305.1	3102.2	3199.0	3141.3	2972.1	2974.9	0.0	3217.6	2110.7	2355.0	3469.0
00107	1170	7	10	3356.0	3491.7	3906.9	3452.8	3246.7	3343.7	3285.2	3115.6	3127.6	0.0	3363.9	1714.9	2350.0	3615.2
00108	1180	13	40	3015.5	3144.7	3558.8	3103.4	2900.4	2999.1	2937.8	2767.0	2796.8	0.0	3017.3	2616.6	2348.0	3265.9
00109	1190	18	10	3236.2	3365.5	3784.0	3325.9	3126.9	3219.1	3170.3	2995.1	3019.8	0.0	3243.0	2067.9	2357.6	3491.2
00110	1200	21	0	3233.6	3363.4	3780.6	3323.4	3122.1	3215.1	3164.6	2991.0	3012.8	0.0	3240.4	2079.9	2360.0	3487.0
00111	1220	21	20	3462.2	0.0	3984.6	3544.1	3337.8	3430.6	3381.3	3206.2	0.0	0.0	3457.6	1512.6	2359.2	3706.0
00112	1230	4	10	2949.0	0.0	3489.7	3027.4	2822.4	2920.2	2869.0	**	0.0	0.0	2942.5	2843.3	2360.4	3187.8
00113	1240	16	10	3245.9	0.0	3790.2	3332.5	3126.2	3223.0	3171.5	2998.9	0.0	0.0	3244.7	2062.6	2360.0	3493.8
00114	1250	20	20	3216.6	0.0	3756.8	3299.1	3093.9	3190.9	3138.7	2964.0	0.0	0.0	3215.2	2150.0	2364.1	3459.5
00115	1260	2	20	3316.7	0.0	3862.0	3404.4	3195.7	3294.4	3241.9	3069.0	0.0	0.0	3315.2	1885.8	2365.6	3563.9
00116	1320	20	10	3497.4	3505.2	4018.2	3565.6	3353.8	3375.4	0.0	3223.5	3160.4	2054.8	3491.7	1469.8	2351.6	3721.8
00117	1330	3	20	2937.8	2941.8	3453.8	3004.9	2791.8	2833.4	0.0	2660.1	2603.5	1775.3	2931.2	2933.8	2351.0	3156.2
00118	1340	15	20	3302.6	3308.5	3818.3	3354.9	3155.1	3166.3	0.0	3025.6	2973.4	1956.8	3293.3	1934.2	2340.5	3522.3
00119	1350	20	20	3223.7	3231.2	3738.1	3277.6	3075.8	3086.2	0.0	2945.9	2897.6	1919.1	3216.8	2133.8	2340.1	3442.9
00120	1360	1	40	3328.8	3335.7	3848.8	3385.1	3183.1	3190.8	0.0	3053.1	3006.4	1971.7	3321.9	1845.9	2339.0	3551.1

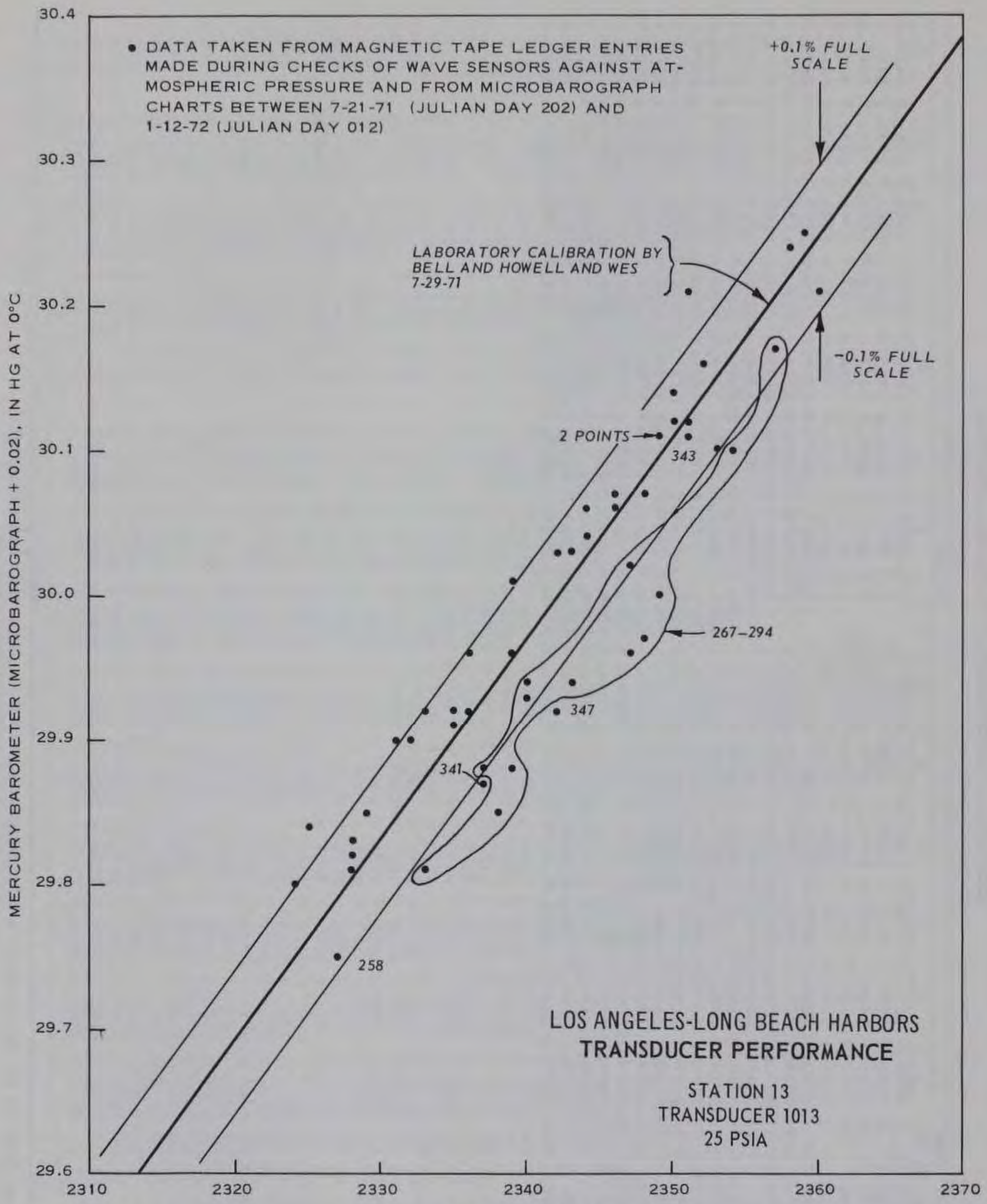
(Continued)

** Erroneous data due to, for example, a calibration check extending into the 10-min interval.

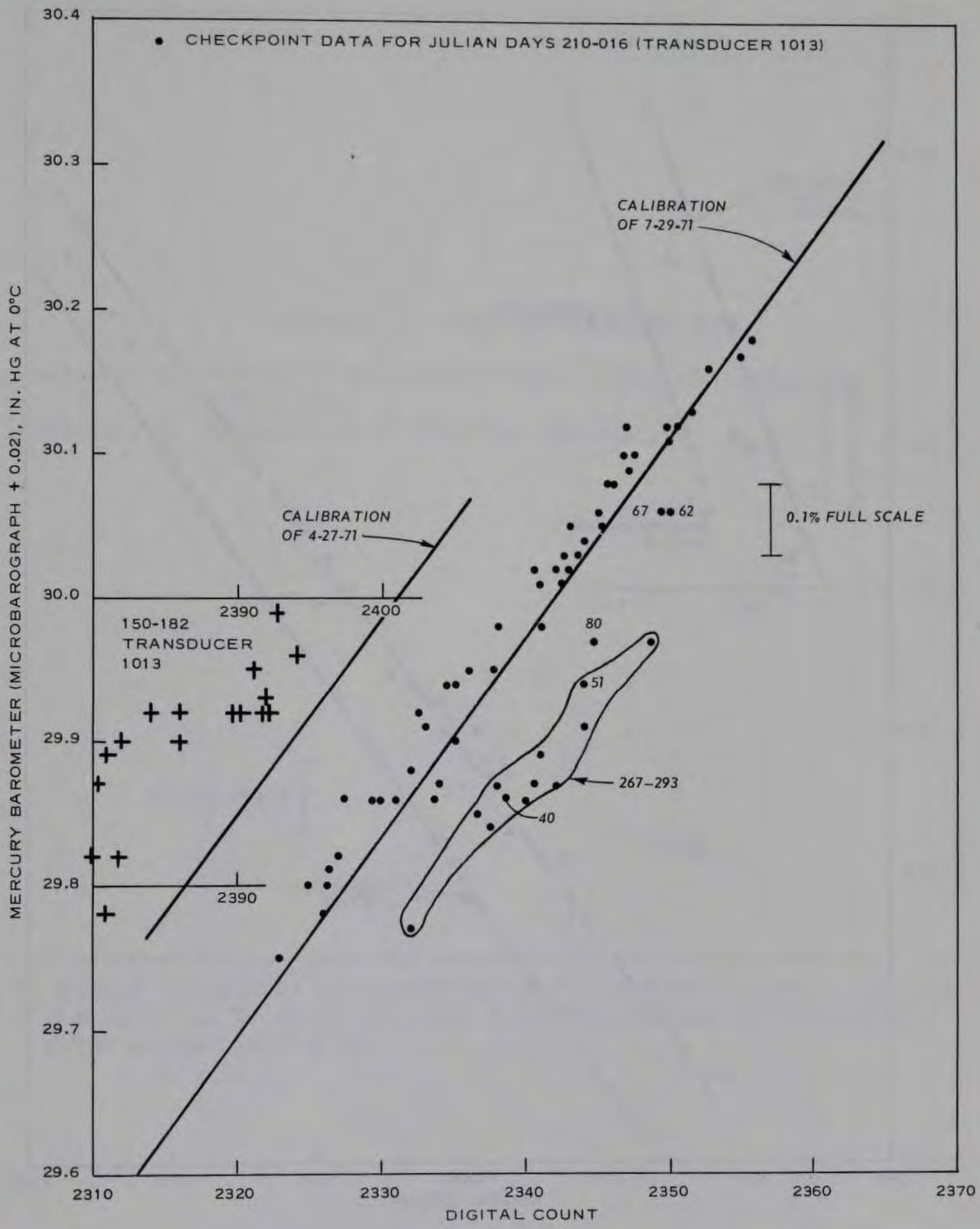
Checkpoint Data Mean-Digital-Count Values (Concluded)

Line No.	ID No.	Time Hr	Time Min	Station 1	2	3	4	5	6	7	8	9	10	11	12	13	14
00121	1370	10	10	3264.7	3270.6	3788.7	3324.0	3118.3	3127.2	0.0	2982.6	2937.7	1940.2	3257.0	2082.3	2351.3	3484.4
00122	1380	14	20	3191.5	3197.0	3715.7	3255.3	3045.7	3053.9	0.0	2907.9	2848.0	1905.8	3183.3	2280.0	2346.3	3411.4
00123	1390	20	50	3419.8	3426.7	3945.5	3480.3	3275.6	3285.3	0.0	3143.0	3088.6	2017.0	3412.9	1670.4	2346.5	3642.2
00124	1400	4	20	2997.9	3002.7	3519.4	3056.4	2850.7	2867.4	0.0	2713.5	2667.8	1806.4	2987.5	2741.3	2346.8	3214.0
00125	1410	11	0	3266.1	3272.4	3786.1	3322.7	3121.5	3128.3	0.0	2985.5	2924.7	1935.4	3257.8	2092.4	2349.0	3487.7
00126	1420	15	0	3202.5	3208.5	3723.4	3261.4	3054.8	3061.9	0.0	2918.1	2877.4	1909.8	3194.5	2257.5	2341.0	3421.0
00127	1430	1	50	3315.3	3320.3	3831.1	3375.7	3171.0	3178.8	0.0	3032.4	2980.8	1964.4	3306.1	1935.3	2346.9	3536.4
00128	1440	20	10	3222.2	3228.5	3742.3	3284.3	3078.3	3085.2	0.0	2940.3	2886.9	1920.3	3215.1	2162.6	2348.0	3442.9
00129	1450	1	30	3318.4	3324.2	3836.5	3378.5	3170.2	3179.2	0.0	3032.7	2990.6	1966.1	3309.7	1915.7	2348.3	3536.6
00130	1460	19	50	3507.0	3512.9	0.0	3571.2	3364.3	3370.9	3262.9	3221.6	3170.2	2061.3	3500.8	1452.5	2351.0	3730.0
00131	1470	3	20	2938.3	2940.5	3451.8	2997.7	2791.1	2804.0	2693.7	2652.6	2599.6	1776.0	2928.8	2898.4	2347.9	3154.6
00132	1480	22	30	3170.3	3175.5	3691.6	3236.2	3029.0	3033.9	2931.5	2887.6	2827.9	1894.1	3162.2	2311.0	2351.0	3395.5
00133	1490	3	50	3259.3	3264.8	3778.0	3322.5	3114.1	3118.1	3014.1	2969.8	2916.2	1937.3	3252.5	2071.2	2351.2	3473.3
00134	1500	9	30	3163.9	3169.8	3680.0	3226.7	3021.0	3025.5	2924.5	2879.7	2829.2	1889.4	3158.6	2386.1	2354.0	3377.8
00135	1510	1	0	3289.6	3295.6	3806.0	3347.3	3142.0	3145.4	3046.9	3001.5	2957.4	1950.5	3275.8	2044.0	2358.0	3508.5
00136	1520	14	20	3207.2	3213.6	3705.5	3267.7	3062.0	3063.5	2964.3	2917.8	2881.0	1909.3	3195.4	2271.9	2354.0	3427.9
00137	1530	20	30	3446.9	3455.7	3969.4	**	3303.4	3306.7	3208.8	3162.0	3111.8	2030.6	3435.8	1600.5	2355.0	3674.3
00138	1540	0	40	2992.8	2998.2	3513.8	3055.6	2847.8	2854.8	2748.1	2702.2	2643.2	1804.9	2978.2	2783.4	2357.0	3212.9
00139	1550	10	40	3278.4	3285.9	3799.4	3342.3	3135.0	3136.7	3036.0	2989.7	2940.7	1946.1	3266.5	2072.9	2357.5	3502.8
00140	1560	14	50	3197.3	3204.0	3715.9	3259.9	3051.7	3052.5	2956.2	2909.0	2875.9	1907.0	3186.7	2298.3	2353.1	3419.3

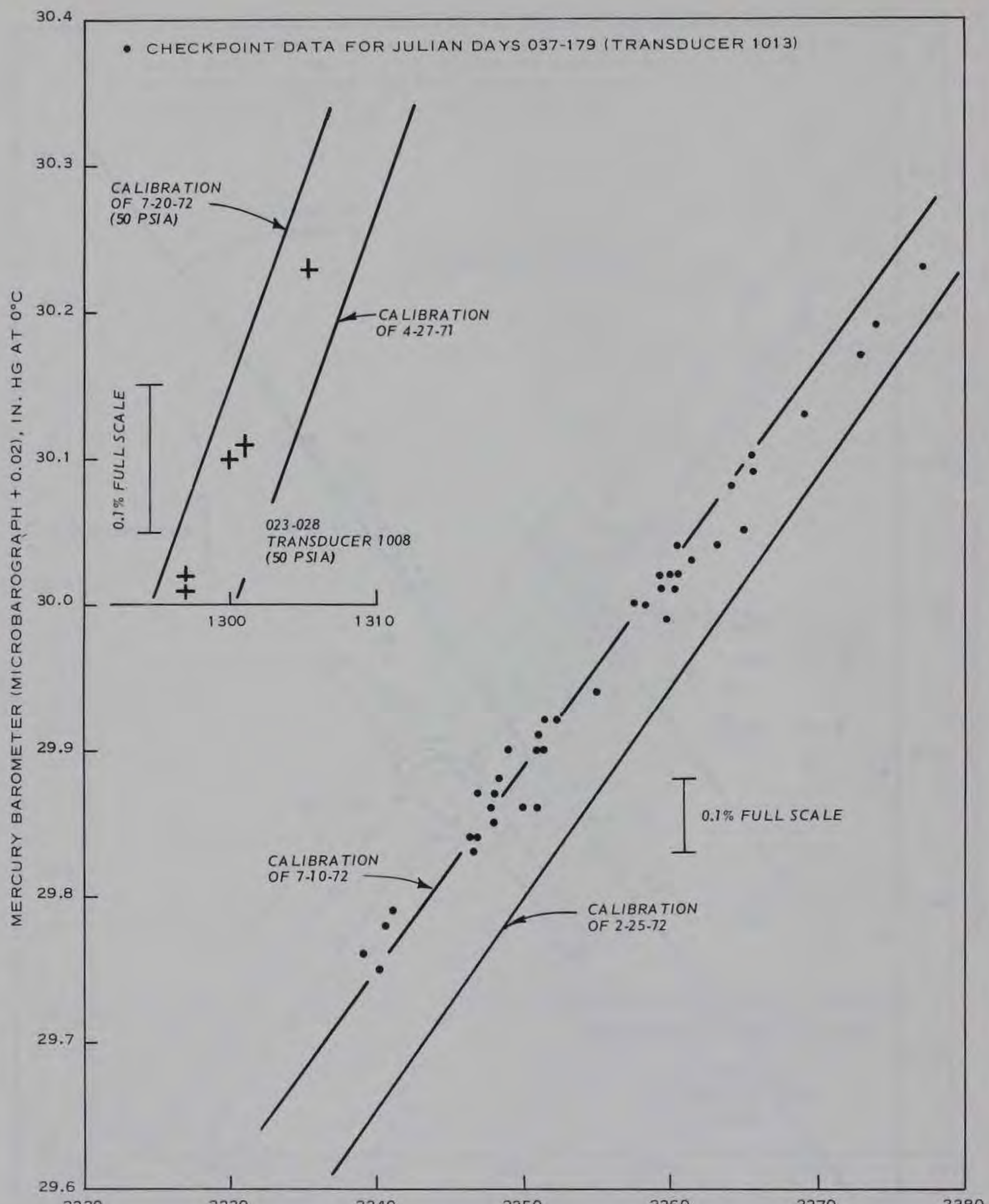
** Erroneous data due to, for example, a calibration check extending into the 10-min interval.



Incl 3 (Sheet 1 of 3)



Incl 3 (Sheet 2 of 3)



Incl 3 (Sheet 3 of 3)

APPENDIX H: TIDE AND BAROMETER DATA

Inclosure 1: Predicted and Observed Tide Levels and Barometric Pressures*

Inclosure 2: Correlation of Tide Gage Records

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* Weekly comparisons of microbarograph and mercury barometer indicate that 0.02 in. Hg should be added to microbarograph chart readings given in this tabulation.

Predicted and Observed Tide Levels and Barometric Pressures
High and Low Waters, May 1971-June 1972

1971 May Day*	Time PST	Tide Table LA	Observed Tide LA	LB-J	LB-P	Barometer in.Hg
1	0112	4.4	8.1			
SA	0912	0.1	3.8			
121	1648	3.6	7.4			
	2130	2.8	6.6			
2	0248	4.0	7.8			
SU	1012	0.2	4.0			
122	1730	3.9	7.8			
	2248	2.4	6.2			
3	0412	3.9	7.7			
M	1100	0.4	4.0			
123	1754	4.2	7.9			
	2342	1.8	5.4			
4	0518	3.8	7.4			
TU	1142	0.6	4.1			
124	1818	4.5	8.2			
5	0024	1.3	5.0			
W	0612	3.8	7.5			
125	1212	0.8	4.5			
	1836	4.8	8.8			
6	0100	0.8	4.7			
TH	0654	3.8	7.8			
126	1236	1.0	4.9			
	1854	5.0	9.0			
7	0136	0.3	4.1			
F	0736	3.8	7.6			
127	1300	1.3	5.0			
	1918	5.3	9.1			
8	0212	-0.1	3.7			
SA	0818	3.7	6.9			
128	1324	1.5	5.2			
	1942	5.5	9.2			
9	0236	-0.4	3.3			
SU	0854	3.6	7.4			
129	1348	1.7	5.3			
	2006	5.7	9.4			
10	0312	-0.6	3.1			
M	0936	3.5	7.3			
130	1418	1.9	5.7			
	2030	5.7	9.7			
11	0348	-0.7	3.0			
TU	1018	3.3	6.5			
131	1442	2.1	5.8			
	2100	5.7	9.8			
12	0430	-0.7	2.9			
W	1112	3.2	7.1			
132	1512	2.3	5.9			
	2136	5.6	9.6			
13	0518	-0.6	3.0			
TH	1212	3.1	7.0			
133	1542	2.6	6.1			
	2218	5.5	9.3			
14	0606	-0.5	3.3			
F	1324	3.1	7.0			
134	1630	2.8	6.3			
	2306	5.2	9.0			
15	0706	-0.3	3.4			
SA	1436	3.3	6.4			
135	1800	3.0	6.5			
16	0012	4.8	8.7			
SU	0800	-0.2	3.5			
136	1536	3.6	7.3			
	1954	2.9	6.6			
17	0136	4.4	8.3			
M	0900	0.0	3.7			
137	1612	4.1	7.3			
	2142	2.3	6.1			
18	0306	4.1	8.0			
TU	0954	0.2	3.8			
138	1648	4.6	8.2			
	2254	1.5	5.3			
19	0430	3.9	7.8			
W	1042	0.4	4.0			
139	1724	5.2	9.0			
	2354	0.6	4.5			
20	0548	3.9	7.8			
TH	1130	0.7	4.3			
140	1800	5.7	9.7			
21	0048	-0.2	3.9			
F	0648	3.9	7.9			
141	1212	1.0	4.8			
	1836	6.2	10.2			
22	0136	-0.9	3.1			
SA	0748	3.9	7.8			
142	1254	1.3	5.2			
	1912	6.5	10.3			
23	0218	-1.4	2.5			
SU	0842	3.9	7.7			
143	1330	1.6	5.5			
	1948	6.7	10.4			
24	0306	-1.6	2.2			
M	0936	3.8	7.5			
144	1412	1.9	5.7			
	2030	6.6	10.5			
25	0354	-1.6	2.2			
TU	1030	3.7	7.6			
145	1454	2.1	6.1			
	2112	6.4	10.3			
26	0442	-1.4	2.5			
W	1130	3.5	7.4			
146	1536	2.4	6.1			
	2200	6.0	9.9			
27	0530	-1.0	2.6			
TH	1230	3.5	7.2			
147	1630	2.6	6.1			
	2242	5.5	9.2			
28	0624	-0.6	3.0			
F	1330	3.5	7.2			30.03
148	1730	2.8	6.3			29.97
	2330	5.0	8.7			29.98
29	0712	-0.2	3.5			29.94
SA	1430	3.6	7.4			29.92
149	1854	2.9	6.6			29.89
30	0030	4.4	8.2			29.90
SU	0806	0.2	4.1			29.90
150	1530**	3.9	7.6			29.93
	2036**	2.8	6.4			29.94
31	0142**	3.9	7.5			29.97
M	0854	0.6	4.2			30.00
151	1612	4.1	7.7			30.00
	2200	2.4	5.9			30.00

(Continued)

* Day identification: 1 - day of month; SA - day of week; 121 - Julian date.
** Calibration checkpoint.

1971 Jun Day	Time PST	Tide Table LA	Observed Tide LA	Observed Tide LB-J	Observed Tide LB-P	Barometer in.Hg
1	0306	3.5	7.1	3.2	3.2	30 00
TU	0942	0.9	4.5	0.8	0.8	30.00
152	1642	4.4	7.9	4.2	4.1	29.96
	2312	1.8	5.4	1.7	1.7	29.94
2	0430	3.2	6.9	3.2	3.1	29.89
W	1024	1.3	4.9	1.2	1.1	29.93
153	1712	4.7	8.2	4.5	4.5	29.92
3	0000	1.2	4.9	1.2	1.2	29.98
TH	0542	3.2	6.8	3.1	3.0	29.98
154	1100	1.6	5.1	1.6	1.4	30.06
	1742	5.0	7.6	4.7	4.7	30.04
4	0042	0.7	-	0.6	0.5	30.07
F	0642	3.2	-	3.1	3.0	30.04
155	1136	1.8	-	1.7	1.6	30.05
	1806	5.3	-	5.1	5.0	30.00
5	0118	0.2	-	0.1	0.1	30.00
SA	0736	3.3	-	3.3	3.2	30.02
156	1212	2.0	5.5	1.8	1.8	30.02
	1836	5.6	9.2	5.4	5.4	29.98
6	0154	-0.2	3.3	-0.4	-0.4	29.98
SU	0818	3.3	7.1	3.3	3.2	30.00
157	1242	2.1	5.7	1.9	1.9	30.00
	1906	5.8	9.0	5.7	5.7	29.96
7	0230	-0.6	3.1	-0.6	-0.7	29.95
M	0900	3.4	7.2	3.3	3.3	29.98
158	1312	2.3	5.9	2.2	2.1	29.97
	1936	6.0	9.8	6.0	5.9	29.93
8	0306	-0.8	2.8	-0.9	-0.9	29.91
TU	0942	3.4	7.2	3.4	3.4	29.96
159	1348	2.3	6.0	2.3	2.3	29.97
	2012	6.1	10.0	6.2	6.1	29.92
9	0342	-1.0	2.7	-1.0	-1.1	29.91
W	1024**	3.4	7.2	3.5	3.4	29.91
160	1430**	2.4	6.0	2.3	2.3	29.90
	2048**	6.2	10.0	6.2	6.2	29.90
10	0424**	-1.0	2.7	-1.0	-1.0	29.87
TH	1106**	3.5	7.2	3.5	3.4	29.91
161	1512**	2.5	6.0	2.4	2.4	29.91
	2130	6.1	10.0	6.2	6.1	29.90
11	0506	-1.0	2.7	-1.0	-1.0	29.90
F	1154	3.6	7.3	3.6	3.5	29.95
162	1600	2.6	6.1	2.4	2.4	29.93
	2212	5.8	9.7	5.9	5.8	29.96
12	0548	-0.8	2.9	-0.9	-0.9	29.96
SA	1248	3.7	7.4	3.6	3.5	29.98
163	1700	2.7	6.1	2.4	2.4	29.92
	2306	5.4	9.2	5.4	5.4	29.98
13	0636	-0.5	3.1	-0.6	-0.6	29.96
SU	1336	3.9	7.6	3.8	3.8	29.92
164	1818	2.6	6.2	2.5	2.4	29.86
14	0000	4.9	8.7	4.9	4.9	29.87
M	0718	-0.1	3.6	-0.1	-0.2	29.87
165	1424**	4.3	8.2	4.3	4.3	29.80
	1948**	2.4	6.1	2.4	2.3	29.78
15	0112**	4.2	8.2	4.4	4.4	29.80
TU	0806	0.3	4.1	0.4	0.3	29.81
166	1512	4.7	8.5	4.8	4.7	29.78
	2124	1.9	5.6	1.9	1.9	29.81
16	0242	3.7	7.7	3.9	3.9	29.79
W	0900	0.8	4.7	0.9	0.9	29.84
167	1600	5.2	9.1	5.3	5.3	29.78
	2242	1.1	5.1	1.4	1.3	29.78
17	0424	3.4	7.4	3.7	3.6	29.77
TH	0948	1.3	5.2	1.5	1.5	29.82
168	1642	5.6	9.6	5.8	5.7	29.77
	2348	0.3	4.2	0.5	0.5	29.80
18	0554	3.3	7.4	3.6	3.5	29.82
F	1042	1.7	5.5	1.8	1.8	29.90
169	1724	6.1	9.9	6.1	6.0	29.86
19	0042	-0.4	3.5	-0.2	-0.2	29.89
SA	0706	3.4	7.4	3.6	3.6	29.90
170	1136	1.9	5.8	2.1	2.0	29.95
	1812	6.4	10.2	6.4	6.3	29.88
20	0136	-1.0	3.0	-0.8	-0.8	29.88
SU	0806	3.5	7.7	3.8	3.8	29.88
171	1224	2.1	6.0	2.3	2.2	29.89
	1854	6.6	10.5	6.7	6.6	29.83
21	0218	-1.3	2.6	-1.2	-1.2	29.86
M	0900	3.7	7.6	3.8	3.7	29.92
172	1312	2.2	6.0	2.3	2.2	29.93
	1936**	6.7	10.5	6.7	6.7	29.88
22	0306**	-1.4	2.3	-1.4	-1.4	29.90
TU	0942	3.7	7.6	3.8	3.8	29.94
173	1400	2.3	6.0	2.3	2.2	29.91
	2018	6.6	10.4	6.7	6.6	29.85
23	0348	-1.4	2.5	-1.3	-1.3	29.84
W	1024	3.8	7.7	3.9	3.9	29.86
174	1448	2.3	6.2	2.5	2.4	29.85
	2100	6.4	10.3	6.5	6.5	29.84
24	0424	-1.2	2.7	-1.1	-1.1	29.86
TH	1106	3.8	7.6	3.8	3.8	29.94
175	1530	2.4	6.1	2.3	2.3	29.92
	2142	6.1	9.8	6.1	6.0	29.90
25	0506	-0.9	3.0	-0.7	-0.8	29.93
F	1148	3.9	7.6	3.8	3.7	29.99
176	1618	2.5	6.2	2.5	2.4	29.94
	2224	5.7	9.4	5.7	5.5	29.94
26	0542	-0.5	3.4	-0.3	-0.4	29.91
SA	1236	3.9	7.7	4.0	3.8	29.94
177	1712	2.6	6.3	2.6	2.5	29.87
	2306	5.1	8.9	5.2	5.0	29.87
27	0618	0.0	3.9	0.2	0.1	29.86
SU	1318	4.0	7.9	4.1	4.0	29.89
178	1818	2.6	6.4	2.7	2.6	29.82
	2348	4.5	8.4	4.6	4.5	29.86
28	0654	0.5	4.4	0.7	0.6	29.88
M	1400	4.1	8.0	4.2	4.1	29.93
179	1930	2.6	6.3	2.6	2.5	29.89
29	0042	3.9	7.6	3.8	3.7	29.91
TU	0730	1.0	4.9	1.2	1.0	29.97
180	1442	4.3	8.1	4.3	4.2	29.96
	2100	2.4	6.0	2.4	2.3	29.92
30	0154	3.3	7.1	3.3	3.2	29.92
W	0812	1.5	5.1	1.5	1.4	29.95
181	1524	4.5	8.3	4.5	4.4	29.90
	2224**	1.9	5.6	2.0	1.8	29.88

(Continued)

** Calibration checkpoint.

1971 Jul Day	Time PST	Tide Table LA	Observed Tide LA	LB-J	LB-P	Barometer in.Hg
1	0342**	2.9	6.7	3.0	2.8	29 85
TH	0854**	1.9	5.8	2.0	1.9	29.90
182	1600	4.8	8.7		4.6	29.84
	2330	1.4	5.3		1.3	29.87
2	0530	2.8	6.9		2.8	29.87
F	0942	2.2	6.1		2.2	29.92
183	1642	5.0	9.0		5.0	29.88
3	0024	0.8	4.5		0.7	29.93
SA	0648	3.0	6.9		2.9	29.94
184	1030	2.5	6.3		2.3	29.97
	1724	5.4	9.1		5.2	29.92
4	0106	0.3	4.1		0.1	29.96
SU	0742	3.2	7.1		3.1	29.97
185	1124	2.6	6.3		2.4	29.98
	1800	5.7	9.5		5.5	29.90
5	0142	-0.2	3.6		-0.3	29.91
M	0824	3.3	7.3		3.3	29.91
186	1212	2.6	6.4		2.5	29.91
	1842	6.0	10.0		6.0	29.83
6	0218	-0.6	3.3		-0.7	29.85
TU	0854	3.5	7.5		3.5	29.89
187	1300	2.5	6.4		2.5	29.88
	1924	6.3	10.3		6.3	29.82
7	0254	-0.9	2.8		-1.0	29.88
W	0930	3.7	7.5		3.6	29.92
188	1342	2.4	6.2		2.3	29.90
	2000	6.5	10.4		6.5	29.88
8	0330	-1.1	2.6		-1.4	29.90
TH	1006	3.8	7.7		3.7	29.94
189	1424	2.3	6.1		2.2	29.92
	2042	6.6	10.5		6.5	29.87
9	0406	-1.2	2.6		-1.3	29.88
F	1036	4.0	7.8		3.9	29.93
190	1512	2.2	5.9		2.0	29.91
	2124	6.5	10.4		6.4	29.86
10	0442	-1.1	2.9		-1.1	29.86
SA	1118	4.2	8.1		4.1	29.88
191	1606	2.1	5.9		1.9	29.82
	2212	6.1	10.3		6.3	29.77
11	0518	-0.8	3.3		-0.7	29.78
SU	1154	4.5	8.5		4.5	29.80
192	1706	2.1	5.9		2.0	29.74
	2300	5.5	9.7		5.7	29.78
12	0554	-0.3	3.7		-0.3	29.78
M	1236	4.7	8.7		4.8	29.88
193	1812	1.9	5.8		1.9	29.84
13	0000	4.8	8.9		4.9	29.84
TU	0636	0.3	4.2		0.3	29.88
194	1318	5.0	9.0		5.0	29.84
	1936	1.7	5.7		1.7	29.80
14	0106	4.0	8.0		4.0	29.82
W	0718	1.0	4.9		0.9	29.84
195	1412	5.3	9.4		5.3	29.84
	2106**	1.4	5.4		1.4	29.82
15	0242**	3.3	7.4		3.4	29.78
TH	0806**	1.6	5.5		1.6	29.85
196	1512	5.5	9.6	5.8	5.6	29.82
	2236	0.8	4.8	1.0	0.9	29.84

1971 Jul Day	Time PST	Tide Table LA	Observed Tide LA	LB-J	LB-P	Barometer in.Hg
16	0442	3.0	7.1	3.2	3.1	29.84
F	0906	2.1	6.1	2.3	2.2	29.88
197	1606	5.8	9.8	6.0	5.8	29.89
	2348	0.1	4.1	0.3	0.2	29.91
17	0624	3.2	7.2	3.3	3.2	29.94
SA	1018	2.5	6.5	2.6	2.5	29.96
198	1706	6.1	9.9	6.1	5.9	29.88
18	0048	-0.4	3.5	-0.4	-0.4	29.92
SU	0730	3.5	7.6	3.8	3.6	29.93
199	1124	2.6	6.5	2.7	2.6	29.92
	1800	6.3	10.2	6.4	6.2	29.84
19	0136	-0.8	3.1	-0.8	-0.9	29.88
M	0818	3.7	7.8	4.0	3.8	29.92
200	1224	2.6	6.4	2.6	2.5	29.89
	1848	6.5	10.4	6.7	6.5	29.86
20	0218	-1.0	2.9	-1.0	-1.0	29.87
TU	0900	3.9	7.8	4.0	3.9	29.91
201	1318	2.4	6.2	2.5	2.4	29.86
	1930**	6.6	10.5	6.7	6.6	29.84
21	0254**	-1.1	2.9	-1.0	-1.1	29.84
W	0930	4.0	8.0	4.2	4.1	29.88
202	1400	2.3	6.1	2.3	2.2	29.85
	2012	6.5	10.4	6.6	6.5	29.85
22	0330	-1.0	2.9	-1.1	-1.0	29.91
TH	1000	4.1	8.0	4.1	4.0	29.95
203	1442	2.2	6.0	2.1	2.1	29.88
	2054	6.4	10.3	6.4	6.2	29.90
23	0400	-0.8	3.1	-0.8	-0.9	29.90
F	1030	4.2	8.0	4.2	4.1	29.92
204	1524	2.1	6.0	2.1	2.0	29.82
	2124	6.0	9.9	6.1	6.0	29.84
24	0430	-0.5	3.5	-0.4	-0.4	29.84
SA	1100	4.3	8.2	4.4	4.2	29.88
205	1600	2.1	6.0	2.2	2.1	29.82
	2200	5.6	9.4	5.6	5.5	29.89
25	0500	-0.1	3.9	-	0.0	29.88
SU	1130	4.4	8.3	-	4.3	29.90
206	1648	2.1	5.9	-	2.0	29.83
	2236	5.1	8.9	-	4.9	29.88
26	0524	0.4	4.3	0.3	0.4	29.88
M	1200	4.4	8.3	4.4	4.4	29.91
207	1730	2.2	5.8	2.1	2.0	29.83
	2312	4.5	8.2	4.4	4.3	29.88
27	0548	0.9	4.8	0.9	0.9	-
TU	1230	4.5	8.4	4.6	4.4	29.84
208	1830	2.2	6.0	2.2	2.1	29.76
28	0000	3.8	7.7	3.9	3.8	29.77
W	0612	1.4	5.4	1.5	1.4	29.82
209	1306	4.5	8.5	4.7	4.5	29.83
	1942	2.2	6.0	2.2	2.2	29.79
29	0100	3.2	7.1	3.3	3.1	29.84
TH	0636	1.9	5.7	1.9	1.8	29.89
210	1354	4.6	8.5	4.8	4.6	29.84
	2124**	1.9	5.7	1.9	1.8	29.88
30	0300**	2.7	6.5	2.7	2.5	29.89
F	0700**	2.4	6.2	2.3	2.2	29.92
211	1442	4.7	8.6	4.8	4.6	29.83
	2300	1.5	5.1	1.4	1.3	29.86
31	1542	4.9	6.7	5.2	5.0	29.77
SA						
212						

(Continued)

