TEXAS WATER DEVELOPMENT BOARD

REPORT 69

CHARACTERISTICS OF TIDE-AFFECTED FLOW IN THE BRAZOS RIVER NEAR FREEPORT, TEXAS MARCH 29-30, 1965

By

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INTRODUCTION

Purpose and Scope of Investigation

The ever-changing flow regimen of the Brazos River estuary near Freeport, Texas, was the subject of this study which was undertaken by the U.S. Geological Survey in 1965. The investigation had four major objectives:

(1) To determine the upstream and downstream flow characteristics and compute the discharge of the Brazos River during the selected tidal cycle.

(2) To determine the presence, character, and changes of salinity stratification at the study site.

(3) To investigate the stratified flow regimen and determine whether or not a continuous discharge record could be obtained with known methods for computing unsteady, open-channel flow.

(4) To obtain data with which to investigate alternate methods of determining a continuous record of discharge--for example, by relating observed velocities in one vertical (an imaginary vertical line) to the overall flow pattern in cross section.

Measurements were made of flow and salinity during a complete tidal cycle when the Brazos River at the gaging station near Juliff, 33 miles north of Freeport, had a flow of about 2,000 cfs (cubic feet per second). Among the more important factors that were studied and that influenced the flow were amplitude and character of the tide from the Gulf of Mexico, fresh water from upriver, surface winds, saline-water intrustion from the Gulf of Mexico, saline industrial effluent, and channel geometry of the estuary. Prior to this study, no data had been gathered at this location to study these interrelated factors and their net effect upon the flow regimen. Additional investigations are being considered to further define the flow regimen.

Previous Investigation

A similar investigation was made near Freeport in 1958 at a site 2.0 miles downstream from the present site (Grozier and Yost, 1959). Discharge was

computed from velocity observations in three verticals in a cross section and the stage record was obtained only at the site. The variation of chloride content of water at various depths in the cross sections also was determined to show the interrelated effects of tidal stage, velocity of flow, and chloride content. Because the site was near the mouth of the river, the flow and salinity of the river was greatly affected by the tidal cycle.

Description of Site of Investigation

The site of the investigation (Figure 1) is at mile 2.7 (distance upstream from river mouth as measured along the channel). The site is 2.2 miles upstream from the intracoastal canal crossing and 2.0 miles upstream from the site of the 1958 investigation.

The natural channel of the Brazos River has been dammed, and all flow of the river now passes through a diversion channel that extends from the river mouth to mile 4.8. The diversion channel is straight and is fairly uniform in width throughout its length. The width of the diversion channel, at the site of the study and for a few miles upstream, is about 400 feet. Downstream from the site the channel widens to 480 feet at the site of the 1958 investigation. About 20 feet on each side of the channel are mud flats covered with shallow water. The channel deepens downstream from an average depth of about 17 feet at the site to about 20 feet at the site of the former investigation. Soft clay and sand compose the bed and banks of the channel.

Acknowledgements

A special acknowledgment is extended to Dow Chemical Company for cooperative assistance in the investigation. Appreciation is likewise expressed to Robert A. Baltzer, Hydraulic Engineer, Research, U.S. Geological Survey, Washington, D. C. for his help as consultant and advisor on many of the problems of analyzing the data.

GENERAL FLOW CHARACTERISTICS OF TIDAL STREAMS

In the lower reach of a tidal stream, flow periodically changes direction in response to the rise and fall of the ocean tide. Ocean tides, extending into the lower reach of the river as long, shallow-water, low-amplitude waves (translatory waves), are manifested by the cyclic upstream and downstream movement of water in the river and by the periodic rise and fall of the water level. Because the translatory waves are superimposed on the normal stream motion, the average velocity of flow in the tidal reach is the vector sum of the wave-induced flow and the velocity of the flow from upstream sources (Baltzer and Shen, 1961).

The velocity distribution of the flow in a vertical in a tidal reach will vary considerably with location, time, and degree of salinity stratification. For a well-mixed flow regimen, the velocity distribution in a vertical will be relatively uniform. For a flow that is poorly mixed or highly stratified, the velocity in the vertical will become distorted and may reverse direction near the bottom of the river.

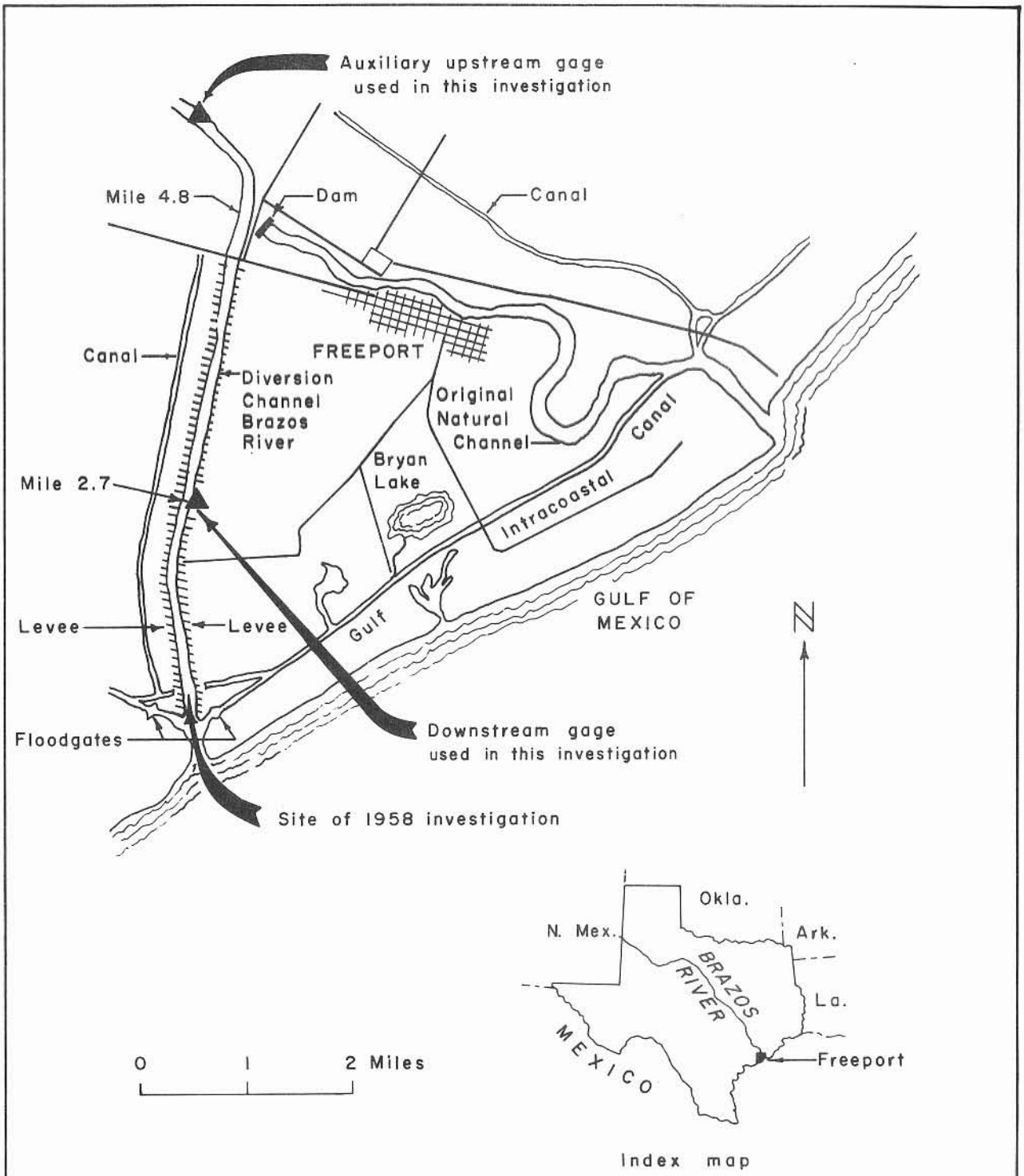

Figure 1

Sites of Investigations

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Because of the effect of salinity stratification on velocity distribution, a knowledge of the extent of mixing of fresh and salt water is important in evaluating the flow characteristics of a tidal stream. The degree of mixing of fresh water from upstream sources with salt water from the ocean depends upon: the quantity of fresh-water discharge; tidal current and range of tides; relative densities of the fresh and salt water; winds and turbulence; and depth, width, roughness, and other configurations of the river channel. River water flowing from upstream sources into the tidal reach is opposed by the cyclic effect of the tides, through whose forces the salt water is periodically pushed upstream. Because salt water has greater density than fresh water, sea water tends to move along the stream bottom, while fresh water tends to override the salt water. Complete stratification is not attained, however, because the fresh water flowing downstream erodes away the wedge of salt water intruding upstream. The salt-water intrusion may range in occurrence from a well-defined wedge to any intermediate form, even to that of a more or less complete mixture (of salt and fresh water) in which no salinity wedge can be detected.

Generally, the flow regimen of tidal streams may be separated into three broad categories (oral communication, R. A. Baltzer, December 1965):

(Type 1) The highly stratified flow regimen--in which a rather distinct interface separates the supernatant fresh water flowing out to sea from the saline-water layer intruding beneath the fresh water.

(Type 2) The partly mixed flow regimen--in which the tidal currents are sufficient to produce considerable vertical mixing, and only a poorly defined interface exists between the fresher water near the surface and the more saline water beneath. However, there is usually a discontinuity in the vertical salinity and in the vertical velocity profiles.

(Type 3) The well mixed flow regimen--in which the convective forces of the tidal-wave motion predominate over the fresh-water flow to such an extent that the fresh waters and saline waters are fairly well mixed throughout the vertical section.

When fresh-water inflow to the tidal reach is small compared to the intertidal volume (the volume represented by the difference between low and high tide), the well mixed condition will tend to exist. As upland inflow increases, partial mixing occurs. At even greater upland flows the fresh water will override the salt water and the regimen will become highly stratified (Keighton, 1954, p. 12). If inflow is great enough, the salt water will be completely flushed from the river.