** Calibration checkpoint.

1971 Aug Day	Time PST	Tide Table LA	Observed Tide LA	Observed Tide LB-J	Observed Tide LB-P	Barometer in.Hg
1	0000	0.9	-	0.9	0.7	29.82
SU	0718**	3.1	-	3.2	3.0	29.84
213	0924**	3.0	6.9	3.0	2.9	29.84
	1648	5.3	9.4	5.5	5.3	29.74
2	0042	0.4	4.0	0.3	0.2	29.82
M	0748	3.4	7.1	3.5	3.3	29.81
214	1106	3.0	6.7	3.0	2.9	29.83
	1736	5.7	9.6	5.8	5.7	29.74
3	0118	-0.1	3.5	-0.2	-0.3	29.78
TU	0806	3.6	7.5	3.8	3.6	29.80
215	1206	2.8	6.5	2.8	2.8	29.79
	1824	6.1	10.1	6.4	6.2	29.75
4	0154	-0.6	3.2	-0.6	-0.6	29.82
W	0830	3.9	7.7	4.0	3.8	29.84
216	1254	2.5	6.2	2.5	2.5	29.82
	1906	6.5	10.3	6.7	6.5	29.82
5	0224	-0.9	2.9	-0.8	-0.9	29.84
TH	0854	4.1	8.0	4.3	4.2	29.85
217	1342	2.1	5.9	2.2	2.1	29.81
	1954	6.7	10.7	6.9	6.8	29.79
6	0300	-1.0	2.7	-1.0	-1.1	29.80
F	0924	4.4	8.2	4.5	4.4	29.82
218	1424	1.8	5.7	1.9	1.9	29.76
	2036	6.8	10.7	7.0	6.8	29.75
7	0330	-1.0	2.7	-1.1	-1.1	29.76
SA	0954	4.8	8.5	4.9	4.7	29.80
219	1512	1.5	5.3	1.6	1.5	29.74
	2118	6.5	10.5	6.8	6.6	29.75
8	0406	-0.7	3.0	-0.7	-0.8	29.74
SU	1030	5.1	9.0	5.2	5.1	29.80
220	1600	1.3	5.1	1.3	1.3	29.73
	2206	6.0	10.0	6.2	6.1	29.77
9	0442	-0.3	3.4	-0.2	-0.3	29.78
M	1106	5.3	9.4	5.6	5.5	29.83
221	1654	1.1	4.9	1.2	1.1	29.80
	2254	5.3	9.3	5.5	5.4	29.84
10	0512	0.4	4.2	0.4	0.3	29.80
TU	1142	5.5	9.5	5.8	5.7	29.88
222	1800	1.1	4.9	1.2	1.1	29.79
	2348	4.5	8.4	4.6	4.5	29.88
11	0548	1.1	4.9	1.1	1.1	29.82
W	1230	5.6	9.6	5.9	5.7	29.84
223	1918	1.1	5.0	1.2	1.1	29.82
12	0112	3.6	7.4	3.6	3.5	29.86
TH	0630	1.8	5.4	1.7	1.7	29.87
224	1324	5.6	9.6	5.8	5.6	29.88
	2048	0.9	4.7	0.9	0.9	29.85
13	0306	3.1	6.8	3.0	2.9	29.88
F	0718	2.4	6.1	2.4	2.3	29.90
225	1424	5.6	9.2	5.6	5.5	29.88
	2224	0.6	4.3	0.6	0.5	29.88
14	0524**	3.2	7.0	3.2	3.1	29.90
SA	0842**	2.9	6.6	2.9	2.8	29.93
226	1542	5.7	9.4	5.6	5.5	29.86
	2342	0.1	3.9	0.1	0.0	29.87
15	0648	3.5	7.3	3.6	3.5	29.89
SU	1024	3.0	6.7	2.9	2.8	29.92
227	1654	5.8	9.5	5.9	5.7	29.84
16	0042	-0.3	3.4	-0.2	-0.3	29.90
M	0730	3.9	7.7	3.9	3.8	29.88
228	1142	2.8	6.5	2.8	2.7	29.92
	1754	6.0	9.9	6.1	6.0	29.84
17	0124	-0.5	3.2	-0.5	-0.6	29.89
TU	0806	4.1	7.9	4.1	4.0	29.92
229	1242	2.5	6.1	2.4	2.3	29.92
	1848	6.2	10.2	6.4	6.2	29.87
18	0200	-0.6	3.2	-0.5	-0.7	29.90
W	0830	4.3	8.1	4.2	4.2	29.90
230	1324	2.2	5.9	2.1	2.0	29.88
	1930**	6.3	10.2	6.3	6.1	29.84
19	0230**	-0.6	3.2	-0.5	-0.6	29.84
TH	0854	4.5	8.3	4.5	4.4	29.88
231	1400	2.0	5.6	1.9	1.8	29.87
	2006	6.2	10.0	6.2	6.0	29.83
20	0300	-0.4	3.3	-0.4	-0.5	29.89
F	0918	4.6	8.4	4.6	4.4	29.94
232	1436	1.8	5.4	1.7	1.6	29.92
	2036	6.0	9.9	6.1	5.9	29.92
21	0324	-0.2	3.5	-0.1	-0.2	29.95
SA	0942	4.7	8.6	4.7	4.5	29.96
233	1506	1.6	5.3	1.1	1.5	29.93
	2106	5.7	9.6	5.8	5.7	29.90
22	0348	0.2	4.0	0.2	0.2	29.91
SU	1000	4.8	8.6	4.9	4.7	29.92
234	1542	1.5	5.3	1.6	1.4	29.85
	2142	5.3	9.1	5.3	5.2	29.86
23	0406	0.6	4.4	0.6	0.6	29.84
M	1024	4.9	8.7	4.9	4.8	29.90
235	1618	1.5	5.2	1.5	1.4	29.82
	2212	4.8	8.5	4.8	4.6	29.86
24	0430	1.0	4.9	1.1	1.0	29.85
TU	1048	4.9	8.7	4.9	4.8	29.92
236	1700	1.5	5.2	1.5	1.4	29.86
	2248	4.3	8.0	4.3	4.1	29.90
25	0448	1.5	5.2	1.4	1.4	29.88
W	1112	4.9	8.8	5.0	4.9	29.91
237	1748	1.6	5.3	1.6	1.5	29.83
	2330	3.7	7.5	3.7	3.6	29.86
26	0500	1.9	-	1.9	1.7	29.84
TH	1142	4.9	-	5.0	4.9	29.86
238	1848	1.7	-	1.7	1.6	29.77
27	0030	3.1	-	3.1	3.0	29.84
F	0506	2.4	-	2.2	2.1	29.83
239	1224	4.8	8.6	4.9	4.7	29.84
	2018	1.7	5.4	1.7	1.6	29.76
28	1318	4.7	8.5	4.8	4.6	29.84
SA	2212	1.4	5.0	1.3	1.2	29.82
240						
29	1448	4.8	8.5	4.9	4.7	29.81
SU	2324	0.9	4.6	0.9	0.7	29.83
241						
30	0718**	3.4	7.2	3.4	3.2	29.86
M	0924**	3.3	7.0	3.3	3.1	29.87
242	1612	5.1	8.8	5.2	5.0	29.82
31	0012	0.4	3.9	0.3	0.2	29.84
TU	0712	3.7	7.3	3.8	3.6	29.86
243	1106	3.1	6.6	3.1	2.9	29.87
	1718	5.5	9.3	5.7	5.5	29.76

(Continued)

** Calibration checkpoint.

1971 Sep Day	Time PST	Tide Table LA	Observed Tide LA	Observed Tide LB-J	Observed Tide LB-P	Barometer in.Hg
1	0048	-0.1	3.4	-0.1	-0.3	29.78
W	0730	4.0	7.6	4.0	3.9	29.77
244	1200	2.6	6.2	2.7	2.6	29.80
	1806	6.0	9.7	6.1	6.0	29.72
2	0118	-0.4	3.2	-	-0.5	29.79
TH	0748	4.4	8.0	-	4.3	29.78
245	1248	2.1	5.8	2.2	2.1	29.79
	1854	6.4	10.1	6.5	6.4	29.74
3	0148	-0.6	2.9	-0.7	-0.8	29.77
F	0812	4.8	8.4	4.9	4.7	29.78
246	1330	1.5	5.1	1.7	1.5	29.79
	1936**	6.5	10.4	6.7	6.6	29.76
4	0224**	-0.7	2.9	-0.7	-0.8	29.80
SA	0836	5.2	8.9	5.3	5.1	29.84
247	1418	0.9	4.7	1.1	1.0	29.81
	2024	6.5	10.2	6.6	6.5	29.80
5	0254	-0.4	3.1	-0.5	-0.6	29.82
SU	0906	5.6	9.3	5.8	5.6	29.82
248	1500	0.5	4.2	0.6	0.5	29.76
	2112	6.1	9.9	6.2	6.1	29.76
6	0324	0.0	3.6	0.0	-0.1	29.76
M	0942	5.9	9.8	6.1	6.0	29.80
249	1548	0.2	4.0	-	0.2	29.74
	2200	5.5	9.3	-	5.6	29.88
7	0400	0.5	4.1	out	0.5	
TU	1012	6.1	10.0	out	6.3	29.86
250	1642	0.1	4.0	0.5	0.2	29.76
	2248	4.8	8.4	5.0	4.8	29.81
8	0436	1.2	4.8	1.3	1.1	29.80
W	1054	6.1	8.5	6.5	6.3	29.84
251	1748	0.2	4.1	0.6	0.4	29.76
	2354	4.0	7.7	4.3	4.0	29.83
9	0506	1.8	5.5	2.1	1.9	29.81
TH	1142	6.0	9.8	6.3	6.1	29.83
252	1900	0.4	4.3	0.9	0.6	29.77
10	0124	3.4	7.2	3.7	3.4	29.81
F	0548	2.5	6.2	2.8	2.6	29.80
253	1236	5.7	9.4	5.9	5.7	29.80
	2030	0.5	4.4	-	0.7	29.76
11	0348**	3.2	7.1	-	3.3	29.78
SA	0648**	3.0	6.7	-	3.1	29.78
254	1354	5.4	9.2	-	5.4	29.74
	2212	0.4	4.2	-	0.5	29.76
12	0542	3.6	7.4	-	3.7	29.76
SU	0900	3.3	7.0	-	3.4	29.80
255	1530	5.3	9.1	-	5.4	29.71
	2324	0.1	4.0	-	0.3	29.72
13	0630	4.0	7.9	-	4.1	29.71
M	1048	3.0	6.9	3.4	3.1	29.73
256	1648	5.4	9.4	5.9	5.7	29.63
14	0012	-0.1	3.9	0.4	0.2	29.66
TU	0706	4.3	8.2	4.7	4.4	29.69
257	1154	2.6	6.3	3.0	2.7	29.69
	1748	5.6	9.5	6.1	5.8	29.60
15	0054	-0.2	3.8	0.4	0.2	29.68
W	0730	4.5	8.4	5.0	4.7	29.71
258	1242	2.2	5.8	2.4	2.2	29.73
	1836**	5.7	9.6	6.1	5.8	29.73
16	0130**	-0.1	3.7	0.3	0.1	29.78
TH	0754	4.7	8.5	5.0	4.7	29.80
259	1318	1.8	5.4	1.9	1.7	29.86
	1918	5.7	9.6	6.1	5.8	29.81
17	0154	0.0	3.8	0.4	0.2	29.83
F	0812	4.9	8.7	5.2	4.9	29.86
260	1354	1.4	5.1	1.7	1.5	29.88
	1948	5.6	9.4	6.0	5.7	29.84
18	0218	0.2	4.1	0.6	0.4	29.85
SA	0830	5.1	9.0	5.5	5.2	29.86
261	1424	1.2	4.9	1.5	1.2	29.84
	2024	5.4	9.1	5.7	5.4	29.88
19	0236	0.5	4.3	0.8	0.6	29.93
SU	0848	5.2	8.9	5.4	5.1	29.98
262	1454	0.9	4.5	1.1	0.8	29.92
	2054	5.1	8.8	5.3	5.0	29.92
20	0300	0.9	4.4	1.0	0.8	29.95
M	0906	5.3	8.9	5.4	5.1	29.96
263	1524	0.8	4.3	0.9	0.7	29.90
	2124	4.8	8.4	5.0	4.6	29.88
21	0318	1.2	4.9	1.4	1.1	29.88
TU	0930	5.4	9.0	5.5	5.2	29.93
264	1554	0.8	4.2	0.8	0.6	29.88
	2200	4.4	7.8	4.4	4.1	29.90
22	0336	1.6	5.2	1.7	1.5	29.92
W	0948	5.4	9.0	5.5	5.2	29.96
265	1630	0.8	4.3	0.9	0.6	29.86
	2236	3.9	7.4	3.9	3.7	29.91
23	0354	2.0	5.4	2.0	1.9	29.92
TH	1012	5.3	8.7	5.3	5.1	29.97
266	1718	1.0	4.3	0.9	0.7	29.89
	2324	3.4	7.0	3.5	3.2	29.92
24	0406	2.4	5.7	2.3	2.0	29.90
F	1042	5.2	8.6	5.2	4.9	29.94
267	1818**	1.2	4.4	1.0	0.8	29.84
25	0036**	3.0	6.6	3.2	2.8	29.85
SA	0354**	2.7	6.1	2.7	2.4	29.84
268	1118	5.0	8.5	5.1	4.8	29.90
	1936	1.3	4.6	1.2	0.9	29.84
26	1212	4.8	8.3	4.9	4.5	29.92
SU	2118	1.1	4.4	1.0	0.7	29.88
269						
27	1354	4.7	8.1	4.7	4.4	29.90
M	2236	0.8	4.1	0.7	0.4	29.86
270						
28	0630**	3.7	7.1	3.7	3.3	29.84
TU	0936**	3.4	6.8	3.4	3.1	29.88
271	1536**	4.8	8.4	4.9	4.6	29.82
	2324	0.4	3.8	0.4	0.1	29.80
29	0624	4.0	7.6	4.2	3.9	29.78
W	1100	2.9	6.5	3.0	2.7	29.79
272	1648	5.2	8.9	5.4	5.1	29.74
30	0000	0.1	3.6	0.2	-0.1	29.84
TH	0642	4.4	8.1	4.6	4.3	29.78
273	1154	2.2	5.8	2.4	2.1	29.84
	1748	5.6	9.2	5.8	5.5	29.81

(Continued)

** Calibration checkpoint.

1971 Oct Day	Time PST	Tide Table LA	Observed Tide LA	LB-J	LB-P	Barometer in.Hg
1	0036	-0.1	3.3	-0.1	-	29.86
F	0700	4.9	8.4	5.0	-	29.92
274	1236	1.4	5.1	1.5	1.3	29.98
	1836	5.8	9.5	6.0	5.7	29.92
2	0106	-0.1	3.3	-0.2	-0.5	29.98
SA	0724	5.5	9.0	5.5	5.2	29.97
275	1324	0.7	4.3	0.7	0.5	29.99
	1924	5.9	9.7	6.1	5.7	29.92
3	0142	0.0	3.6	0.0	-0.3	29.94
SU	0754	6.0	9.8	6.2	5.9	29.94
276	1406	0.0	3.6	0.1	-0.1	29.90
	2012	5.7	9.6	6.0	5.7	29.84
4	0212	0.3	3.9	0.3	0.1	29.87
M	0824	6.4	10.4	6.7	6.4	29.88
277	1454	-0.5	3.3	-0.2	-0.5	29.82
	2106	5.4	9.2	5.6	5.2	29.84
5	0248	0.8	4.5	1.0	0.7	29.88
TU	0900**	6.7	10.7	7.1	6.8	29.95
278	1542**	-0.7	3.2	-0.5	-0.7	29.87
	2200	4.9	8.6	5.0	4.7	29.91
6	0318	1.3	5.0	1.5	1.2	29.90
W	0936	6.7	10.8	7.1	6.8	29.94
279	1636	-0.7	3.2	-0.4	-0.7	29.82
	2254	4.3	8.2	4.5	4.2	
7	0354	1.9	5.8	2.2	1.9	29.84
TH	1018	6.5	10.6	7.0	6.6	29.84
280	1736	-0.5	3.5	-0.1	-0.4	29.76
8	0006	3.7	7.6	3.9	3.7	29.83
F	0436	2.4	6.3	2.7	2.4	29.86
281	1100	6.1	10.0	6.4	6.0	29.92
	1842	-0.1	3.8	0.3	-0.1	29.84
9	0148	3.4	7.4	3.8	3.4	29.91
SA	0518	2.9	6.7	3.2	2.9	29.90
282	1200	5.6	9.5	5.8	5.5	29.96
	2006	0.2	4.1	0.5	0.2	29.87
10	0354	3.5	7.6	4.0	3.6	29.88
SU	0654	3.3	7.2	3.6	3.3	29.90
283	1324	5.1	9.0	5.5	5.1	29.88
	2136	0.2	4.3	0.7	0.4	29.84
11	0518**	3.9	8.0	4.4	4.0	29.83
M	0918**	3.3	7.3	3.7	3.4	29.85
284	1506**	4.9	8.9	5.3	4.9	29.78
	2242	0.2	4.3	0.7	0.5	29.80
12	0554	4.3	8.3	4.6	4.3	29.83
TU	1054	2.9	6.8	3.1	2.8	29.88
285	1630	4.8	8.7	5.2	-	29.81
	2336	0.2	4.3	0.8	-	29.87
13	0618	4.6	8.5	4.8		29.86
W	1154	2.3	6.1	2.6		29.92
286	1730	4.9	8.8	5.3		29.84
					CLOCK REPAIR	
14	0012	0.3	4.4	0.8		29.89
TH	0648	4.9	8.7	5.2		29.84
287	1230	1.8	5.6	2.1		29.87
	1818	4.9	8.9	5.3		29.82
15	0042	0.5	4.5	0.9		29.84
F	0712	5.1	9.0	5.4		29.80
288	1306	1.3	5.3	1.7		29.81
	1900	4.9	9.0	5.4		29.71

1971 Oct Day	Time PST	Tide Table LA	Observed Tide LA	LB-J	LB-P	Barometer in.Hg
16	0112	0.7	4.7	1.2		29.73
SA	0724	5.3	9.3	5.6		29.71
289	1336	0.9	4.8	1.3		29.74
	1936	4.8	8.8	5.2		29.70
17	0130	1.0	5.0	1.4		29.73
SU	0742	5.5	9.4	5.8		29.74
290	1406	0.6	4.3	0.8		29.83
	2012	4.6	8.4	4.9		29.85
18	0154	1.3	5.2	1.6		29.92
M	0806	5.7	9.4	5.8		29.98
291	1436	0.3	3.9	0.3		30.00
	2048	4.4	8.0	4.4		30.06
19	0212	1.5	5.2	1.6		30.10
TU	0824	5.8	9.2	5.7		30.15
292	1512	0.2	3.6	0.1		30.06
	2124	4.2	7.7	4.2		30.03
20	0230	1.8	5.6	2.0		30.00
W	0842	5.8	9.4	5.9		29.99
293	1542**	0.1	3.7	0.2		29.93
	2200	3.9	7.5	4.0		29.97
21	0248	2.1	5.8	2.1		29.99
TH	0906	5.8	9.3	5.9		30.06
294	1618	0.2	3.7	0.2		30.01
	2242	3.5	7.2	-	CLOCK REPAIR	30.08
22	0306	2.4	6.0	-		30.06
F	0936	5.7	9.4	5.8		30.06
295	1700	0.4	4.0	0.4		29.92
	2342	3.2	7.1	3.6		29.90
23	0324	2.7	6.4	2.9		29.87
SA	1006	5.5	9.4	5.8		29.84
296	1754	0.5	4.3	0.7		29.70
24	0106	3.0	7.1	3.5		29.70
SU	0336	2.9	6.7	3.1		29.69
297	1042	5.2	9.2	5.7		29.70
	1906	0.7	4.3	0.8		29.71
25	1142	4.9	6.9	5.1		29.92
M	2024	0.7	4.2	0.7		29.96
298						
26	1312	4.6	8.1	4.6		30.01
TU	2130	0.5	4.1	0.6	0.3	30.00
299						
27	0512**	3.9	7.5	4.1	3.7	29.93
W	0936**	3.3	6.9	3.3	3.0	29.93
300	1454**	4.5	8.3	4.7	4.4	29.86
	2224	0.4	4.1	0.6	0.3	29.84
28	0524	4.4	8.2	4.6	4.3	29.80
TH	1042	2.5	6.3	2.8	2.5	29.83
301	1624	4.6	8.4	4.8	4.4	29.81
	2312	0.4	3.7	0.2	0.0	29.98
29	0548	4.9	8.3	4.8	4.5	30.04
F	1142	1.7	5.1	1.6	1.3	30.12
302	1724	4.8	8.2	4.7	4.3	30.12
	2348	0.4	3.6	0.1	-0.2	30.15
30	0612	5.5	8.8	5.3	4.9	30.18
SA	1230	0.8	4.2	0.7	0.4	30.08
303	1824	4.9	8.3	4.8	4.5	29.98
31	0024	0.6	4.0	0.4	0.2	29.99
SU	0642	6.1	9.6	6.1	5.8	29.96
304	1312	-0.1	3.5	-0.1	-0.3	29.94
	1924	4.9	8.3	4.8	4.5	29.99

(Continued)

** Calibration checkpoint.

1971 Nov Day	Time PST	Tide Table LA	Observed Tide LA	Observed Tide LB-J	Observed Tide LB-P	Barometer in.Hg
1	0100	0.8	4.2	0.7	0.4	30.05
M	0718	6.6	10.9	6.5	6.2	30.08
305	1400	-0.8	2.6	-0.8	-1.1	30.02
	2012	4.8	8.2	4.7	4.3	30.04
2	0136	1.2	4.7	1.2	0.9	30.04
TU	0748	6.9	10.5	7.0	6.7	30.09
306	1448	-1.2	2.3	-1.2	-1.4	30.03
	2106	4.6	7.9	4.3	4.4	30.10
3	0212	1.5	5.0	1.5	1.3	30.08
W	0830**	7.1	10.6	7.1	6.9	30.10
307	1536**	-1.4	2.1	-1.4	-1.6	30.00
	2200	4.3	7.7	4.2	4.1	30.02
4	0248	1.9	5.5	1.9	1.7	29.98
TH	0906	7.0	10.5	7.0	6.8	30.00
308	1624	-1.2	2.4	-1.1	-1.4	29.88
	2300	3.9	7.6	4.0	3.8	29.91
5	0330	2.3	6.0	2.5	2.2	29.89
F	0954	6.7	10.4	6.8	6.5	29.92
309	1724	-0.9	2.9	-0.7	-1.0	29.88
6	0012	3.7	7.6	3.9	3.6	29.94
SA	0418	2.7	6.5	2.8	2.5	29.94
310	1042	6.1	9.8	6.2	5.9	30.02
	1824	-0.5	3.2	-0.3	-0.6	30.00
7	0136	3.6	7.4	3.7	3.4	30.03
SU	0518	3.1	6.6	3.0	2.8	30.02
311	1136	5.5	9.1	5.5	5.2	30.06
	1936	-0.1	3.6	0.0	-0.3	30.02
8	0306	3.7	7.5	4.0	3.6	30.02
M	0654	3.3	6.9	3.3	3.0	30.04
312	1248	4.9	8.5	5.0	4.6	30.01
	2042	0.2	4.1	0.4	0.2	30.03
9	0418	4.0	7.9	4.2	3.9	30.03
TU	0900	3.2	6.7	3.2	2.9	30.09
313	1418	4.4	8.1	4.4	4.1	30.02
	2142	0.4	4.2	0.6	0.3	30.10
10	0500**	4.4	8.1	4.5	4.2	30.09
W	1030**	2.7	6.1	2.5	2.3	30.11
314	1548**	4.2	7.8	4.2	3.9	30.03
	2236	0.7	4.5	0.9	0.6	30.06
11	0530	4.7	8.5	4.9	4.6	30.04
TH	1136	2.1	5.6	2.1	1.8	30.05
315	1700	4.1	7.8	4.2	3.9	30.01
	2312	0.9	4.7	1.1	0.9	30.03
12	0554	5.0	8.8	5.2	4.8	30.00
F	1212	1.5	5.0	1.5	1.2	30.04
316	1800	4.0	7.7	4.0	3.8	30.06
	2354	1.2	4.8	1.3	1.0	30.07
13	0618	5.2	8.9	5.2	4.9	30.09
SA	1254	1.0	-	1.0	0.7	30.01
317	1848	4.0	-	4.1	3.8	29.98
14	0018	1.4	-	1.6	1.4	29.94
SU	0642	5.5	-	5.6	5.3	29.90
318	1324	0.5	-	0.7	0.4	29.87
	1930	4.0	-	4.1	3.8	29.85
15	0042	1.7	-	1.9	1.6	29.85
M	0700	5.7	-	5.9	5.5	29.85
319	1400	0.1	-	0.2	0.0	29.79
	2012	3.9	-	4.1	3.8	29.84
16	0106	1.9	-	2.0	1.7	29.88
TU	0724	5.9	-	5.9	5.6	29.98
320	1430	-0.1	-	-0.3	-0.6	29.98
	2048	3.8	7.3	3.8	3.4	30.04
17	0130	2.1	5.5	2.0	1.7	30.06
W	0748	6.0	9.5	5.9	5.6	30.11
321	1506	-0.3	3.0	-0.5	-0.8	30.06
	2130	3.7	7.2	3.6	3.3	30.09
18	0200	2.3	5.7	2.2	1.8	30.08
TH	0818**	6.1	9.7	6.1	5.8	30.05
322	1536**	-0.4	3.1	-0.4	-0.7	29.96
	2206	3.6	7.2	3.6	3.3	30.05
19	0218	2.4	5.9	2.5	2.1	30.06
F	0848	6.0	9.7	6.2	5.8	30.10
323	1612	-0.4	3.2	-0.4	-0.7	30.02
	2254	3.4	7.2	3.6	3.2	30.04
20	0248	2.6	6.1	2.7	2.3	30.01
SA	0918	5.9	9.7	6.1	5.7	30.04
324	1654	-0.3	3.2	-0.4	-0.7	30.04
	2348	3.3	7.0	3.4	3.0	30.12
21	0318	2.8	6.1	2.7	2.3	30.14
SU	0954	5.7	9.3	5.7	5.3	30.20
325	1742	-0.1	3.2	-0.3	-0.6	30.11
22	0054	3.3	7.0	3.3	3.0	30.14
M	0406	3.0	6.3	2.8	2.5	30.12
326	1036	5.4	9.0	5.4	5.1	30.13
	1836	0.0	3.5	0.0	-0.3	30.04
23	0206	3.5	7.1	3.6	3.2	30.04
TU	0506	3.2	6.6	3.1	2.8	30.02
327	1130	5.0	8.6	5.1	4.7	30.05
	1930	0.2	3.7	0.2	-0.1	30.05
24	0300	3.8	7.4	3.8	3.5	30.04
W	1706	3.2	6.5	3.1	2.8	30.06
328	1248	4.6	8.1	4.6	4.1	30.00
	2024	0.4	3.9	0.4	0.0	30.02
25	0348**	4.2	7.8	4.2	3.8	30.03
TH	0906**	2.8	6.0	2.6	2.2	30.14
329	1418**	4.1	7.7	4.1	3.7	30.10
	2118	0.6	3.8	0.4	0.1	30.15
26	0424	4.7	8.2	4.6	4.2	30.16
F	1030	2.0	5.3	1.8	1.5	30.20
330	1554	3.9	7.5	3.9	3.5	30.10
	2206	0.9	4.1	0.7	0.3	30.10
27	0454	5.3	8.8	5.2	4.8	30.05
SA	1130	1.1	4.6	1.1	0.8	30.03
331	1718	3.9	7.6	4.0	3.6	29.97
	2254	1.1	4.5	1.1	0.7	30.00
28	0530	5.9	9.5	5.9	5.6	29.98
SU	1224	0.2	3.8	0.3	0.0	29.96
332	1824	4.0	7.6	4.0	3.7	29.92
	2342	1.4	5.0	1.6	1.2	29.92
29	0612	6.4	10.3	6.7	6.3	29.86
M	1312	-0.6	3.0	-0.5	-0.8	29.81
333	1924	4.0	7.7	4.2	3.8	29.80
30	0024	1.6	5.2	1.8	1.5	29.84
TU	0648	6.8	10.6	7.0	6.6	29.88
334	1400	-1.2	2.4	-1.0	-1.4	29.86
	2024	4.0	7.8	4.2	3.8	29.90

(Continued)

** Calibration checkpoint.

1971 Dec Day	Time PST	Tide Table LA	Observed Tide LA	Observed Tide LB-J	Observed Tide LB-P	Barometer in.Hg
1	0106	1.8	5.4	2.0	1.7	29.94
W	0730**	7.1	10.8	7.2	6.8	29.99
335	1442**	-1.6	2.1	-1.5	-1.8	30.00
	2118	4.0	7.7	4.1	3.7	30.05
2	0148	2.0	5.6	2.0	1.7	30.07
TH	0812	7.1	10.6	7.1	6.7	30.14
336	1530	-1.6	1.9	1.7	-2.1	30.08
	2206	3.9	7.6	3.9	3.5	30.08
3	0236	2.2	5.7	2.1	1.7	30.06
F	0854	7.0	10.4	6.8	6.4	30.08
337	1618	-1.5	2.0	-1.6	-2.0	29.96
	2300	3.9	7.7	4.1	3.8	29.85
4	0318	2.4	6.0	2.4	2.1	29.78
SA	0936	6.6	10.2	6.6	6.2	29.89
338	1706	-1.2	2.3	-1.3	-1.6	29.88
	2354	3.8	7.5	3.8	3.5	30.02
5	0412	2.6	6.0	2.4	2.0	30.04
SU	1024	6.1	9.4	5.8	5.5	30.12
339	1754	-0.7	2.7	-1.0	-1.3	30.05
6	0054	3.8	7.5	3.8	3.4	30.06
M	0506	2.8	6.2	2.8	2.3	30.00
340	1112	5.5	9.0	5.4	5.0	29.96
	1848	-0.3	3.4	-0.2	-0.5	29.82
7	0154	3.9	7.7	3.9	3.7	29.75
TU	0624	2.9	6.4	2.9	2.5	29.78
341	1206	4.8	8.3	4.6	4.2	29.83
	1936	0.2	3.8	0.2	-0.2	29.87
8	0254**	4.1	7.6	4.0	3.6	30.04
W	0800**	2.9	6.0	2.4	2.1	30.11
342	1312**	4.1	7.3	3.7	3.3	30.11
	2024	0.7	4.0	0.4	0.0	30.15
9	0342	4.3	7.6	4.0	3.7	30.14
TH	0948	2.5	-	2.2	1.8	30.14
343	1442	3.6	-	3.4	2.9	30.03
	2118	1.1	4.8	1.1	0.8	30.02
10	0424	4.6	8.2	4.5	4.1	30.02
F	1100	2.0	5.4	1.7	1.4	30.06
344	1618	3.3	6.9	3.2	2.7	30.00
	2206	1.5	5.1	1.5	1.1	30.03
11	0500	4.9	8.4	4.8	4.4	30.08
SA	1154	1.4	4.6	1.1	0.7	30.17
345	1736	3.2	6.7	3.0	2.6	30.14
	2242	1.8	5.3	1.6	1.3	30.21
12	0530	5.1	8.7	5.0	4.6	30.18
SU	1236	0.8	4.2	0.6	0.2	30.13
346	1842	3.3	6.9	3.2	2.8	30.10
	2324	2.1	5.7	2.0	1.6	30.05
13	0554	5.4	9.2	5.6	5.2	29.90
M	1312	0.3	3.7	0.0	-0.3	29.90
347	1936	3.4	7.1	3.4	3.0	29.92
14	0000	2.3	5.8	2.2	1.9	29.95
TU	0624	5.7	9.5	5.8	5.3	29.99
348	1348	-0.1	3.4	-0.3	-0.6	29.92
	2018	3.5	7.2	3.5	3.1	29.96
15	0036	2.4	6.0	2.3	2.0	29.96
W	0700	5.9	9.7	6.0	5.6	29.98
349	1424	-0.4	3.1	-0.5	-0.9	29.98
	2054	3.5	7.1	3.5	3.1	30.10
16	0106	2.4	5.8	2.2	1.8	30.18
TH	0730	6.1	9.5	5.9	5.5	30.25
350	1454	-0.7	2.5	-1.2	-1.5	30.22
	2130	3.6	7.0	3.3	3.0	30.26
17	0142	2.4	5.9	2.2	1.9	30.26
F	0800	6.2	9.9	6.2	5.8	30.20
351	1530	-0.8	2.6	-1.0	-1.3	30.10
	2206**	3.6	7.3	3.6	3.2	30.06
18	0218**	2.5	6.1	2.5	2.1	29.99
SA	0836**	6.3	10.0	6.4	6.0	30.02
352	1606**	-0.9	2.6	-1.0	-1.3	30.01
	2248**	3.6	7.2	3.6	3.2	30.07
19	0254**	2.5	5.9	2.3	1.9	30.08
SU	0912	6.2	9.9	6.2	5.8	30.10
353	1642	-0.8	2.7	-0.9	-1.3	30.03
	2324	3.7	7.3	3.7	3.3	30.06
20	0336	2.6	6.0	2.4	2.0	30.07
M	0954	6.0	9.7	6.0	5.6	30.14
354	1718	-0.7	2.9	-0.8	-1.1	30.06
21	0006	3.8	7.6	3.9	3.5	30.07
TU	0430	2.6	6.0	2.4	2.0	30.06
355	1036	5.6	9.3	5.7	5.3	30.10
	1800	-0.4	3.3	-0.3	-0.7	30.00
22	0054	4.0	7.8	4.1	3.8	30.04
W	0536	2.6	6.1	2.6	2.2	30.01
356	1124	5.0	8.8	5.2	4.8	30.09
	1842	0.0	3.5	-0.2	-0.4	30.16
23	0142	4.2	7.9	4.3	3.9	30.18
TH	0700	2.5	5.8	2.3	2.0	30.18
357	1230	4.3	8.0	4.4	4.0	30.14
	1924	0.5	4.0	0.3	0.1	30.06
24	0230	4.6	8.5	4.6	4.5	30.00
F	0836	2.1	5.8	2.1	2.0	30.01
358	1354	3.7	7.5	3.7	3.7	29.96
	2012	1.0	4.7	1.0	0.7	29.99
25	0318	5.0	9.1	5.0	5.0	29.99
SA	1006**	1.4	5.4	1.4	1.4	30.00
359	1542**	3.2	7.4	3.2	3.2	29.99
	2112**	1.5	5.3	1.5	1.5	29.92
26	0406	5.5	9.5	5.5	5.5	29.94
SU	1124	0.6	4.5	0.6	0.6	30.00
360	1724	3.2	7.0	3.2	3.2	29.98
	2206	1.9	5.5	1.9	1.9	30.00
27	0454	6.0	10.2	6.0	6.0	29.90
M	1224	-0.2	3.9	-0.2	-0.1	29.90
361	1848	3.3	7.4	3.7	3.3	29.95
	2306	2.1	5.9	2.4	2.1	30.01
28	0542	6.4	10.3	6.6	6.2	30.00
TU	1312	-0.9	3.0	-0.6	-1.0	30.01
362	1948	3.6	7.5	3.8	3.3	30.08
29	0000	2.2	5.9	2.3	2.2	30.13
W	0630	6.7	10.4	6.7	6.7	30.17
363	1400	-1.4	2.3	-1.4	-1.7	30.17
	2036	3.7	7.5	3.9	3.5	30.18
30	0054	2.2	5.9	2.2	2.2	30.20
TH	0718	6.9	10.7	7.0	6.6	30.12
364	1442	-1.6	2.2	-1.5	-1.8	30.04
	2118	3.9	7.8	4.1	3.9	30.05
31	0142	2.2	6.0	2.4	2.0	30.02
F	0800**	6.9	10.9	7.1	6.8	30.01
365	1524**	-1.6	2.2	-1.4	-1.8	29.95
	2200	4.0	7.9	4.2	3.8	30.01

(Continued)

** Calibration checkpoint.

1972 Jan Day	Time PST	Tide Table LA	Observed Tide LA	Observed Tide LB-J	Observed Tide LB-P	Barometer in.Hg
1	0233	2.0	5.8	2.2	1.8	30.02
SA	0847	6.7	10.7	6.9	6.5	30.08
001	1603	-1.4	2.4	-1.3	-1.7	30.01
	2236	4.1	5.0	4.3	3.8	30.05
2	0321	2.0	5.9	2.3	1.9	30.02
SU	0928	6.4	10.4	6.8	6.3	29.97
002	1640	-1.1	2.9	-0.7	-1.1	29.80
	2317	4.2	8.3	4.5	4.2	29.78
3	0405	2.1	6.2	2.6	2.2	29.72
M	1009	5.9	-	6.4	6.0	29.80
003	1717	-0.7	-		-0.7	29.81
	2354	4.2	-		4.1	29.98
4	0457	2.2	-		2.1	30.10
TU	1048	5.3	-		5.0	30.22
004	1751	-0.1	-		-0.4	30.16
5	0036	4.2	-		3.9	30.18
W	0553	2.3	-		1.9	30.16
005	1133	4.6	8.2		4.2	30.20
	1824	0.4	2.7		0.1	30.12
6	0118	4.3	6.8		4.0	30.12
TH	0702	2.3	4.7		2.1	30.08
006	1218	3.8	6.3		3.6	30.04
	1857	1.0	3.5		0.8	30.00
7	0203	4.3	7.0		4.2	30.04
F	0832	2.2	4.8		2.2	30.04
007	1324	3.1	5.7		2.9	29.98
	1932	1.5	4.0		1.4	29.99
8	0249	4.5	7.1		-	30.02
SA	1009**	1.8	4.3		-	30.10
008	1528**	2.7	5.1		-	30.03
	2013**	2.0	4.3		-	30.08
9	0342	4.6	7.2		-	30.08
SU	1131	1.3	3.7		1.2	30.11
009	1744	2.7	5.2		2.6	30.03
	2115	2.4	4.8		2.2	30.07
10	0431	4.9	7.4		4.7	30.08
M	1223	0.7	3.1		0.5	30.07
010	1906	2.9	5.3		2.8	30.07
	2224	2.6	5.0		2.4	30.10
11	0517	5.2	7.6		4.9	30.09
TU	1304	0.2	2.6		0.0	30.06
011	1947	3.1	5.6		2.9	30.02
	2327	2.6	5.0		2.5	30.02
12	0600	5.5	8.0		5.3	29.96
W	1337	-0.2	2.2		-0.4	29.91
012	2016	3.3	6.0		-	29.90
13	0019	2.6	5.1		-	29.90
TH	0641	5.8	8.5		5.7	29.92
013	1410	-0.6	1.7		-0.8	29.91
	2045	3.5	6.0		3.3	29.98
14	0057	2.4	4.8		2.2	30.00
F	0716	6.1	8.6		5.8	30.04
014	1439	-0.9	1.4		-1.2	30.01
	2114	3.7	6.0		3.3	30.07
15	0135	2.2	4.5		2.0	30.08
SA	0752	6.3	8.7		6.1	30.11
015	1510	-1.1	1.2		-1.4	30.04
	2141	3.9	6.2		3.6	30.04

1972 Jan Day	Time PST	Tide Table LA	Observed Tide LA	Observed Tide LB-J	Observed Tide LB-P	Barometer in.Hg
16	0218	2.1	4.5		2.0	30.03
SU	0827**	6.4	9.0		6.3	30.04
016	1542**	-1.2	1.2		-1.4	29.96
	2210	4.0	6.5		3.7	29.98
17	0257	1.9	4.4		1.8	29.98
M	0908	6.3	8.9		6.2	30.00
017	1613	-1.1	1.3		-1.3	29.96
	2239	4.2	6.6		3.9	30.01
18	0343	1.8	4.2		1.5	30.02
TU	0947	6.0	8.5		5.8	30.06
018	1646	-0.8	1.4		-1.2	30.02
	2313	4.4	6.9		4.1	30.09
19	0433	1.7	3.9		1.3	30.08
W	1032	5.5	7.9		5.2	30.16
019	1719	-0.4	1.8		-0.8	30.11
	2350	4.6	7.0		4.2	30.18
20	0533	1.6	3.7		1.1	30.16
TH	1117	4.8	7.1		4.3	30.22
020	1752	0.2	2.4		-0.3	30.16
21	0031	4.8	7.3		4.4	30.19
F	0644	1.5	3.7		1.2	30.16
021	1217	3.9	6.4		3.6	30.14
	1831	0.8	3.0		0.4	30.05
22	0119	5.0	7.6		4.8	30.05
SA	0807	1.3	3.8		-	30.04
022	1348	3.2	5.6		-	29.99
	1912	1.5	3.9		-	29.98
23	0216	5.2	7.8		-	30.00
SU	0950**	0.9	3.4		-	30.08
023	1555**	2.8	5.1		-	30.00
	2014**	2.1	4.5		-	29.99
24	0327	5.4	8.0		5.2	30.00
M	1118	0.2	2.7		0.1	30.04
024	1803	2.9	5.5		2.7	29.98
	2137	2.4	4.9		2.2	29.98
25	0436	5.7	8.3		5.4	29.97
TU	1221	-0.4	2.1		-0.6	29.96
025	1908	3.3	5.9		3.1	29.92
	2305	2.5	5.0		2.3	29.95
26	0538	6.0	8.6		5.8	29.92
W	1310	-0.9	1.5		-1.2	29.98
026	1955	3.6	6.1		3.3	30.08
27	0012	2.3	4.5		1.9	30.16
TH	0628	6.3	8.6		5.8	30.18
027	1355	-1.2	1.1		-1.8	30.20
	2032	3.9	6.2		3.4	30.22
28	0106	2.1	4.2		1.5	30.22
F	0717**	6.5	8.8		6.0	30.21
028	1432**	-1.4	1.0		-1.8	30.08
	2103	4.1	6.4		3.6	30.08
29	0154	1.8	4.2		1.5	30.06
SA	0800	6.5	9.0		6.1	30.03
029	1505	-1.3	1.1		-1.6	29.96
	2136	4.3	6.7		3.9	29.98
30	0232	1.6	4.1		1.4	30.02
SU	0840	6.3	8.9		6.1	30.06
030	1538	-1.1	1.2		-1.4	29.98
	2203	4.4	6.8		4.0	30.00
31	0313	1.5	4.0		1.3	29.95
M	0915	6.0	8.6		5.8	29.98
031	1607	-0.8	1.7		-0.9	29.99
	2231	4.5	7.0		4.1	29.92

(Continued)

** Calibration checkpoint.

1972 Feb Day	Time PST	Tide Table LA	Observed Tide LA	LB-J	LB-P	Barometer in.Hg
1	0353	1.4	4.0		1.3	29.89
TU	0952	5.5	8.3		5.5	29.90
032	1636	-0.4	2.3		-0.4	29.82
	2300	4.5	7.1		4.2	29.94
2	0433	1.5	4.0		1.3	30.00
W	1026	5.0	7.5		4.7	30.14
033	1658	0.2	2.5		-0.1	30.08
	2329	4.5	7.0		4.2	30.16
3	0516	1.5	3.9		1.2	30.13
TH	1103	4.3	6.8		4.0	30.16
034	1723	0.7	3.2		0.5	30.03
	2355	4.5	7.2		4.3	30.04
4	0604	1.6	4.2		1.4	30.04
F	1136	3.6	6.2		3.4	30.03
035	1742	1.2	3.7		1.1	29.99
5	0027	4.5	7.1		4.3	30.02
SA	0713	1.7	4.3		1.6	30.04
036	1233	2.9	5.5		2.8	30.07
	1803	1.8	4.2		1.6	30.08
6	0115	4.4	7.0		4.2	30.14
SU	0856**	1.7	4.0		1.4	30.21
037	1421**	2.4	4.8		2.0	30.17
	1806**	2.2	4.4		1.8	30.15
7	0210	4.4	6.8		4.1	30.16
M	1049	1.3	3.7		1.0	30.15
038						
8	0326	4.5	7.1		4.2	30.04
TU	1200	0.8	3.2		0.5	30.05
039						
9	0439	4.8	7.4		4.6	29.95
W	1239	0.2	2.8		0.2	29.92
040	1950	3.2	5.8		3.0	29.92
	2309	2.8	5.3		2.7	29.94
10	0533	5.1	7.8		4.9	29.94
TH	1314	-0.2	2.3		-0.4	29.95
041	2003	3.4	6.1		3.2	30.02
11	0005	2.5	5.0		2.3	30.07
F	0621	5.6	8.0		5.2	30.10
042	1343	-0.6	1.6		-1.0	30.10
	2020	3.7	6.1		3.3	30.11
12	0051	2.2	4.6		1.9	30.13
SA	0658	5.9	8.4		5.6	30.12
043	1413	-0.9	1.4		-1.3	30.07
	2035	4.0	6.5		3.6	30.07
13	0128	1.8	4.2		1.5	30.07
SU	0740	6.2	8.9		6.0	30.06
044	1441	-1.1	1.3		-1.3	29.95
	2102	4.3	6.9		4.1	29.94
14	0209	1.4	4.0		1.3	29.94
M	0821**	6.2	9.0		6.2	29.96
045	1509**	-1.1	1.4		-1.3	29.98
	2130	4.6	7.1		4.4	30.02
15	0253	1.0	3.6		0.9	30.03
TU	0859	6.1	8.7		6.0	30.11
046	1540	-0.9	1.4		-1.3	30.04
	2159	4.9	7.5		4.7	30.06

1972 Feb Day	Time PST	Tide Table LA	Observed Tide LA	LB-J	LB-P	Barometer in.Hg
16	0338	0.7	3.1		0.5	30.06
W	0941	5.7	8.2		5.6	30.12
047	1609	-0.5	1.9		-0.8	30.00
	2228	5.2	7.8		5.0	30.04
17	0427	0.5	3.0		0.4	30.01
TH	1028	5.1	7.7		4.9	30.02
048	1640	0.1	2.4		-0.2	29.96
	2303	5.3	8.0		5.3	30.00
18	0522	0.5	3.0		0.3	29.97
F	1119	4.3	6.9		4.1	30.03
049	1714	0.7	3.0		0.4	29.98
	2342	5.4	8.2		5.3	30.06
19	0630	0.5	2.9		0.3	30.08
SA	1225	3.5	5.9		-	30.13
050	1751	1.4	3.4		-	30.12
20	0028	5.3	7.8		-	30.16
SU	0755	0.6	2.9		-	30.14
051	1404	2.8	5.3		-	30.08
	1832	2.0	4.3		-	30.09
21	0134	5.2	7.7		-	30.11
M	0938	0.4	2.6		-	30.14
052	1643**	2.7	5.2		-	30.07
	1941**	2.5	5.0		-	30.10
22	0256	5.2	7.5		-	30.17
TU	1105	0.0	2.2		-0.5	30.20
053	1820	3.1	5.6		2.8	30.12
	2151	2.7	5.0		2.3	30.14
23	0425	5.3	7.7		4.9	30.11
W	1210	-0.5	1.7		-0.9	30.12
054	1914	3.5	6.0		3.2	30.04
	2325	2.5	4.8		2.1	30.05
24	0534	5.5	8.1		5.3	30.01
TH	1258	-0.8	1.5		-1.1	29.98
055	1937	3.9	6.4		3.6	29.93
25	0023	2.1	4.5		1.8	29.94
F	0629	5.7	8.3		5.6	29.94
056	1335	-0.9	1.5		-1.2	29.92
	2006	4.1	6.6		3.9	29.94
26	0111	1.7	4.1		1.4	29.97
SA	0711**	5.9	8.4		5.6	30.01
057	1410**	-0.9	1.4		-1.2	30.00
	2033	4.4	6.8		4.0	30.02
27	0151	1.3	3.6		1.0	30.05
SU	0752	5.8	8.4		5.6	30.06
058	1439	-0.8	1.6		-1.1	30.00
	2056	4.6	6.9		4.2	30.04
28	0226	1.0	3.4		0.8	30.05
M	0828	5.6	8.2		-	30.05
059	1504	-0.5	1.8		-0.8	29.98
	2118	4.7	7.1		4.5	30.01
29	0301	0.8	3.3		0.7	30.02
TU	0903	5.3	7.8		5.1	30.02
060	1527	-0.2	2.3		-0.3	29.92
	2140	4.8	7.5		4.8	29.94

(Continued)

** Calibration checkpoint.

1972 Mar Day	Time PST	Tide Table LA	Observed Tide LA	LB-J	LB-P	Barometer in.Hg
1	0336	0.7	3.2		0.6	29.94
W	0934	4.9	7.5		4.8	30.02
061	1550	0.2	2.6		0.1	29.95
	2205	4.9	7.4		4.8	30.00
2	0412	0.7	3.1		0.6	30.00
TH	1009	4.5	6.9		4.3	30.04
062	1612	0.7	3.2		0.6	29.93
	2226	4.9	7.5		4.8	29.96
3	0449	0.7	3.3		0.7	29.92
F	1044	3.9	6.5		3.9	29.94
063	1627	1.1	3.8		1.2	29.81
	2251	4.8	7.5		4.9	29.85
4	0531	0.9	3.5		1.0	29.84
SA	1123	3.3	6.1		3.4	29.87
064	1642	1.6	4.2		1.7	29.84
	2316	4.7	7.4		4.7	29.98
5	0624	1.1	3.6		1.0	30.00
SU	1216	2.8	5.3		2.6	30.03
065	1654	2.0	4.4		1.9	29.97
	2348	4.5	7.1		4.5	30.04
6	0743**	1.2	3.7		1.1	30.03
M	1415**	2.3	4.8		2.2	30.01
066	1621**	2.3	4.7		2.1	30.00
7	0043	4.3	6.9		4.3	30.05
TU	0944	1.1	3.5		1.0	30.10
067						
8	0208	4.2	6.9		4.2	30.10
W	1109	0.7	3.1		0.6	30.15
068						
9	0351	4.4	7.0		4.3	30.08
TH	1154	0.3	2.7		0.2	30.14
069	1910	3.3	5.7		3.1	30.10
	2259	2.8	5.3		2.7	30.10
10	0502	4.7	7.2		4.5	30.07
F	1232	-0.1	2.2		-0.3	30.08
070	1917	3.6	6.2		3.5	30.02
	2354	2.3	4.8		2.2	30.05
11	0556	5.1	7.7		-	30.03
SA	1303	-0.5	1.9		-	30.04
071	1934	4.0	6.5		-	30.01
12	0039	1.7	4.2		-	30.04
SU	0639	5.5	8.2		-	30.05
072	1331	-0.7	1.7		-	30.04
	1953	4.4	6.9		-	30.04
13	0120	1.1	3.6		-	30.04
M	0724**	5.7	8.4		-	30.02
073	1400**	-0.7	1.6		-0.9	29.99
	2017	4.8	7.5		4.8	29.97
14	0201	0.5	3.2		0.5	29.94
TU	0806	5.7	8.4		5.7	29.98
074	1429	-0.6	1.7		-0.7	29.92
	2044	5.3	8.0		5.3	29.98
15	0243	0.0	2.6		0.1	29.95
W	0851	5.5	8.3		out	30.03
075	1503	-0.3	2.0		-0.4	29.94
	2113	5.6	8.4		5.7	30.02

1972 Mar Day	Time PST	Tide Table LA	Observed Tide LA	LB-J	LB-P	Barometer in.Hg
16	0327	-0.4	-		-0.4	29.99
TH	0936	5.1	-		4.9	30.02
076	1533	0.2	-		0.1	29.94
	2148	5.9	8.7		5.9	29.98
17	0419	-0.6	2.0		-0.5	29.95
F	1031	4.5	7.2		4.5	29.98
077	1607	0.7	3.2		0.7	29.93
	2225	5.9	8.8		6.0	29.94
18	0516	-0.5	2.0		-0.5	29.93
SA	1127	3.8	6.5		3.7	29.96
078	1642	1.3	3.9		1.3	29.87
	2306	5.8	8.7		6.0	29.89
19	0620	-0.3	2.3		-0.2	29.88
SU	1242	3.2	6.0		3.3	29.90
079	1718	1.9	4.5		1.9	29.90
	2357	5.5	8.3		5.7	29.96
20	0739	-0.1	2.5		0.0	30.00
M	1435	2.9	5.5		2.9	29.92
080	1807	2.4	5.0		2.5	29.91
21	0106	5.1	7.9		5.2	29.94
TU	0911	0.0	2.5		0.1	29.94
081	1646**	3.1	5.9		3.2	29.86
	2003**	2.8	5.4		2.9	29.91
22	0242	4.8	7.5		4.8	29.96
W	1036	-0.2	2.3		-0.2	30.04
082	1754	3.5	6.1		3.5	29.95
	2214	2.7	5.2		2.7	29.98
23	0413	4.8	7.4		4.7	29.98
TH	1142	-0.4	2.2		-0.3	30.02
083	1835	3.9	6.5		3.8	29.02
	2333	2.2	4.7		2.2	29.96
24	0522	4.9	7.6		4.9	29.95
F	1225	-0.4	2.2		-0.4	29.92
084	1904	4.2	6.9		4.2	29.86
25	0026	1.7	4.3		1.7	29.92
SA	0616	5.0	7.8		5.2	29.87
085	1302	-0.4	2.3		-0.2	29.88
	1927	4.5	7.2		4.6	29.81
26	0105	1.2	4.0		1.4	29.86
SU	0702**	5.1	7.9		5.3	29.84
086	1333**	-0.3	2.5		0.0	29.86
	1956	4.7	7.6		4.9	29.83
27	0143	0.8	3.5		0.9	29.86
M	0743	5.0	7.8		5.1	29.88
087	1400	0.0	2.5		0.0	29.92
	2011	4.9	7.5		4.9	29.96
28	0216	0.4	3.0		0.4	30.02
TU	0816	4.8	7.5		4.8	30.10
088	1421	0.3	2.9		0.3	30.04
	2034	5.1	7.7		5.0	30.01
29	0251	0.2	2.8		0.2	29.97
W	0851	4.5	7.2		4.5	29.98
089	1443	0.6	3.3		0.7	29.91
	2054	5.2	7.8		5.2	29.93
30	0320	0.1	2.6		0.0	29.98
TH	0926	4.2	6.8		4.2	30.02
090	1506	0.9	3.5		1.0	29.97
	2115	5.2	7.8		5.2	30.00
31	0352	0.0	2.5		0.0	30.00
F	1000	3.9	6.4		3.8	30.04
091	1527	1.3	3.8		1.3	29.99
	2138	5.2	7.8		5.2	30.01

(Continued)

** Calibration checkpoint.

1972 Apr Day	Time PST	Tide Table LA	Observed Tide LA	LB-J	LB-P	Barometer in.Hg
1	0429	0.1	2.6		0.1	29.99
SA	1038	3.5	6.1		3.4	30.04
092	1542	1.6	4.1		1.6	29.98
	2159	5.1	7.8		5.2	29.98
2	0506	0.2	2.7		0.2	29.92
SU	1123	3.1	5.7		-	29.96
093	1603	2.0	4.5		-	29.86
	2228	4.9	7.7		5.1	29.88
3	0554	0.5	3.0		-	29.90
M	1227	2.7	-		2.8	29.96
094	1610	2.3	4.7		2.2	29.90
	2303	4.7	7.4		4.8	29.96
4	0702	0.7	3.0		0.7	29.99
TU	2348	4.4	7.1		4.5	29.94
095						
5	0832	0.7	3.2		0.8	29.94
W						
096						
6	0109	4.2	7.0		4.3	29.94
TH	0956	0.5	2.9		0.5	30.02
097	1810**	3.2	5.8		3.2	29.98
	2054**	3.1	5.5		3.1	30.00
7	0253	4.1	6.7		4.1	29.99
F	1052	0.3	2.7		0.3	30.00
098	1803	3.5	6.0		3.6	29.92
	2239	2.6	5.3		2.8	29.96
8	0417	4.3	6.9		4.3	29.95
SA	1133	0.1	2.5		0.1	29.99
099	1818	3.9	6.4		4.0	29.93
	2336	2.0	4.6		2.1	29.95
9	0524	4.6	7.2		4.6	29.92
SU	1208	-0.1	2.3		-0.1	29.92
100	1839	4.4	7.2		4.5	29.87
10	0022	1.2	3.7		1.3	29.96
M	0619	4.8	7.4		4.9	29.97
101	1242	-0.1	2.3		-0.1	29.95
	1901	4.9	7.5		5.0	29.94
11	0108	0.4	2.9		0.4	30.00
TU	0708	5.0	7.4		4.9	30.06
102	1315	0.0	2.2		-0.2	30.06
	1930	5.5	7.8		5.4	30.02
12	0149	-0.4	2.1		-0.3	30.04
W	0759	4.9	7.3		4.8	30.06
103	1349	0.2	2.5		0.0	30.03
	1959	6.0	8.4		6.0	29.97
13	0236	-0.9	1.5		-0.8	29.92
TH	0847	4.8	7.0		4.6	29.89
104	1424	0.5	2.8		0.4	29.86
	2036	6.3	8.9		6.4	29.87
14	0321	-1.3	1.3		-1.3	29.88
F	0939	4.4	6.8		4.3	29.94
105	1500	0.9	3.4		0.9	29.94
	2111**	6.4	9.0		6.5	30.00
15	0410**	-1.4	1.1		-1.4	30.02
SA	1036	4.0	6.3		3.8	30.06
106	1535	1.4	3.8		1.4	30.00
	2154	6.3	8.9		6.4	30.01
16	0506	-1.3	1.2		-1.2	30.00
SU	1136	3.6	5.9		3.4	30.01
107	1618	1.9	4.3		1.8	29.93
	2241	6.0	8.5		6.0	29.96
17	0611	-0.9	1.4		-0.9	29.94
M	1259	3.3	5.7		3.2	29.92
108	1706	2.3	4.8		2.4	29.89
	2335	5.5	8.2		5.6	29.89
18	0723	-0.6	2.0		-0.5	29.88
TU	1436	3.2	5.7		3.2	29.87
109	1821	2.7	5.0		2.6	29.90
19	0044	5.0	7.4		4.9	29.92
W	0840	-0.3	2.0		-0.4	29.98
110	1606**	3.5	5.7		3.3	30.00
	2020**	2.8	5.0		2.7	30.06
20	0216**	4.5	6.8		4.3	30.08
TH	0954	-0.2	2.0		-0.4	30.16
111	1709	3.8	6.0		3.5	30.12
	2211	2.4	4.6		2.2	30.15
21	0346	4.3	6.4		4.0	30.12
F	1053	-0.1	2.1		-0.3	30.11
112	1750	4.2	6.3		3.9	29.99
	2325	1.9	4.1		1.7	30.00
22	0502	4.3	6.5		4.0	29.94
SA	1141	0.1	2.5		0.1	29.97
113	1819	4.5	6.8		4.3	29.90
23	0018	1.3	3.6		1.2	29.98
SU	0600	4.2	6.4		4.0	30.00
114	1215	0.3	2.5		0.2	30.04
	1844	4.8	7.0		4.5	29.99
24	0057	0.8	3.1		0.6	30.02
M	0648	4.2	6.4		3.9	30.03
115	1246	0.6	2.8		0.4	30.02
	1907	5.0	7.3		4.9	29.92
25	0132	0.4	2.7		0.2	29.94
TU	0730	4.1	6.5		4.0	29.96
116	1313	0.8	3.3		0.9	29.92
	1930	5.2	7.7		5.2	29.85
26	0204	0.0	2.5		0.0	29.86
W	0811	4.0	6.4		3.9	29.89
117	1336	1.1	3.7		1.2	29.87
	1951	5.4	7.8		5.3	29.86
27	0238	-0.2	2.1		-0.3	29.92
TH	0848	3.8	6.2		3.7	29.96
118	1359	1.4	3.7		1.4	29.94
	2012	5.5	7.9		5.3	29.95
28	0308	-0.4	1.8		-0.6	29.98
F	0923	3.7	6.0		3.4	30.00
119	1425	1.6	4.0		1.5	29.94
	2038	5.5	7.9		5.4	29.92
29	0343	-0.4	1.8		-0.5	29.91
SA	1002	3.5	5.9		3.4	29.92
120	1448	1.9	4.3		1.8	29.88
	2101	5.5	7.8		5.4	29.90
30	0418	-0.4	1.8		-0.5	29.90
SU	1047	3.2	5.5		3.0	30.00
121	1509	2.1	4.3		1.8	29.93
	2128	5.4	7.7		5.2	29.94

(Continued)

** Calibration checkpoint.

1972 May Day	Time PST	Tide Table LA	Observed Tide LA	Observed Tide LB-J	Observed Tide LB-P	Barometer in.Hg
1	0454	-0.2	1.9		-0.5	29.94
M	1133	3.0	5.4		2.9	29.99
122	1532	2.3	4.5		2.1	29.93
	2203	5.2	7.6		5.0	29.96
2	0545	-0.1	2.0		-0.3	29.95
TU	1241	2.9	5.3		2.8	29.93
123	1553	2.6	4.7		2.3	29.88
	2238	4.9	7.5		4.9	29.90
3	0636	0.1	2.2		-0.1	29.87
W	1418	2.9	5.2		2.8	29.87
124	1636	2.8	4.9		2.5	29.85
	2323	4.6	7.1		4.6	29.90
4	0737	0.2	2.4		0.1	29.92
TH	1548	3.1	5.4		2.9	29.94
125	1804	3.0	-		2.7	29.91
5	0031	4.3	-		4.2	29.97
F	0840	0.3	-		0.1	29.98
126	1621	3.4	5.6		3.1	29.94
	2034	2.9	5.1		2.7	29.97
6	0200	4.0	6.3		3.8	29.98
SA	0939	0.3	2.4		0.0	29.99
127	1648	3.9	6.0		3.6	29.96
	2211	2.4	4.6		2.2	29.98
7	0336	3.9	6.1		3.6	30.00
SU	1026	0.4	2.4		0.0	30.04
128	1713	4.4	6.5		4.1	30.01
	2312	1.6	3.8		1.5	30.02
8	0453	4.0	6.2		3.8	30.02
M	1112	0.5	2.5		0.1	30.04
129	1741	4.9	7.3		4.7	29.93
9	0005	0.7	3.0		0.6	29.94
TU	0600	4.1	6.4		3.9	29.92
130	1147	0.6	2.9		0.4	29.91
	1815	5.5	7.9		5.4	29.86
10	0054	-0.2	2.3		-0.1	29.88
W	0658	4.1	6.5		4.0	29.92
131	1228	0.8	3.0		0.7	29.88
	1850	6.1	8.5		6.0	29.84
11	0143	-0.9	1.5		-0.9	29.89
TH	0756	4.2	6.5		4.0	29.96
132	1310	1.1	3.3		1.0	29.93
	1926	6.5	9.0		6.5	29.89
12	0227	-1.5	0.8		-1.5	29.95
F	0850	4.1	6.3		3.8	30.00
133	1348	1.3	3.7		1.3	29.94
	2005**	6.8	9.4		6.8	29.89
13	0316**	-1.8	0.6		-1.7	29.89
SA	0945	4.0	6.3		3.9	29.91
134	1430	1.6	4.1		1.7	29.81
	2048	6.8	9.5		6.9	29.82
14	0405	-1.8	0.7		-1.7	29.84
SU	1044	3.8	6.2		3.7	29.88
135	1517	1.9	4.4		2.0	29.78
	2137	6.6	9.3		6.7	29.80
15	0500	-1.6	1.0		-1.5	29.82
M	1145	3.6	6.3		3.7	29.89
136	1612	2.2	4.6		2.2	29.84
	2225	6.2	8.7		6.1	29.90
16	0555	-1.2	1.1		-1.2	29.88
TU	1256	3.6	6.0		3.5	29.91
137	1707	2.5	4.7		2.3	29.89
	2319	5.6	8.2		5.5	29.92
17	0652	-0.8	1.6		-0.8	29.91
W	1404	3.7	6.1		3.6	29.88
138	1827	2.6	4.9		2.6	29.83
18	0021	5.0	7.6		4.9	29.84
TH	0757	-0.4	2.1		-0.4	29.81
139	1513**	3.9	6.6		4.0	29.76
	2004**	2.6	5.2		2.8	29.73
19	0139**	4.3	7.1		4.5	29.74
F	0857	0.0	2.6		0.2	29.82
140	1608	4.2	6.8		4.2	29.86
	2145	2.3	4.7		2.4	29.88
20	0301	3.9	6.5		3.9	29.90
SA	0954	0.4	2.9		0.5	30.00
141	1651	4.5	7.0		4.4	30.03
	2302	1.7	4.0		1.7	30.08
21	0429	3.6	5.9		3.4	30.06
SU	1039	0.8	3.1		0.7	30.10
142	1724	4.8	7.1		4.6	30.04
	2357	1.2	3.6		1.1	30.04
22	0538	3.5	5.9		3.4	30.01
M	1118	1.1	3.6		1.2	30.00
143	1755	5.0	7.6		5.0	29.92
23	0040	0.7	3.0		0.6	29.92
TU	0635	3.4	6.1		3.5	29.94
144	1153	1.4	3.9		1.5	29.95
	1822	5.3	7.8		5.3	29.86
24	0120	0.2	2.7		0.2	29.86
W	0724	3.4	6.1		3.5	29.88
145	1222	1.7	4.0		1.7	29.89
	1845	5.4	8.0		5.4	29.84
25	0152	-0.1	2.2		-0.1	29.87
TH	0811	3.4	6.0		3.4	29.91
146	1256	1.9	4.2		1.8	29.91
	1914	5.6	8.0		5.5	29.90
26	0227	-0.4	1.9		-0.5	
F	0851	3.4	5.9		3.3	
147	1320	2.0	4.4		2.0	29.93
	1940	5.7	8.0		5.5	29.97
27	0301	-0.6	1.6		-0.8	-
SA	0928	3.4	5.9		3.2	-
148	1349	2.2	4.5		2.0	29.92
	2012	5.8	8.2		5.6	29.98
28	0336	-0.6	1.7		-0.8	29.93
SU	1009**	3.4	5.9		3.4	30.00
149	1418**	2.3	4.7		2.3	29.91
	2041**	5.8	8.4		5.8	29.92
29	0412**	-0.6	1.7		-0.7	29.84
M	1052**	3.3	5.9		3.3	29.88
150	1451**	2.4	4.9		2.5	29.80
	2112	5.7	8.3		5.8	29.81
30	0447	-0.6	1.8		-0.6	29.82
TU	1139	3.3	6.0		3.4	29.84
151	1532	2.6	4.9		2.5	29.81
	2149	5.5	8.2		5.6	29.86
31	0526	-0.5	2.0		-0.5	29.89
W	1230	3.3	6.2		3.4	29.86
152	1615	2.7	5.0		2.6	29.81
	2228	5.3	8.1		5.4	29.86

(Continued)

** Calibration checkpoint.

1972 Jun Day	Time PST	Tide Table LA	Observed Tide LA	LB-J	LB-P	Barometer in.Hg
1	0609	-0.3	2.3		0.2	29.86
TH	1319	3.4	6.2		3.9	29.80
153	1704	2.8	5.1		3.1	29.79
	2315	4.9	7.7		5.4	29.87
2	0652	-0.1	2.5		0.4	29.86
F	1408	3.6	6.4		4.1	29.86
154	1830	2.8	5.3		3.3	29.83
3	0012	4.4	7.3		4.9	29.88
SA	0744	0.2	2.8		0.6	29.88
155	1454**	4.0	6.8		4.5	29.85
	2007**	2.6	5.1		3.1	29.84
4	0128**	3.9	6.8		4.4	29.86
SU	0827	0.5	3.2		1.0	29.86
156	1532	4.4	7.3		4.9	29.79
	2144	2.0	4.7		2.5	29.82
5	0259	3.6	6.5		4.1	29.82
M	0916	0.8	3.5		1.3	29.82
157	1614	4.9	7.8		5.5	29.80
	2257	1.2	4.0		1.9	29.78
6	0433	3.4	6.4		3.9	29.78
TU	1011	1.2	3.8		1.5	29.84
158	1656	5.5	8.3		6.0	29.80
	2354	0.3	3.1		0.8	29.82
7	0553	3.4	6.3		3.7	29.82
W	1100	1.4	4.0		1.6	29.84
159	1736	6.0	8.9		6.3	29.78
8	0048	-0.5	2.3		0.0	29.80
TH	0701	3.6	6.5		3.9	29.81
160	1148	1.7	4.3		2.0	29.82
	1816	6.5	9.4		6.8	29.79
9	0137	-1.2	1.6		-0.7	29.83
F	0804	3.7	6.5		3.9	29.84
161	1239	1.8	4.5		2.1	29.88
	1904	6.8	9.5		6.9	29.88
10	0226	-1.6	1.0		-1.5	29.90
SA	0857	3.8	6.5		3.9	29.96
162	1328	1.9	4.5		2.0	29.94
	1949**	7.0	9.6		7.0	29.89
11	0311**	-1.8	-		-1.8	29.84
SU	0950	3.9	6.6		4.1	29.85
163	1415	2.0	4.7		2.3	29.78
	2035	7.0	9.8		7.2	29.74
12	0359	-1.8	1.0		-1.6	29.73
M	1039	3.9	6.6		4.1	29.77
164	1510	2.1	4.7		2.4	29.71
	2123	6.7	9.5		7.0	29.74
13	0447	-1.6	1.1		-1.3	29.76
TU	1128	4.0	6.6		4.1	29.84
165	1601	2.2	4.8		2.3	29.80
	2212	6.3	8.9		6.4	29.85
14	0535	-1.2	1.4		-1.1	29.84
W	1220	4.0	6.6		4.1	29.89
166	1703	2.3	4.7		2.2	29.88
	2301	5.7	8.2		5.7	29.89
15	0621	-0.7	1.8		-0.6	29.90
TH	1311	4.1	6.6		4.1	29.88
167	1811	2.4	4.9		2.4	29.83
	2357	4.9	7.5		4.9	29.87

1972 Jun Day	Time PST	Tide Table LA	Observed Tide LA	LB-J	LB-P	Barometer in.Hg
16	0704	-0.1	2.5		0.1	29.85
F	1408	4.3	6.9		4.4	29.80
168	1932	2.4	5.0		2.5	29.78
17	0053	4.2	6.9		4.3	29.78
SA	0750	0.5	3.1		0.7	29.80
169	1455	4.5	7.2		4.6	29.79
	2100	2.2	4.9		2.4	29.80
18	0214	3.6	6.2		3.7	29.81
SU	0836	1.0	3.7		1.3	29.86
170	1542	4.7	7.3		4.8	29.83
	2223**	1.8	4.3		1.9	29.88
19	0346**	3.1	5.8		3.2	29.88
M	0922**	1.5	4.0		1.6	29.93
171	1624	4.9	7.4		4.9	29.86
	2331	1.2	3.7		1.3	29.91
20	0515	3.0	5.6		3.1	29.94
TU	1011	1.9	4.4		2.0	29.90
172	1659	5.1	7.6		5.0	29.92
21	0026	0.7	3.1		0.8	29.82
W	0635	3.0	5.8		3.2	29.81
173	1053	2.2	4.7		2.3	29.83
	1740	5.3	7.8		5.3	29.81
22	0109	0.3	2.7		0.3	29.86
TH	0736	3.2	5.8		3.3	29.90
174	1142	2.4	4.8		2.4	29.96
	1814	5.5	7.9		5.4	29.95
23	0140	-0.1	2.3		-0.1	29.98
F	0819	3.3	5.9		3.3	30.01
175	1219	2.5	4.8		2.4	30.03
	1849	5.7	8.1		5.6	29.98
24	0215	-0.4	2.0		-0.4	29.96
SA	0854	3.4	6.0		3.5	29.98
176	1259	2.5	5.0		2.5	29.97
	1920	5.9	8.4		5.9	29.92
25	0250	-0.6	1.9		-0.6	29.94
SU	0927	3.5	6.1		3.5	29.97
177	1334	2.5	4.4		2.5	29.96
	1953	6.0	8.6		6.0	29.90
26	0321	-0.7	1.7		-0.7	29.90
M	0958**	3.6	6.1		3.5	29.96
178	1411**	2.5	4.8		2.3	29.92
	2029**	6.1	8.6		6.0	29.94
27	0356**	0.8	1.5		-1.0	29.96
TU	1033**	3.7	6.1		3.5	29.97
179	1446**	2.5	4.7		2.2	29.92
	2105	6.0	8.5		5.9	29.96
28	0428	-0.7	1.5		-1.0	29.96
W	1107	3.8	6.1		3.6	29.97
180	1529	2.5	4.6		2.1	29.92
	2140	5.9	8.2		5.7	29.92
29	0500	-0.6	1.7		-0.8	29.89
TH	1142	3.9	6.3		3.7	29.89
181	1615	2.5	4.6		2.1	29.82
	2221	5.5	8.0		5.5	29.84
30	0535	-0.4	2.1		-0.4	29.85
F	1218	4.1	6.5		3.9	29.88
182	1716	2.4	4.6		2.1	29.82
	2303	5.1	7.6		5.0	29.85

** Calibration checkpoint.

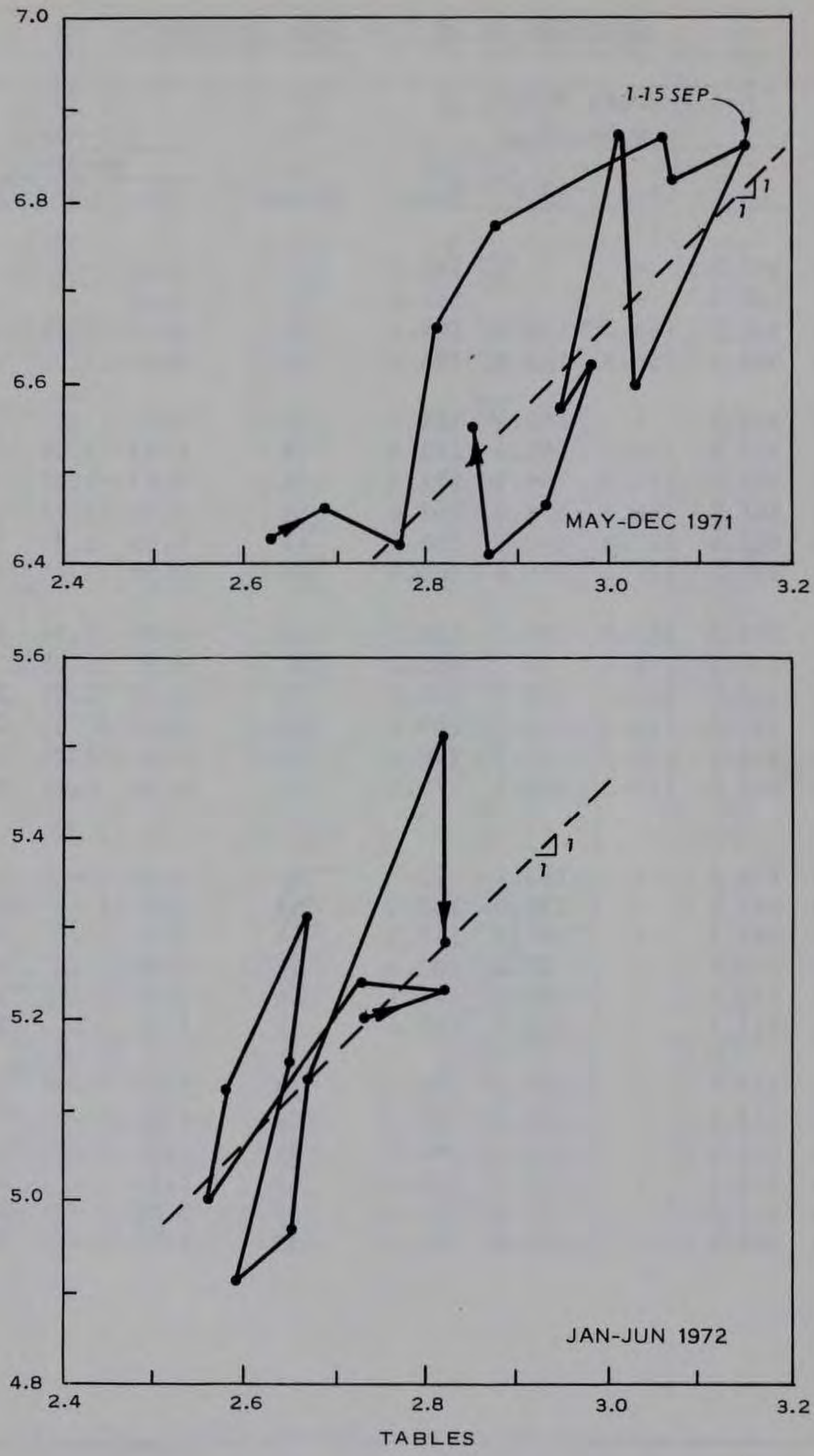
Correlation of Tide Gage Records*

1/2-Month Period	1/2-Month Totals of Gage Readings				No. of Ridges**	1/2-Month Averages			
						Observed			
	LA	LB-J	LB-P	LA Table		LA	LB-J	LB-P	LA Table
1971									
01-15 May	373.5	-	-	152.3	58	6.43	-	-	2.63
16-31 May	400.6	-	-	166.9	62	6.46	-	-	2.69
01-15 Jun	334.2	141.2	138.9	144.2	52	6.42	2.71	2.67	2.77
16-30 Jun	386.3	169.6	163.8	163.1	58	6.66	2.92	2.82	2.81
01-15 Jul	393.2	-	163.4	166.3	58	6.77	-	2.81	2.87
16-31 Jul	375.8	167.5	161.6	163.9	55	6.83	3.04	2.93	2.98
01-15 Aug	385.0	175.2	169.9	171.5	56	6.87	3.12	3.03	3.06
16-31 Aug	361.5	166.3	156.8	162.6	53	6.82	3.13	2.95	3.07
01-15 Sep	302.0	141.8	140.1	138.6	44	6.86	3.22	3.18	3.15
16-30 Sep	356.2	170.4	155.6	163.5	54	6.59	3.15	2.88	3.03
01-15 Oct	295.5	145.8	127.7	129.3	43	6.87	3.39	2.96	3.01
16-31 Oct	374.5	174.1	-	168.2	57	6.57	3.05	-	2.95
01-15 Nov	318.0	145.7	132.7	143.0	48	6.62	3.03	2.76	2.98
16-30 Nov	355.3	161.4	141.9	160.9	55	6.46	2.93	2.58	2.93
01-15 Dec	359.1	159.3	135.3	160.6	56	6.41	2.84	2.42	2.87
16-31 Dec	407.0	177.3	160.5	176.6	62	6.56	2.85	2.58	2.85
1972									
01-15 Jan	176.8	-	185.7	92.7	34	5.20	-	2.52	2.73
16-31 Jan	287.9	-	138.0	155.0	55	5.23	-	2.50	2.82
01-15 Feb	283.1	-	134.2	147.3	54	5.24	-	2.48	2.73
16-29 Feb	210.4	-	97.2	107.6	42	5.00	-	2.31	2.56
01-15 Mar	230.5	-	107.9	116.1	45	5.12	-	2.39	2.58
16-31 Mar	313.7	-	160.1	157.4	59	5.31	-	2.71	2.67
01-15 Apr	257.7	-	133.3	132.7	50	5.15	-	2.66	2.65
16-30 Apr	285.3	-	143.2	150.3	58	4.91	-	2.46	2.59
01-15 May	273.6	-	139.1	145.7	55	4.97	-	2.52	2.65
16-31 May	318.6	-	164.3	165.5	62	5.13	-	2.65	2.67
01-15 Jun	314.3	-	177.9	160.5	57	5.51	-	3.12	2.82
16-30 Jun	306.4	-	163.9	163.5	58	5.28	-	2.82	2.82