FLOW CONDITIONS AT THE SITE OF INVESTIGATION

The flow of the Brazos River, when unaffected by tidal action, includes the quantity of water measured at the streamflow station near Juliff, the inflow to the river from tributaries downstream from the Juliff station, and effluent from Dow Chemical Company plant. The discharge at the Juliff station receded from 4,750 cfs on March 23, 1965, to 2,100 cfs on March 30, 1965. Time-of-travel from Juliff to Freeport was not computed because of small channel slope, deep water, and unknown effect of tide in the reach.

During the investigation the amount of tributary inflow downstream from the Juliff station was less than 10 cfs, but Dow Chemical Company plant was pumping salt water from the Gulf of Mexico through an independent channel and discharging effluent into the Brazos River upstream from the site of the investigation. The average discharge of effluent reported by Dow Chemical Company for March 29-30, 1965, was 3,950 cfs.

FACTORS AFFECTING THE SALINITY OF THE WATER

During this investigation definition of the changes in salinity caused by the tidal movement of sea water in an upstream direction was complicated by three factors: (1) A substantial flow of salt water, which Dow Chemical Company pumped from the Gulf of Mexico through an independent channel, was discharging into the Brazos River upstream from the study site; (2) a morning rainstorm accompanied by high wind occurred on March 30; (3) during measurement 9, a tug boat and barge train moved down the Brazos River.

Of these three factors the most important was the salt-water effluent from Dow Chemical Company plant. This effluent significantly affected the salinity of the water during the study. The effect of the rainstorm, which caused a small amount of dilution and mixing of the water passing the site, was probably small and insignificant. The tug boat and barge train, which came down the Brazos River during measurement 9, may have caused some mixing of the water, but this was not detected.

FIELD PROCEDURES AND EQUIPMENT

The fieldwork consisted of making discharge measurements and collecting water samples for analyses during a complete tidal cycle. A total of 22 discharge measurements were made over a 28-hour period, which lasted about 3 hours longer than a complete tidal cycle. The first measurement began at 1200 hours on March 29, 1965, and the last measurement was completed at 1623 hours on March 30. Four boats were used, three of which were involved in making discharge measurements (Figure 2). The fourth boat was used in collecting water-quality data and in operating the flow-direction indicator; it functioned also as a service boat.

Personnel Duties

Two field parties worked 10-hour shifts. Each party was made up of 12 men (8 for making discharge measurements and for collecting water samples, 2 for reading gages, 1 for analyzing samples, and 1, an engineer-in-charge, for coordinating the work). Dow Chemical Company employees operated the boat used to collect water-quality data. The engineer-in-charge plotted velocity observations immediately after the measurements were made.

Discharge-Measuring Procedure

To minimize the time required for each discharge measurement, the cross section of the stream was divided into three parts. Each discharge measurement was made simultaneously from three boats--each boat being assigned a third of

Figure 2

Boats Used in Making Discharge Measurements. Water-Stage Recorder in Foreground

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the stream. A tag-line, which was used to span the stream, held the boats in position while the observations were made. Velocity observations, at 16 to 18 sounding stations per cross section, were made at 0.9, 0.8, 0.6, 0.4, and 0.2 of the river depths; an additional observation at 1.0 foot below the water surface was made at a few stations during the last 14 measurements.

Water-Sampling Procedure

The water-quality study was made concurrently with the flow study. In 19 of the 22 sets of flow measurements, specific conductance and temperature of water in the cross section were determined at 2-foot depth intervals in each of three verticals (70, 220, and 370 feet from the left bank). Water samples for chemical analysis were collected at the surface and bottom in each vertical and at intermediate depths where specific-conductance measurements indicated significant differences in salinity. The same procedure was followed in each of nine verticals during the first and last measurements. The chloride content and specific conductance of each sample and the densities of a number of samples were determined. The densities of the other samples were calculated on the basis of the relation between density and chloride content. These data, in conjunction with flow data, were used to select a number of samples for more complete chemical analysis.

Stage-Recording Equipment

Two water-stage recorders, each with 4.8-inches-per-day time scale and 1:6 stage scale, were installed on 24-inch galvanized pipe stilling wells near the left bank. The downstream recorder was at the site of the investigation; the other recorder was 3.8 miles upstream. Throughout the investigation, simultaneous gage readings at both stage recorders were made with the aid of a two-way radio. The recording gages were set to mean sea level, datum of 1929, through the supplementary adjustments of 1957 and 1959. A record of the tide stage at the upstream and downstream gages is shown by hydrograph (Figure 3) and by tabulation (Table 3).

Velocity-Measuring Equipment

Magnitude of Flow

Standard U.S. Geological Survey boat-measuring equipment was used in making measurements of the magnitude of flow. Hand-operated reels, which were mounted on booms, were adequate for raising and lowering the current meters and sounding weights. The measuring equipment performed satisfactorily, and good results were obtained. Occasionally, small surface waves caused vertical movement of the current meters, thus tending to make flow observations too high. The effect of most of the waves was negligible, however, because the majority of them were small.

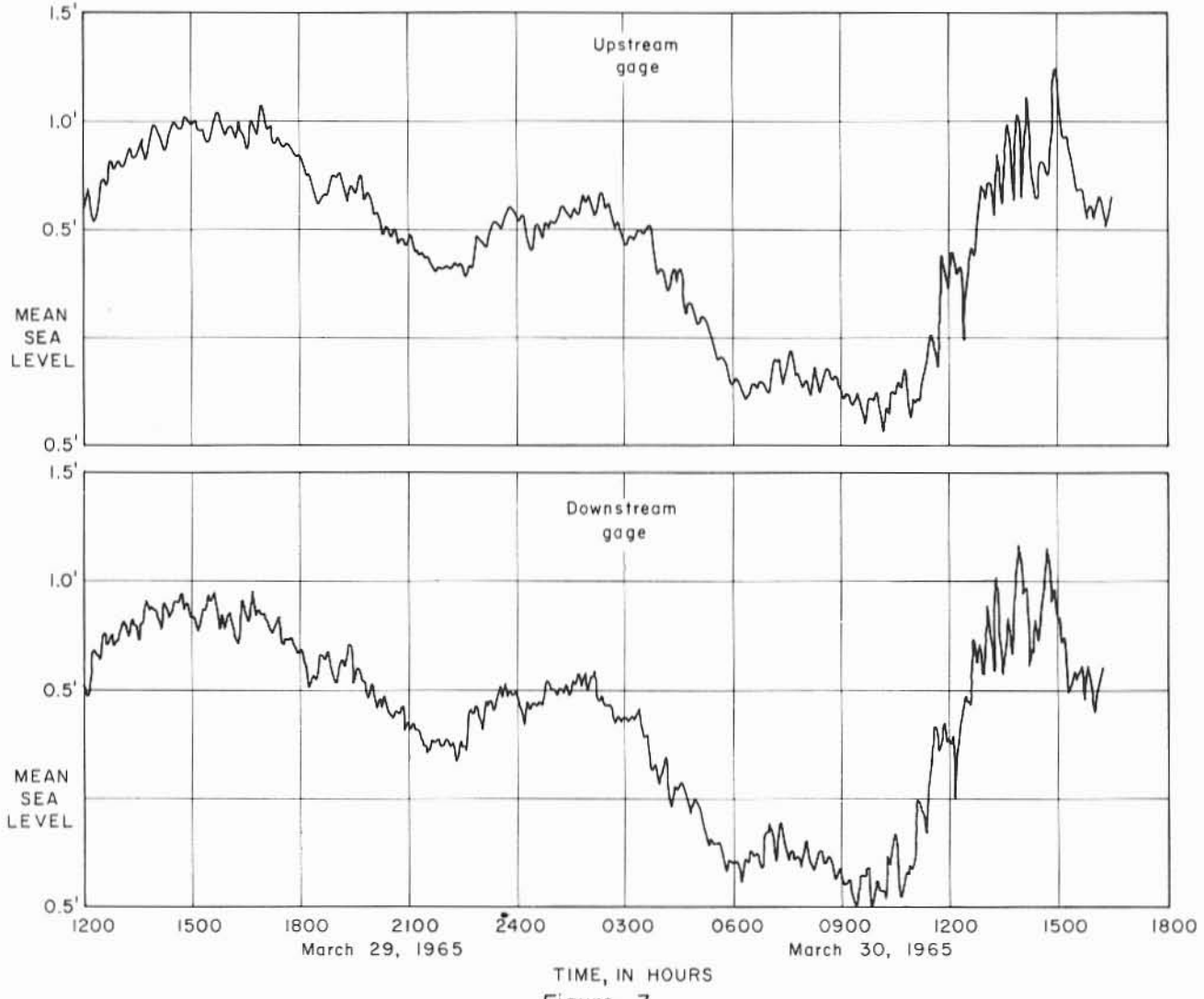

Figure 3

Hydrographs of Tidal Stage at Upstream and Downstream Gages

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Direction of Flow

Flow-direction indicators made of vanes on 20-foot rods were used for the first discharge measurement. Because the rods were easily bent, these indicators proved unsatisfactory.

For the remainder of the investigation a gyrocompass was used as a flow-direction indicator. The gyrocompass was in a waterproof container having an attached vane. This entire apparatus was lowered into the water, and a compass in the boat gave the direction of flow. The instrument was operated from the boat that was used to collect water samples, and directions were obtained at 3 to 5 stations during each measurement. The gyrocompass gave good results except during very low flows. Because tidal flow varies with time and location, and because this variation is considerable during times of slack water, the flow-directions applied only when and where they were taken, and did not necessarily represent the conditions that existed when flows were determined at a station.