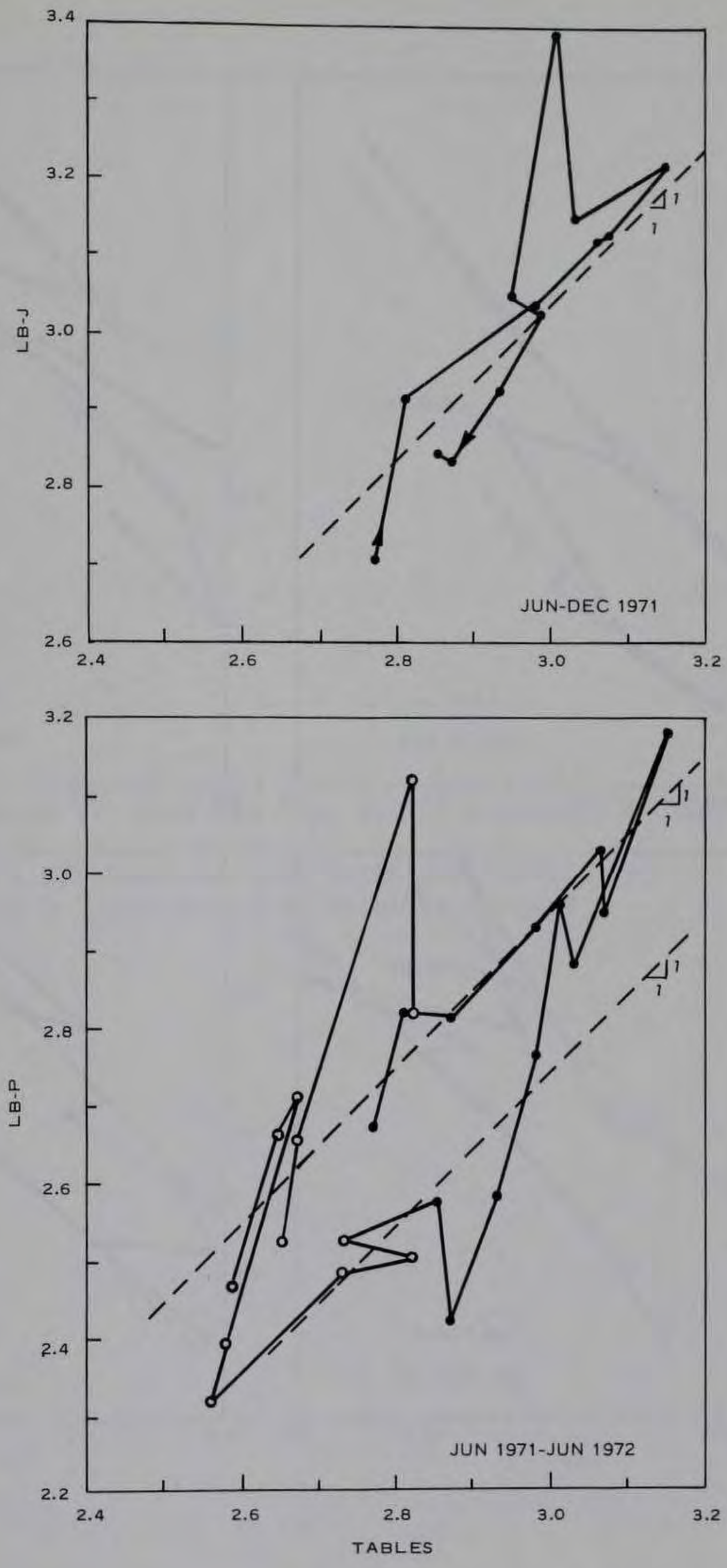
* Basic data are listed in Appendix H, Incl 1.

** Only comparable sets of LA, LB-J, LB-P, and predicted (LA table) readings were used in obtaining totals and averages.

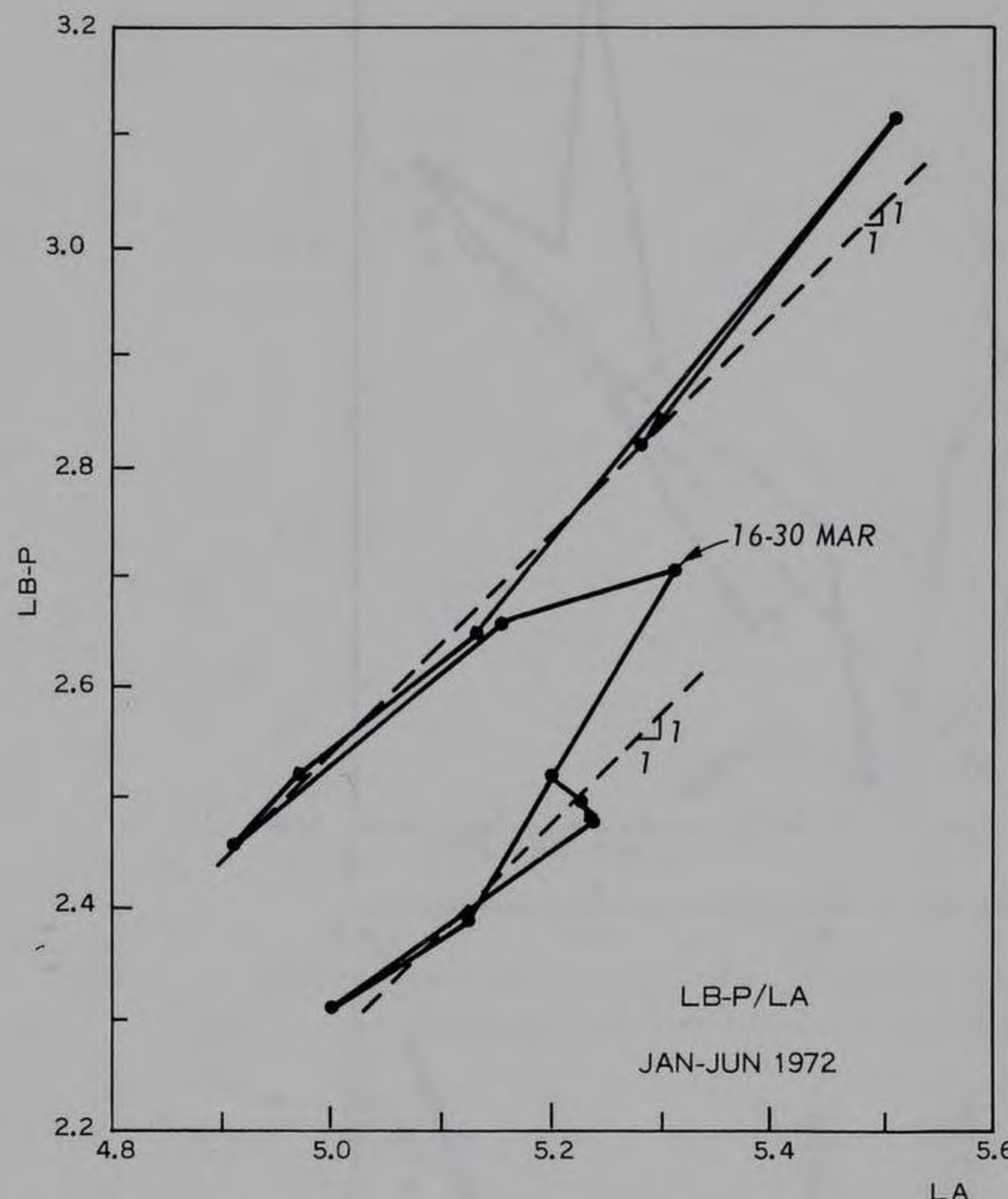
Incl 2 (Sheet 1 of 4)

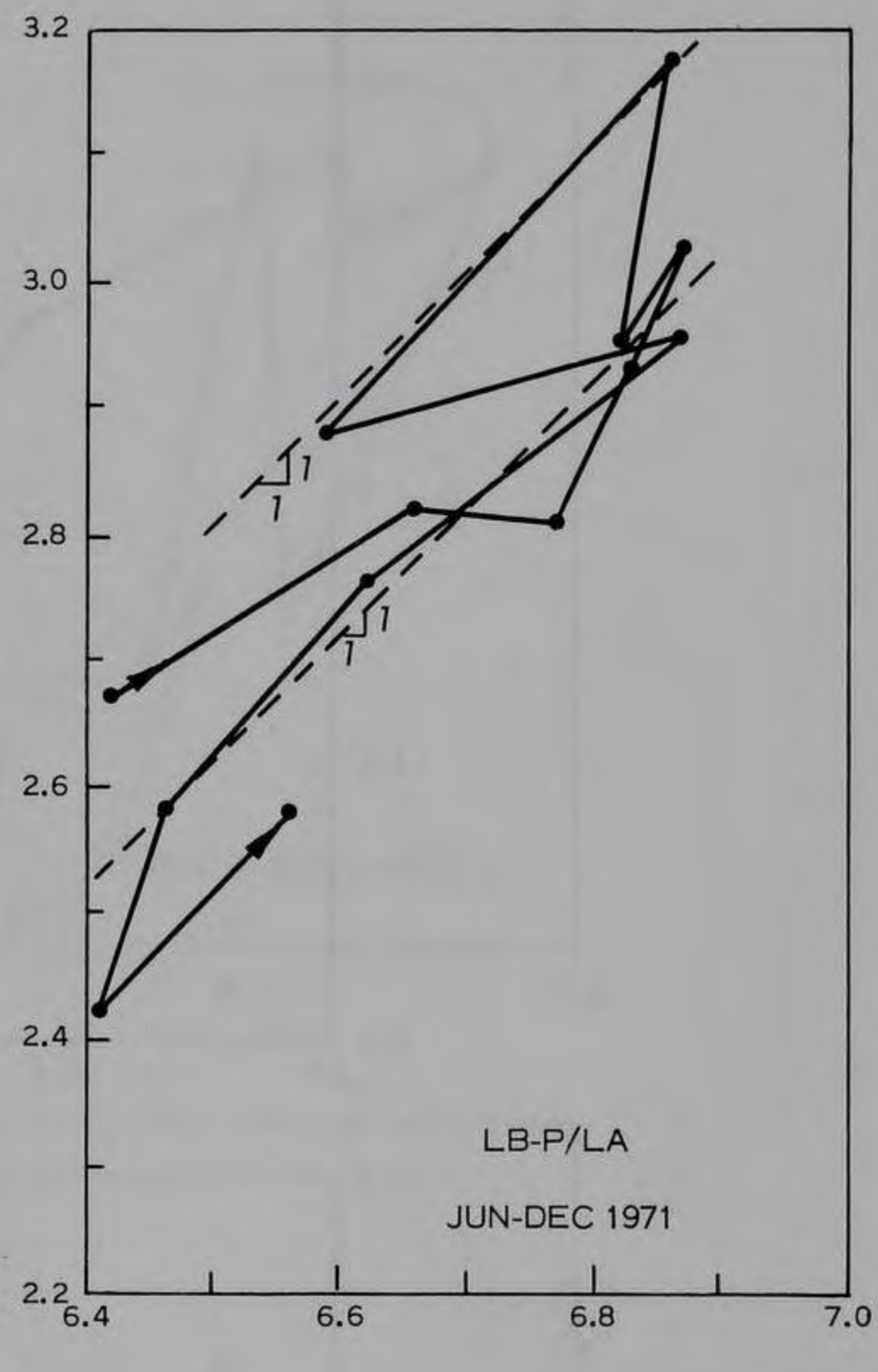


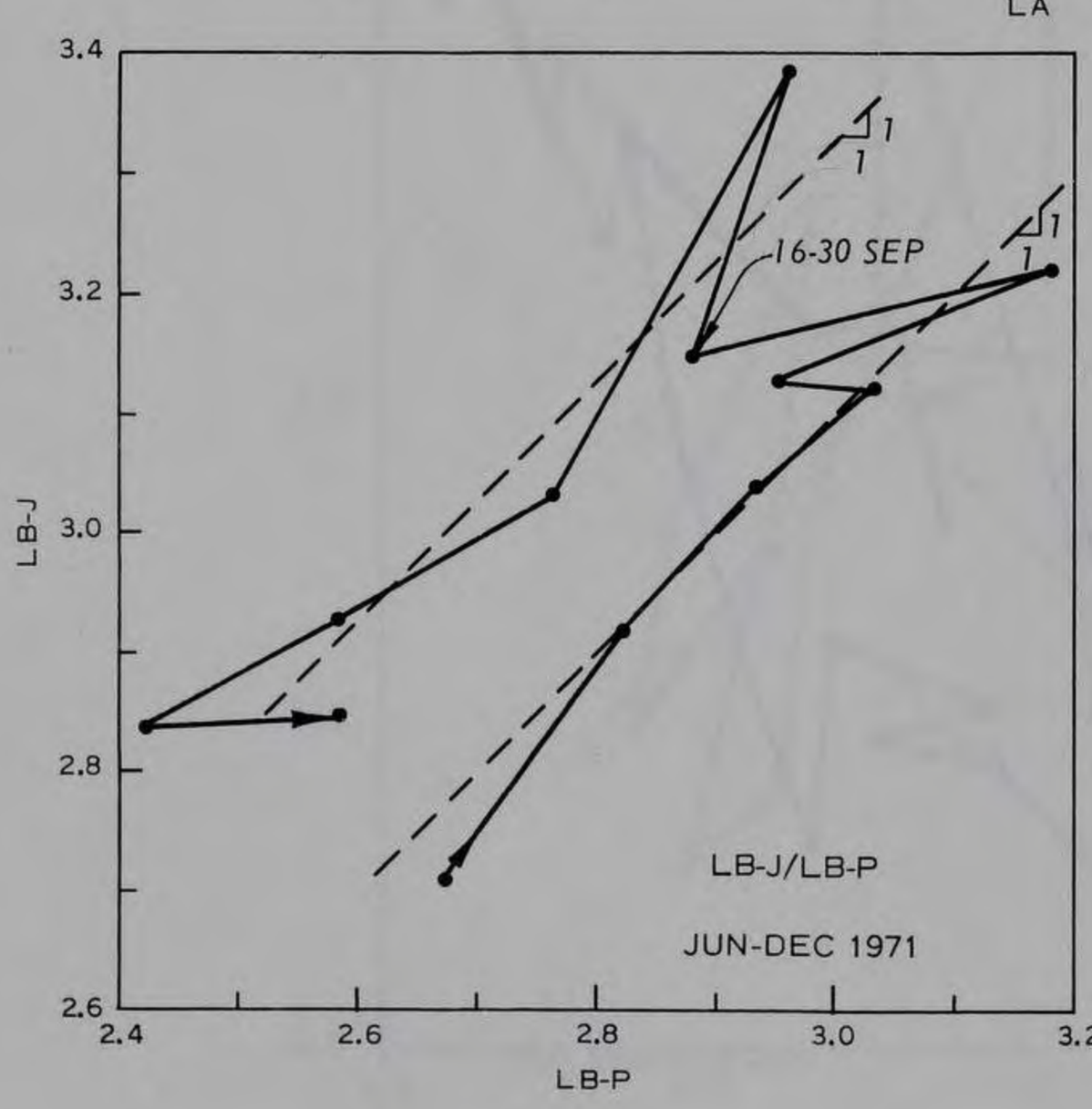
Incl 2 (Sheet 2 of 4)

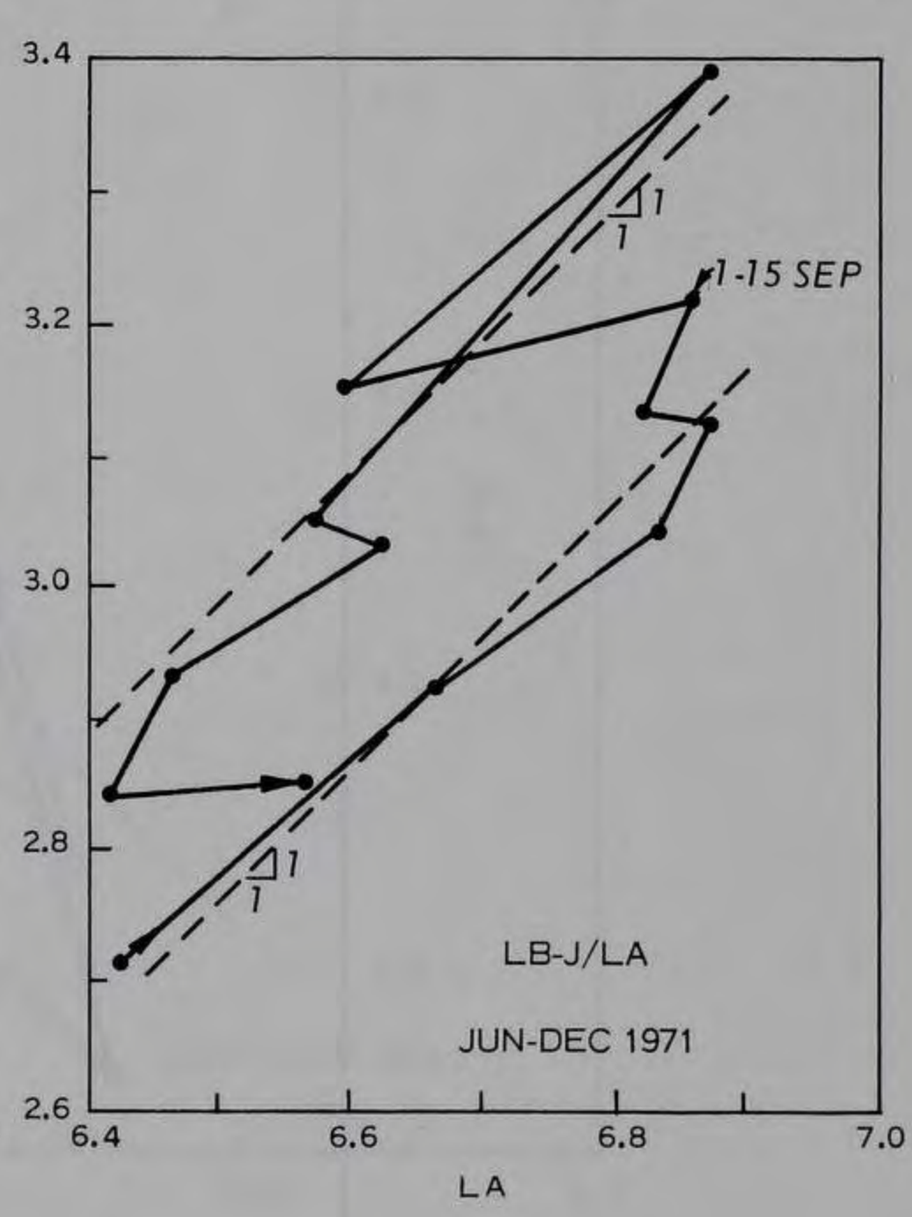


Incl 2 (Sheet 3 of 4)









Incl 2 (Sheet 4 of 4)

APPENDIX I: STATIONS 1-12 AND 14 SUBMERGENCE CALCULATIONS

Inclosure 1: Computed Tide Heights--Preliminary
Inclosure 2: Computed Tide Heights--Revised

Checkpoint Data Computed Tide Heights

(Preliminary Calibration Values)

Line No.	ID No.	Elev Rank	Sta 13 ft,sea water	LA Tide Gage	Tide Height in Feet Above mllw for Indicated Stations*												
					1	2	3	4	5	6	7	8	9	10	11	12	14
00001	60	98	33.98	3.90	3.53	0.00(2)	0.00	0.00	0.00	0.00	0.00	4.11	0.00	0.00	0.00	3.44	0.00
00002	70	63	34.03	2.80	2.82	0.00	0.00	0.00	0.00	0.00	0.00	3.50	0.00	0.00	0.00	2.75	0.00
00003	80	99	34.01	3.80	3.59	0.00	0.00	0.00	0.00	0.00	0.00	4.23	0.00	0.00	0.00	3.53	0.00
00004	90	87	33.99	3.50	3.46	3.27	0.00	0.00	3.23	3.23	3.32	4.15	3.47	0.00	4.13	0.00	0.00
00005	100	45	33.96	2.30	2.29	2.13	0.00	0.00	2.10	2.10	2.10	2.92	1.97	0.00	2.99	0.00	0.00
00006	110	125	33.99	6.30	6.21	6.03	0.00	0.00	5.99	5.99	5.99	6.85	6.20	0.00	6.91	0.00	0.00
00007	120	12	33.83	-1.00	-.87	-1.02	0.00	0.00	-1.06	-1.01	-.99	-.20	-1.02	0.00	-.18	0.00	0.00
00008	130	91	33.99	3.50	3.50*	3.33	0.00	0.00	3.28	3.28	3.25	4.10	3.42	0.00	**	3.78	0.00
00009	140	50	33.96	2.30	2.31	2.17	0.00	0.00	2.13	2.15	2.13	2.94	2.00	0.00	**	2.22	0.00
00010	150	111	33.81	4.50	4.34	4.17	0.00	0.00	4.11	4.10	4.19	**	4.16	0.00	5.04	**	0.00
00011	160	46	33.83	2.40	2.40	2.26	0.00	0.00	2.20	2.23	2.27	3.03	2.22	0.00	3.14	**	0.00
00012	170	108	33.84	4.50	4.44	4.27	0.00	0.00	4.21	4.19	4.26	5.07	4.44	0.00	5.14	**	0.00
00013	180	134	33.90	6.80	6.79	6.61	0.00	0.00	6.43	6.50	6.63	7.39	6.82	0.00	7.49	6.66	0.00
00014	190	5	33.90	-1.40	-1.32	-1.49	0.00	0.00	-1.64	-1.49	-1.40	-.68	-1.48	0.00	-.66	-1.43	0.00
00015	200	36	33.84	1.90	2.11	1.87	0.00	0.00	1.71	1.96	2.07	0.00	2.18	0.00	2.76	2.02	0.00
00016	210	68	33.81	3.00	3.03	2.81	0.00	0.00	2.60	2.83	2.91	0.00	3.03	0.00	3.68	2.97	0.00
00017	220	37	33.87	2.10	2.12	1.89	0.00	0.00	1.72	1.97	2.04	0.00	1.95	0.00	2.77	2.04	0.00
00018	230	28	†	1.40	1.56	1.97	1.53	1.54	2.07	2.26	2.10	1.24	1.87	**	0.00	1.65	0.00
00019	240	82	†	3.70	3.65	4.01	3.54	3.55	4.04	4.23	4.04	3.16	3.97	**	0.00	3.62	0.00
00020	270	32	†	1.80	†	2.21	1.76	1.78	2.27	2.47	2.31	1.43	2.08	**	0.00	1.79	0.00
00021	280	133	†	6.80	†	7.17	6.73	0.00	8.23	7.71	7.36	6.51	6.88	**	0.00	6.78	0.00
00022	290	10	†	-.80	†	-.45	-.91	0.00	0.68	0.11	-.24	-1.13	-.89	-.89	0.00	-.83	0.00
00023	300	38	33.11	2.00	†	0.00	1.98	1.98	0.00	0.00	0.00	1.79	0.00	1.98	0.00	1.99	0.00
00024	310	58	33.09	2.80	†	0.00	2.72	2.68	0.00	0.00	0.00	2.54	0.00	2.70	0.00	2.78	0.00
00025	320	47	33.12	2.50	†	0.00	2.49	2.45	0.00	0.00	0.00	2.36	0.00	2.50	0.00	2.44	0.00
00026	330	74	33.03	0.00	†	0.00	3.24	3.27	0.00	0.00	0.00	3.02	0.00	3.24	0.00	3.19	0.00
00027	340	71	33.00	3.20	†	0.00	3.20	3.16	0.00	0.00	0.00	2.97	0.00	3.19	0.00	3.20	0.00
00028	370	78	33.10	3.30	3.22	0.00	3.22	3.21	0.00	3.45	0.00	2.93	0.00	0.00	3.13	3.26	0.00
00029	380	69	33.13	2.90	2.89	0.00	2.91	2.89	0.00	3.14	0.00	2.60	0.00	0.00	0.00	6.46	0.00
00030	390	127	33.06	6.50	6.33	0.00	6.32	6.25	6.26	6.55	0.00	5.97	0.00	0.00	6.15	6.32	0.00
00031	400	19	33.04	-.50	-.49	0.00	-.52	-.62	-.53	-.34	0.00	-.89	0.00	0.00	-.63	-.51	0.00
00032	410	88	33.10	3.50	3.41	3.37	3.39	3.29	3.36	3.59	0.00	3.02	3.72	3.34	3.21	3.28	0.00
00033	420	83	33.12	3.00	3.31	3.26	3.31	3.21	3.26	3.48	3.03	2.86	3.54	3.23	3.11	3.26	0.00
00034	430	131	32.98	6.70	6.69	6.68	6.71	6.65	6.66	6.91	6.44	6.20	6.92	6.57	6.50	6.68	0.00
00035	440	16	33.00	-.80	-.53	-.58	-.58	-.69	-.59	-.36	-.90	0.00	-.21	-.70	-.67	-.59	0.00
00036	450	79	32.97	3.40	3.52	3.50	3.45	3.39	3.43	3.71	3.33	3.05	3.84	3.45	3.50	3.48	0.00
00037	460	72	32.98	3.00	3.26	3.24	3.26	3.16	3.18	3.45	3.00	2.73	3.38	3.23	0.00	0.00	0.00
00038	470	119	32.94	5.90	5.81	5.87	5.84	5.81	5.84	6.12	5.65	5.40	6.20	0.00	0.00	0.00	0.00
00039	480	23	32.99	0.10	0.23	0.20	0.28	0.09	0.17	0.39	-.05	-.33	0.64	0.00	0.00	0.00	0.00
00040	490	26	33.18	0.70	0.83	0.82	0.87	0.78	0.85	1.03	0.57	0.34	1.01	0.00	0.83	0.86	0.00

(Continued)

* An all-zero value in any of the "station" columns indicates that meaningful mean-digital-count data are not available; the transducer or data channel may have been inoperable, or the 10-min mean may include erroneous data (due to, for example, a calibration check infringing into the 10-min interval).

** Erroneous data due to, for example, a calibration check extending into the 10-min interval.

† These data channels were not operating during the period indicated. Values for station 1 are reconstructed from station 3 data; values for station 13 are reconstructed from the analog barometer record.

Checkpoint Data Computed Tide Heights (Continued)

(Preliminary Calibration Values)

Line No.	ID No.	Elev Rank	Sta 13 ft,sea water	LA Tide Gage	Tide Height in Feet Above mllw for Indicated Stations												
					1	2	3	4	5	6	7	8	9	10	11	12	14
00041	500	73	33.20	2.90	2.87	2.85	2.87	2.83	2.87	3.09	2.67	2.49	3.00	0.00	2.86	2.97	0.00
00042	510	59	33.20	2.40	2.52	2.49	2.49	2.41	2.43	2.66	2.20	2.02	2.66	0.00	2.50	2.62	0.00
00043	520	96	33.23	3.40	3.31	3.28	3.27	3.23	3.24	3.48	3.00	2.81	3.56	0.00	3.28	3.48	0.00
00044	530	89	33.26	3.10	3.21	3.19	3.23	3.12	**	4.90	2.90	2.70	3.49	0.00	3.19	3.34	0.00
00045	540	116	33.16	4.70	4.52	4.53	4.60	4.51	4.54	4.73	4.25	4.05	4.77	0.00	4.47	4.61	0.00
00046	550	135	33.32	7.00	6.76	6.75	6.69	6.67	6.64	6.91	6.44	6.42	7.01	5.19	6.66	6.64	0.00
00047	560	17	33.21	-.50	-.65	-.68	-.68	-.76	-.63	-.45	-.88	-.91	-.47	0.00	-.67	-.84	0.00
00048	570	100	33.15	4.30	4.01	0.00	4.02	4.00	3.97	4.20	3.73	3.69	4.07	4.01	3.87	4.06	0.00
00049	580	84	33.17	3.60	3.47	0.00	3.42	3.39	3.39	3.62	3.16	3.14	3.60	3.39	3.37	3.43	0.00
00050	590	117	33.07	5.20	4.97	0.00	4.97	5.00	4.99	5.22	4.71	4.64	5.07	4.95	4.86	4.86	0.00
00051	610	24	33.26	0.10	0.05	0.00	0.01	-.05	0.02	0.11	-.26	-.28	0.06	0.00	-.02	0.06	0.00
00052	620	101	33.16	3.80	3.87	0.00	3.87	3.81	3.79	3.94	3.56	3.56	4.02	3.81	3.75	3.90	0.00
00053	630	85	33.16	3.20	3.23	3.09	3.22	3.15	3.15	3.26	2.85	2.84	3.42	3.18	3.13	3.21	0.00
00054	640	114	33.07	4.60	4.57	4.45	4.61	4.51	4.54	4.66	4.28	4.28	4.68	4.55	4.45	4.61	0.00
00055	650	139	33.36	6.90	6.90	6.81	6.93	6.81	6.77	6.92	6.55	6.49	7.19	6.88	6.76	6.76	0.00
00056	660	6	33.24	-1.60	-1.50	-1.68	-1.58	-1.70	-1.54	-1.44	-1.78	-1.68	-1.46	-1.59	-1.58	-1.81	0.00
00057	670	113	33.35	4.40	4.34	4.25	4.36	4.21	4.23	4.38	4.02	4.12	4.53	4.35	4.21	4.41	0.00
00058	680	60	33.37	2.40	2.44	2.35	2.49	2.37	2.34	2.47	2.08	2.17	2.55	2.53	2.36	2.47	0.00
00059	690	109	33.27	4.10	4.07	3.96	4.06	3.97	3.96	4.06	3.82	3.96	4.38	4.06	3.94	4.09	0.00
00060	700	123	33.29	6.00	5.98	5.90	6.02	5.92	5.91	6.07	5.74	5.91	6.18	6.02	5.84	6.08	0.00
00061	710	21	33.21	-.60	-.51	-.66	-.53	-.62	-.57	-.52	-.87	-.74	-.32	-.45	-.61	-.53	0.00
00062	720	110	33.35	4.10	3.94	3.85	3.98	3.88	3.83	3.94	3.61	3.79	3.99	4.01	3.79	4.08	0.00
00063	730	64	33.39	2.30	2.42	2.32	2.46	2.39	2.32	2.43	2.05	2.23	2.56	2.52	2.31	2.44	0.00
00064	740	105	33.35	4.00	3.89	3.81	3.91	3.82	3.79	3.89	3.58	3.76	4.14	3.95	3.76	3.93	0.00
00065	750	140	33.23	7.50	7.09	7.02	7.15	7.02	6.96	7.09	6.71	6.91	7.19	7.13	6.93	7.16	0.00
00066	760	3	33.23	-1.60	-1.60	-1.76	-1.63	-1.64	-1.55	-1.48	-1.88	-1.72	-1.80	-1.50	-1.69	-1.77	0.00
00067	770	106	33.34	3.90	3.75	3.66	3.81	3.67	3.61	3.76	3.41	3.60	3.68	3.83	3.60	3.95	0.00
00068	780	70	33.43	2.30	2.26	2.15	2.35	2.22	2.20	2.31	1.97	2.15	2.21	2.44	2.13	2.37	0.00
00069	790	107	33.44	3.60	3.47	3.38	3.53	3.40	3.38	3.52	3.19	3.36	3.53	3.58	3.34	3.64	0.00
00070	800	93	33.29	3.60	3.52	3.41	3.56	3.43	3.41	3.52	3.26	3.41	3.68	3.58	3.52	3.54	0.00
00071	810	51	33.21	2.40	2.38	2.30	2.46	2.34	2.33	2.42	2.10	2.27	2.31	2.55	2.26	2.38	0.00
00072	820	128	33.26	6.30	6.24	6.16	6.33	6.21	6.11	6.26	5.91	6.08	6.45	6.36	6.06	6.29	0.00
00073	830	13	33.24	-1.10	-1.01	-1.16	-1.02	-1.14	-1.08	-1.01	-1.34	-1.20	-.87	-.89	-1.11	-1.07	0.00
00074	840	94	33.31	3.50	3.47	3.38	3.51	3.37	3.37	3.48	3.15	3.31	3.56	3.54	3.33	3.49	0.00
00075	850	52	33.31	2.20	2.24	2.14	2.29	2.12	2.12	2.20	1.91	2.06	2.38	2.37	2.13	2.23	0.00
00076	860	29	33.20	1.70	1.72	1.61	1.77	0.00	1.64	1.73	1.45	1.61	1.63	1.85	1.61	1.60	0.00
00077	870	80	33.08	3.70	3.50	3.39	3.53	3.40	3.36	3.48	3.14	3.28	3.49	3.54	3.35	3.46	0.00
00078	880	30	33.14	1.60	1.68	1.58	1.71	1.58	1.63	1.72	1.44	1.59	1.56	1.78	1.58	1.61	0.00
00079	890	137	33.25	7.20	7.02	6.95	7.14	6.98	6.92	7.05	6.70	6.87	6.88	0.00	6.84	7.18	0.00
00080	900	4	33.27	-1.50	-1.28	-1.46	-1.35	-1.47	-1.40	-1.31	-1.59	-1.45	-1.26	0.00	-1.42	-1.33	0.00

(Continued)

** Erroneous data due to, for example, a calibration check extending into the 10-min interval.

Checkpoint Data Computed Tide Heights (Continued)

(Preliminary Calibration Values)

Line No.	ID No.	Elev Rank	Sta 13 ft,sea water	LA Tide Gage	Tide Height in Feet Above mllw for Indicated Stations												
					1	2	3	4	5	6	7	8	9	10	11	12	14
00081	910	34	33.30	1.80	1.82	1.90	2.06	1.95	1.90	1.99	1.65	1.80	1.67	0.00	1.89	2.12	0.00
00082	920	61	33.24	2.60	2.57	2.65	2.77	2.63	2.63	2.73	2.46	2.61	2.52	0.00	2.63	2.91	0.00
00083	930	39	33.30	1.80	1.88	1.96	2.10	1.98	1.96	2.06	1.79	1.94	1.42	0.00	1.95	2.20	0.00
00084	940	129	33.27	6.50	6.40	6.50	6.47	6.53	6.45	6.59	6.31	6.46	6.48	0.00	6.41	6.66	0.00
00085	950	9	33.17	-1.30	-1.23	-1.21	-1.24	-1.16	-1.14	-1.04	-1.36	-1.22	-1.46	0.00	-1.15	-1.15	0.00
00086	960	25	33.17	0.90	1.02	1.09	1.04	1.11	1.08	1.28	0.87	1.00	1.36	0.00	1.10	1.22	0.00
00087	970	65	33.05	2.60	2.71	2.79	2.70	2.80	2.81	2.79	2.63	2.77	2.11	0.00	2.77	2.85	0.00
00088	980	40	33.05	2.00	2.13	2.20	2.12	2.21	2.22	2.20	2.02	2.16	2.27	0.00	2.20	2.27	0.00
00089	990	132	33.30	6.30	6.23	6.33	6.30	6.36	6.30	6.23	6.16	6.31	6.16	0.00	6.18	6.52	0.00
00090	1000	7	33.14	-1.50	-1.48	-1.48	-1.49	-1.42	-1.38	-1.44	-1.56	-1.44	-1.62	0.00	-1.47	-1.44	0.00
00091	1010	33	33.47	1.50	1.57	1.65	1.60	1.67	1.67	1.61	1.52	1.70	1.51	0.00	1.59	1.84	0.00
00092	1020	48	33.42	2.30	2.14	2.20	2.16	2.24	2.23	2.14	2.07	2.22	2.36	0.00	2.14	2.37	0.00
00093	1030	41	33.40	1.90	2.00	2.06	2.01	2.09	2.11	2.03	1.99	2.16	1.95	0.00	2.00	2.30	0.00
00094	1040	126	33.20	6.50	6.21	6.46	6.42	6.49	6.43	6.34	6.36	6.51	0.00	0.00	6.31	6.71	0.00
00095	1050	11	33.18	-1.10	-1.14	-1.14	-1.19	-1.11	-1.06	-1.13	-1.17	-1.02	0.00	0.00	-1.12	-.91	0.00
00096	1060	62	33.29	2.70	2.51	2.56	2.51	2.62	2.64	2.56	2.60	2.72	2.43	0.00	2.55	2.78	0.00
00097	1070	53	33.34	2.50	2.41	2.46	2.35	2.49	2.46	2.40	2.42	2.53	2.41	0.00	2.45	2.70	0.00
00098	1080	122	33.22	5.90	5.72	5.81	5.80	5.88	5.81	5.71	5.94	5.95	5.62	0.00	5.72	6.10	0.00
00099	1090	14	33.21	-1.10	-1.05	-1.05	-1.10	-1.02	-.98	-1.06	-.91	-.95	-.95	0.00	-.98	-.81	0.00
00100	1100	27	33.28	1.20	1.25	1.14	1.07	1.17	1.17	1.08	1.46	1.21	0.82	0.00	1.18	1.43	1.34
00101	1110	42	33.21	2.30	2.28	2.23	2.19	2.28	2.29	2.19	2.55	2.29	0.00	0.00	2.26	2.47	2.45
00102	1120	43	33.20	2.20	2.21	2.18	2.15	2.25	2.21	2.13	2.51	2.24	0.00	0.00	2.21	2.42	2.41
00103	1130	120	33.25	5.90	5.63	5.77	5.37	5.82	5.77	5.66	6.10	5.80	5.92	0.00	5.71	6.04	5.99
00104	1140	18	33.19	-.90	-.73	-.87	-1.25	-.84	-.83	-.90	-.51	-.85	-.79	0.00	-.82	-.69	-.67
00105	1150	75	33.08	3.40	3.14	3.30	3.13	3.32	3.36	3.20	3.72	3.35	2.68	0.00	3.35	3.47	3.53
00106	1160	66	33.13	2.90	2.87	3.01	2.87	3.04	3.04	2.94	3.43	3.05	2.51	0.00	3.06	3.24	3.23
00107	1170	118	33.05	5.40	5.10	5.32	5.19	5.37	5.30	5.21	5.69	5.30	4.92	0.00	5.33	5.57	5.51
00108	1180	22	33.02	-.10	-.03	0.05	-.07	0.05	0.11	0.01	0.45	0.04	-.10	0.00	0.17	0.25	0.28
00109	1190	81	33.17	3.30	3.17	3.28	3.20	3.31	3.38	3.20	3.83	3.36	3.16	0.00	3.41	3.49	3.53
00110	1200	76	33.20	3.00	3.09	3.21	3.11	3.24	3.27	3.11	3.71	3.26	3.02	0.00	3.33	3.42	3.43
00111	1220	130	33.19	6.50	6.57	0.00	6.22	6.63	6.53	6.39	7.00	6.54	0.00	0.00	6.60	6.77	6.74
00112	1230	8	33.21	-1.40	-1.23	0.00	-1.31	-1.30	-1.26	-1.37	-.78	**	0.00	0.00	-1.14	-1.09	-1.09
00113	1240	92	33.20	3.20	3.28	0.00	3.26	3.38	3.33	3.23	3.81	3.38	0.00	0.00	3.39	3.52	3.53
00114	1250	67	33.27	2.50	2.77	0.00	2.69	2.80	2.78	2.68	3.25	2.78	0.00	0.00	2.89	3.00	2.95
00115	1260	115	33.29	4.30	4.26	0.00	4.26	4.39	4.29	4.22	4.79	4.35	0.00	0.00	4.37	4.56	4.50
00116	1320	136	33.07	6.90	6.82	5.50	6.85	7.08	6.89	5.67	0.00	6.91	5.40	6.63	7.23	7.02	7.09
00117	1330	1	33.07	-1.90	-1.65	-3.10	-1.71	-1.50	-1.57	-2.55	0.00	-1.63	-3.10	-1.87	-1.17	-1.62	-1.42
00118	1340	102	32.90	4.10	4.04	2.67	3.98	4.02	4.06	2.66	0.00	4.08	2.71	3.82	4.42	4.28	4.26
00119	1350	56	32.90	2.70	2.85	1.49	2.77	2.84	2.88	1.46	0.00	2.88	1.56	2.68	3.28	3.10	3.07
00120	1360	112	32.88	4.60	4.46	3.11	4.47	4.51	4.51	3.06	0.00	4.52	3.24	4.29	4.87	4.80	4.71

(Continued)

** Erroneous data due to, for example, a calibration check extending into the 10-min interval.

Checkpoint Data Computed Tide Heights (Concluded)

(Preliminary Calibration Values)

Line No.	ID No.	Elev Rank	Sta 13 ft,sea water	LA Tide Gage	Tide Height in Feet Above mllw for Indicated Stations												
					1	2	3	4	5	6	7	8	9	10	11	12	14
00121	1370	90	33.07	3.40	3.29	1.92	3.37	3.38	3.34	1.91	0.00	3.26	2.00	3.15	3.71	3.40	3.52
00122	1380	44	32.99	2.20	2.26	0.87	2.34	2.41	2.33	0.87	0.00	2.20	0.71	2.18	2.68	2.24	2.50
00123	1390	121	33.00	5.90	5.72	4.38	5.83	5.85	5.79	4.38	0.00	5.77	4.38	5.56	6.12	5.84	5.97
00124	1400	20	33.00	-.80	-.68	-2.10	-.65	-.65	-.62	-1.97	0.00	-.75	-2.05	-.86	-.26	-.49	-.49
00125	1410	86	33.03	3.40	3.35	1.98	3.37	3.40	3.43	1.96	0.00	3.34	1.84	3.04	3.76	3.34	3.61
00126	1420	49	32.91	2.40	2.51	1.13	2.54	2.58	2.54	1.07	0.00	2.44	1.24	2.38	2.93	2.37	2.72
00127	1430	104	33.00	0.00	4.13	2.75	4.08	4.24	4.21	2.76	0.00	4.09	2.73	3.95	4.52	4.27	4.37
00128	1440	57	33.02	0.00	2.70	1.33	2.72	2.82	2.79	1.32	0.00	2.67	1.28	2.59	3.13	2.93	2.95
00129	1450	103	33.02	0.00	4.15	2.79	4.14	4.26	4.17	2.74	0.00	4.07	2.86	3.98	4.55	4.39	4.35
00130	1460	138	33.07	0.00	6.97	5.63	0.00	7.17	7.06	5.61	5.34	6.90	5.56	6.84	7.37	7.12	7.23
00131	1470	2	33.02	0.00	-1.60	-3.07	-1.70	-1.56	-1.54	-2.95	-3.25	-1.70	-3.11	-1.80	-1.16	-1.42	-1.40
00132	1480	35	33.07	0.00	1.87	0.47	1.90	2.04	2.00	0.49	0.31	1.82	0.33	1.75	2.30	2.05	2.19
00133	1490	77	33.07	0.00	3.21	1.83	3.21	3.36	3.28	1.77	1.56	3.07	1.68	3.06	3.65	3.47	3.36
00134	1500	31	33.11	0.00	1.73	0.34	1.68	1.85	1.84	0.32	0.16	1.66	0.30	1.56	2.20	1.61	1.87
00135	1510	95	33.17	0.00	3.57	2.20	3.53	3.64	3.60	2.08	1.95	3.45	2.20	3.36	3.89	3.63	3.78
00136	1520	54	33.11	0.00	2.38	1.01	2.06	2.48	2.45	0.90	0.76	2.24	1.10	2.16	2.75	2.28	2.63
00137	1530	124	33.13	0.00	6.00	4.69	6.06	0.66	6.08	4.57	4.45	5.93	4.61	5.84	6.34	6.25	6.33
00138	1540	15	33.16	0.00	-.91	-2.33	-.89	-.82	-.82	-2.31	-2.56	-1.08	-2.58	-1.06	-.55	-.74	-.66
00139	1550	97	33.17	0.00	3.41	2.06	3.44	3.57	3.50	1.95	1.80	3.27	1.95	3.23	3.76	3.46	3.70
00140	1560	55	33.10	0.00	2.25	0.88	2.24	2.37	2.31	0.74	0.65	2.12	1.03	2.11	2.63	2.13	2.51

Checkpoint Data Computed Tide Heights

(Revised Calibration Values)

Line No.	ID No.	Elev Rank	Sta 13 ft,sea water	LA Tide Gage	Tide Height in Feet Above mllw for Indicated Stations												
					1	2	3	4	5	6	7	8	9	10	11	12	14
00001	60	98	33.13	3.90	3.55	0.00	0.00	0.00	0.00	0.00	0.00	3.50	0.00	0.00	0.00	3.44	0.00
00002	70	63	33.18	2.80	2.84	0.00	0.00	0.00	0.00	0.00	0.00	2.89	0.00	0.00	0.00	2.75	0.00
00003	80	99	33.16	3.80	3.61	0.00	0.00	0.00	0.00	0.00	0.00	3.62	0.00	0.00	0.00	3.53	0.00
00004	90	87	33.14	3.50	3.48	3.45	0.00	0.00	3.57	3.43	3.47	3.54	3.56	0.00	3.48	0.00	0.00
00005	100	45	33.11	2.30	2.31	2.31	0.00	0.00	2.44	2.30	2.25	2.31	2.06	0.00	2.34	0.00	0.00
00006	110	125	33.14	6.30	6.23	6.21	0.00	0.00	6.33	6.19	6.14	6.24	6.29	0.00	6.26	0.00	0.00
00007	120	12	32.98	-1.00	-.85	-.84	0.00	0.00	-.72	-.81	-.84	-.81	-.93	0.00	-.83	0.00	0.00
00008	130	91	33.14	3.50	3.52	3.51	0.00	0.00	3.62	3.48	3.40	3.49	3.51	0.00	0.00	3.78	0.00
00009	140	50	33.11	2.30	2.33	2.35	0.00	0.00	2.47	2.35	2.28	2.33	2.09	0.00	0.00	2.22	0.00
00010	150	111	32.96	4.50	4.36	4.35	0.00	0.00	4.45	4.30	4.34	0.00	4.25	0.00	4.39	0.00	0.00
00011	160	46	32.98	2.40	2.42	2.44	0.00	0.00	2.54	2.43	2.42	2.42	2.31	0.00	2.49	0.00	0.00
00012	170	108	32.99	4.50	4.46	4.45	0.00	0.00	4.55	4.39	4.41	4.46	4.53	0.00	4.49	0.00	0.00
00013	180	134	33.05	6.80	6.81	6.79	0.00	0.00	6.77	6.70	6.78	6.78	6.91	0.00	6.84	6.66	0.00
00014	190	5	33.05	-1.40	-1.30	-1.31	0.00	0.00	-1.30	-1.29	-1.25	-1.29	-1.39	0.00	-1.31	-1.43	0.00
00015	200	36	32.99	1.90	2.13	2.05	0.00	0.00	2.05	2.16	2.22	0.00	2.27	0.00	2.11	2.02	0.00
00016	210	68	32.96	3.00	3.05	2.99	0.00	0.00	2.94	3.03	3.06	0.00	3.12	0.00	3.03	2.97	0.00
00017	220	37	33.02	2.10	2.14	2.07	0.00	0.00	2.06	2.17	2.19	0.00	2.04	0.00	2.12	2.04	0.00
00018	250	28	33.16	1.40	1.58	1.57	1.55	1.56	1.61	1.61	1.59	1.58	1.74	0.00	0.00	1.65	0.00
00019	260	82	32.98	3.70	3.67	3.61	3.56	3.57	3.58	3.58	3.53	3.50	3.84	0.00	0.00	3.62	0.00
00020	270	32	33.12	1.80	1.78	1.81	1.78	1.80	1.81	1.82	1.80	1.77	1.95	0.00	0.00	1.79	0.00
00021	280	133	33.10	6.80	6.75	6.77	6.75	0.00	6.73	6.75	6.75	6.85	6.75	0.00	0.00	6.78	0.00
00022	290	10	33.10	-.80	-.89	-.85	-.89	0.00	-.82	-.85	-.85	-.79	-1.02	-.87	0.00	-.83	0.00
00023	300	38	33.11	2.00	2.00	0.00	2.00	2.00	0.00	0.00	0.00	2.13	0.00	2.00	0.00	1.99	0.00
00024	310	58	33.09	2.80	2.74	0.00	2.74	2.70	0.00	0.00	0.00	2.88	0.00	2.72	0.00	2.78	0.00
00025	320	47	33.12	2.50	2.51	0.00	2.51	2.47	0.00	0.00	0.00	2.70	0.00	2.52	0.00	2.44	0.00
00026	330	74	33.03	0.00	3.26	0.00	3.26	3.29	0.00	0.00	0.00	3.36	0.00	3.26	0.00	3.19	0.00
00027	340	71	33.00	3.20	3.22	0.00	3.22	3.18	0.00	0.00	0.00	3.31	0.00	3.21	0.00	3.20	0.00
00028	370	78	33.10	3.30	3.24	0.00	3.24	3.29	0.00	3.29	0.00	3.27	0.00	0.00	3.32	3.26	0.00
00029	380	69	33.13	2.90	2.91	0.00	2.93	2.97	0.00	2.98	0.00	2.94	0.00	0.00	0.00	6.46	0.00
00030	390	127	33.06	6.50	6.35	0.00	6.34	6.33	6.35	6.39	0.00	6.31	0.00	0.00	6.34	6.32	0.00
00031	400	19	33.04	-.50	-.47	0.00	-.50	-.54	-.44	-.50	0.00	-.55	0.00	0.00	-.44	-.51	0.00
00032	410	88	33.10	3.50	3.43	3.39	3.41	3.37	3.45	3.43	0.00	3.36	3.58	3.44	3.40	3.28	0.00
00033	420	83	33.12	3.00	3.33	3.28	3.33	3.29	3.35	3.32	3.35	3.20	3.40	3.33	3.30	3.26	0.00
00034	430	131	32.98	6.70	6.71	6.70	6.73	6.73	6.75	6.75	6.76	6.54	6.78	6.67	6.69	6.68	0.00
00035	440	16	33.00	-.80	-.51	-.56	-.56	-.61	-.50	-.52	-.58	0.00	-.35	-.60	-.48	-.59	0.00
00036	450	79	32.97	3.40	3.54	3.52	3.47	3.47	3.52	3.55	3.65	3.39	3.70	3.55	3.52	3.48	0.00
00037	460	72	32.98	3.00	3.28	3.26	3.28	3.24	3.27	3.29	3.32	3.07	3.24	3.33	0.00	0.00	0.00
00038	470	119	32.94	5.90	5.83	5.89	5.86	5.89	5.93	5.96	5.97	5.74	6.06	0.00	0.00	0.00	0.00
00039	480	23	32.99	0.10	0.25	0.22	0.30	0.17	0.26	0.23	0.27	0.01	0.50	0.00	0.00	0.00	0.00
00040	490	26	33.18	0.70	0.85	0.84	0.89	0.86	0.94	0.87	0.89	0.68	0.87	0.00	0.85	0.86	0.00

(Continued)

Checkpoint Data Computed Tide Heights (Continued)

(Revised Calibration Values)

Line No.	ID No.	Elev Rank	Sta 13 ft,sea water	LA Tide Gage	Tide Height in Feet Above mllw for Indicated Stations												
					1	2	3	4	5	6	7	8	9	10	11	12	14
00041	500	73	33.20	2.90	2.89	2.87	2.89	2.91	2.96	2.93	2.99	2.83	2.86	0.00	2.88	2.97	0.00
00042	510	59	33.20	2.40	2.54	2.51	2.51	2.49	2.52	2.50	2.52	2.36	2.52	0.00	2.52	2.62	0.00
00043	520	96	33.23	3.40	3.33	3.30	3.29	3.31	3.33	3.32	3.32	3.15	3.42	0.00	3.30	3.48	0.00
00044	530	89	33.26	3.10	3.23	3.21	3.25	3.20	0.00	4.74	3.22	3.04	3.35	0.00	3.21	3.34	0.00
00045	540	116	33.16	4.70	4.54	4.55	4.62	4.59	4.63	4.57	4.57	4.39	4.63	0.00	4.49	4.61	0.00
00046	550	135	33.32	7.00	6.78	6.77	6.71	6.75	6.73	6.75	6.76	6.76	6.87	5.26	6.79	6.64	0.00
00047	560	17	33.21	-.50	-.63	-.66	-.66	-.68	-.54	-.61	-.56	-.57	-.61	0.00	-.54	-.84	0.00
00048	570	100	33.15	4.30	4.03	0.00	4.04	4.08	4.06	4.04	4.05	4.03	3.93	4.08	4.00	4.06	0.00
00049	580	84	33.17	3.60	3.49	0.00	3.44	3.47	3.48	3.46	3.48	3.48	3.46	3.46	3.50	3.43	0.00
00050	590	117	33.07	5.20	4.99	0.00	4.99	5.08	5.08	5.06	5.03	4.98	4.93	5.02	4.99	4.86	0.00
00051	610	24	33.26	0.10	0.07	0.00	0.03	0.03	0.11	0.09	0.06	0.06	-.08	0.07	0.11	0.06	0.00
00052	620	101	33.16	3.80	3.89	0.00	3.89	3.89	3.88	3.92	3.88	3.90	3.88	3.88	3.88	3.90	0.00
00053	630	85	33.16	3.20	3.25	3.21	3.24	3.23	3.24	3.24	3.17	3.18	3.28	3.25	3.26	3.21	0.00
00054	640	114	33.07	4.60	4.59	4.57	4.63	4.59	4.63	4.64	4.60	4.62	4.54	4.62	4.58	4.61	0.00
00055	650	139	33.36	6.90	6.92	6.93	6.95	6.89	6.86	6.90	6.87	6.83	7.05	6.95	6.89	6.76	0.00
00056	660	6	33.24	-1.60	-1.48	-1.56	-1.56	-1.62	-1.45	-1.46	-1.46	-1.34	-1.60	-1.52	-1.45	-1.81	0.00
00057	670	113	33.35	4.40	4.36	4.37	4.38	4.29	4.32	4.36	4.34	4.29	4.39	4.30	4.34	4.41	0.00
00058	680	60	33.37	2.40	2.46	2.47	2.51	2.45	2.43	2.45	2.40	2.34	2.41	2.48	2.49	2.47	0.00
00059	690	109	33.27	4.10	4.09	4.08	4.08	4.05	4.05	4.04	4.14	4.13	4.24	4.01	4.07	4.09	0.00
00060	700	123	33.29	6.00	6.00	6.02	6.04	6.00	6.00	6.05	6.06	6.08	6.04	5.97	5.97	6.08	0.00
00061	710	21	33.21	-.60	-.49	-.54	-.51	-.54	-.48	-.54	-.55	-.57	-.46	-.50	-.48	-.53	0.00
00062	720	110	33.35	4.10	3.96	3.97	4.00	3.96	3.92	3.92	3.93	3.96	3.85	3.96	3.92	4.08	0.00
00063	730	64	33.39	2.30	2.44	2.44	2.48	2.47	2.41	2.41	2.37	2.40	2.42	2.47	2.44	2.44	0.00
00064	740	105	33.35	4.00	3.91	3.93	3.93	3.90	3.88	3.87	3.90	3.93	4.00	3.90	3.89	3.93	0.00
00065	750	140	33.23	7.50	7.11	7.14	7.17	7.10	7.05	7.07	7.03	7.08	7.21	7.08	7.06	7.16	0.00
00066	760	3	33.23	-1.60	-1.58	-1.64	-1.61	-1.56	-1.46	-1.50	-1.56	-1.55	-1.78	-1.55	-1.56	-1.77	0.00
00067	770	106	33.34	3.90	3.77	3.78	3.83	3.75	3.70	3.74	3.73	3.77	3.70	3.78	3.73	3.95	0.00
00068	780	70	33.43	2.30	2.28	2.27	2.37	2.30	2.29	2.29	2.29	2.32	2.23	2.39	2.26	2.37	0.00
00069	790	107	33.44	3.60	3.49	3.50	3.55	3.48	3.47	3.50	3.51	3.53	3.55	3.53	3.47	3.64	0.00
00070	800	93	33.29	3.60	3.54	3.53	3.58	3.51	3.50	3.50	3.58	3.58	3.70	3.53	3.65	3.54	0.00
00071	810	51	33.21	2.40	2.40	2.42	2.48	2.42	2.42	2.40	2.42	2.44	2.33	2.50	2.39	2.38	0.00
00072	820	128	33.26	6.30	6.26	6.28	6.35	6.29	6.20	6.24	6.23	6.25	6.47	6.31	6.19	6.29	0.00
00073	830	13	33.24	-1.10	-.99	-1.04	-1.00	-1.06	-.99	-1.03	-1.02	-1.03	-.85	-.94	-.98	-1.07	0.00
00074	840	94	33.31	3.50	3.49	3.50	3.53	3.45	3.46	3.46	3.47	3.48	3.58	3.49	3.46	3.49	0.00
00075	850	52	33.31	2.20	2.26	2.26	2.31	2.20	2.21	2.18	2.23	2.23	2.40	2.32	2.26	2.23	0.00
00076	860	29	33.20	1.70	1.74	1.73	1.79	0.00	1.73	1.71	1.77	1.78	1.65	1.80	1.74	1.60	0.00
00077	870	80	33.08	3.70	3.52	3.51	3.55	3.48	3.45	3.46	3.46	3.45	3.51	3.49	3.48	3.46	0.00
00078	880	30	33.14	1.60	1.70	1.70	1.73	1.66	1.72	1.70	1.76	1.76	1.58	1.73	1.71	1.61	0.00
00079	890	137	33.25	7.20	7.04	7.07	7.16	7.06	7.01	7.03	7.02	7.04	6.90	0.00	6.97	7.18	0.00
00080	900	4	33.27	-1.50	-1.26	-1.34	-1.33	-1.39	-1.31	-1.33	-1.27	-1.28	-1.24	0.00	-1.29	-1.33	0.00

(Continued)

Checkpoint Data Computed Tide Heights (Continued)

(Revised Calibration Values)

Line No.	ID No.	Elev Rank	Sta 13 ft,sea water	LA Tide Gage	Tide Height in Feet Above mllw for Indicated Stations												
					1	2	3	4	5	6	7	8	9	10	11	12	14
00081	910	34	33.30	1.80	1.84	1.88	2.08	1.90	1.83	1.85	1.77	1.82	1.75	0.00	1.88	1.92	0.00
00082	920	61	33.24	2.60	2.59	2.63	2.79	2.58	2.56	2.59	2.58	2.63	2.60	0.00	2.62	2.71	0.00
00083	930	39	33.30	1.80	1.90	1.94	2.12	1.93	1.89	1.92	1.91	1.96	1.50	0.00	1.94	2.00	0.00
00084	940	129	33.27	6.50	6.42	6.48	6.49	6.48	6.38	6.45	6.43	6.48	6.56	0.00	6.40	6.46	0.00
00085	950	9	33.17	-1.30	-1.21	-1.23	-1.22	-1.21	-1.21	-1.18	-1.24	-1.20	-1.38	0.00	-1.16	-1.35	0.00
00086	960	25	33.17	0.90	1.04	1.07	1.06	1.06	1.01	1.13	0.99	1.02	1.44	0.00	1.09	1.02	0.00
00087	970	65	33.05	2.60	2.73	2.77	2.72	2.75	2.74	2.64	2.75	2.79	2.19	0.00	2.76	2.65	0.00
00088	980	40	33.05	2.00	2.15	2.18	2.14	2.16	2.15	2.05	2.14	2.18	2.35	0.00	2.19	2.07	0.00
00089	990	132	33.30	6.30	6.25	6.31	6.32	6.31	6.23	6.25	6.28	6.33	6.24	0.00	6.17	6.32	0.00
00090	1000	7	33.14	-1.50	-1.46	-1.50	-1.47	-1.47	-1.45	-1.42	-1.44	-1.42	-1.54	0.00	-1.48	-1.64	0.00
00091	1010	33	33.47	1.50	1.59	1.63	1.62	1.62	1.60	1.63	1.64	1.72	1.59	0.00	1.58	1.64	0.00
00092	1020	48	33.42	2.30	2.16	2.18	2.18	2.19	2.16	2.16	2.19	2.24	2.44	0.00	2.13	2.17	0.00
00093	1030	41	33.40	1.90	2.02	2.04	2.03	2.04	2.04	2.05	2.11	2.18	2.03	0.00	1.99	2.10	0.00
00094	1040	126	33.20	6.50	6.23	6.44	6.44	6.44	6.36	6.36	6.34	6.53	0.00	0.00	6.30	6.51	0.00
00095	1050	11	33.18	-1.10	-1.12	-1.16	-1.17	-1.16	-1.13	-1.11	-1.19	-1.00	0.00	0.00	-1.13	-1.11	0.00
00096	1060	62	33.29	2.70	2.53	2.54	2.53	2.57	2.57	2.58	2.58	2.74	2.51	0.00	2.54	2.58	0.00
00097	1070	53	33.34	2.50	2.43	2.44	2.37	2.44	2.39	2.42	2.40	2.55	2.49	0.00	2.44	2.50	0.00
00098	1080	122	33.22	5.90	5.74	5.79	5.82	5.83	5.74	5.73	5.76	5.97	5.70	0.00	5.71	5.90	0.00
00099	1090	14	33.21	-1.10	-1.03	-1.07	-1.08	-1.07	-1.05	-1.04	-1.09	-.93	-.87	0.00	-.99	-1.01	0.00
00100	1100	27	33.28	1.20	1.27	1.12	1.09	1.12	1.10	1.10	1.28	1.23	0.90	0.00	1.17	1.23	1.11
00101	1110	42	33.21	2.30	2.30	2.21	2.21	2.23	2.22	2.21	2.37	2.31	0.00	0.00	2.25	2.27	2.22
00102	1120	43	33.20	2.20	2.23	2.16	2.17	2.20	2.14	2.15	2.33	2.26	0.00	0.00	2.20	2.22	2.18
00103	1130	120	33.25	5.90	5.65	5.75	5.39	5.77	5.70	5.68	5.92	5.82	6.00	0.00	5.70	5.84	5.76
00104	1140	18	33.19	-.90	-.71	-.89	-1.23	-.89	-.90	-.88	-.69	-.83	-.71	0.00	-.83	-.89	-.90
00105	1150	75	33.08	3.40	3.16	3.28	3.15	3.27	3.29	3.22	3.20	3.37	2.76	0.00	3.21	3.27	3.30
00106	1160	66	33.13	2.90	2.89	2.99	2.89	2.99	2.97	2.96	2.91	3.07	2.59	0.00	2.92	3.04	3.00
00107	1170	118	33.05	5.40	5.12	5.30	5.21	5.32	5.23	5.23	5.17	5.32	5.00	0.00	5.19	5.37	5.28
00108	1180	22	33.02	-.10	-.01	0.03	-.05	0.00	0.04	0.03	-.07	0.06	-.02	0.00	0.03	0.05	0.05
00109	1190	81	33.17	3.30	3.19	3.26	3.22	3.26	3.31	3.22	3.31	3.38	3.24	0.00	3.27	3.29	3.30
00110	1200	76	33.20	3.00	3.11	3.19	3.13	3.19	3.20	3.13	3.19	3.28	3.10	0.00	3.19	3.22	3.20
00111	1220	130	33.19	6.50	6.59	0.00	6.24	6.58	6.46	6.41	6.48	6.56	0.00	0.00	6.46	6.57	6.51
00112	1230	8	33.21	-1.40	-1.21	0.00	-1.29	-1.35	-1.33	-1.35	-1.30	0.00	0.00	0.00	-1.28	-1.29	-1.32
00113	1240	92	33.20	3.20	3.30	0.00	3.28	3.33	3.26	3.25	3.29	3.40	0.00	0.00	3.25	3.32	3.30
00114	1250	67	33.27	2.50	2.79	0.00	2.71	2.75	2.71	2.70	2.73	2.80	0.00	0.00	2.75	2.80	2.72
00115	1260	115	33.29	4.30	4.28	0.00	4.28	4.34	4.22	4.24	4.27	4.37	0.00	0.00	4.23	4.36	4.27
00116	1320	136	33.07	6.90	6.84	6.90	6.87	7.03	6.82	6.69	0.00	6.93	6.78	6.85	6.84	6.82	6.86
00117	1330	1	33.07	-1.90	-1.63	-1.70	-1.69	-1.55	-1.64	-1.53	0.00	-1.61	-1.72	-1.65	-1.56	-1.82	-1.65
00118	1340	102	32.90	4.10	4.06	4.07	4.00	3.97	3.99	4.06	0.00	4.10	4.09	4.04	4.03	4.08	4.03
00119	1350	56	32.90	2.70	2.87	2.89	2.79	2.79	2.81	2.86	0.00	2.90	2.94	2.90	2.89	2.90	2.84
00120	1360	112	32.88	4.60	4.48	4.51	4.49	4.46	4.44	4.46	0.00	4.54	4.62	4.51	4.48	4.60	4.48

(Continued)

Checkpoint Data Computed Tide Heights (Concluded)

(Revised Calibration Values)

Line No.	ID No.	Elev Rank	Sta 13 ft,sea water	LA Tide Gage	Tide Height in Feet Above mllw for Indicated Stations												
					1	2	3	4	5	6	7	8	9	10	11	12	14
00121	1370	90	33.07	3.40	3.31	3.32	3.39	3.33	3.27	3.31	0.00	3.28	3.38	3.37	3.32	3.20	3.29
00122	1380	44	32.99	2.20	2.28	2.27	2.36	2.36	2.26	2.27	0.00	2.22	2.09	2.40	2.29	2.04	2.27
00123	1390	121	33.00	5.90	5.74	5.78	5.85	5.80	5.72	5.78	0.00	5.79	5.76	5.78	5.73	5.64	5.74
00124	1400	20	33.00	-.80	-.66	-.70	-.63	-.70	-.69	-.57	0.00	-.73	-.67	-.64	-.65	-.69	-.72
00125	1410	86	33.03	3.40	3.37	3.38	3.39	3.35	3.36	3.36	0.00	3.36	3.22	3.26	3.37	3.14	3.38
00126	1420	49	32.91	2.40	2.53	2.53	2.56	2.53	2.47	2.47	0.00	2.46	2.62	2.60	2.54	2.17	2.49
00127	1430	104	33.00	0.00	4.15	4.15	4.10	4.19	4.14	4.16	0.00	4.11	4.11	4.17	4.13	4.07	4.14
00128	1440	57	33.02	0.00	2.72	2.73	2.74	2.77	2.72	2.72	0.00	2.69	2.66	2.81	2.74	2.73	2.72
00129	1450	103	33.02	0.00	4.17	4.19	4.16	4.21	4.10	4.14	0.00	4.09	4.24	4.20	4.16	4.19	4.12
00130	1460	138	33.07	0.00	6.99	7.03	0.00	7.12	6.99	7.01	7.02	6.92	6.94	7.06	6.98	6.92	7.00
00131	1470	2	33.02	0.00	-1.58	-1.67	-1.68	-1.61	-1.61	-1.55	-1.57	-1.68	-1.73	-1.58	-1.55	-1.62	-1.63
00132	1480	35	33.07	0.00	1.89	1.87	1.92	1.99	1.93	1.89	1.99	1.84	1.71	1.97	1.91	1.85	1.96
00133	1490	77	33.07	0.00	3.23	3.23	3.23	3.31	3.21	3.17	3.24	3.09	3.06	3.28	3.26	3.27	3.13
00134	1500	31	33.11	0.00	1.75	1.74	1.70	1.80	1.77	1.72	1.84	1.68	1.68	1.78	1.81	1.41	1.64
00135	1510	95	33.17	0.00	3.59	3.60	3.55	3.59	3.53	3.48	3.63	3.47	3.58	3.58	3.50	3.43	3.55
00136	1520	54	33.11	0.00	2.40	2.41	2.08	2.43	2.38	2.30	2.44	2.26	2.48	2.38	2.36	2.08	2.40
00137	1530	124	33.13	0.00	6.02	6.09	6.08	0.00	6.01	5.97	6.13	5.95	5.99	6.06	5.95	6.05	6.10
00138	1540	15	33.16	0.00	-.89	-.93	-.87	-.87	-.89	-.91	-.88	-1.06	-1.20	-.84	-.94	-.94	-.89
00139	1550	97	33.17	0.00	3.43	3.46	3.46	3.52	3.43	3.35	3.48	3.29	3.33	3.45	3.37	3.26	3.47
00140	1560	55	33.10	0.00	2.27	2.28	2.26	2.32	2.24	2.14	2.33	2.14	2.41	2.33	2.24	1.93	2.28

APPENDIX J: RELATIVE ACCURACIES

Inclosure 1: Checkpoint Comparative Plots (Figures J1-J15)