EVALUATION OF DATA

Stage Record

The tide experienced during the investigation was semi-diurnal (Figure 3). The downstream gage at the site of the investigation recorded a range of elevation of the full or primary flood tide between 0.9 foot above mean sea level and 0.5 foot below mean sea level; a secondary crest and trough was recorded at about 0.6 foot and about 0.2 foot above mean sea level. The stage of the upstream auxiliary gage followed the same pattern of the downstream gage except that the elevations of the former were about 0.1 foot higher.

Superimposed on the tidal wave were smaller translatory waves that continually moved upstream. Most of the time these waves had an amplitude between 0.05 and 0.20 foot, and a wavelength between 2 and 3 miles. The frequency was usually 10 to 15 minutes, but was as high as 5 minutes, especially when the amplitude of the waves was very small. After 1200 hours on March 30, the time of a strong north wind, these waves grew to an amplitude of about 0.6 foot. The data indicate that these small waves are caused by wind, but exactly how or where the waves are generated is unknown.

Flow Measurements

Method of Computing Flow

Individual velocity distribution curves at the sounding stations were plotted to compute mean velocities. Sections showing velocity distribution curves for each sounding station and data obtained for the 22 discharge measurements are presented in Figure 7 (page 20). Data used in preparing the sections are given in Table 4 (page 45).

The velocities were plotted on the cross section, on which the sounding station was used as a vertical axis equal to zero velocity. All downstream velocities were plotted on the right side of the axis, and upstream velocities

were plotted on the left side of the axis. A curve was drawn through the plotted points, and the bottom of the curve was taken to zero velocity. To permit plotting of velocity-distribution curves for measurements having low velocities and poorly-defined directions of flow (measurements 1 and 19 through 21), it was often necessary to assign to the velocity determinations a direction of flow that was based on an interpretation of data obtained in a nearby vertical at a slightly different time. (See Table 5.)

The discharge was computed by planimetering the area enclosed by the velocity distribution curve, the vertical axis of the sounding station, and the water surface. This area, which represents the product of flow rate and depth in square feet per second, was multiplied by the effective width between stations, and a partial discharge for the section was computed. For measurements with both upstream and downstream flows, the areas were planimetered separately, and both the upstream and downstream discharges were computed.

Variations in the elevation of the water surface are emphasized by the velocity distribution curves in Figure 4. The various water surfaces are due to the small translatory waves superimposed on the tidal wave. For example, when the sounding was made at station 250, the water surface was at elevation "a." During the time the five velocity observations were being made at this station, a small translatory wave caused the water surface to rise to elevation "b." After the velocity observations were completed at station 250, the boat was moved to station 280 and a sounding was made. At the time of this sounding the water surface was at elevation "c." At the end of five velocity observations at station 280 the water surface had dropped to elevation "d" because the small translatory wave, which was present when the sounding was made, moved upstream. The average elevation of the water surface during the time of velocity observations was used to compute the area enclosed by the velocity distribution curve, the vertical axis of the sounding station, and the water surface. The areas planimetered are represented by the shaded areas in Figure 4.

Results of Flow Measurements

The results of the computation of flow for each measurement are summarized in Table 1. On the basis of information in this table, a hydrograph of the streamflow was prepared (Figure 5). The downstream and upstream flow are shown separately so that actual flow conditions can be readily determined. During the tidal cycle the flow was downstream except for about $3\frac{1}{2}$ hours when bidirectional flow occurred. The last measurement (22), which was made during a strong north (downstream) wind, did not reflect normal tidal conditions. Two measurements (20 and 21) were made when the amplitude of the small translatory waves was maximum and when the primary flood tide was cresting. Variation of the average velocities at each station with the passage of time indicates that the translatory waves had considerable effect on the instantaneous discharge of the river.

The average net flow for the period of the complete tidal cycle was 5,500 cfs. The discharge of the river near Juliff plus the discharge of effluent from Dow Chemical Company plant was greater than the discharge measured at the site. The effect of storage fluctuations on the inflow from upriver sources could not be adequately defined by measurements during only one tidal cycle. Measurements during several tidal cycles would, therefore, be necessary to determine the effect of storage. Some channel losses could likewise be expected from seepage, evaporation, and transpiration.

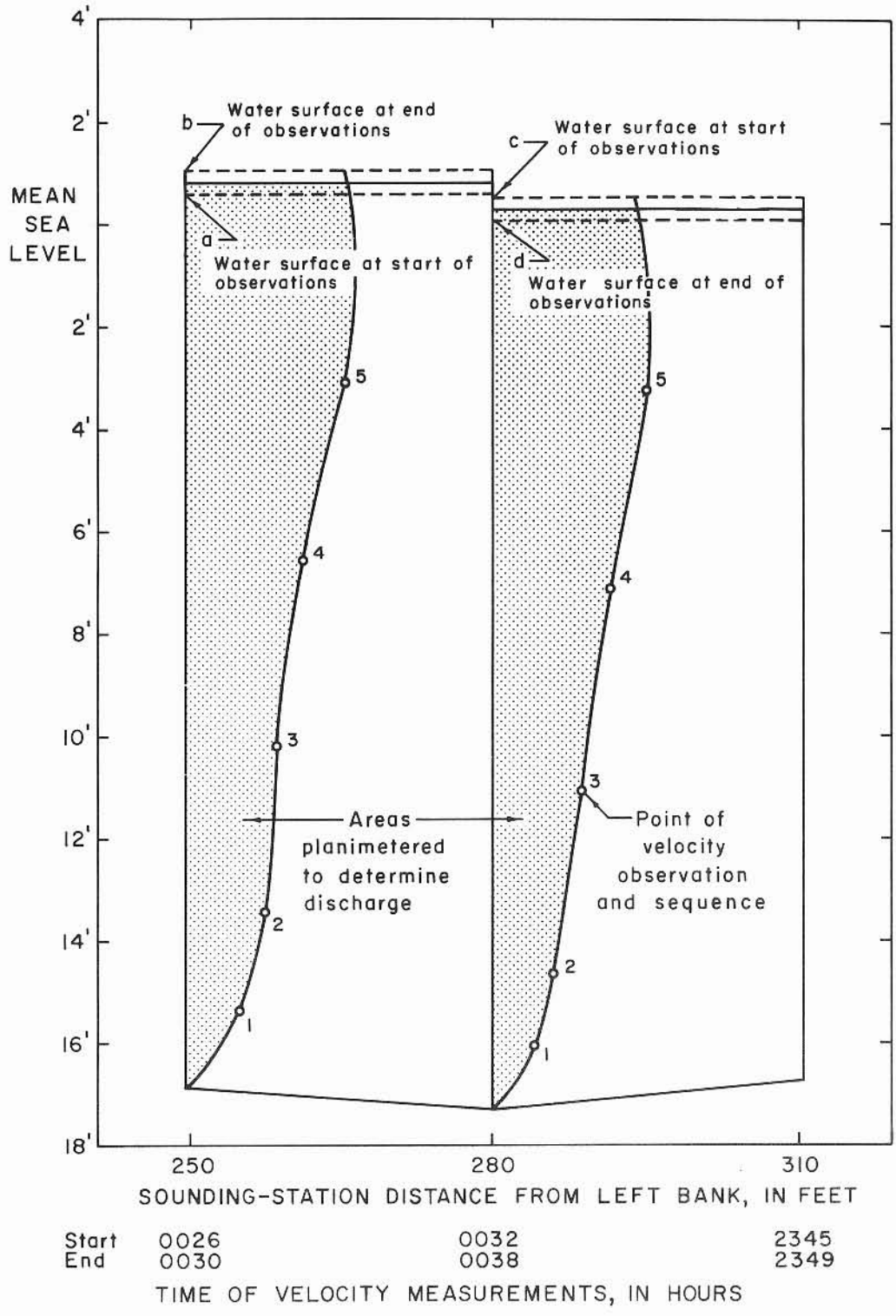

Figure 4

Detailed Section Showing Water-Surface Variations During Time of Velocity Measurements

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Table 1. Summary of flow determinations and of tide stages at upstream and downstream gages for each discharge measurement

Measurement	Date	Mean time (hours)	Down-stream stage (ft)	Upstream stage (ft)	Fall (ft)	Down-stream flow (cfs)	Upstream flow (cfs)
1	Mar. 29, 1965	1231	0.12	0.16	+0.04	1,430	350
2	do	1405	.83	.90	+ .07	1,930	--
3	do	1542	.85	.97	+ .12	4,680	--
4	do	1646	.82	.94	+ .12	5,960	--
5	do	1744	.73	.85	+ .12	7,420	--
6	do	1901	.60	.69	+ .09	7,640	--
7	do	2020	.43	.50	+ .07	8,210	--
8	do	2117	.30	.39	+ .09	8,200	--
9	do	2234	.26	.33	+ .07	6,460	--
10	Mar. 30, 1965	0008	.42	.55	+ .13	5,000	--
11	do	0122	.52	.58	+ .04	4,300	--
12	do	0234	.48	.56	+ .08	5,820	--
13	do	0346	.25	.37	+ .12	8,020	--
14	do	0502	-.07	+.08	+ .15	9,260	--
15	do	0601	-.29	-.13	+ .16	9,230	--
16	do	0715	-.24	-.15	+ .09	7,180	--
17	do	0826	-.29	-.19	+ .10	6,410	--
18	do	0951	-.43	-.37	+ .06	6,420	--
19	do	1126	.40	.40	0	2,620	445
20	do	1246	.63	.48	- .15	886	1,090
21	do	1401	.82	.89	+ .07	1,620	1,120
22	do	1545	.56	.65	+ .09	5,300	--