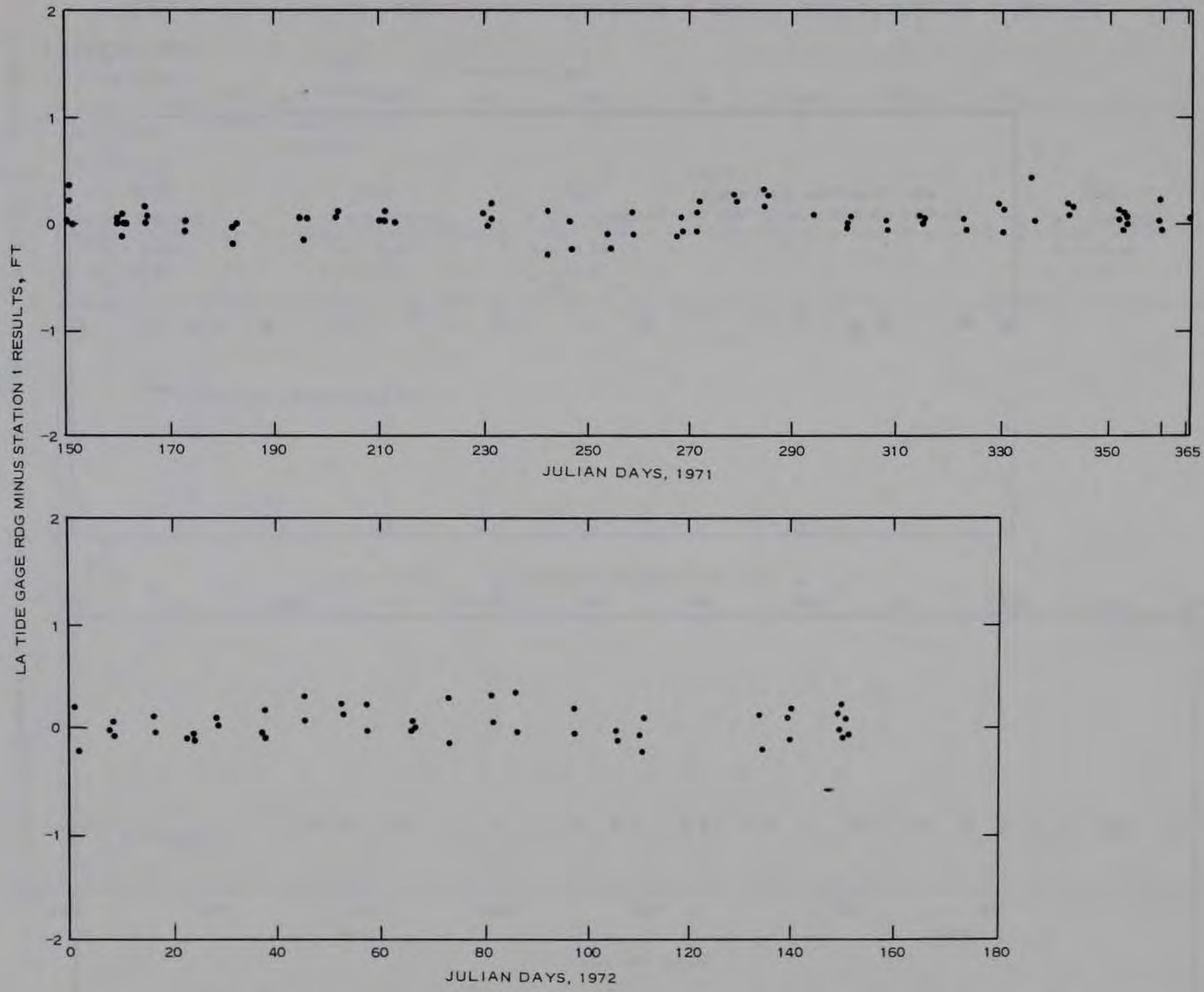


Figure J1. Datum comparison; corrected LA gage and station 1

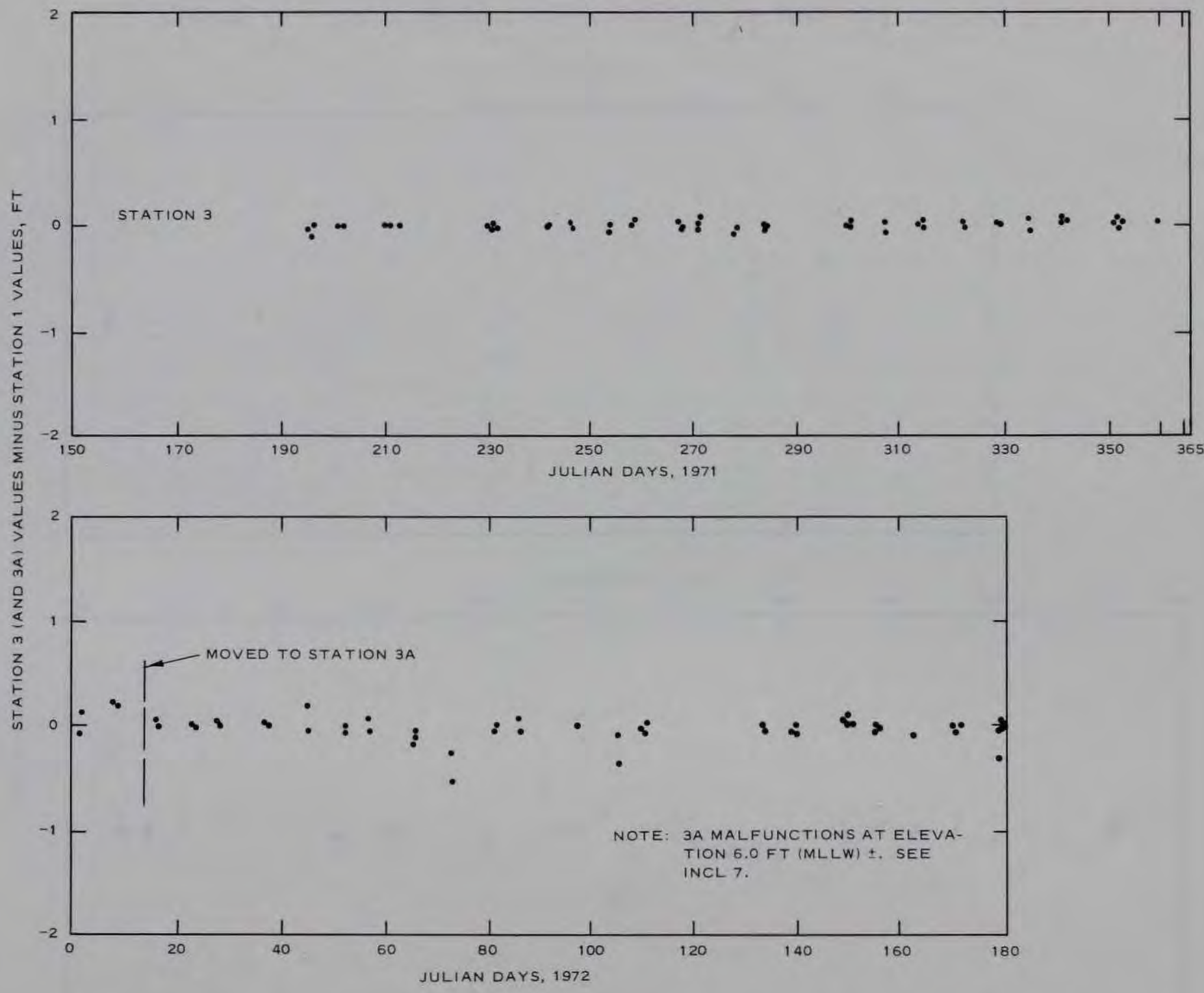


Figure J2. Datum comparison; stations 1 and 3 and stations 1 and 3A

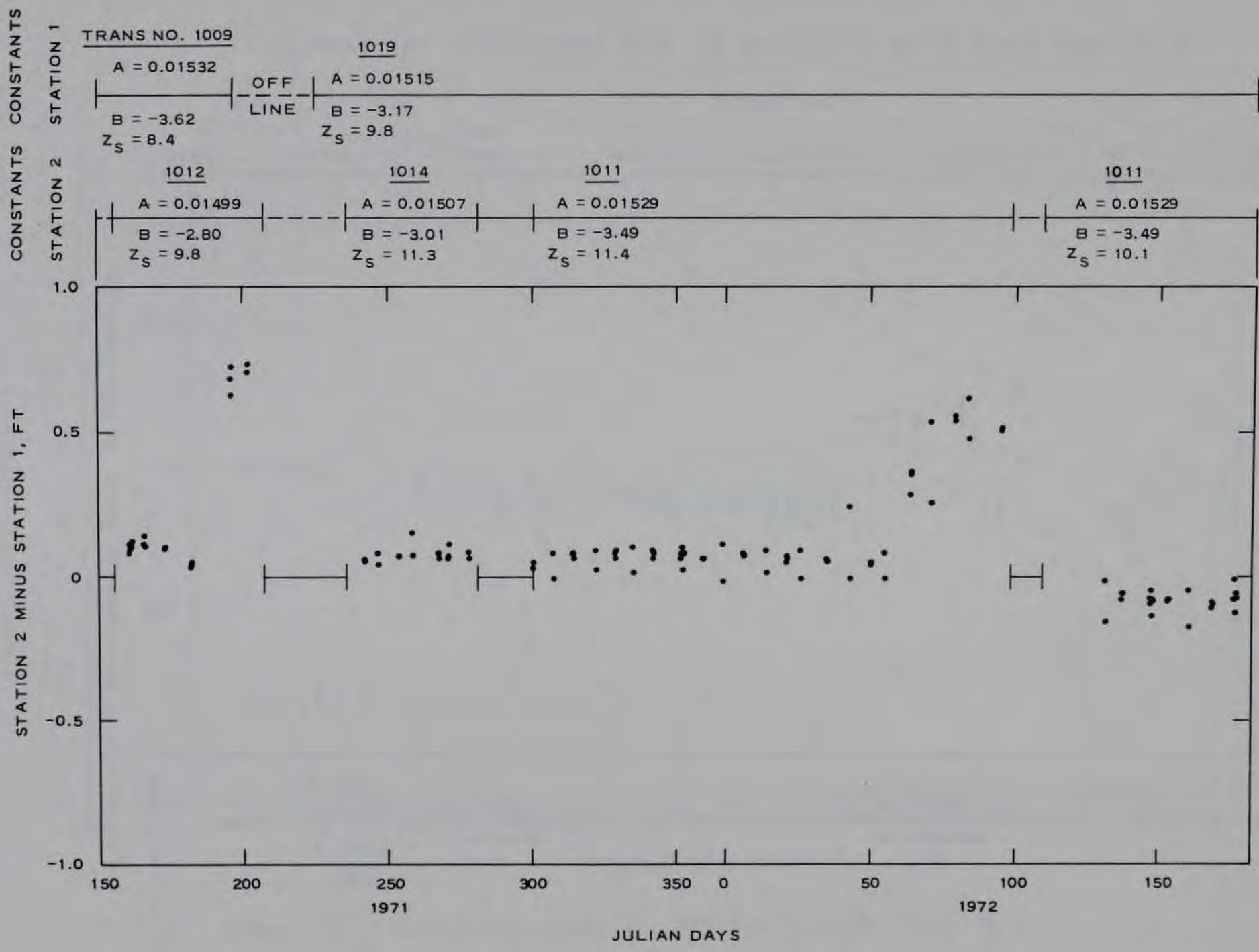


Figure J3. Comparison plot for station 2 minus station 1

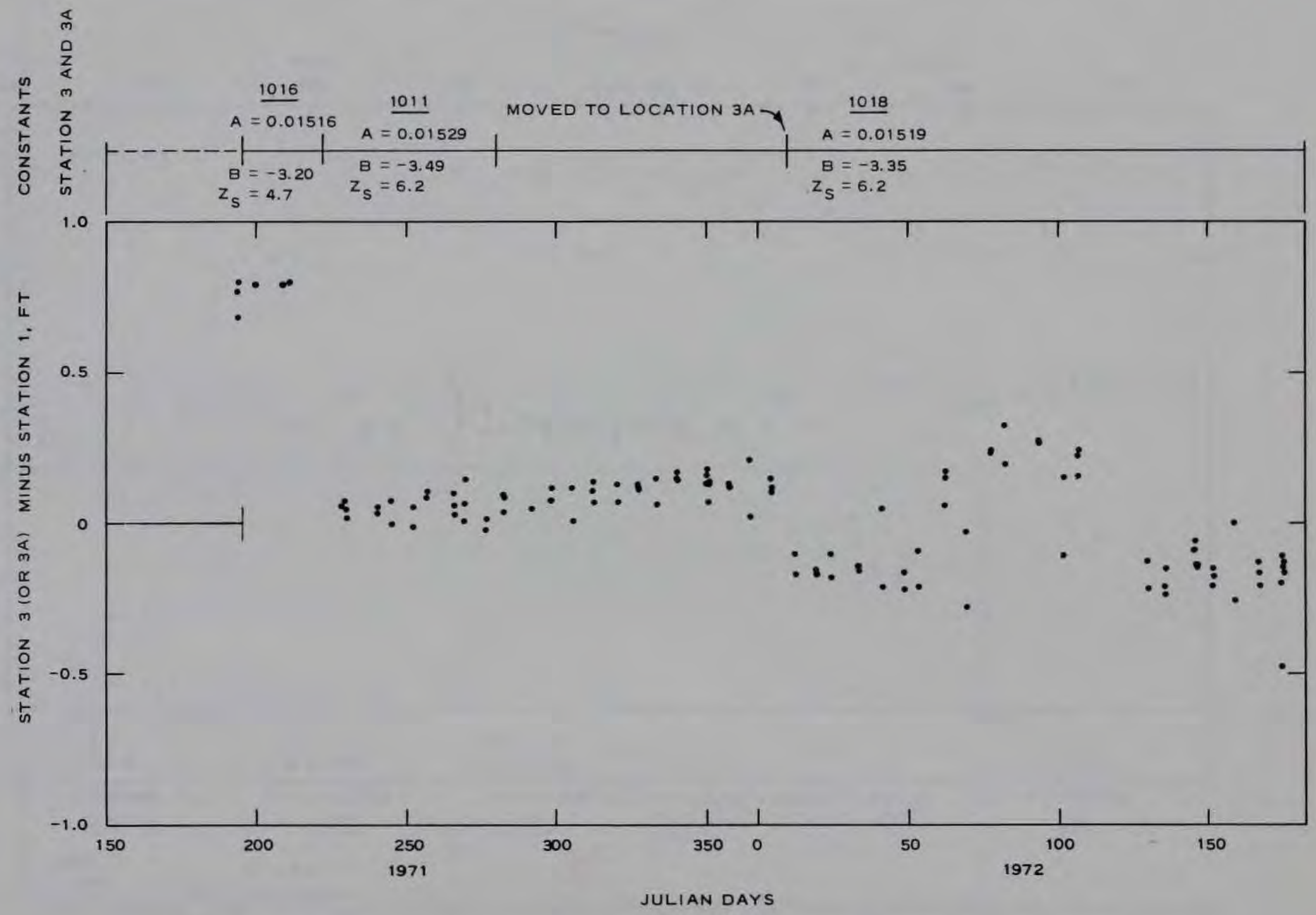


Figure J4. Comparison plot for station 3 or 3A minus station 1

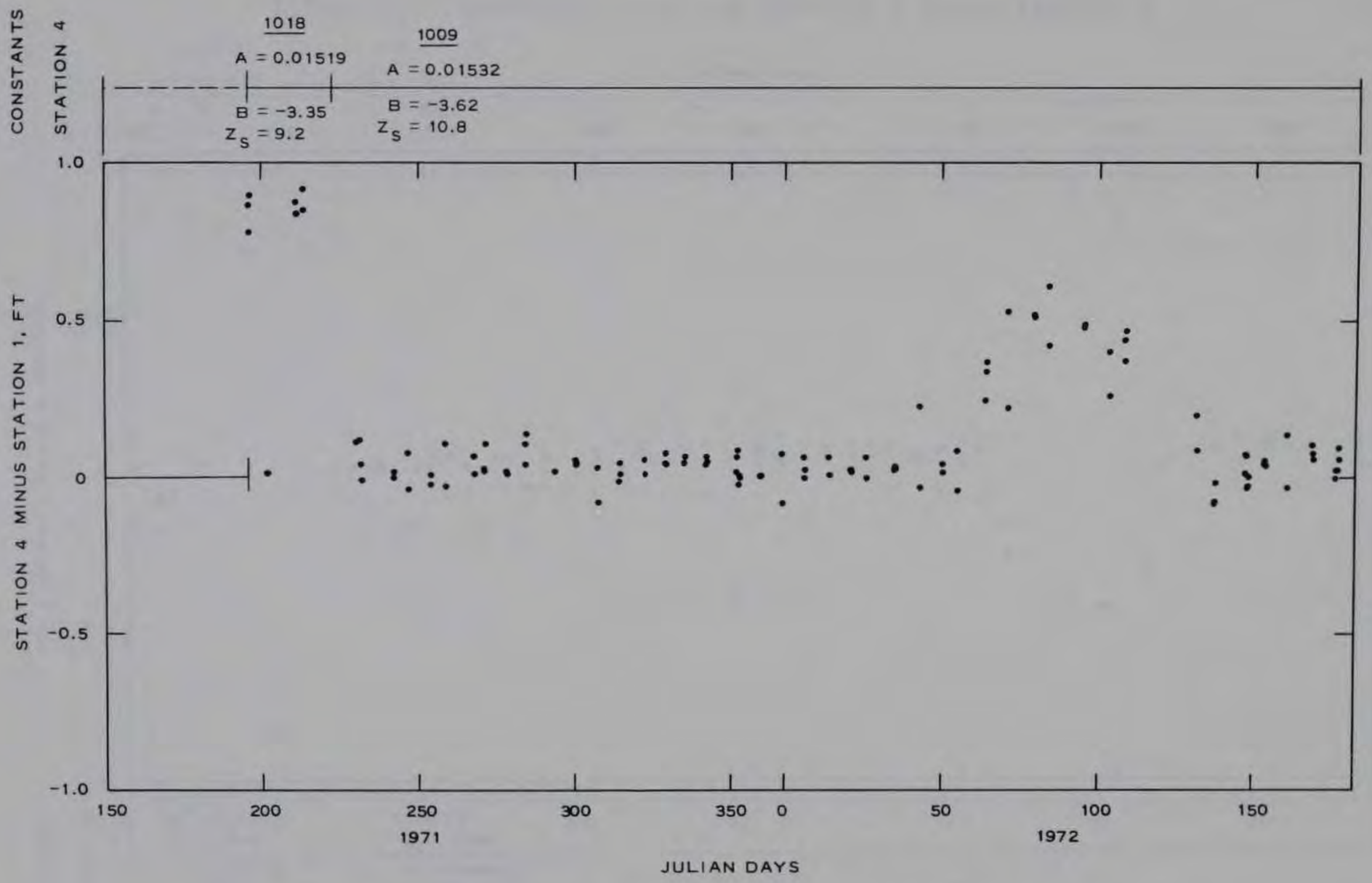


Figure J5. Comparison plot for station 4 minus station 1

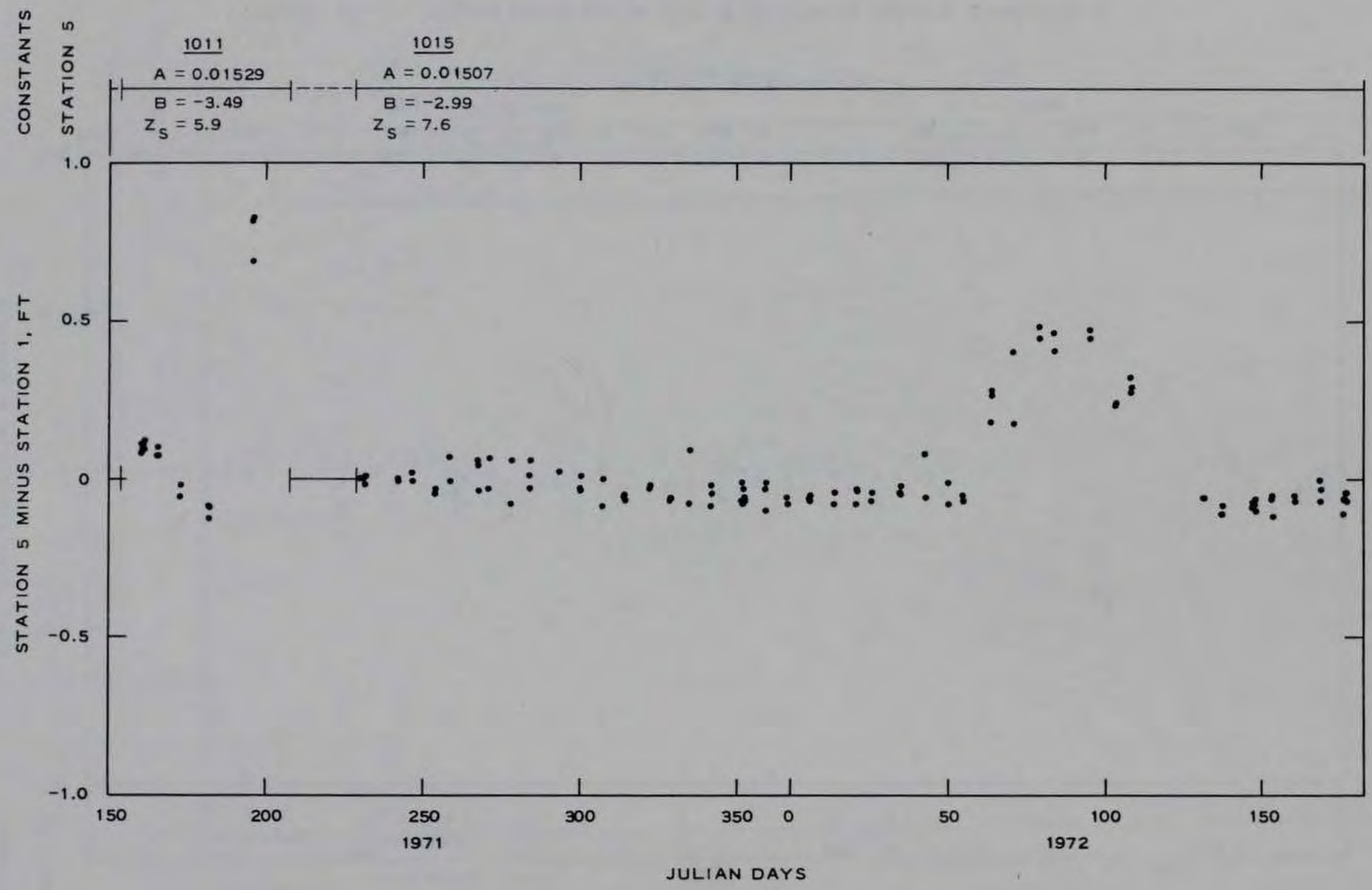


Figure J6. Comparison plot for station 5 minus station 1

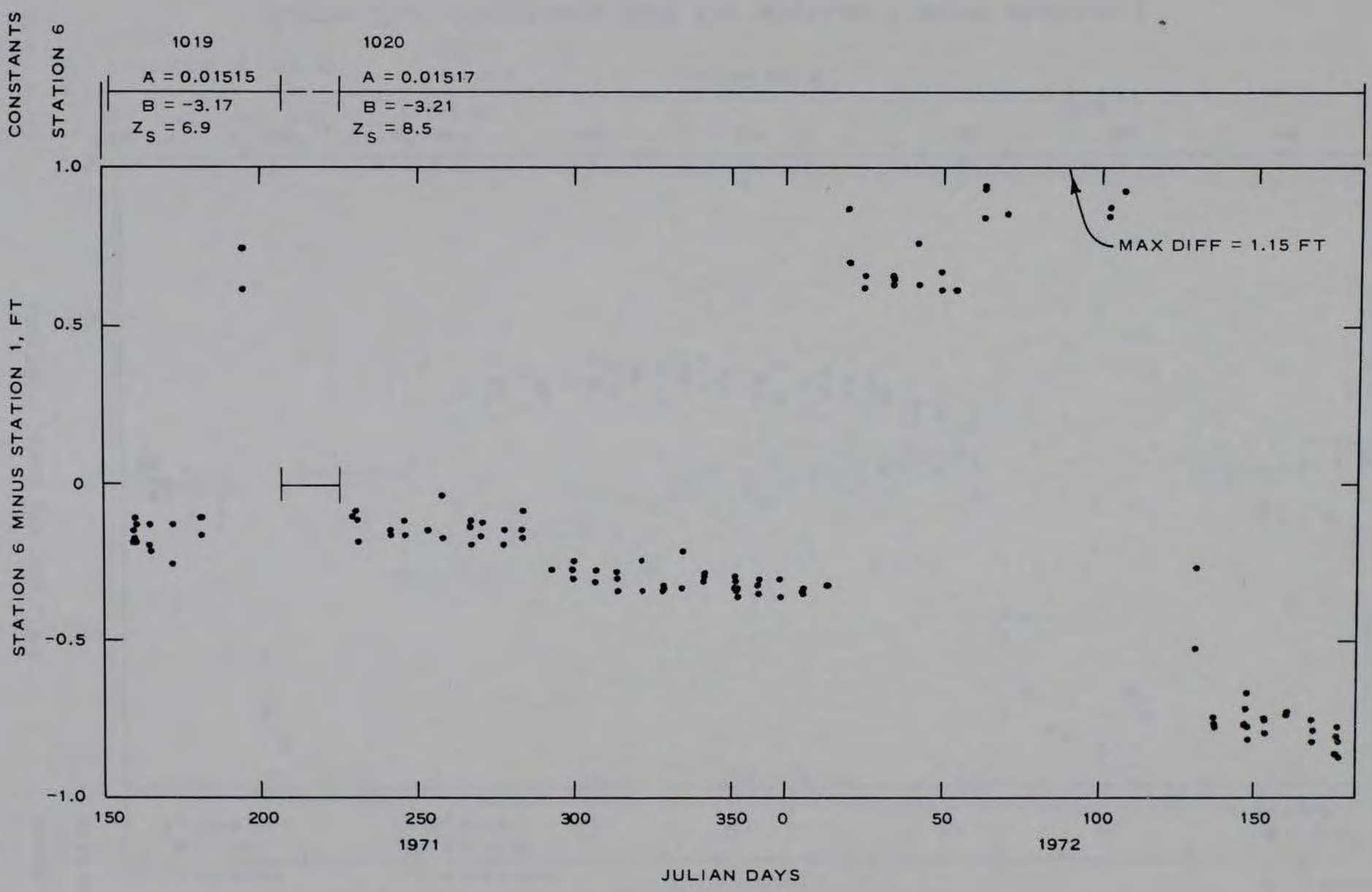


Figure J7. Comparison plot for station 6 minus station 1

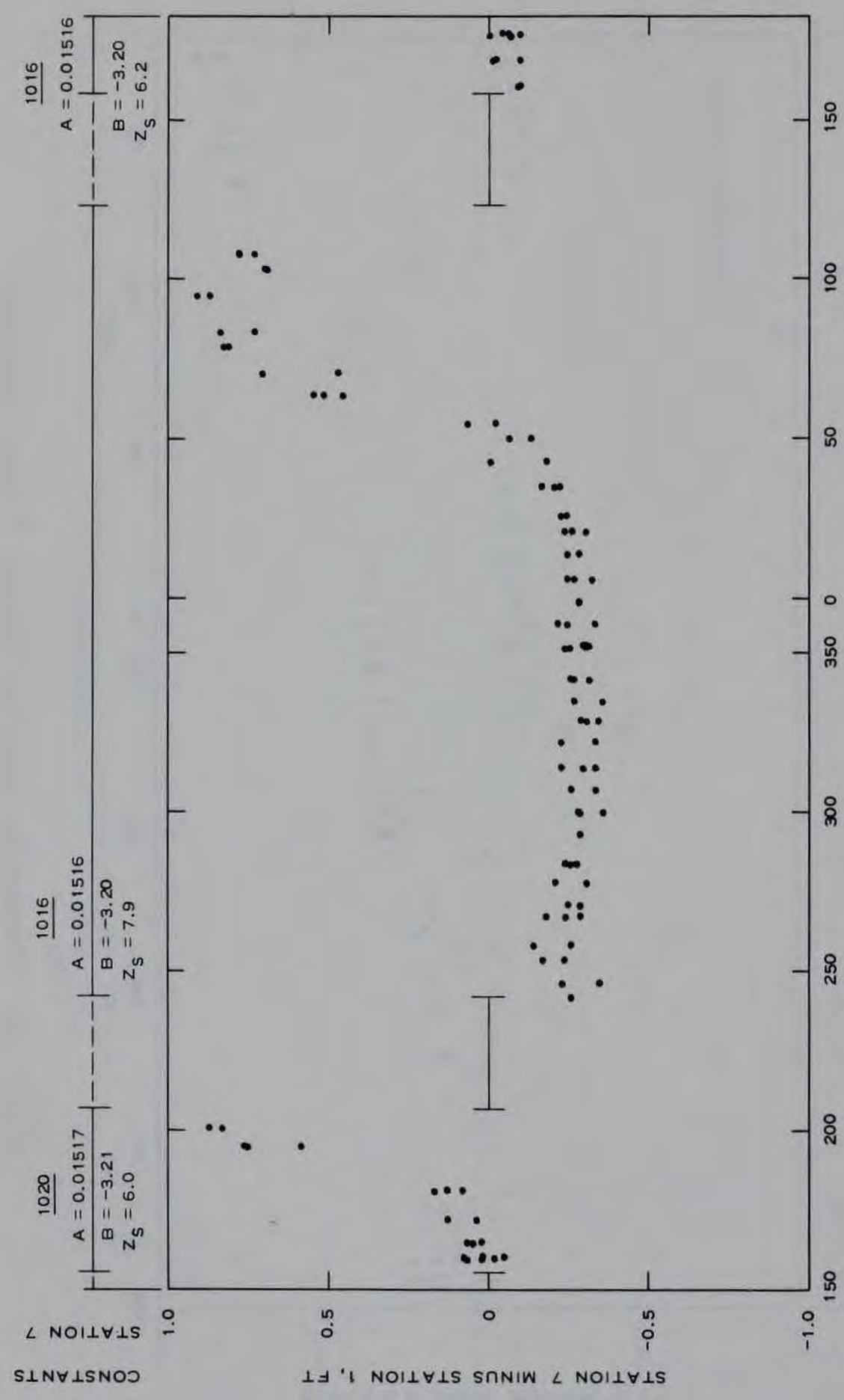


Figure J8. Comparison plot for station 7 minus station 1

Incl 1 (Sheet 8 of 15)

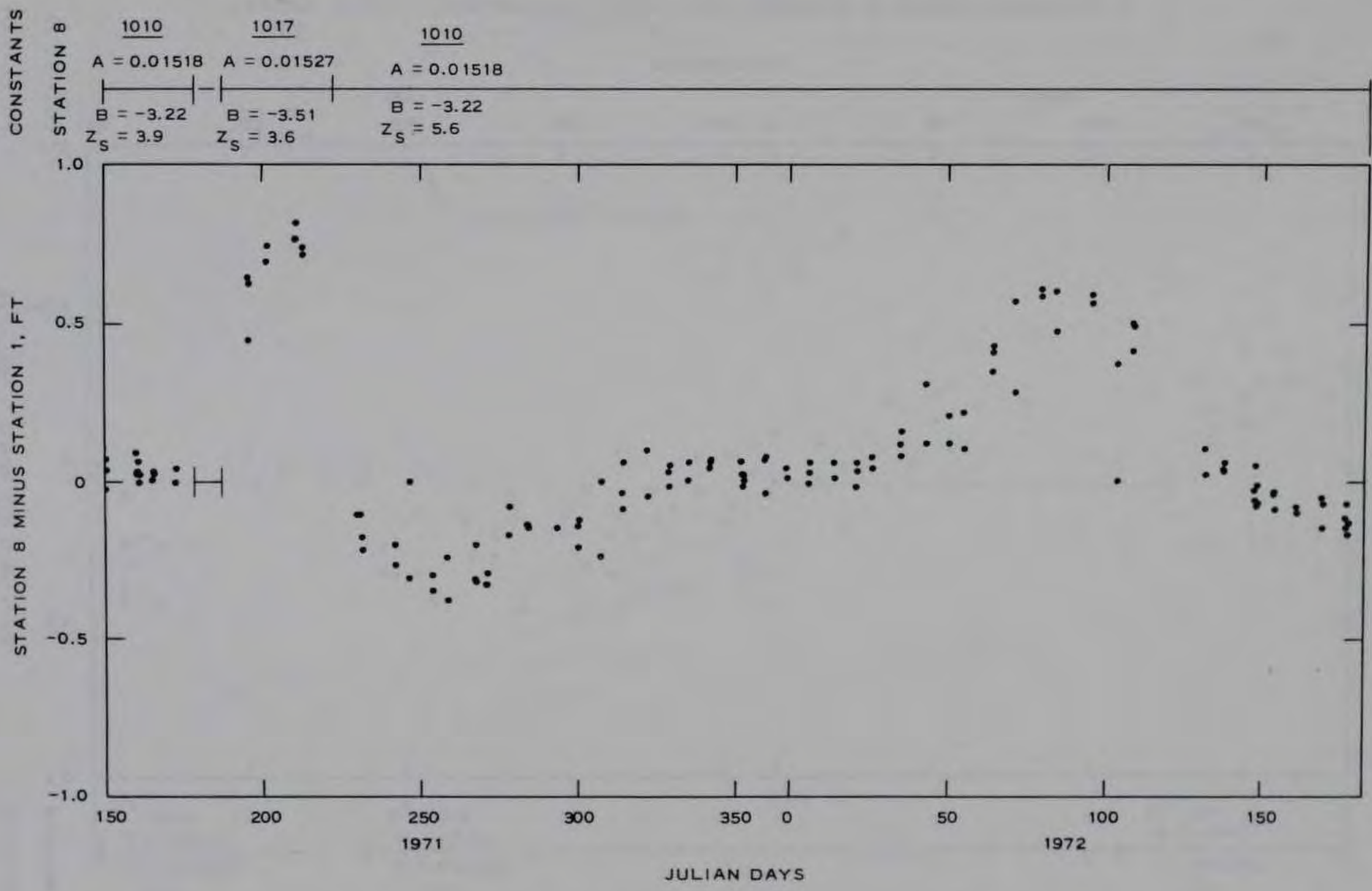


Figure J9. Comparison plot for station 8 minus station 1

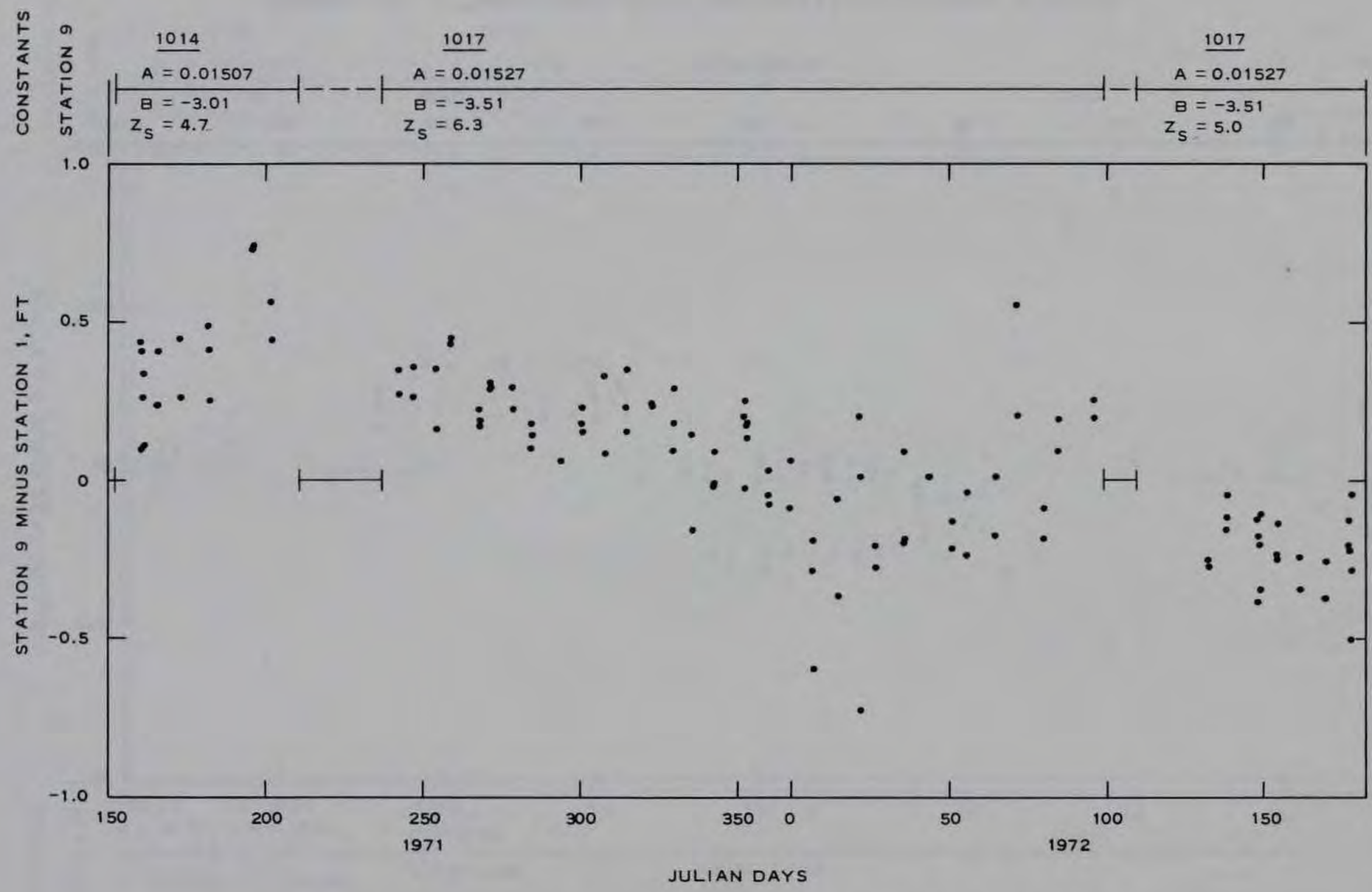


Figure J10. Comparison plot for station 9 minus station 1

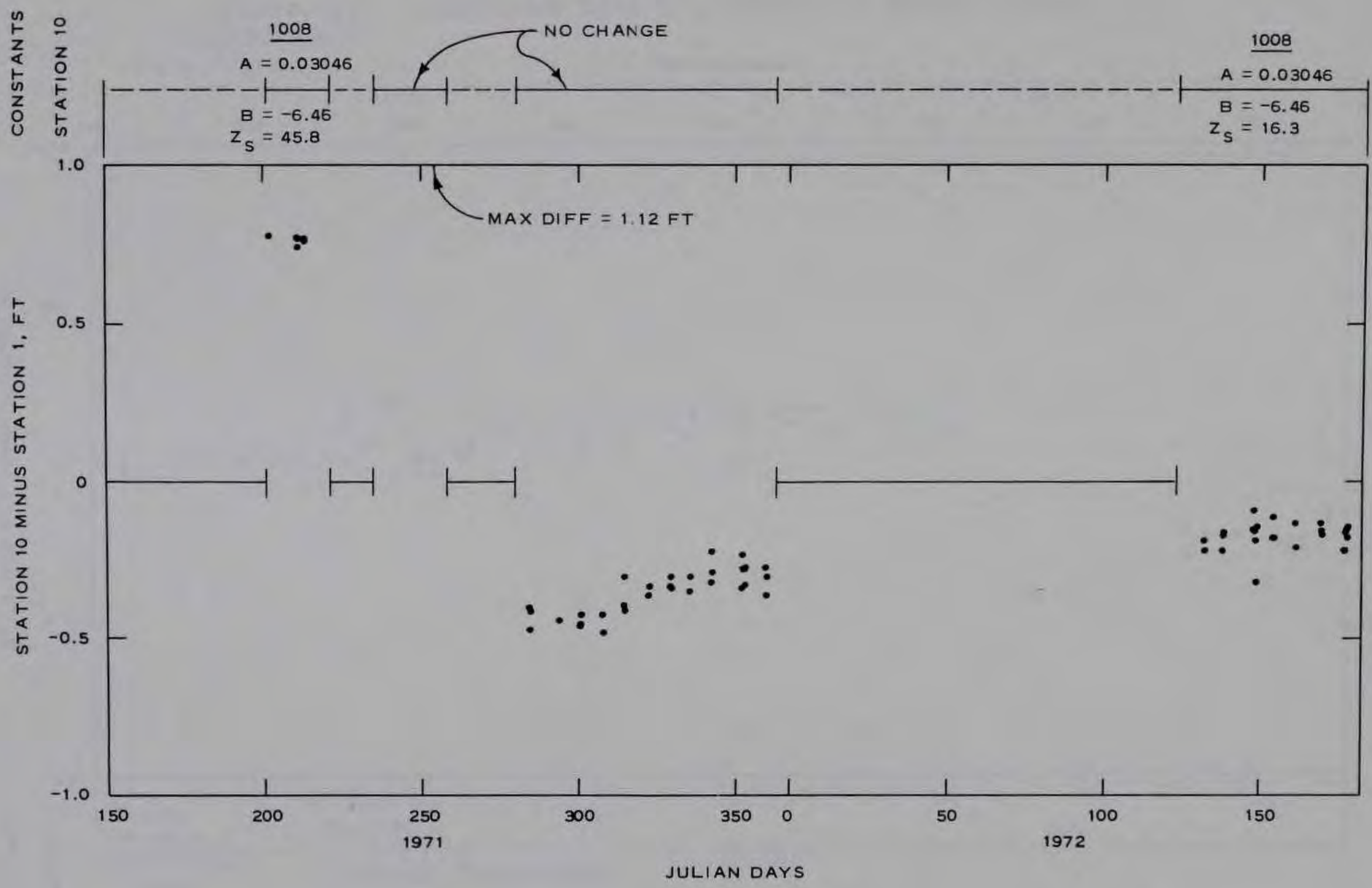


Figure J11. Comparison plot for station 10 minus station 1

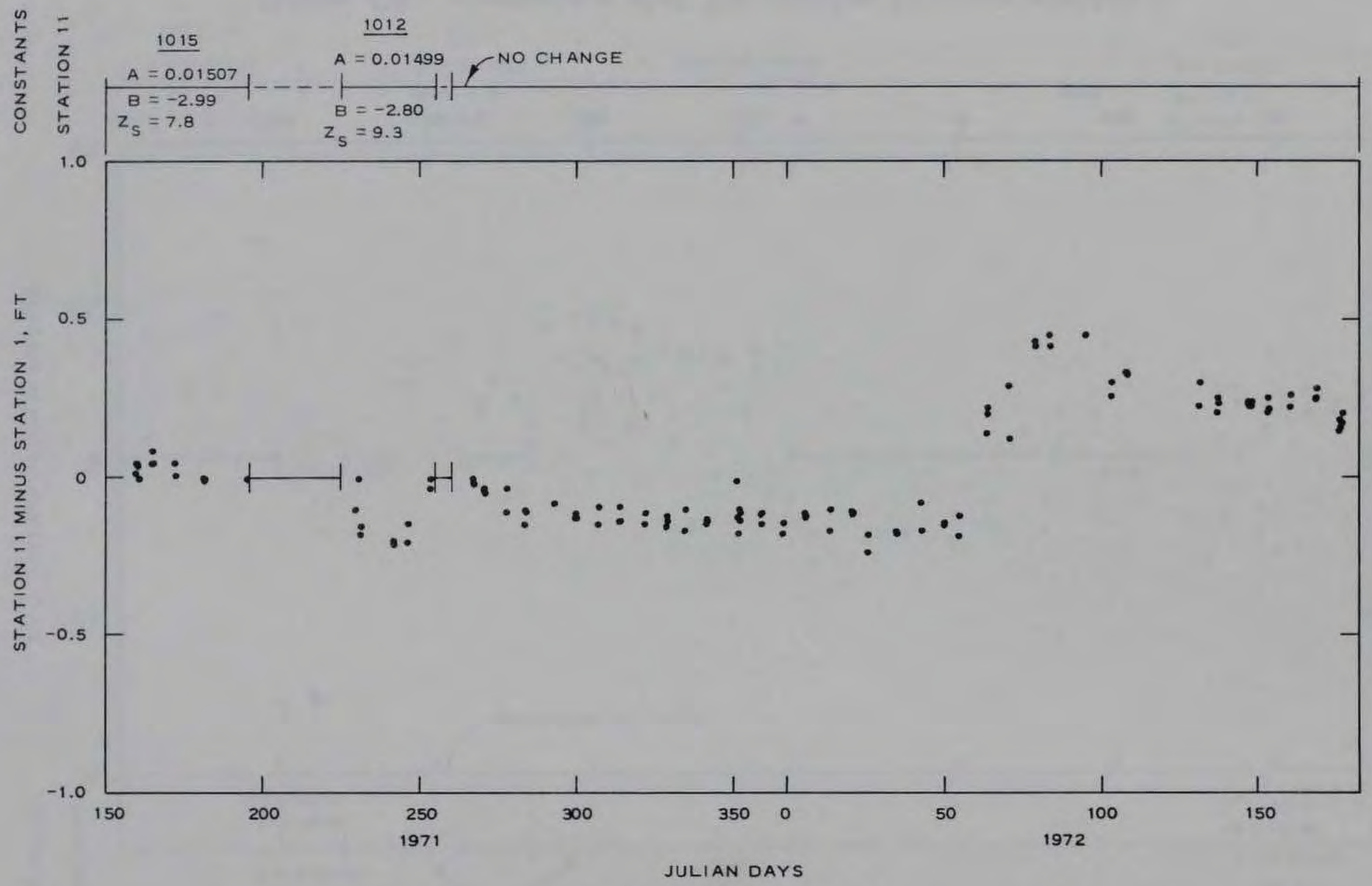


Figure J12. Comparison plot for station 11 minus station 1

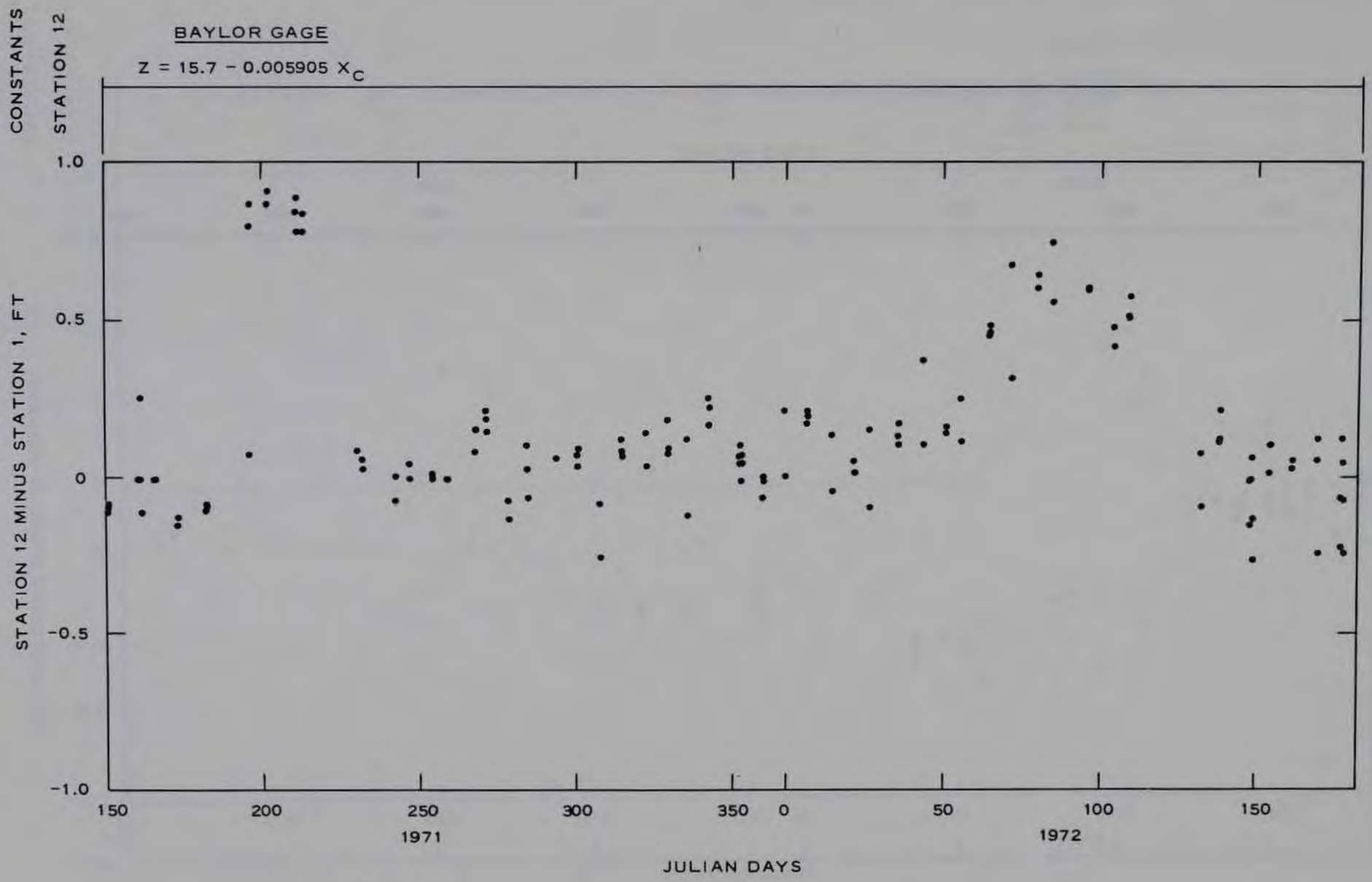


Figure J13. Comparison plot for station 12 minus station 1

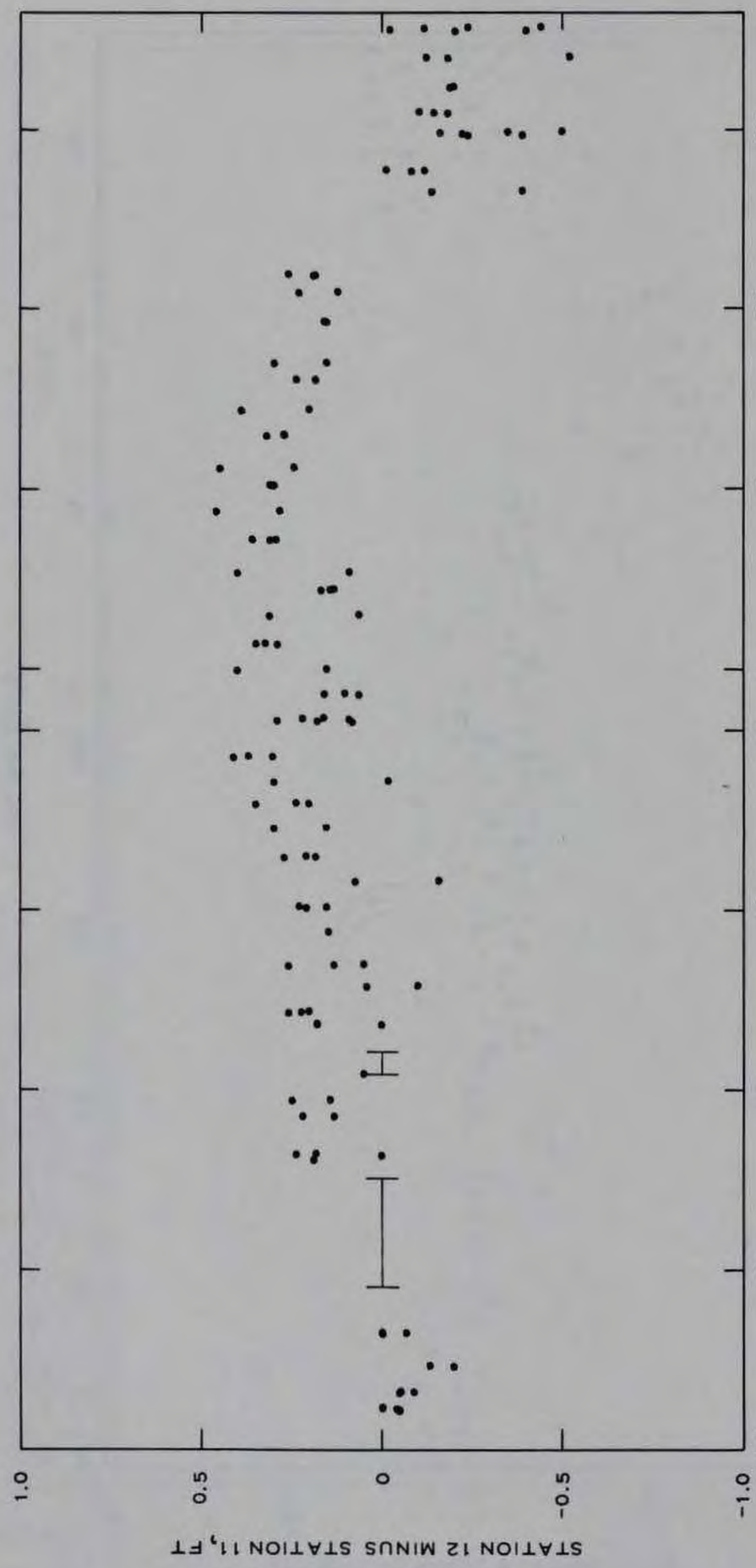


Figure J14. Comparison plot for station 12 minus station 11

Incl 1 (Sheet 14 of 15)

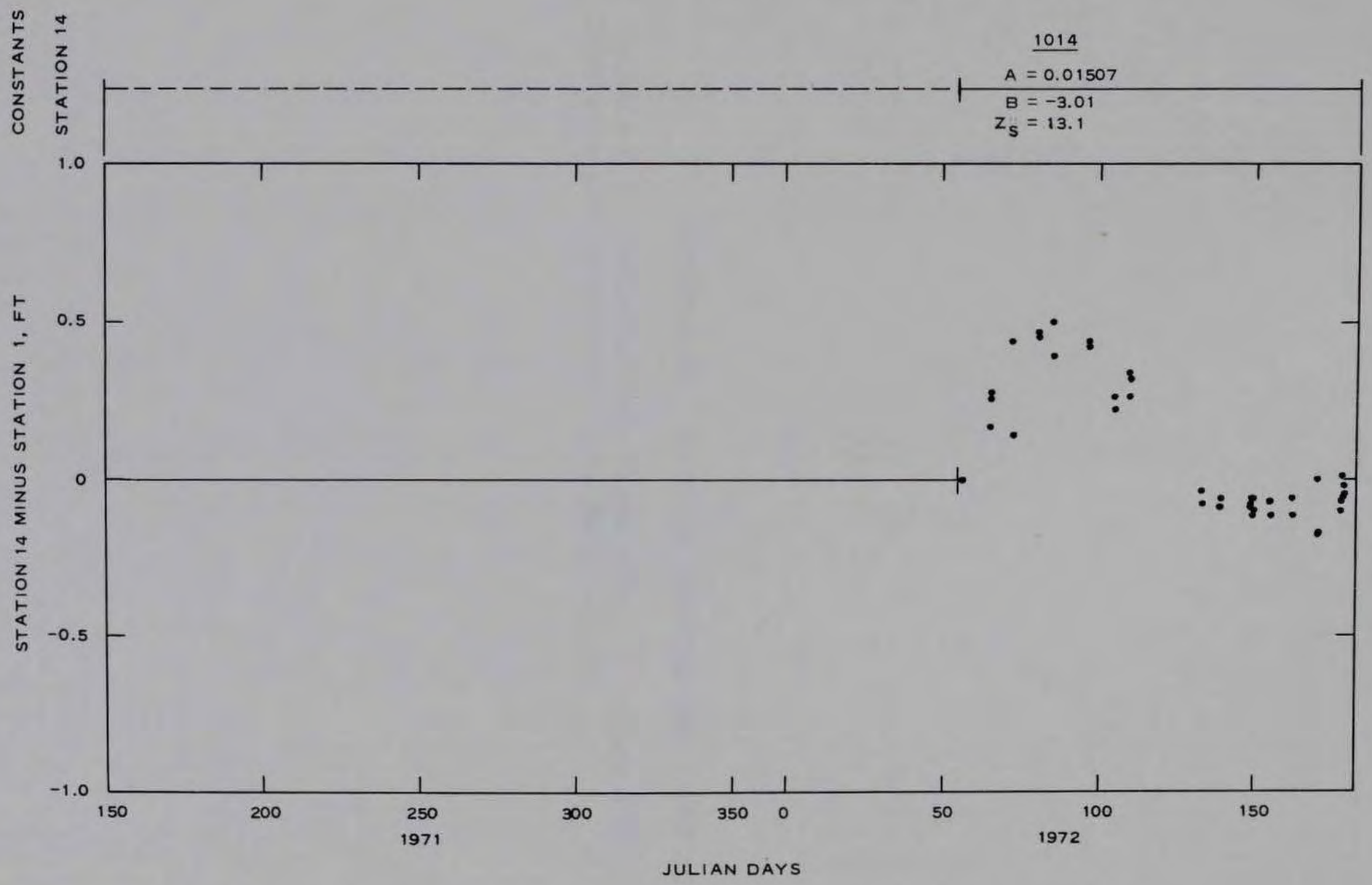


Figure J15. Comparison plot for station 14 minus station 1

APPENDIX K: ACCURACY CALCULATIONS (JUNE 1972)

Inclosure 1: Water-Surface Elevations, 7-10 June 1972
Inclosure 2: Comparative Tide Height Plots

Water Surface Elevations (7-10 June 1972) for Indicated Stations

Time*	13	1	2	3A	4	5	6	7	8	9	10	11	14	12
5.	32.94	6.23	6.29	5.61	6.35	6.21	6.31	6.27	6.18	6.35	6.28	6.24	6.23	6.25
15.	32.94	6.26	6.26	6.25	6.34	6.21	6.27	6.24	6.15	6.34	6.27	6.22	6.23	6.24
25.	32.94	6.21	6.26	6.19	6.30	6.19	6.29	6.27	6.20	6.21	6.24	6.22	6.22	6.25
35.	32.94	6.21	6.23	6.05	6.26	6.16	6.22	6.18	6.09	6.17	6.21	6.18	6.18	6.13
45.	32.95	6.13	6.15	5.49	6.23	6.09	6.18	6.11	6.03	6.19	6.14	6.18	6.11	6.12
55.	32.95	6.15	6.08	6.01	6.15	6.03	6.11	6.12	6.04	6.11	6.08	6.04	6.06	6.06
65.	32.95	6.02	6.06	5.97	6.08	5.97	6.06	6.01	5.92	6.05	6.02	6.01	5.98	5.98
75.	32.96	5.89	5.92	5.80	5.95	5.83	5.91	5.89	5.82	5.99	5.87	5.88	5.86	5.90
85.	32.96	5.70	5.73	5.68	5.81	5.68	5.76	5.77	5.68	5.79	5.71	5.69	5.70	5.71
95.	32.96	5.60	5.63	5.51	5.65	5.54	5.62	5.56	5.48	5.61	5.59	5.58	5.57	5.59
105.	32.96	5.42	5.43	5.30	5.44	5.38	5.44	5.41	5.33	5.42	5.39	5.38	5.40	5.37
115.	32.96	5.16	5.21	5.15	5.30	5.14	5.22	5.23	5.14	5.22	5.23	5.18	5.17	5.13
125.	32.96	5.09	5.10	5.01	5.13	5.01	5.05	5.01	4.92	5.16	5.09	5.06	5.03	4.98
135.	32.96	4.91	4.96	4.88	5.01	4.90	4.96	4.95	4.86	4.90	4.96	4.93	4.93	4.89
145.	32.97	4.77	4.78	4.67	4.83	4.77	4.82	4.85	4.76	4.78	4.76	4.75	4.79	4.77
155.	32.96	4.58	4.62	4.49	4.64	4.53	4.60	4.59	4.50	4.76	4.57	4.59	4.55	4.56
165.	32.97	4.36	4.37	4.24	4.37	4.29	4.36	4.36	4.27	4.48	4.34	4.35	4.31	4.32
175.	32.97	4.09	4.10	3.97	4.12	4.05	4.14	4.12	4.04	4.08	4.12	4.06	4.06	4.04
185.	32.97	3.85	3.86	3.78	3.93	3.80	3.88	3.78	3.71	3.75	3.89	3.83	3.82	3.70
195.	32.98	3.66	3.67	3.57	3.72	3.61	3.70	3.63	3.55	3.53	3.69	3.64	3.62	3.50
205.	32.98	3.45	3.45	3.37	3.49	3.45	3.50	3.51	3.42	3.46	3.47	3.45	3.43	3.40
215.	32.99	3.23	3.24	3.10	3.26	3.18	3.27	3.25	3.16	3.43	3.23	3.25	3.19	3.17
225.	32.99	3.00	2.99	2.84	2.99	2.93	2.98	2.99	2.90	3.14	2.98	2.99	2.93	2.94
235.	32.99	2.71	2.72	2.63	2.76	2.68	2.75	2.72	2.64	2.66	2.76	2.73	2.68	2.63
245.	32.99	2.50	2.50	2.42	2.56	2.47	2.52	2.46	2.38	2.33	2.54	2.51	2.47	2.39
255.	32.99	2.25	2.26	2.22	2.35	2.27	2.32	2.27	2.18	2.20	2.33	2.29	2.26	2.16
265.	32.99	2.11	2.09	1.97	2.12	2.06	2.12	2.13	2.04	2.18	2.13	2.12	2.06	2.00
275.	32.99	1.92	1.91	1.74	1.90	1.87	1.93	1.93	1.83	2.05	1.92	1.95	1.87	1.84
285.	32.99	1.66	1.66	1.57	1.70	1.62	1.69	1.68	1.59	1.76	1.71	1.70	1.62	1.60
295.	32.99	1.45	1.45	1.34	1.50	1.43	1.51	1.45	1.36	1.38	1.50	1.49	1.42	1.40
305.	32.99	1.24	1.24	1.14	1.29	1.26	1.33	1.25	1.17	1.08	1.30	1.28	1.25	1.14
315.	32.99	1.03	1.01	0.94	1.08	1.00	1.09	1.06	0.98	1.02	1.09	1.07	1.00	0.99
325.	32.98	0.89	0.87	0.76	0.90	0.83	0.92	0.86	0.76	0.98	0.94	0.93	0.82	0.88

* Times, min, for centers of 10 min averaging periods beginning 1730 on 7 June (Julian day 159) and ending 0220 on 10 June (Julian day 162).

Water Surface Elevations (7-10 June 1972) for Indicated Stations

Time*	13	1	2	3A	4	5	6	7	8	9	10	11	14	12
335.	32.98	0.74	0.72	0.62	0.74	0.68	0.77	0.74	0.64	0.82	0.78	0.78	0.68	0.74
345.	32.98	0.60	0.57	0.49	0.63	0.56	0.66	0.62	0.53	0.51	0.63	0.63	0.55	0.60
355.	32.97	0.48	0.46	0.42	0.55	0.49	0.57	0.47	0.37	0.39	0.54	0.53	0.49	0.39
365.	32.97	0.39	0.36	0.30	0.43	0.39	0.48	0.41	0.32	0.36	0.43	0.43	0.37	0.34
375.	32.97	0.31	0.29	0.19	0.31	0.28	0.37	0.36	0.27	0.32	0.35	0.36	0.28	0.28
385.	32.97	0.23	0.18	0.08	0.20	0.15	0.24	0.21	0.10	0.33	0.24	0.26	0.13	0.22
395.	32.96	0.09	0.06	0.04	0.14	0.07	0.14	0.09	-.01	0.12	0.16	0.13	0.06	0.04
405.	32.96	0.06	0.03	-.00	0.11	0.05	0.13	0.07	-.02	-.19	0.11	0.09	0.04	-.14
415.	32.96	0.03	0.00	-.08	0.05	0.02	0.08	0.04	-.06	-.16	0.07	0.07	0.01	-.15
425.	32.96	-.03	-.06	-.10	0.01	-.06	0.01	-.01	-.12	0.01	0.03	0.02	-.08	-.10
435.	32.96	-.00	-.04	-.14	-.02	-.06	0.00	-.02	-.12	0.09	0.04	0.04	-.06	-.14
445.	32.96	0.03	-.00	-.10	0.02	0.01	0.06	0.03	-.06	-.03	0.04	0.07	-.02	-.06
455.	32.96	-.00	-.03	-.06	0.05	-.01	0.06	0.05	-.04	-.15	0.05	0.04	-.01	-.11
465.	32.96	0.03	0.00	-.03	0.08	0.02	0.09	0.02	-.07	-.05	0.09	0.07	0.00	-.04
475.	32.95	0.10	0.08	0.01	0.11	0.07	0.15	0.09	-.02	0.07	0.16	0.16	0.06	0.05
485.	32.95	0.17	0.13	0.05	0.16	0.15	0.22	0.20	0.11	0.15	0.20	0.21	0.13	0.14
495.	32.94	0.25	0.22	0.18	0.28	0.21	0.31	0.26	0.16	0.24	0.29	0.30	0.21	0.23
505.	32.94	0.34	0.32	0.26	0.39	0.35	0.43	0.34	0.25	0.27	0.39	0.40	0.33	0.28
515.	32.94	0.44	0.40	0.37	0.48	0.43	0.52	0.49	0.40	0.32	0.47	0.48	0.43	0.42
525.	32.94	0.53	0.51	0.46	0.56	0.52	0.59	0.55	0.45	0.52	0.58	0.59	0.50	0.54
535.	32.94	0.65	0.62	0.52	0.66	0.60	0.69	0.63	0.53	0.68	0.69	0.69	0.59	0.68
545.	32.94	0.73	0.72	0.68	0.80	0.73	0.81	0.78	0.69	0.71	0.80	0.79	0.73	0.65
555.	32.94	0.89	0.87	0.85	0.98	0.89	0.97	0.91	0.82	0.78	0.93	0.94	0.89	0.89
565.	32.94	1.05	1.04	0.96	1.09	1.04	1.11	1.06	0.97	0.96	1.09	1.09	1.03	1.05
575.	32.94	1.18	1.16	1.09	1.22	1.14	1.22	1.20	1.11	1.19	1.25	1.23	1.14	1.16
585.	32.94	1.32	1.31	1.28	1.38	1.30	1.37	1.32	1.23	1.39	1.38	1.38	1.29	1.28
595.	32.94	1.52	1.51	1.43	1.57	1.51	1.58	1.51	1.44	1.48	1.57	1.56	1.51	1.39
605.	32.94	1.68	1.69	1.62	1.75	1.70	1.76	1.74	1.65	1.57	1.75	1.74	1.70	1.57
615.	32.94	1.87	1.85	1.80	1.90	1.82	1.88	1.87	1.78	1.89	1.91	1.91	1.82	1.67
625.	32.94	2.02	2.01	1.94	2.08	1.99	2.04	2.01	1.91	2.13	2.05	2.06	1.99	1.82
635.	32.94	2.15	2.15	2.09	2.23	2.15	2.20	2.23	2.14	2.17	2.22	2.20	2.16	2.04
645.	32.95	2.34	2.32	2.27	2.38	2.32	2.36	2.34	2.26	2.28	2.36	2.37	2.32	2.23
655.	32.95	2.44	2.45	2.39	2.49	2.44	2.47	2.42	2.34	2.45	2.50	2.49	2.43	2.27
665.	32.96	2.56	2.55	2.53	2.63	2.53	2.57	2.58	2.50	2.58	2.63	2.58	2.53	2.39
675.	32.96	2.75	2.75	2.74	2.81	2.74	2.79	2.74	2.65	2.69	2.80	2.79	2.74	2.66
685.	32.96	2.94	2.94	2.86	2.97	2.91	2.96	2.95	2.88	2.89	2.95	2.95	2.91	2.86
695.	32.96	3.02	3.02	2.98	3.09	3.01	3.07	3.07	2.99	3.10	3.04	3.04	3.01	2.92
705.	32.96	3.17	3.16	3.11	3.22	3.14	3.20	3.15	3.06	3.27	3.17	3.18	3.13	2.99
715.	32.96	3.30	3.30	3.19	3.29	3.25	3.31	3.28	3.21	3.24	3.31	3.31	3.24	3.20
725.	32.97	3.37	3.37	3.34	3.44	3.36	3.42	3.38	3.30	3.29	3.41	3.38	3.36	3.34
735.	32.97	3.49	3.48	3.45	3.58	3.49	3.53	3.47	3.39	3.48	3.49	3.49	3.48	3.27
745.	32.97	3.59	3.59	3.50	3.64	3.60	3.64	3.63	3.56	3.61	3.57	3.59	3.59	3.45

*0300 hrs 7 June 72 to 0600 hrs 10 June 72

Water Surface Elevations (7-10 June 1972) for Indicated Stations

Time*	13	1	2	3A	4	5	6	7	8	9	10	11	14	12
755. 0600 hrs	32.97	3.67	3.67	3.49	3.65	3.62	3.67	3.69	3.61	3.75	3.61	3.66	3.61	3.58
765.	32.97	3.64	3.64	3.56	3.69	3.58	3.62	3.59	3.50	3.80	3.62	3.63	3.56	3.56
775.	32.97	3.67	3.68	3.66	3.79	3.64	3.71	3.63	3.54	3.57	3.72	3.67	3.65	3.52
785.	32.98	3.78	3.79	3.69	3.85	3.77	3.85	3.81	3.75	3.47	3.80	3.77	3.79	3.61
795. 0700 hrs 8 June 72	32.99	3.83	3.83	3.75	3.89	3.79	3.87	3.84	3.77	3.81	3.82	3.81	3.81	3.75
805.	32.99	3.86	3.86	3.78	3.93	3.80	3.87	3.84	3.74	4.24	3.82	3.86	3.81	3.75
815.	32.99	3.90	3.90	3.75	3.89	3.83	3.91	3.94	3.86	4.26	3.83	3.88	3.85	3.75
825.	32.99	3.86	3.87	3.77	3.85	3.83	3.90	3.88	3.81	3.96	3.83	3.85	3.83	3.78
835.	32.99	3.79	3.79	3.73	3.87	3.72	3.81	3.72	3.64	3.89	3.77	3.78	3.75	3.73
845.	33.00	3.71	3.73	3.69	3.81	3.68	3.77	3.73	3.64	3.87	3.75	3.72	3.71	3.69
855. 0800 hrs	32.99	3.76	3.76	3.63	3.75	3.66	3.75	3.76	3.67	3.92	3.73	3.75	3.70	3.70
865.	32.99	3.71	3.71	3.58	3.73	3.62	3.69	3.68	3.59	4.04	3.68	3.70	3.64	3.57
875.	32.99	3.64	3.63	3.53	3.68	3.60	3.66	3.63	3.54	3.92	3.61	3.63	3.61	3.50
885.	32.99	3.56	3.57	3.45	3.60	3.55	3.60	3.59	3.51	3.70	3.54	3.57	3.55	3.48
895.	32.99	3.48	3.47	3.37	3.52	3.44	3.49	3.44	3.35	3.62	3.46	3.48	3.43	3.29
905.	32.99	3.36	3.37	3.25	3.39	3.31	3.37	3.34	3.25	3.41	3.34	3.38	3.32	3.14
915.	32.99	3.25	3.25	3.15	3.30	3.21	3.27	3.26	3.17	3.30	3.28	3.27	3.21	3.14
925.	32.99	3.21	3.21	3.10	3.23	3.15	3.20	3.15	3.06	3.17	3.22	3.22	3.15	3.15
935. 0900 hrs	32.99	3.15	3.03	2.96	3.10	3.02	3.08	3.07	2.98	3.02	3.05	3.05	3.02	2.87
945.	32.99	2.97	2.97	2.86	3.00	2.92	2.98	2.96	2.86	3.07	2.96	2.99	2.92	2.75
955.	32.99	2.86	2.85	2.74	2.89	2.81	2.86	2.86	2.76	2.96	2.86	2.88	2.81	2.67
965.	32.99	2.72	2.73	2.62	2.77	2.71	2.75	2.75	2.67	2.70	2.75	2.75	2.71	2.61
975.	32.99	2.60	2.60	2.49	2.65	2.56	2.60	2.57	2.48	2.51	2.64	2.63	2.56	2.53
985. 1000 hrs	32.99	2.49	2.49	2.43	2.57	2.44	2.49	2.45	2.36	2.43	2.55	2.52	2.45	2.40
995.	32.98	2.44	2.43	2.32	2.48	2.41	2.45	2.43	2.34	2.41	2.48	2.47	2.40	2.33
1005.	32.98	2.39	2.39	2.29	2.44	2.37	2.41	2.40	2.31	2.40	2.43	2.43	2.37	2.29
1015.	32.98	2.35	2.34	2.23	2.38	2.31	2.34	2.36	2.26	2.43	2.35	2.39	2.31	2.22
1025.	32.97	2.26	2.26	2.16	2.31	2.25	2.28	2.29	2.19	2.34	2.29	2.31	2.24	2.12
1035.	32.97	2.19	2.17	2.06	2.22	2.16	2.19	2.20	2.11	2.19	2.19	2.23	2.15	2.05
1045. 1100 hrs	32.97	2.08	2.08	1.96	2.14	2.06	2.09	2.06	1.97	2.06	2.11	2.13	2.06	1.91
1055.	32.97	2.01	2.00	1.89	2.05	1.97	2.01	1.99	1.90	2.08	2.07	2.05	1.96	1.86
1065.	32.97	1.97	1.98	1.90	2.06	1.94	1.98	1.95	1.86	2.05	2.05	2.03	1.94	1.91
1075.	32.97	2.03	2.02	1.93	2.09	2.01	2.04	2.02	1.93	2.11	2.06	2.07	2.00	1.90
1085.	32.97	2.08	2.08	2.00	2.15	2.10	2.14	2.12	2.03	2.16	2.11	2.12	2.10	1.87
1095. 1200 hrs 9 June 72	32.97	2.12	2.11	1.99	2.15	2.09	2.14	2.16	2.06	2.30	2.12	2.17	2.10	2.00
1105.	32.97	2.11	2.09	1.98	2.13	2.09	2.13	2.13	2.03	2.39	2.12	2.15	2.08	1.97
1115.	32.97	2.08	2.07	1.97	2.12	2.02	2.08	2.07	1.97	2.14	2.11	2.12	2.03	1.91
1125.	32.97	2.06	2.05	2.01	2.15	2.05	2.10	2.05	1.96	1.96	2.13	2.10	2.05	1.94
1135.	32.97	2.12	2.13	2.07	2.21	2.12	2.16	2.10	2.00	1.91	2.19	2.17	2.11	1.94
1145.	32.97	2.20	2.20	2.15	2.28	2.19	2.23	2.23	2.13	2.33	2.26	2.25	2.19	2.07
1155.	32.97	2.32	2.32	2.23	2.39	2.33	2.35	2.34	2.24	2.55	2.35	2.37	2.31	2.16
1165. 1300 hrs	32.97	2.45	2.43	2.33	2.48	2.44	2.47	2.49	2.39	2.58	2.45	2.48	2.43	2.32

Water Surface Elevations (7-10 June 1972) for Indicated Stations

Time*	13	1	2	3A	4	5	6	7	8	9	10	11	14	12
1175.	32.97	2.52	2.52	2.41	2.55	2.51	2.53	2.56	2.48	2.52	2.56	2.56	2.50	2.39
1185.	32.97	2.57	2.57	2.51	2.66	2.56	2.59	2.55	2.44	2.66	2.65	2.59	2.54	2.47
1195.	32.97	2.66	2.66	2.61	2.76	2.67	2.71	2.64	2.54	2.75	2.77	2.69	2.66	2.52
1205.	32.97	2.86	2.87	2.80	2.90	2.84	2.88	2.86	2.76	2.82	2.93	2.89	2.83	2.78
1215.	32.97	3.04	3.03	2.97	3.10	3.05	3.08	3.07	2.97	3.07	3.07	3.06	3.04	2.93
1225.	32.97	3.22	3.22	3.17	3.30	3.23	3.26	3.26	3.16	3.34	3.29	3.25	3.22	3.13
1235.	32.96	3.45	3.43	3.32	3.45	3.42	3.45	3.46	3.37	3.47	3.46	3.45	3.41	3.35
1245.	32.96	3.57	3.57	3.49	3.63	3.59	3.61	3.58	3.49	3.57	3.62	3.57	3.55	3.50
1255.	32.96	3.70	3.70	3.69	3.79	3.68	3.74	3.70	3.60	3.68	3.77	3.68	3.70	3.60
1265.	32.96	3.90	3.89	3.86	3.97	3.89	3.94	3.90	3.80	3.82	3.96	3.88	3.89	3.86
1275.	32.95	4.07	4.09	4.02	4.13	4.07	4.11	4.12	4.02	4.06	4.14	4.08	4.06	4.00
1285.	32.95	4.24	4.25	4.21	4.30	4.20	4.25	4.26	4.14	4.39	4.31	4.23	4.20	4.18
1295.	32.95	4.45	4.47	4.43	4.52	4.42	4.46	4.42	4.31	4.53	4.52	4.45	4.42	4.27
1305.	32.95	4.66	4.69	4.67	4.77	4.73	4.74	4.74	4.64	4.57	4.72	4.65	4.73	4.61
1315.	32.95	4.87	4.90	4.82	4.96	4.90	4.92	4.96	4.87	4.84	4.89	4.86	4.90	4.69
1325.	32.95	5.03	5.05	4.97	5.09	5.00	5.01	5.02	4.91	5.25	5.03	5.02	5.00	4.85
1335.	32.95	5.13	5.15	5.09	5.20	5.09	5.12	5.18	5.07	5.36	5.14	5.13	5.10	5.12
1345.	32.95	5.26	5.29	5.27	5.38	5.29	5.31	5.30	5.20	5.20	5.34	5.27	5.29	5.18
1355.	32.95	5.46	5.50	5.46	5.54	5.44	5.48	5.43	5.33	5.29	5.53	5.46	5.45	5.36
1365.	32.95	5.59	5.63	5.64	5.75	5.63	5.67	5.66	5.55	5.62	5.67	5.60	5.63	5.55
1375.	32.95	5.85	5.87	5.81	5.91	5.82	5.87	5.89	5.78	5.97	5.76	5.83	5.83	5.82
1385.	32.95	6.02	6.06	5.95	6.06	6.00	6.04	6.06	5.96	6.20	6.01	6.00	6.00	5.96
1395.	32.94	6.10	6.13	5.98	6.18	6.08	6.13	6.15	6.04	6.17	6.09	6.08	6.09	5.99
1405.	32.95	6.17	6.21	6.09	6.28	6.15	6.20	6.17	6.07	6.13	6.22	6.18	6.16	6.03
1415.	32.94	6.30	6.33	6.22	6.43	6.28	6.33	6.26	6.16	6.13	6.37	6.28	6.29	6.25
1425.	32.94	6.43	6.47	6.01	6.56	6.43	6.47	6.50	6.41	6.33	6.48	6.42	6.45	6.26
1435.	32.94	6.57	6.61	5.92	6.67	6.55	6.60	6.60	6.49	6.68	6.62	6.57	6.57	6.58
1445.	32.94	6.71	6.73	6.66	6.78	6.65	6.69	6.70	6.59	6.87	6.69	6.69	6.66	6.61
1455.	32.95	6.72	6.75	5.98	6.85	6.75	6.79	6.82	6.72	6.75	6.72	6.71	6.76	6.52
1465.	32.95	6.75	6.79	6.52	6.86	6.74	6.78	6.78	6.69	6.70	6.73	6.75	6.75	6.67
1475.	32.95	6.72	6.75	4.98	6.79	6.66	6.71	6.68	6.58	6.75	6.68	6.71	6.68	6.60
1485.	32.95	6.62	6.66	6.09	6.75	6.61	6.66	6.67	6.56	6.71	6.65	6.62	6.62	6.58
1495.	32.96	6.66	6.70	6.18	6.73	6.61	6.65	6.63	6.53	6.68	6.67	6.66	6.62	6.62
1505.	32.96	6.61	6.66	6.60	6.73	6.60	6.65	6.63	6.53	6.60	6.64	6.61	6.61	6.56
1515.	32.96	6.60	6.62	6.59	6.73	6.59	6.64	6.64	6.55	6.61	6.61	6.58	6.61	6.43
1525.	32.96	6.58	6.62	5.76	6.65	6.56	6.61	6.61	6.51	6.69	6.55	6.58	6.57	6.54
1535.	32.96	6.45	6.48	6.33	6.49	6.41	6.46	6.50	6.39	6.59	6.39	6.44	6.42	6.39
1545.	32.97	6.26	6.28	6.19	6.34	6.19	6.26	6.27	6.17	6.33	6.24	6.24	6.21	6.14
1555.	32.97	6.11	6.15	6.06	6.20	6.06	6.12	6.06	5.96	6.01	6.14	6.10	6.07	6.08
1565.	32.97	5.96	6.01	5.94	6.09	5.97	6.02	5.98	5.90	5.80	6.03	5.96	5.98	5.91
1575.	32.97	5.87	5.89	5.82	5.96	5.85	5.91	5.89	5.79	5.88	5.89	5.85	5.86	5.83
1585.	32.97	5.77	5.80	5.68	5.84	5.74	5.80	5.79	5.68	5.93	5.75	5.71	5.74	5.79