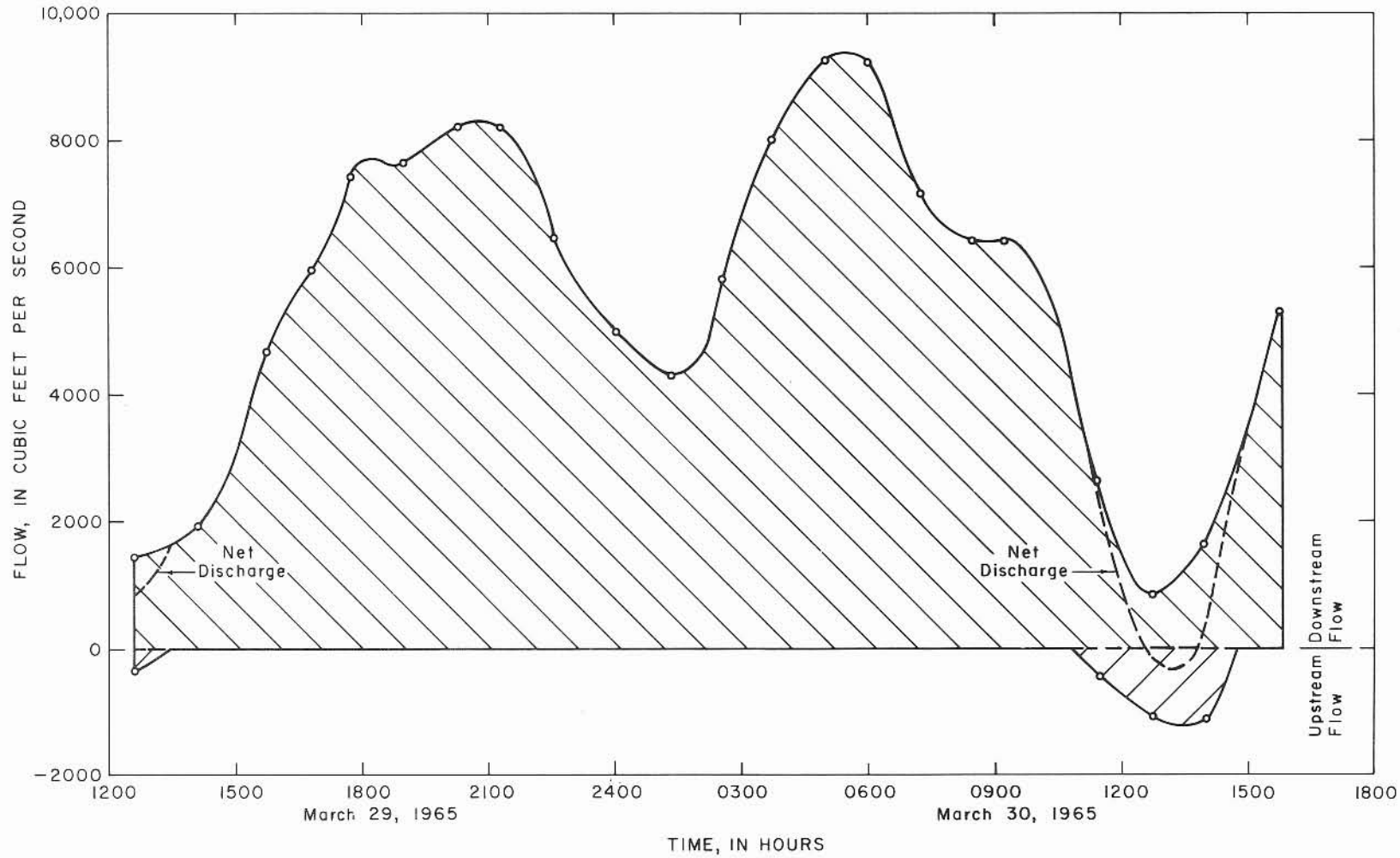

Figure 5

Hydrograph of Streamflow During the Tidal Cycle

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Results of Chemical Analyses

Results of chemical analyses (Table 2) show that the dissolved-solids content of the water at the cross section ranged from 6,440 to 24,100 ppm (parts per million), and that chloride, the principal chemical constituent, ranged from 3,490 to 13,400 ppm. By contrast, water from the Brazos River at Brazoria Reservoir, about 16 miles upstream, ranged from 325 to 330 ppm dissolved solids and from 57 to 59 ppm chloride.

The percentage range of each of the four major constituents of the river water at the investigation site was calculated from the data in Table 2. These percentages, which are based on total negative or positive equivalents per million, are compared in the following table with percentages for sea water calculated from values reported by Rankama and Sahama (1960, p. 290).

Constituent	Percent of total negative or positive equivalents per million	
	Brazos River water at investigation site	Sea water
Chloride	88-91	90
Sulfate	9	9
Sodium plus potassium	78-80	79
Magnesium	16-17	18

According to these calculations, the percentage composition of water at the study site was almost constant and was remarkably similar to that of sea water. However, according to the data in Table 2, the salinity varied from point to point in the cross section and changed with time. To relate these variations to tidal action, the changes in tidal stage and the concurrent changes in chloride content of water at the surface, at the 7-foot depth, and at the bottom are shown in Figure 6. Also shown are the changes in mean chloride content of the water. If the tidal cycle was the dominant influence on the variation of salinity in the cross section, then the general relation would be that as the tide came in, the chloride content would increase. However, no such relation is shown in Figure 6. The mean chloride content in each of the three verticals was at a minimum at the beginning of the study, when the tide was coming in. Conversely, the mean chloride content reached a maximum as the tide was going out, immediately before the secondary flood tide. Obviously, the variation of salinity at the study site was not directly related to tidal action, but resulted largely from discharge of salt water into the river above the study site.

Table 2. Chemical analyses of water from a cross section of the Brazos River near Freeport, Texas, March 29-30, 1965

(Results in parts per million except as indicated)

Date of collection	Hours	Distance from left bank (feet)	Sampling depth (feet)	Temperature (°F)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Dissolved solids (calculated)		Hardness as $CaCO_3$		Percent sodium	Specific conductance (micromhos at 25° C)	pH	Density
													Parts per million	Tons per acre-foot	Calcium, magnesium	Noncarbonate				
Mar. 29	1216	90	Surface	77	4.2	154	279	*2,650		185	649	4,580	8,410	11.5	1,530	1,380	79	13,400	7.9	1.004
Do.	1500	70	15	71	2.3	267	679	*6,170		119	1,490	10,800	19,500	26.8	3,460	3,360	80	27,600	7.6	1.012
Do.	2030	70	17	72	1.5	335	835	7,390	262	120	1,800	13,400	24,100	33.3	4,270	4,170	78	32,300	7.7	1.016
Do.	2031	70	7	72	3.2	228	518	*4,670		170	1,130	8,180	14,800	20.3	2,700	2,560	79	21,700	7.8	1.009
Do.	2032	70	5	72	4.1	174	364	*3,280		179	804	5,720	10,400	14.2	1,930	1,780	79	16,000	7.9	1.005
Do.	2033	70	Surface	70	4.7	155	297	*2,750		183	677	4,780	8,750	11.9	1,610	1,460	79	13,900	7.6	1.004
Do.	2217	220	6	72	2.6	243	584	*5,390		143	1,290	9,410	17,000	23.4	3,010	2,890	80	24,500	7.8	1.010
Mar. 30	0110	70	7	72	3.0	233	525	*4,790		170	1,170	8,370	15,200	20.9	2,790	2,600	79	22,600	7.8	1.009
Do.	0500	220	Surface	68	4.6	130	218	1,940	68	182	499	3,490	6,440	8.78	1,220	1,070	76	10,800	7.8	1.002
Do.	0511	370	12	73	1.9	301	729	*6,750		118	1,610	11,800	21,200	29.2	3,750	3,650	80	29,300	7.6	1.014
Do.	0550	70	14	72	2.0	320	769	*7,010		138	1,670	12,300	22,100	30.5	3,690	3,850	79	30,500	7.4	1.015
Do.	0955	370	6	71	3.5	199	438	*4,180		171	977	7,250	13,100	17.9	2,300	2,160	80	19,200	7.6	1.007
Do.	1400	220	Surface	69	4.4	164	321	*2,810		177	641	4,980	9,010	12.3	1,730	1,580	78	14,300	7.7	1.004
Do.	1400	220	7	70	3.8	214	439	*4,160		175	981	7,250	13,100	17.9	2,340	2,200	79	19,600	7.6	1.007
Do.	1400	220	20	74	1.8	316	715	*6,750		134	1,590	11,800	21,200	29.2	3,730	3,620	80	29,400	7.4	1.014
Do.	1620	355	Surface	71	3.9	194	405	*3,700		179	899	6,460	11,700	16.0	2,150	2,000	79	17,800	7.6	1.006

* Sodium (Na) plus potassium (K).