*1175 = 1300 hrs 6 June 72; 1185 = 1400 hrs; 1195 = 1500 hrs; 1205 = 1600 hrs; 1215 = 1700 hrs; 1225 = 1800 hrs; 1235 = 1900 hrs; 1245 = 2000 hrs; 1255 = 2100 hrs; 1265 = 2200 hrs; 1275 = 2300 hrs; 1285 = 0000 hrs 7 June 72; 1295 = 0100 hrs; 1305 = 0200 hrs; 1315 = 0300 hrs; 1325 = 0400 hrs; 1335 = 0500 hrs; 1345 = 0600 hrs; 1355 = 0700 hrs; 1365 = 0800 hrs; 1375 = 0900 hrs; 1385 = 1000 hrs; 1395 = 1100 hrs; 1405 = 1200 hrs; 1415 = 1300 hrs; 1425 = 1400 hrs; 1435 = 1500 hrs; 1445 = 1600 hrs; 1455 = 1700 hrs; 1465 = 1800 hrs; 1475 = 1900 hrs; 1485 = 2000 hrs; 1495 = 2100 hrs; 1505 = 2200 hrs; 1515 = 2300 hrs; 1525 = 0000 hrs 8 June 72; 1535 = 0100 hrs; 1545 = 0200 hrs; 1555 = 0300 hrs; 1565 = 0400 hrs; 1575 = 0500 hrs; 1585 = 0600 hrs

K4

Water Surface Elevations (7-10 June 1972) for Indicated Stations

Time*	13	1	2	3A	4	5	6	7	8	9	10	11	14	12
1595.	32.98	5.59	5.61	5.44	5.61	5.56	5.61	5.68	5.57	5.73	5.53	5.57	5.57	5.60
1605.	32.99	5.32	5.34	5.23	5.39	5.29	5.33	5.34	5.24	5.39	5.29	5.31	5.31	5.20
1615.	32.99	5. 5	5.08	4.98	5.15	5.02	5.07	5.02	4.96	5.00	5.05	5.03	5.04	4.99
1625.	32.99	4.78	4.82	4.70	4.86	4.78	4.81	4.82	4.74	4.63	4.81	4.77	4.77	4.70
1635.	32.99	4.55	4.57	4.45	4.61	4.51	4.55	4.53	4.43	4.54	4.59	4.54	4.52	4.47
1645.	32.99	4.33	4.35	4.24	4.37	4.28	4.33	4.30	4.19	4.43	4.35	4.32	4.27	4.14
1655.	32.99	4.10	4.10	4.03	4.19	4.10	4.16	4.16	4.06	4.09	4.12	4.08	4.10	4.10
1665.	32.99	3.87	3.88	3.72	3.90	3.86	3.91	3.93	3.83	3.82	3.85	3.85	3.86	3.87
1675.	32.99	3.58	3.57	3.43	3.60	3.53	3.59	3.56	3.46	3.61	3.55	3.56	3.52	3.51
1685.	33.00	3.22	3.23	3.12	3.28	3.18	3.22	3.22	3.12	3.30	3.24	3.23	3.17	3.13
1695.	33.00	2.93	2.93	2.82	2.99	2.93	2.97	2.94	2.85	2.86	2.97	2.93	2.91	2.69
1705.	33.00	2.67	2.68	2.56	2.69	2.63	2.66	2.65	2.56	2.50	2.71	2.69	2.63	2.46
1715.	33.00	2.40	2.39	2.30	2.46	2.38	2.40	2.38	2.28	2.34	2.45	2.42	2.36	2.18
1725.	33.00	2.15	2.15	2.10	2.24	2.15	2.18	2.18	2.08	2.16	2.22	2.19	2.14	1.94
1735.	33.00	1.99	1.97	1.83	2.00	1.98	2.00	2.01	1.92	1.95	1.99	2.01	1.96	1.83
1745.	33.00	1.72	1.71	1.55	1.70	1.69	1.74	1.76	1.66	1.74	1.72	1.76	1.68	1.53
1755.	33.01	1.39	1.37	1.26	1.43	1.35	1.41	1.39	1.28	1.47	1.44	1.42	1.33	1.14
1765.	33.01	1.12	1.13	1.07	1.20	1.10	1.18	1.08	0.98	1.05	1.21	1.17	1.08	0.77
1775.	33.01	0.94	0.93	0.85	0.98	0.96	1.02	0.96	0.88	0.66	0.99	0.97	0.94	0.76
1785.	33.01	0.71	0.69	0.59	0.74	0.71	0.78	0.77	0.67	0.61	0.75	0.75	0.68	0.51
1795.	33.00	0.50	0.46	0.37	0.50	0.45	0.52	0.45	0.34	0.71	0.54	0.54	0.43	0.37
1805.	33.00	0.32	0.29	0.12	0.29	0.25	0.30	0.29	0.19	0.54	0.34	0.36	0.23	0.17
1815.	33.00	0.12	0.08	0.04	0.17	0.14	0.21	0.17	0.07	0.17	0.19	0.15	0.11	-.03
1825.	33.00	-. 1	-.04	-.10	0.05	-.01	0.03	-.04	-.14	-.22	0.02	0.02	-.03	-.10
1835.	33.00	-.18	-.21	-.29	-.15	-.17	-.10	-.17	-.28	-.19	-.14	-.15	-.21	-.24
1845.	33.00	-.32	-.37	-.45	-.32	-.37	-.27	-.28	-.39	-.23	-.28	-.29	-.39	-.42
1855.	32.99	-.42	-.47	-.60	-.47	-.48	-.40	-.46	-.56	-.35	-.40	-.40	-.52	-.49
1865.	32.99	-.53	-.58	-.66	-.54	-.57	-.49	-.58	-.68	-.67	-.48	-.53	-.60	-.61
1875.	32.99	-.63	-.70	-.68	-.57	-.64	-.56	-.67	-.76	-.92	-.55	-.63	-.68	-.77
1885.	32.99	-.61	-.67	-.69	-.56	-.62	-.54	-.65	-.75	-.85	-.58	-.60	-.65	-.78
1895.	32.99	-.61	-.67	-.76	-.61	-.61	-.54	-.56	-.67	-.64	-.60	-.60	-.65	-.75
1905.	32.99	-.63	-.70	-.83	-.71	-.68	-.60	-.58	-.69	-.46	-.64	-.62	-.72	-.79
1915.	32.99	-.70	-.76	-.86	-.77	-.77	-.70	-.76	-.88	-.53	-.70	-.68	-.79	-.82
1925.	32.99	-.78	-.85	-.84	-.74	-.82	-.74	-.84	-.95	-.93	-.71	-.78	-.84	-.92
1935.	32.98	-.75	-.81	-.80	-.68	-.72	-.65	-.77	-.86	-1.23	-.70	-.74	-.74	-.78
1945.	32.98	-.67	-.73	-.78	-.67	-.68	-.60	-.68	-.77	-.98	-.64	-.66	-.71	-.69
1955.	32.99	-.61	-.68	-.73	-.62	-.65	-.58	-.63	-.75	-.46	-.60	-.60	-.70	-.62
1965.	32.99	-.52	-.59	-.66	-.55	-.57	-.49	-.50	-.62	-.08	-.52	-.50	-.60	-.52
1975.	32.99	-.43	-.48	-.57	-.44	-.44	-.36	-.39	-.49	-.43	-.43	-.41	-.46	-.41
1985.	32.99	-.38	-.42	-.48	-.37	-.37	-.29	-.37	-.46	-.61	-.35	-.36	-.39	-.40
1995.	32.99	-.37	-.41	-.40	-.32	-.37	-.29	-.40	-.50	-.49	-.29	-.34	-.41	-.45
2005.	32.99	-.26	-.30	-.29	-.21	-.29	-.19	-.30	-.42	-.29	-.18	-.23	-.30	-.30

Water Surface Elevations (7-10 June 1972) for Indicated Stations

Time*	13	1	2	3A	4	5	6	7	8	9	10	11	14	12
2015.	32.99	-. 6	-.10	-.13	-.06	-.07	-.02	-.04	-.14	-.12	-.02	-.02	-.10	-.07
2025.	32.98	0.14	0.11	0.07	0.16	0.16	0.21	0.18	0.08	0.13	0.19	0.17	0.14	0.14
2035.	32.98	0.32	0.29	0.27	0.34	0.33	0.38	0.34	0.23	0.39	0.35	0.36	0.30	0.34
2045.	32.99	0.48	0.45	0.46	0.53	0.48	0.53	0.51	0.40	0.54	0.51	0.52	0.46	0.52
2055.	32.99	0.65	0.63	0.63	0.70	0.66	0.72	0.70	0.60	0.64	0.71	0.70	0.65	0.70
2065.	32.99	0.83	0.81	0.80	0.86	0.81	0.86	0.83	0.73	0.79	0.89	0.88	0.79	0.83
2075.	32.99	0.98	0.97	0.98	1.04	0.99	1.04	0.98	0.87	0.97	1.05	1.03	0.97	0.96
2085.	32.99	1.18	1.17	1.20	1.28	1.21	1.26	1.22	1.12	1.27	1.25	1.23	1.19	1.20
2095.	32.99	1.42	1.42	1.38	1.48	1.43	1.47	1.46	1.37	1.47	1.45	1.47	1.41	1.34
2105.	32.99	1.62	1.59	1.56	1.67	1.62	1.65	1.64	1.55	1.76	1.61	1.65	1.61	1.57
2115.	32.99	1.76	1.74	1.75	1.81	1.72	1.76	1.77	1.66	1.88	1.79	1.80	1.71	1.61
2125.	32.99	1.96	1.95	1.94	2.03	1.95	1.97	1.94	1.84	1.93	1.98	2.00	1.94	1.89
2135.	32.99	2.14	2.15	2.15	2.24	2.16	2.20	2.19	2.09	1.99	2.17	2.19	2.16	1.99
2145.	32.99	2.34	2.33	2.33	2.43	2.36	2.37	2.38	2.29	2.27	2.35	2.38	2.34	2.29
2155.	32.99	2.52	2.51	2.45	2.55	2.49	2.51	2.54	2.44	2.67	2.50	2.55	2.49	2.45
2165.	32.99	2.63	2.63	2.59	2.68	2.63	2.64	2.67	2.57	2.80	2.64	2.68	2.62	2.54
2175.	33.00	2.80	2.78	2.76	2.83	2.75	2.78	2.78	2.68	2.77	2.81	2.82	2.75	2.64
2185.	33.00	2.89	2.91	2.91	2.99	2.92	2.95	2.90	2.82	2.73	2.95	2.93	2.92	2.76
2195.	33.00	3. 7	3.05	3.08	3.15	3.07	3.10	3.08	2.99	2.91	3.10	3.08	3.06	3.01
2205.	33.00	3.20	3.21	3.17	3.27	3.21	3.23	3.22	3.12	3.29	3.21	3.24	3.20	3.13
2215.	33.01	3.35	3.34	3.28	3.36	3.30	3.33	3.38	3.28	3.52	3.35	3.36	3.29	3.33
2225.	33.02	3.45	3.45	3.39	3.47	3.42	3.45	3.45	3.36	3.50	3.45	3.46	3.42	3.41
2235.	33.02	3.53	3.52	3.50	3.61	3.53	3.55	3.52	3.43	3.44	3.54	3.53	3.51	3.48
2245.	33.03	3.62	3.62	3.62	3.73	3.60	3.66	3.62	3.52	3.46	3.68	3.61	3.62	3.62
2255.	33.03	3.79	3.79	3.71	3.81	3.73	3.78	3.77	3.69	3.71	3.78	3.78	3.74	3.80
2265.	33.02	3.84	3.84	3.81	3.92	3.83	3.87	3.89	3.80	4.02	3.83	3.84	3.84	3.87
2275.	33.03	3.92	3.91	3.82	3.94	3.87	3.92	3.95	3.86	4.08	3.85	3.91	3.88	3.92
2285.	33.03	3.91	3.91	3.80	3.93	3.86	3.91	3.92	3.83	3.94	3.84	3.91	3.87	3.82
2295.	33.03	3.84	3.84	3.78	3.90	3.78	3.84	3.82	3.72	3.78	3.81	3.83	3.79	3.83
2305.	33.03	3.80	3.80	3.77	3.91	3.75	3.80	3.76	3.67	3.70	3.85	3.79	3.77	3.77
2315.	33.04	3.86	3.87	3.81	3.93	3.83	3.87	3.84	3.75	3.72	3.87	3.85	3.83	3.75
2325.	33.04	3.88	3.88	3.78	3.91	3.85	3.90	3.93	3.85	3.90	3.83	3.87	3.86	3.84
2335.	33.04	3.83	3.82	3.74	3.87	3.78	3.83	3.86	3.75	4.06	3.77	3.82	3.79	3.80
2345.	33.04	3.79	3.80	3.65	3.80	3.71	3.76	3.77	3.67	3.91	3.72	3.78	3.72	3.67
2355.	33.03	3.67	3.67	3.58	3.72	3.63	3.70	3.69	3.61	3.56	3.65	3.65	3.65	3.48
2365.	33.03	3.57	3.58	3.53	3.65	3.55	3.57	3.54	3.44	3.42	3.61	3.57	3.53	3.42
2375.	33.04	3.53	3.53	3.45	3.59	3.51	3.52	3.47	3.38	3.46	3.54	3.53	3.48	3.48
2385.	33.05	3.48	3.47	3.39	3.52	3.46	3.47	3.53	3.43	3.49	3.48	3.48	3.44	3.37
2395.	33.05	3.45	3.44	3.33	3.46	3.41	3.44	3.45	3.35	3.54	3.44	3.45	3.39	3.29
2405.	33.05	3.38	3.38	3.25	3.40	3.34	3.37	3.35	3.26	3.44	3.34	3.39	3.33	3.21
2415.	33.05	3.22	3.22	3.15	3.29	3.23	3.27	3.29	3.20	3.20	3.20	3.24	3.22	3.13
2425.	33.05	3.13	3.12	3.01	3.15	3.08	3.11	3.11	3.02	3.07	3.11	3.13	3.07	2.97

Water Surface Elevations (7-10 June 1972) for Indicated Stations

Time*	13	1	2	3A	4	5	6	7	8	9	10	11	14	12
2435.	33.05	3.11	3.00	2.89	3.03	2.93	2.97	2.94	2.84	3.01	3.00	3.01	2.93	2.85
2445.	33.05	2.83	2.84	2.80	2.92	2.83	2.86	2.89	2.80	2.82	2.88	2.86	2.83	2.68
2455.	33.05	2.80	2.79	2.68	2.83	2.77	2.79	2.78	2.69	2.71	2.82	2.81	2.76	2.64
2465.	33.05	2.70	2.71	2.60	2.73	2.67	2.70	2.68	2.59	2.69	2.74	2.72	2.66	2.54
2475.	33.05	2.60	2.58	2.51	2.64	2.56	2.59	2.62	2.53	2.61	2.63	2.61	2.55	2.43
2485.	33.05	2.53	2.52	2.46	2.58	2.49	2.50	2.51	2.41	2.54	2.59	2.56	2.49	2.42
2495.	33.05	2.49	2.48	2.38	2.53	2.47	2.48	2.47	2.39	2.41	2.52	2.51	2.46	2.34
2505.	33.06	2.38	2.38	2.32	2.45	2.40	2.42	2.45	2.36	2.33	2.45	2.42	2.39	2.30
2515.	33.06	2.33	2.31	2.25	2.37	2.30	2.31	2.31	2.21	2.40	2.36	2.35	2.28	2.24
2525.	33.06	2.27	2.26	2.17	2.30	2.23	2.24	2.25	2.15	2.33	2.31	2.30	2.22	2.17
2535.	33.05	2.19	2.18	2.09	2.24	2.19	2.20	2.23	2.14	2.34	2.25	2.23	2.17	2.06
2545.	33.06	2.15	2.14	2.09	2.22	2.14	2.15	2.14	2.05	2.30	2.20	2.19	2.13	1.99
2555.	33.06	2.13	2.12	2.07	2.19	2.12	2.13	2.10	2.00	2.30	2.19	2.17	2.11	1.91
2565.	33.06	2.14	2.12	2.06	2.19	2.12	2.15	2.17	2.08	2.12	2.19	2.16	2.11	1.75
2575.	33.06	2.14	2.14	2.05	2.19	2.16	2.17	2.18	2.09	2.18	2.17	2.19	2.14	2.05
2585.	33.06	2.15	2.11	2.03	2.15	2.10	2.12	2.14	2.04	2.39	2.17	2.16	2.09	2.00
2595.	33.06	2.09	2.09	2.02	2.15	2.09	2.10	2.10	2.00	2.31	2.19	2.14	2.07	1.92
2605.	33.06	2.13	2.10	2.05	2.15	2.10	2.12	2.10	2.01	2.02	2.20	2.15	2.08	1.86
2615.	33.06	2.11	2.11	2.11	2.22	2.14	2.15	2.14	2.03	2.00	2.23	2.16	2.12	1.87
2625.	33.05	2.23	2.21	2.18	2.29	2.22	2.24	2.23	2.13	2.17	2.31	2.25	2.21	2.02
2635.	33.05	2.33	2.32	2.25	2.37	2.33	2.34	2.35	2.25	2.35	2.38	2.37	2.31	2.19
2645.	33.05	2.42	2.39	2.35	2.46	2.42	2.43	2.47	2.37	2.47	2.47	2.45	2.40	2.35
2655.	33.05	2.49	2.48	2.46	2.56	2.49	2.50	2.51	2.41	2.52	2.57	2.53	2.48	2.35
2665.	33.05	2.59	2.58	2.54	2.64	2.59	2.60	2.59	2.49	2.51	2.66	2.62	2.56	2.51
2675.	33.05	2.67	2.66	2.67	2.75	2.69	2.70	2.70	2.60	2.56	2.77	2.70	2.67	2.61
2685.	33.05	2.80	2.80	2.81	2.90	2.82	2.84	2.80	2.70	2.77	2.89	2.83	2.80	2.68
2695.	33.05	3.03	3.01	2.96	3.05	3.00	3.02	3.01	2.91	2.98	3.05	3.03	2.98	2.87
2705.	33.05	3.15	3.15	3.16	3.23	3.18	3.20	3.23	3.13	3.19	3.20	3.18	3.16	3.05
2715.	33.05	3.36	3.34	3.35	3.42	3.36	3.38	3.36	3.26	3.38	3.36	3.36	3.34	3.30
2725.	33.05	3.52	3.52	3.51	3.59	3.54	3.56	3.55	3.45	3.51	3.52	3.51	3.52	3.50
2735.	33.05	3.67	3.66	3.66	3.72	3.64	3.69	3.72	3.62	3.62	3.70	3.65	3.65	3.65
2745.	33.05	3.83	3.83	3.83	3.92	3.80	3.84	3.80	3.70	3.84	3.89	3.82	3.80	3.79
2755.	33.05	4.02	4.02	4.05	4.11	4.01	4.05	4.01	3.91	3.96	4.08	4.00	4.01	4.02
2765.	33.05	4.22	4.24	4.26	4.33	4.25	4.29	4.31	4.22	4.13	4.29	4.21	4.25	4.14
2775.	33.05	4.45	4.47	4.48	4.57	4.46	4.48	4.47	4.37	4.47	4.51	4.44	4.46	4.44
2785.	33.05	4.64	4.66	4.66	4.75	4.64	4.65	4.67	4.57	4.75	4.72	4.64	4.64	4.62
2795.	33.05	4.82	4.83	4.86	4.94	4.83	4.84	4.90	4.80	4.86	4.91	4.82	4.83	4.75
2805.	33.05	5.02	5.03	5.07	5.14	5.01	5.03	5.02	4.92	4.98	5.11	5.01	5.02	4.95
2815.	33.05	5.18	5.20	5.22	5.31	5.20	5.21	5.20	5.11	5.14	5.29	5.18	5.20	5.13
2825.	33.05	5.35	5.37	5.37	5.48	5.36	5.37	5.40	5.30	5.34	5.47	5.34	5.37	5.31
2835.	33.04	5.57	5.59	5.59	5.68	5.55	5.57	5.57	5.46	5.63	5.67	5.57	5.55	5.55
2845.	33.04	5.77	5.79	5.77	5.89	5.78	5.82	5.82	5.72	5.79	5.86	5.76	5.78	5.68

Water Surface Elevations (7-10 June 1972) for Indicated Stations

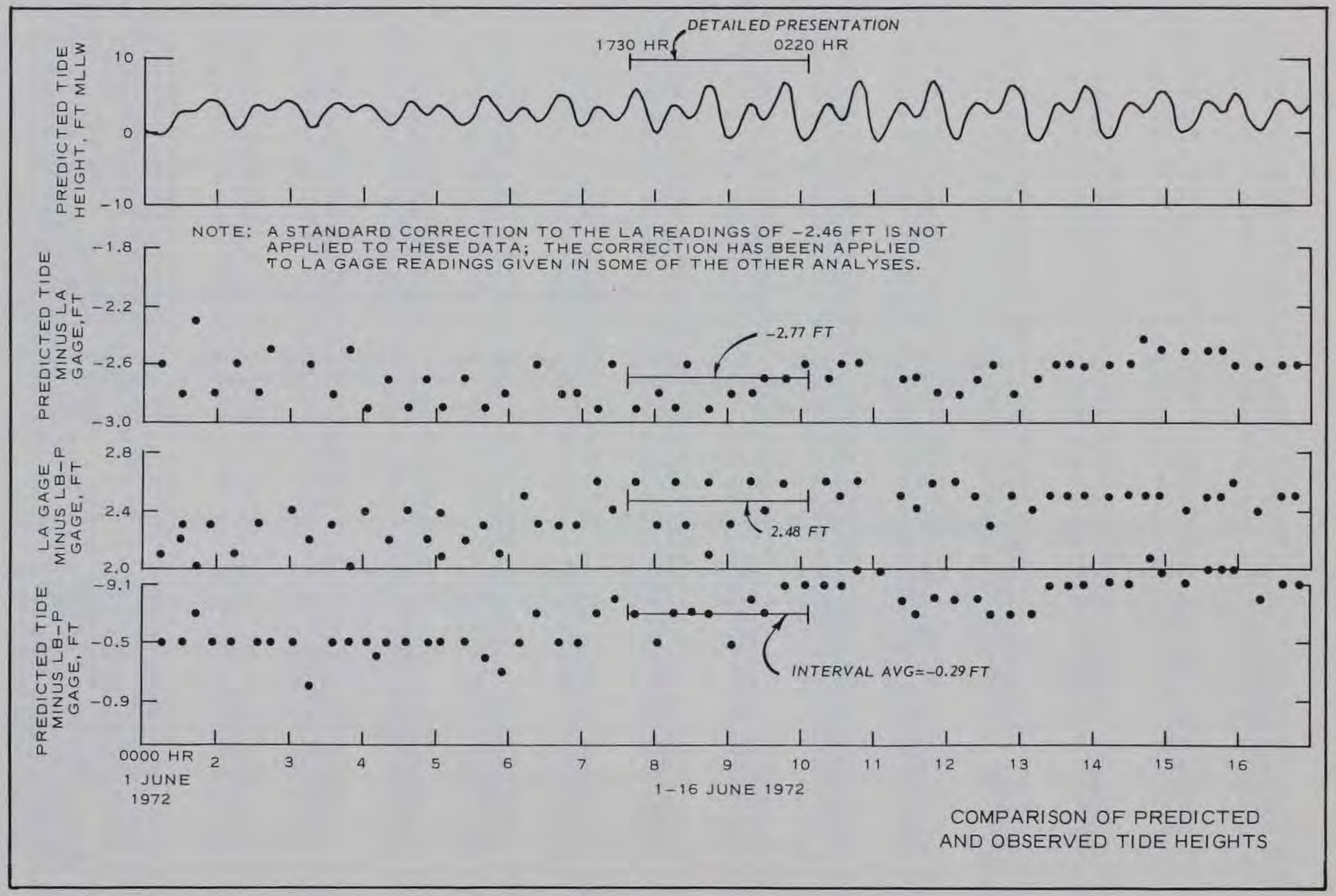
Time*	13	1	2	3A	4	5	6	7	8	9	10	11	14	12
2855.	33.04	5.94	5.97	5.98	6.07	5.96	5.99	6.03	5.93	5.97	6.04	5.94	5.96	5.83
2865.	33.05	6.12	6.15	6.13	6.22	6.10	6.12	6.11	6.00	6.19	6.19	6.11	6.10	6.10
2875.	33.05	6.25	6.27	6.18	6.37	6.24	6.28	6.28	6.18	6.29	6.32	6.24	6.25	6.11
2885.	33.05	6.38	6.42	6.41	6.50	6.40	6.42	6.44	6.35	6.35	6.45	6.39	6.40	6.31
2895.	33.05	6.53	6.54	6.55	6.63	6.49	6.53	6.52	6.42	6.55	6.56	6.52	6.50	6.45
2905.	33.05	6.62	6.65	6.69	6.76	6.61	6.65	6.64	6.54	6.67	6.68	6.62	6.62	6.60
2915.	33.05	6.76	6.80	5.01	6.87	6.76	6.79	6.82	6.72	6.77	6.81	6.76	6.77	6.77
2925.	33.05	6.85	6.88	5.84	6.95	6.83	6.86	6.88	6.78	6.92	6.89	6.85	6.84	6.83
2935.	33.05	6.88	6.92	4.65	7.02	6.87	6.90	6.91	6.80	7.01	6.93	6.88	6.89	6.92
2945.	33.06	6.94	6.96	6.35	7.06	6.94	6.96	6.98	6.88	6.96	6.98	6.94	6.95	6.93
2955.	33.06	6.94	6.98	5.92	7.04	6.93	6.96	6.98	6.89	6.93	6.98	6.95	6.94	6.98
2965.	33.06	6.92	6.95	6.94	7.01	6.87	6.90	6.90	6.80	7.00	6.99	6.92	6.89	6.97
2975.	33.06	6.90	6.94	5.73	7.04	6.89	6.92	6.91	6.81	6.97	6.99	6.91	6.90	6.94
2985.	33.07	6.92	6.95	5.08	7.03	6.91	6.95	6.98	6.89	6.89	6.96	6.92	6.93	6.94
2995.	33.07	6.87	6.90	6.34	6.96	6.86	6.89	6.91	6.82	6.93	6.88	6.87	6.87	6.92
3005.	33.07	6.74	6.78	5.71	6.83	6.70	6.75	6.77	6.67	6.96	6.76	6.73	6.72	6.76
3015.	33.07	6.63	6.65	6.41	6.70	6.58	6.62	6.65	6.54	6.72	6.67	6.60	6.59	6.65
3025.	33.08	6.49	6.54	5.70	6.60	6.46	6.52	6.48	6.39	6.42	6.56	6.48	6.48	6.54
3035.	33.08	6.40	6.42	6.22	6.51	6.39	6.44	6.41	6.31	6.35	6.44	6.37	6.41	6.42
3045.	33.08	6.26	6.30	6.29	6.36	6.24	6.30	6.33	6.24	6.34	6.28	6.25	6.25	6.29
3055.	33.09	6.13	6.15	6.07	6.17	6.08	6.15	6.18	6.07	6.34	6.12	6.11	6.10	6.16
3065.	33.09	5.92	5.95	5.87	5.97	5.88	5.94	5.92	5.82	6.07	5.90	5.90	5.88	5.97
3075.	33.10	5.67	5.69	5.65	5.75	5.63	5.69	5.71	5.61	5.71	5.67	5.64	5.65	5.69
3085.	33.10	5.43	5.47	5.44	5.53	5.41	5.47	5.44	5.35	5.39	5.45	5.42	5.43	5.42
3095.	33.10	5.20	5.23	5.18	5.29	5.18	5.22	5.21	5.12	5.17	5.21	5.18	5.20	5.16
3105.	33.10	4.96	4.98	4.89	5.03	4.94	4.98	5.02	4.92	5.07	4.95	4.95	4.95	4.90
3115.	33.10	4.72	4.75	4.63	4.73	4.67	4.69	4.73	4.63	4.86	4.71	4.71	4.67	4.64
3125.	33.10	4.44	4.45	4.39	4.50	4.40	4.44	4.44	4.35	4.54	4.45	4.42	4.41	4.37
3135.	33.10	4.13	4.16	4.11	4.24	4.14	4.18	4.18	4.09	4.08	4.16	4.12	4.14	4.04
3145.	33.10	3.88	3.88	3.82	3.95	3.85	3.90	3.89	3.80	3.82	3.90	3.85	3.86	3.78
3155.	33.10	3.62	3.62	3.50	3.62	3.56	3.61	3.60	3.50	3.65	3.61	3.60	3.56	3.55
3165.	33.10	3.30	3.29	3.20	3.31	3.27	3.31	3.33	3.23	3.43	3.32	3.30	3.25	3.20
3175.	33.10	3.04	3.03	2.97	3.08	2.97	3.01	3.00	2.90	3.07	3.07	3.03	2.96	2.94
3185.	33.10	2.74	2.75	2.71	2.83	2.76	2.80	2.77	2.68	2.64	2.80	2.76	2.76	2.61
3195.	33.10	2.47	2.46	2.39	2.53	2.48	2.50	2.56	2.46	2.41	2.50	2.48	2.48	2.37
3205.	33.10	2.19	2.18	2.09	2.19	2.14	2.17	2.18	2.08	2.42	2.21	2.22	2.13	2.14
3215.	33.10	1.88	1.85	1.76	1.88	1.83	1.86	1.88	1.77	2.06	1.88	1.90	1.82	1.66
3225.	33.10	1.53	1.52	1.47	1.56	1.51	1.56	1.59	1.49	1.52	1.60	1.57	1.50	1.33
3235.	33.10	1.25	1.24	1.17	1.29	1.23	1.28	1.23	1.14	1.12	1.31	1.29	1.22	1.08
3245.	33.10	0.94	0.93	0.90	1.01	0.94	1.00	0.94	0.84	0.85	1.02	0.99	0.92	0.78
3255.	33.10	0.70	0.68	0.64	0.75	0.69	0.74	0.76	0.65	0.69	0.77	0.74	0.67	0.58
3265.	33.10	0.50	0.48	0.37	0.49	0.46	0.51	0.52	0.41	0.60	0.51	0.55	0.44	0.48

Water Surface Elevations (7-10 June 1972) for Indicated Stations

Time*	13	1	2	3A	4	5	6	7	8	9	10	11	14	12
3275.	33.10	0.22	0.18	0.13	0.25	0.21	0.25	0.26	0.15	0.35	0.26	0.26	0.19	0.11
3285.	33.10	-.14	-.07	-.14	-.02	-.04	-.00	0.00	-.11	-.03	0.02	-.00	-.06	-.17
3295.	33.10	-.24	-.28	-.35	-.24	-.29	-.21	-.29	-.40	-.36	-.20	-.22	-.31	-.37
3305.	33.10	-.48	-.53	-.53	-.44	-.50	-.43	-.48	-.59	-.60	-.42	-.46	-.52	-.66
3315.	33.10	-.62	-.68	-.70	-.61	-.65	-.58	-.62	-.73	-.72	-.57	-.61	-.69	-.76
3325.	33.09	-.71	-.77	-.85	-.77	-.78	-.71	-.76	-.86	-.74	-.70	-.69	-.81	-.77
3335.	33.09	-.87	-.93	-.94	-.85	-.88	-.81	-.85	-.96	-.82	-.83	-.85	-.89	-.90
3345.	33.09	-.95	-1.02	-1.02	-.94	-.96	-.89	-.93	-1.04	-1.01	-.93	-.94	-.97	-1.03
3355.	33.09	-1.03	-1.10	-1.17	-1.07	-1.06	-.98	-1.03	-1.13	-1.14	-1.04	-1.02	-1.07	-1.09
3365.	33.09	-1.19	-1.27	-1.30	-1.22	-1.23	-1.16	-1.19	-1.31	-1.22	-1.18	-1.18	-1.25	-1.24
3375.	33.09	-1.30	-1.39	-1.40	-1.33	-1.39	-1.31	-1.36	-1.47	-1.33	-1.27	-1.27	-1.40	-1.36
3385.	33.09	-1.37	-1.45	-1.46	-1.39	-1.41	-1.34	-1.43	-1.53	-1.53	-1.34	-1.33	-1.43	-1.44
3395.	33.10	-1.42	-1.50	-1.50	-1.42	-1.41	-1.34	-1.39	-1.50	-1.68	-1.40	-1.39	-1.44	-1.47
3405.	33.10	-1.43	-1.51	-1.51	-1.45	-1.43	-1.38	-1.43	-1.53	-1.56	-1.42	-1.39	-1.47	-1.49
A**	0.01535	0.01515	0.01529	0.01519	0.01532	0.01507	0.01517	0.01516	0.01518	0.01527	0.03046	0.01499	0.01507	0.005905
B-Z_s**	-3.02	-13.08	-13.60	-21.10	-14.51	-10.61	-11.07	-9.39	-8.93	-8.48	-22.67	-12.43	-16.15	+15.50

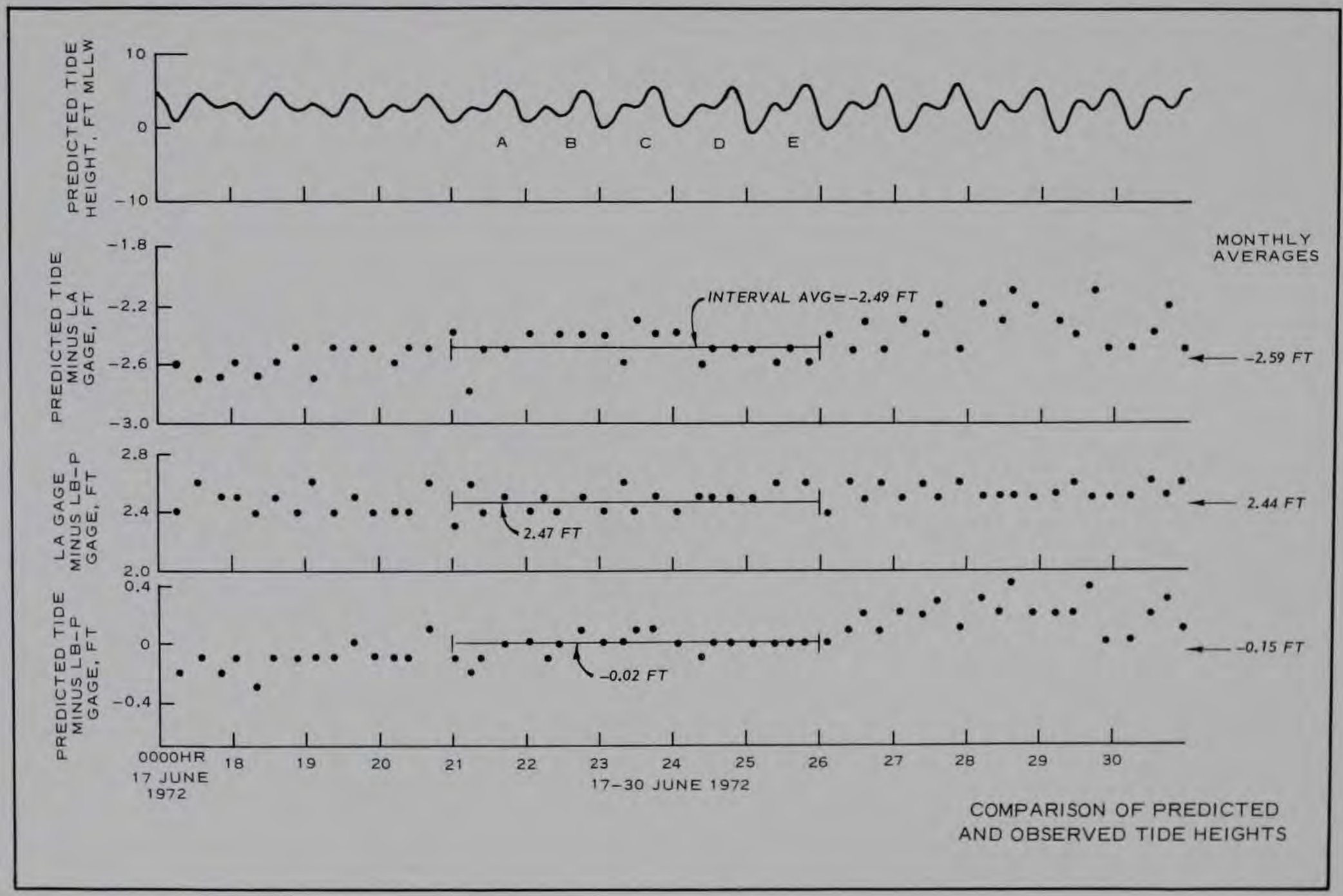
** Calibration equation coefficients used for this tabulation.

Incl 1 (Sheet 9 of 9)



COMPARISON OF PREDICTED AND OBSERVED TIDE HEIGHTS

Incl 2 (Sheet 1 of 2)



COMPARISON OF PREDICTED AND OBSERVED TIDE HEIGHTS

Incl 2 (Sheet 2 of 2)

APPENDIX L: NOTATION

A	Constant coefficient representing scale factor
A_b	Scale factor for barometer, ft seawater per digital count
A_c	A'_c/γ_s ; scale factor for a pressure cell, ft seawater per digital count
A'_c	Scale factor for a pressure cell, psi per digital count
B	Constant coefficient representing a pressure (or water level) at zero count
B_b	Zero offset factor for barometer, ft seawater per digital count
B_c	B'_c/γ_s ; zero offset factor for a pressure cell, ft seawater per digital count
B'_c	Zero offset factor for a pressure cell, psi
H_b	$A_bK_b + B_b$; barometric pressure converted to an equivalent column of seawater
$-H_s$	Elevation of submerged pressure cell relative to mllw, ft
H_t	$A_cK_c + B_c$; pressure transducer measurement converted to an equivalent column of seawater
H_{wt}	Height of column of seawater between surface and mllw, ft
K_b	Digital count recorded by barometer
K_c	Digital count recorded by a submerged pressure cell
P	Pressure, psi
P_b	Barometric pressure, psi
P_s	Pressure due to water column between mllw and submerged depth of cell, psi
P_t	Total pressure, psi
P_{wt}	Pressure due to the variable water column between the surface and mllw due to both waves and tides, psi
P/γ_s	Pressure transducer measurement, ft seawater
$\left(P/\gamma_s\right)_{13}$	Atmospheric pressure at mllw based on station 13 data, ft seawater
REL	$-H_s$
x_c	Transducer response in digital counts
Z_s	Submergence of transducer, ft below mllw
Z_t	Water-surface elevation, ft above mllw
γ_s	Specific weight (64.0 pcf) of seawater at 15°C
ϵ_i	Difference in water-surface levels, ft