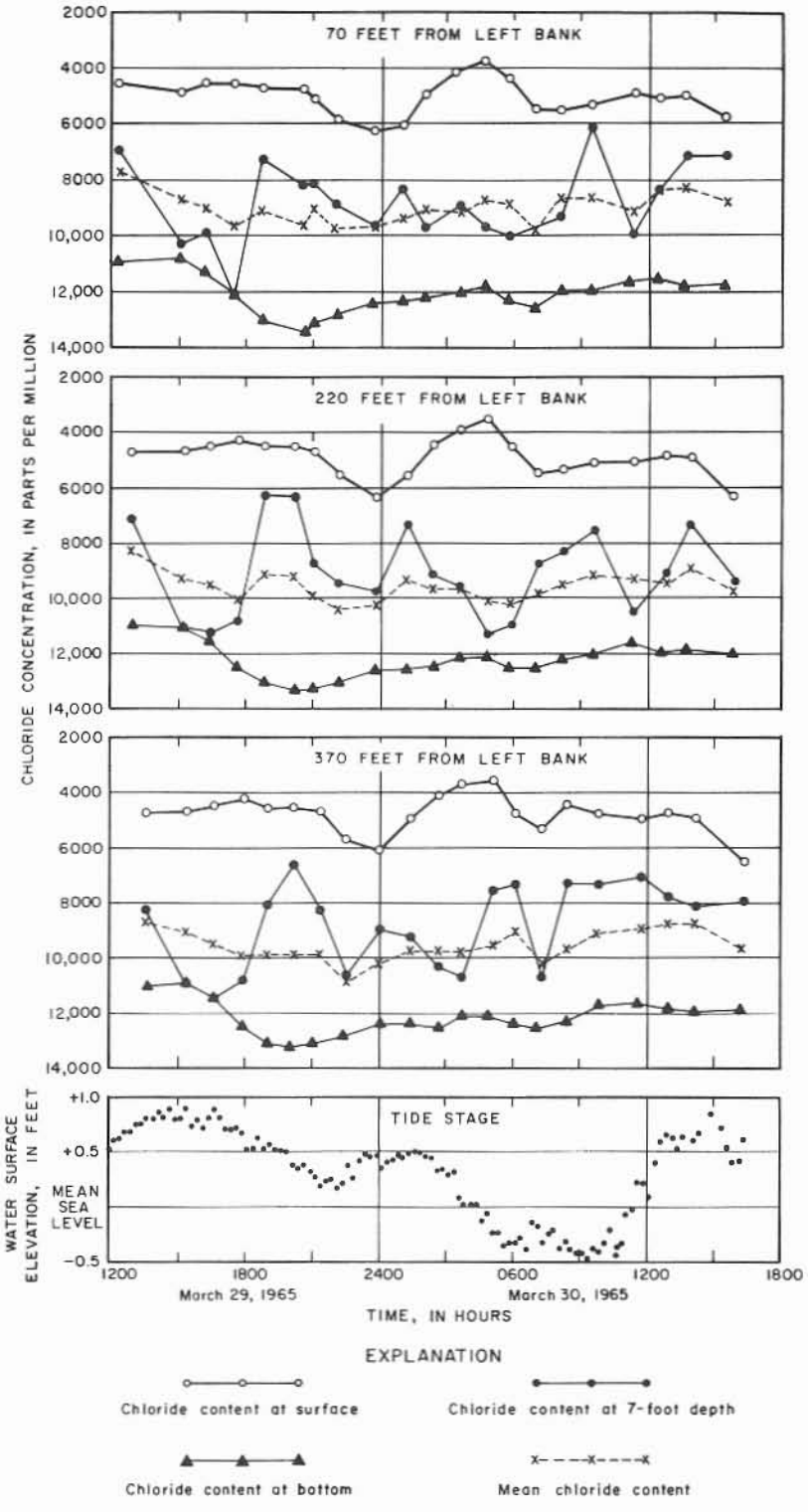

Figure 6

Variations of Chloride Content and Tidal Stage in a Cross Section of the Brazos River at Study Site

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CONCLUSIONS

The following principal conclusions were drawn from this study:

(1) Both upstream and downstream flow took place during the tidal cycle under conditions which prevailed at the time of the study. About $3\frac{1}{2}$ hours of upstream flow, which ranged from 350 to 1,120 cfs, occurred near the bottom of the channel. The water near the surface never was observed to be flowing upstream; however, during the primary flood tide, when the amplitude of the small translatory waves was maximum, some upstream flow of water near the surface could have occurred. Downstream flow ranged from 886 to 9,260 cfs.

The salinity data and the shape of the velocity distribution curves indicate that type 2 flow (as described previously in the section on "General Flow Characteristics of Tidal Streams") probably occurred during the investigation. The salinity variations in the channel were due to poorly mixed river water and Dow Chemical Company effluent and not to a salt-water wedge from the Gulf of Mexico.

(2) Strong north wind during the latter part of the investigation may have significantly influenced the flow characteristics of the tidal cycle.

(3) The small translatory waves had an effect on the discharge, especially when the total discharge of the river was small and when the amplitude of the waves was maximum.

(4) For the conditions existing during the period of investigation, continuous discharge cannot be computed by conventional methods. (The data obtained during this investigation, however, together with those from other investigations, will be useful in formulating methods for computing continuous discharge.)

RECOMMENDATIONS

Research regarding the type and positioning of instruments needed to record discharge continually is progressing. However, if another series of discharge measurements is made through a tidal cycle, the following steps are recommended:

(1) Record velocity continually in three vertical positions at 0.2, 0.5, and 0.8 of the effective width of the stream.

(2) Measure the quality and quantity of Dow Chemical Company plant effluent. Add a tracer dye to the effluent and observe the dye at the study site to determine amount of mixing.

(3) Reference all quality-of-water samples from the bottom of the channel to determine salinity at the same points throughout the investigation.

(4) Observe bottom velocity at 1 foot from the bottom, rather than at 0.9 depth, and take an extra observation at 1 foot from the surface.

(5) Use flow-direction indicators with each boat.

(6) Sample water at different depths in Gulf of Mexico near the mouth of the river.

(7) Record wind velocity.

(8) Collect continuous conductivity records in at least three points in a vertical section at the midpoint of the stream.

(9) Use 9.6-inches-per-day time scale and 10:12 stage scale on the stage recorders.

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Grozier, R. U., and Yost, I. D., 1959, Characteristics of tide-affected flow of Brazos River below Freeport, Texas: U.S. Geol. Survey open-file rept.

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Rankama, K., and Sahama, T. G., 1950, Geochemistry: Chicago Univ. Press.

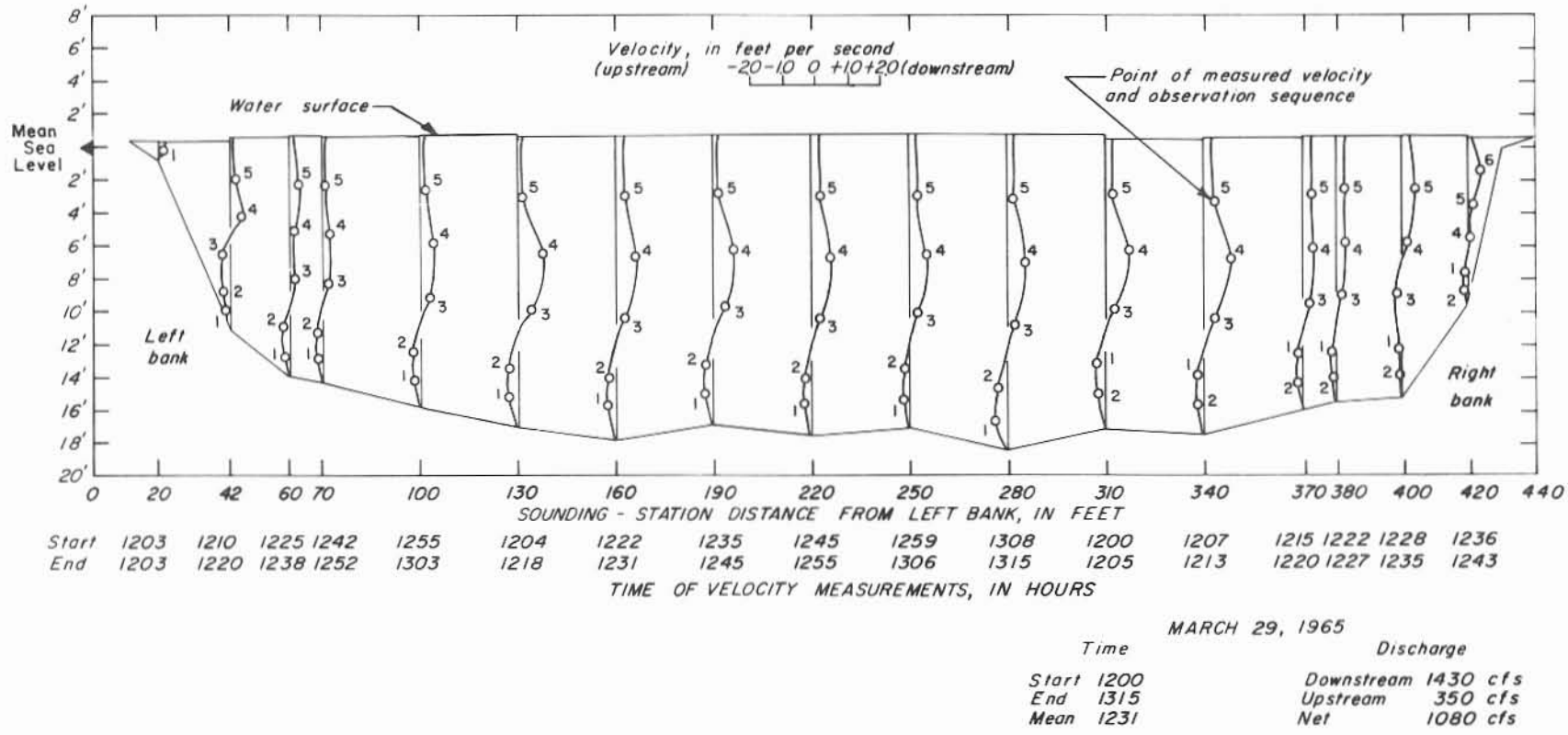


Figure 7 (Measurement 1 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U. S. Geological Survey in cooperation with the Texas Water Development Board

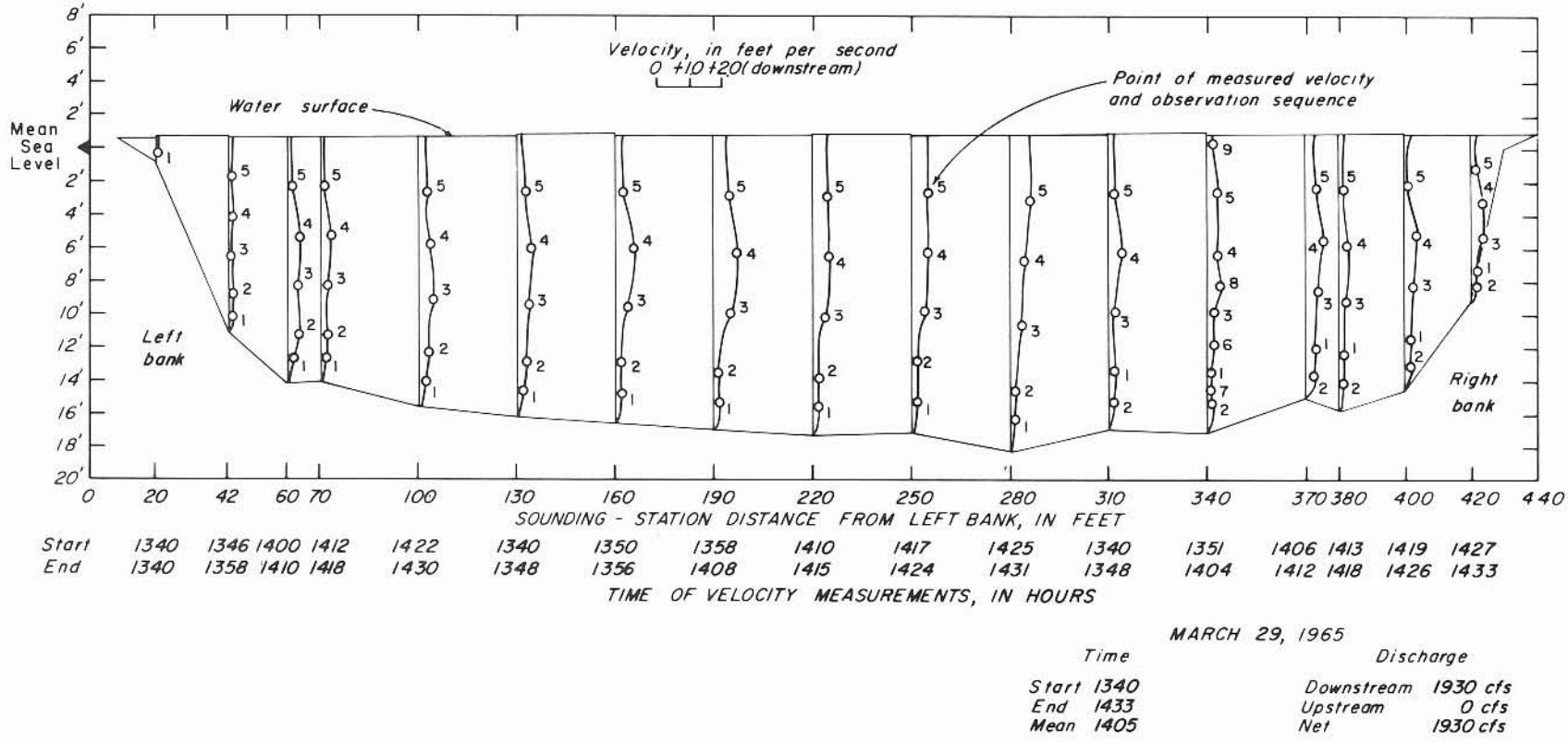


Figure 7 (Measurement 2 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

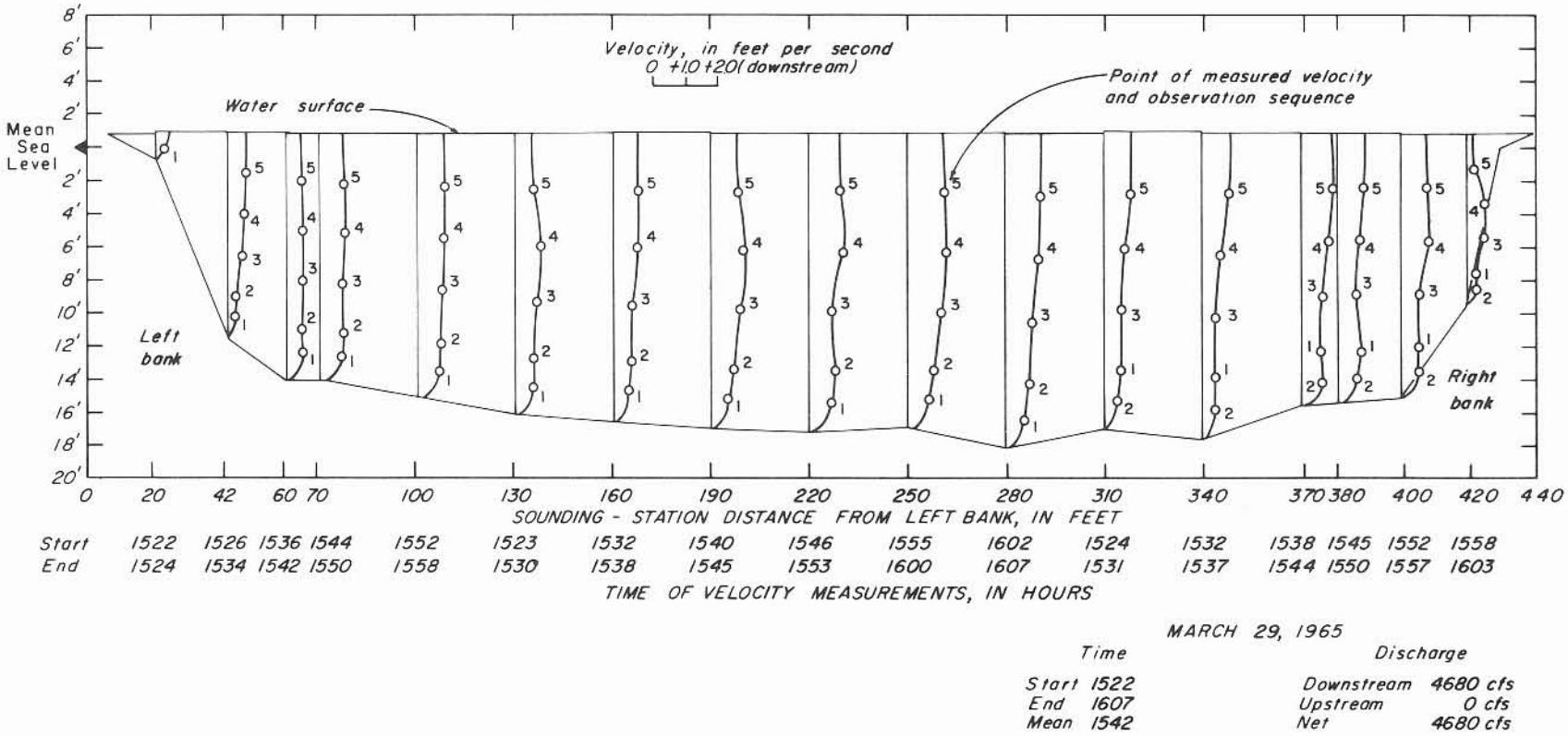


Figure 7 (Measurement 3 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

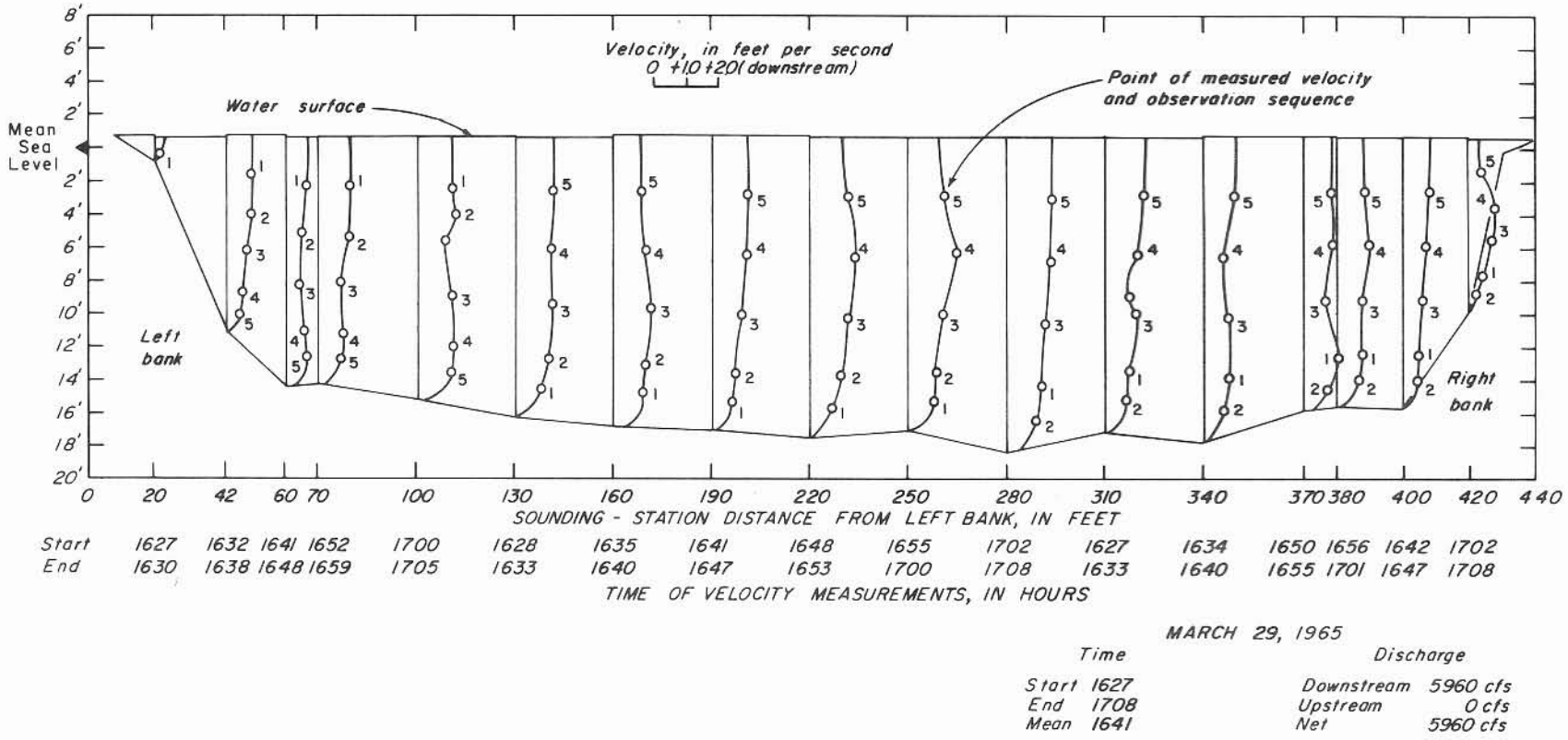
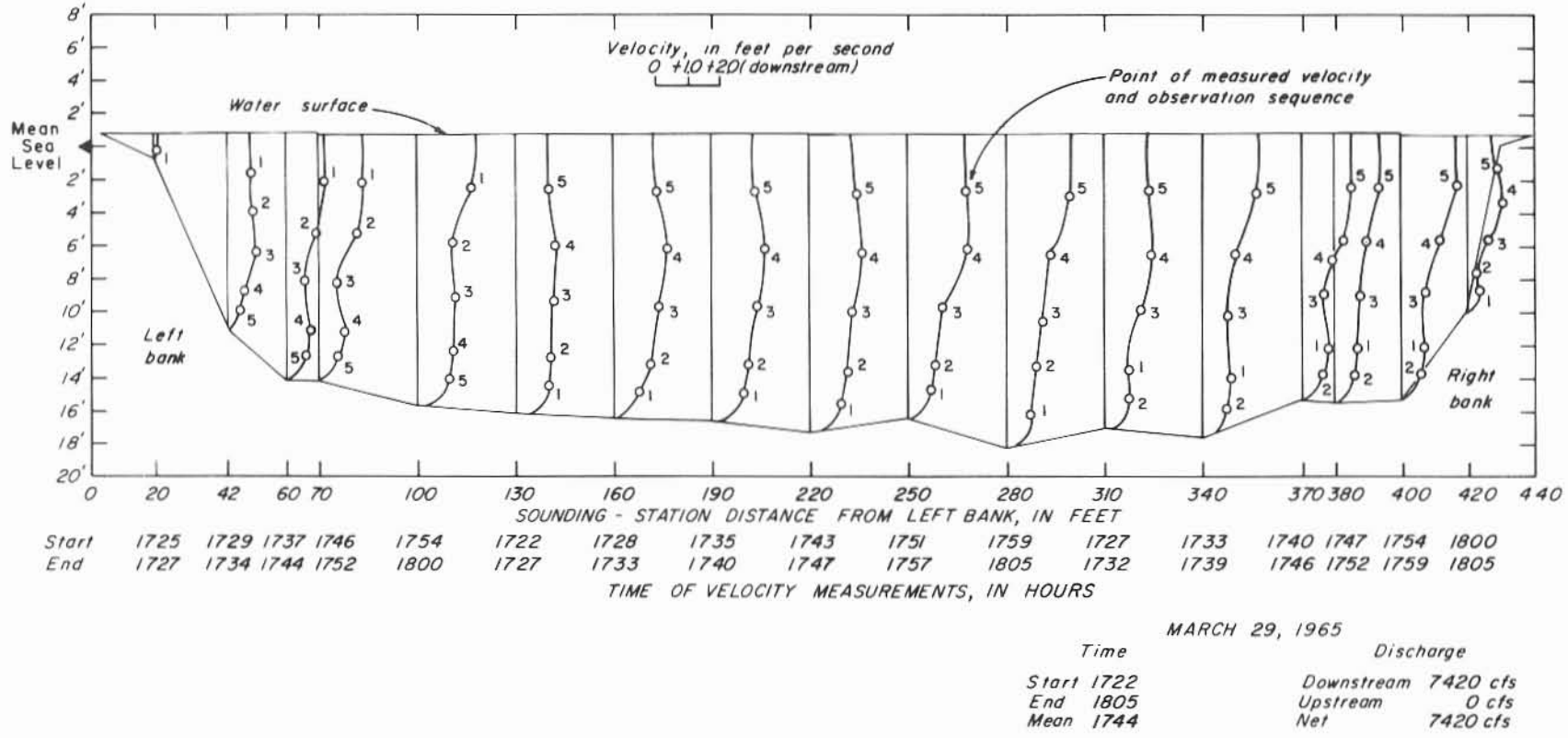


Figure 7 (Measurement 4 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board



MARCH 29, 1965

Time		Discharge	
Start	1722	Downstream	7420 cfs
End	1805	Upstream	0 cfs
Mean	1744	Net	7420 cfs

Figure 7 (Measurement 5 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

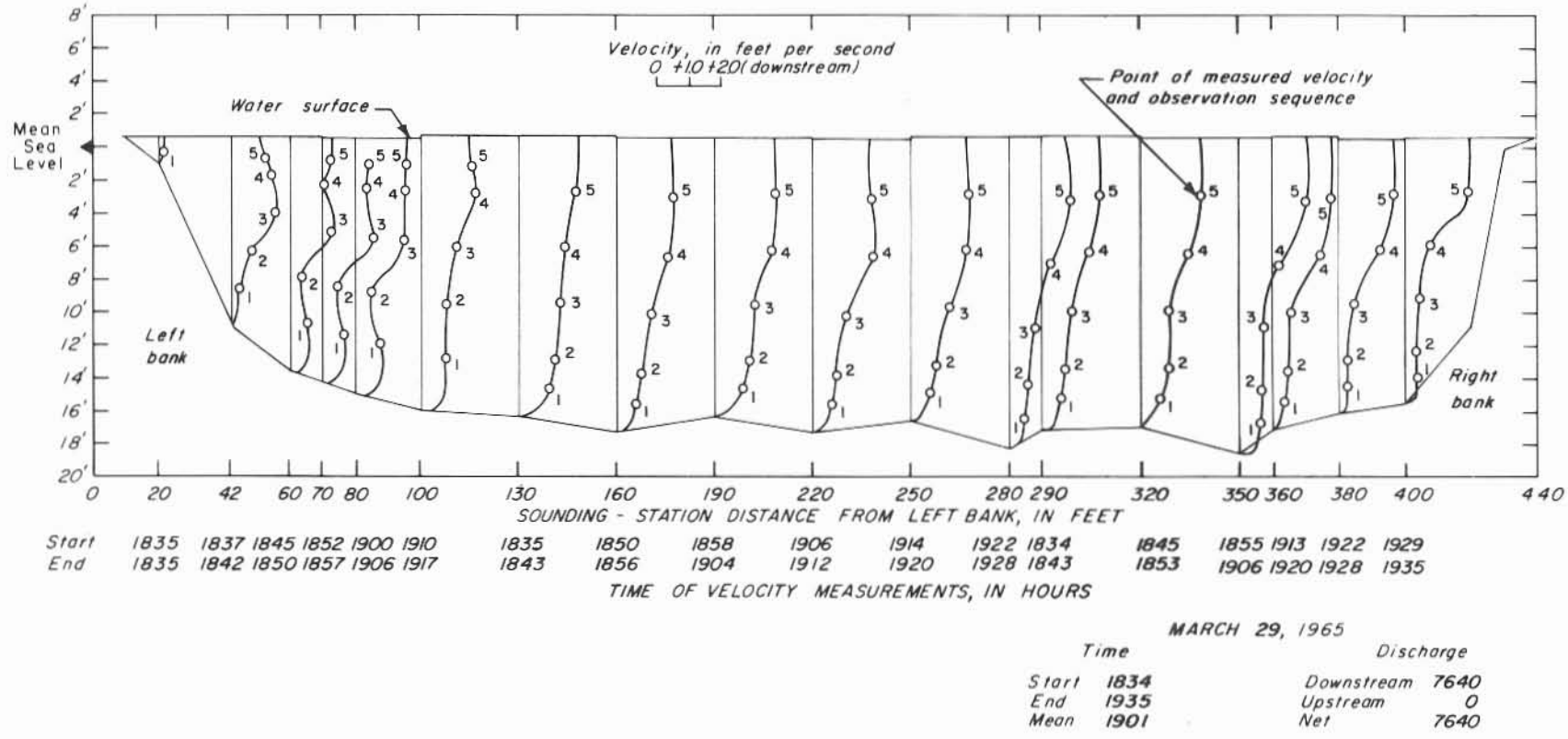


Figure 7 (Measurement 6 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

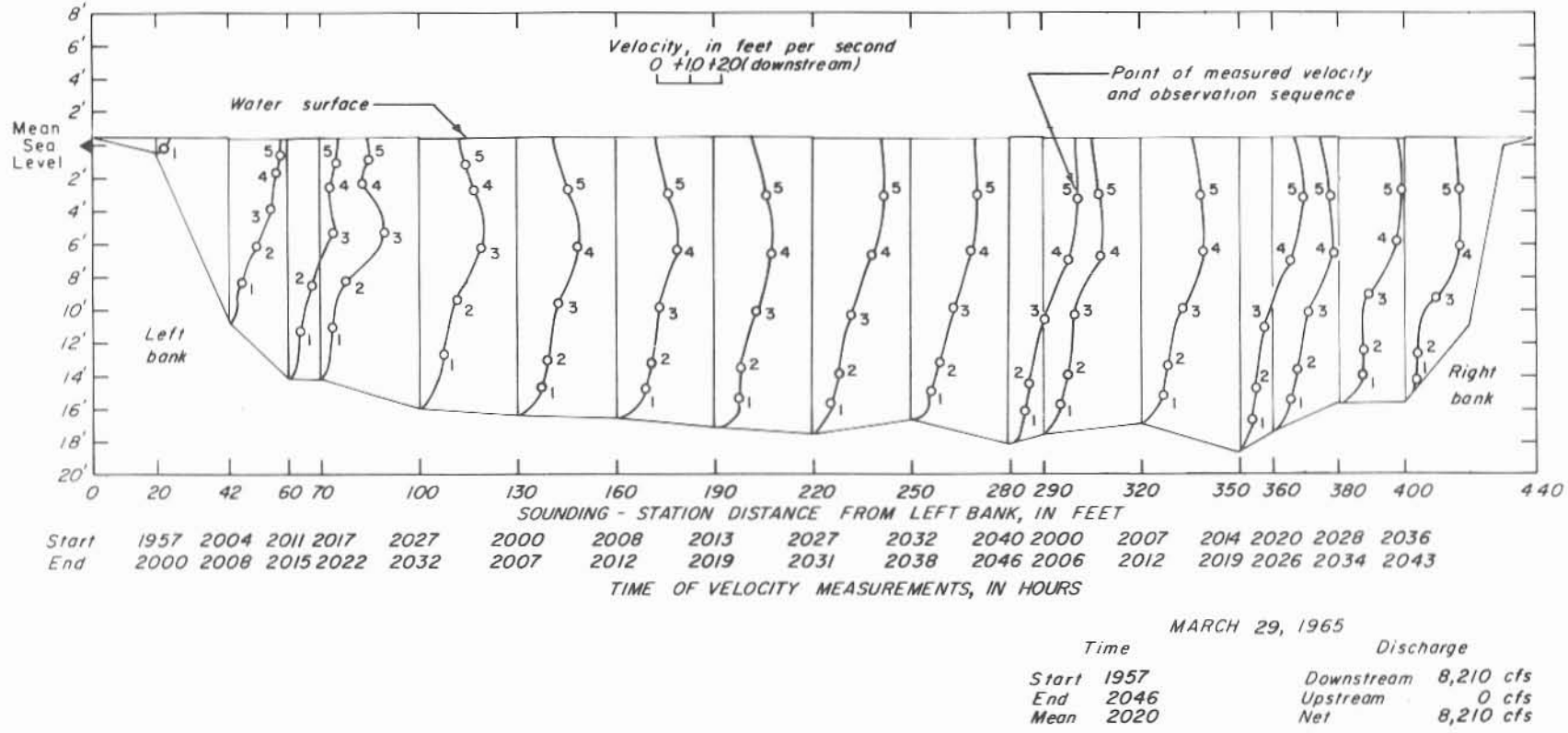


Figure 7 (Measurement 7 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

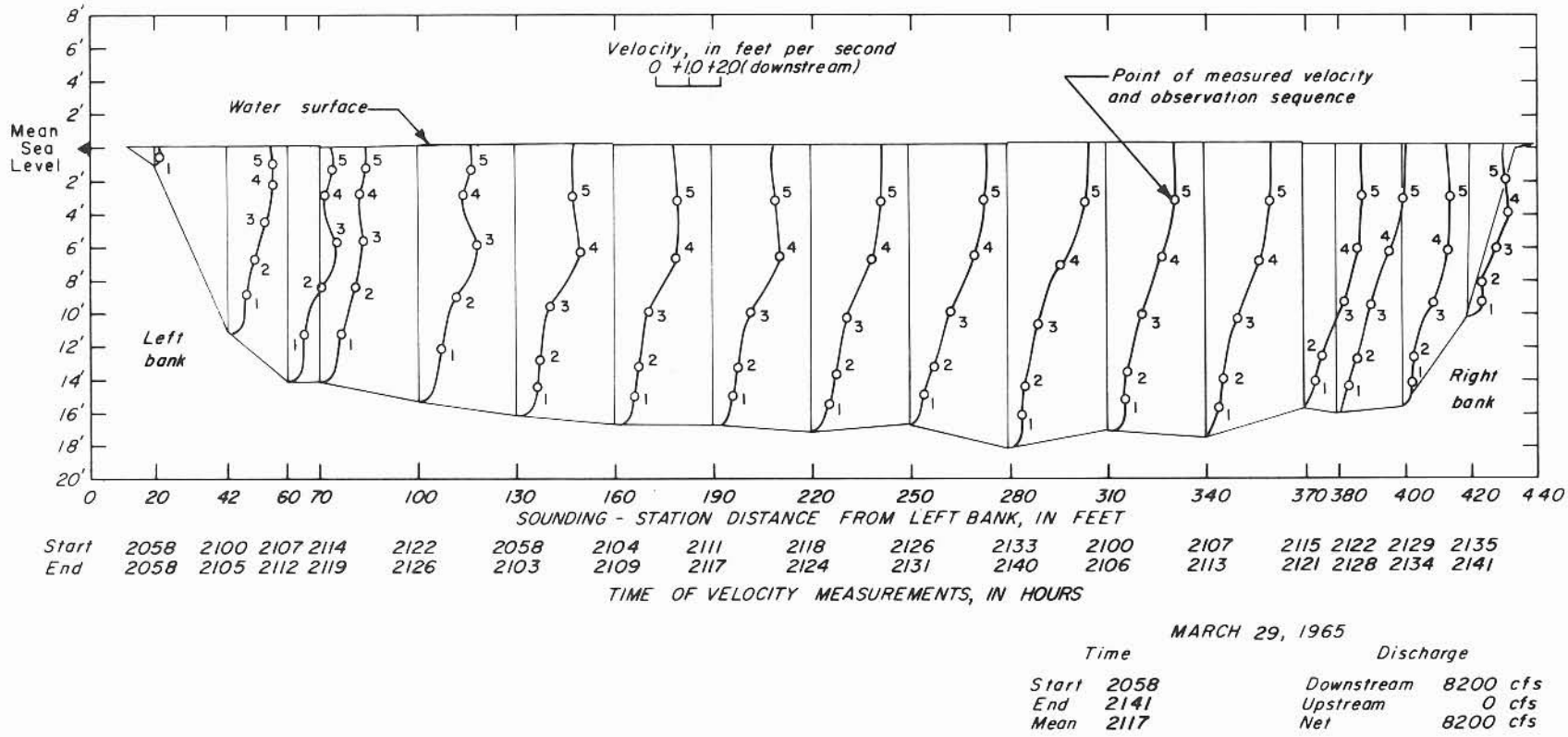


Figure 7 (Measurement 8 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

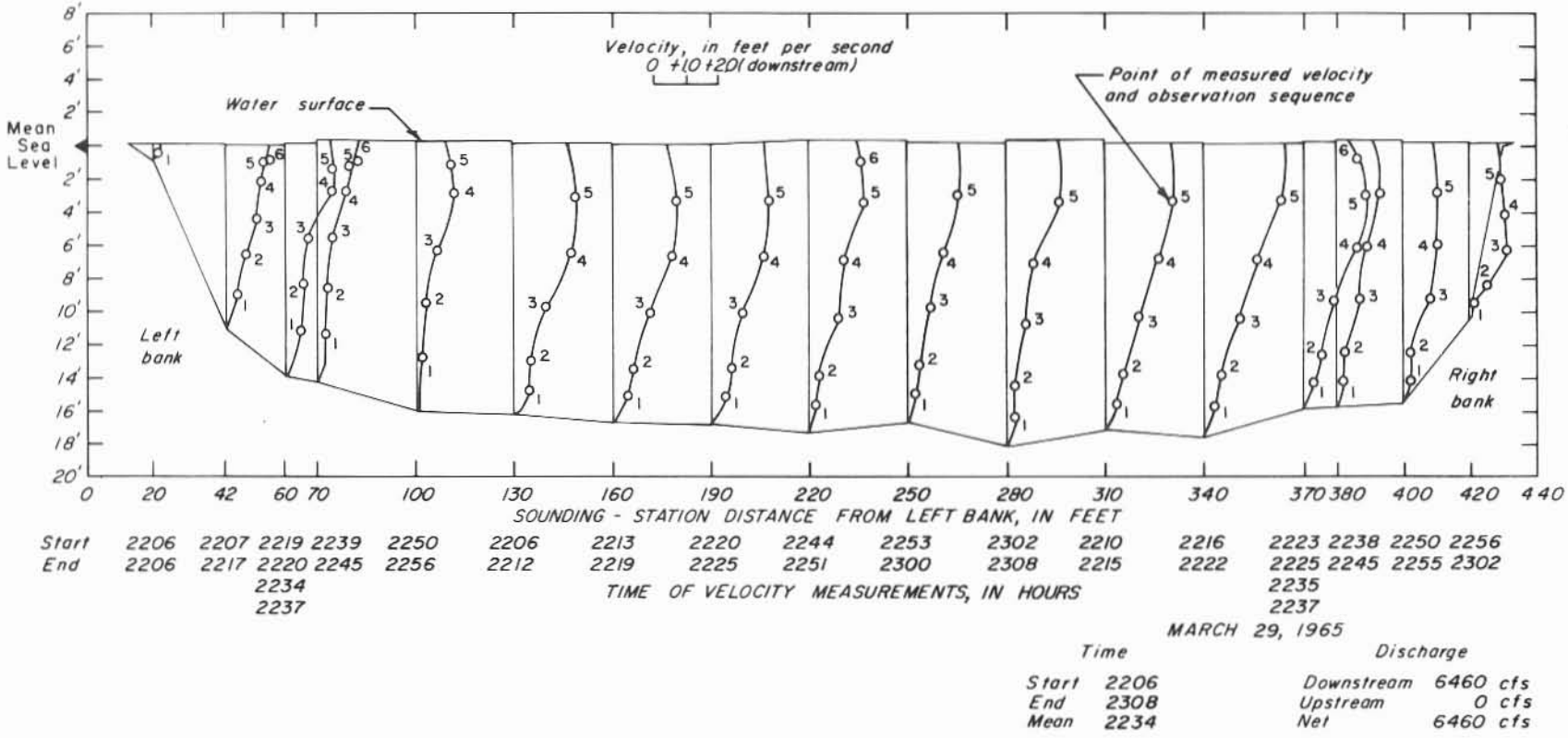


Figure 7 (Measurement 9 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

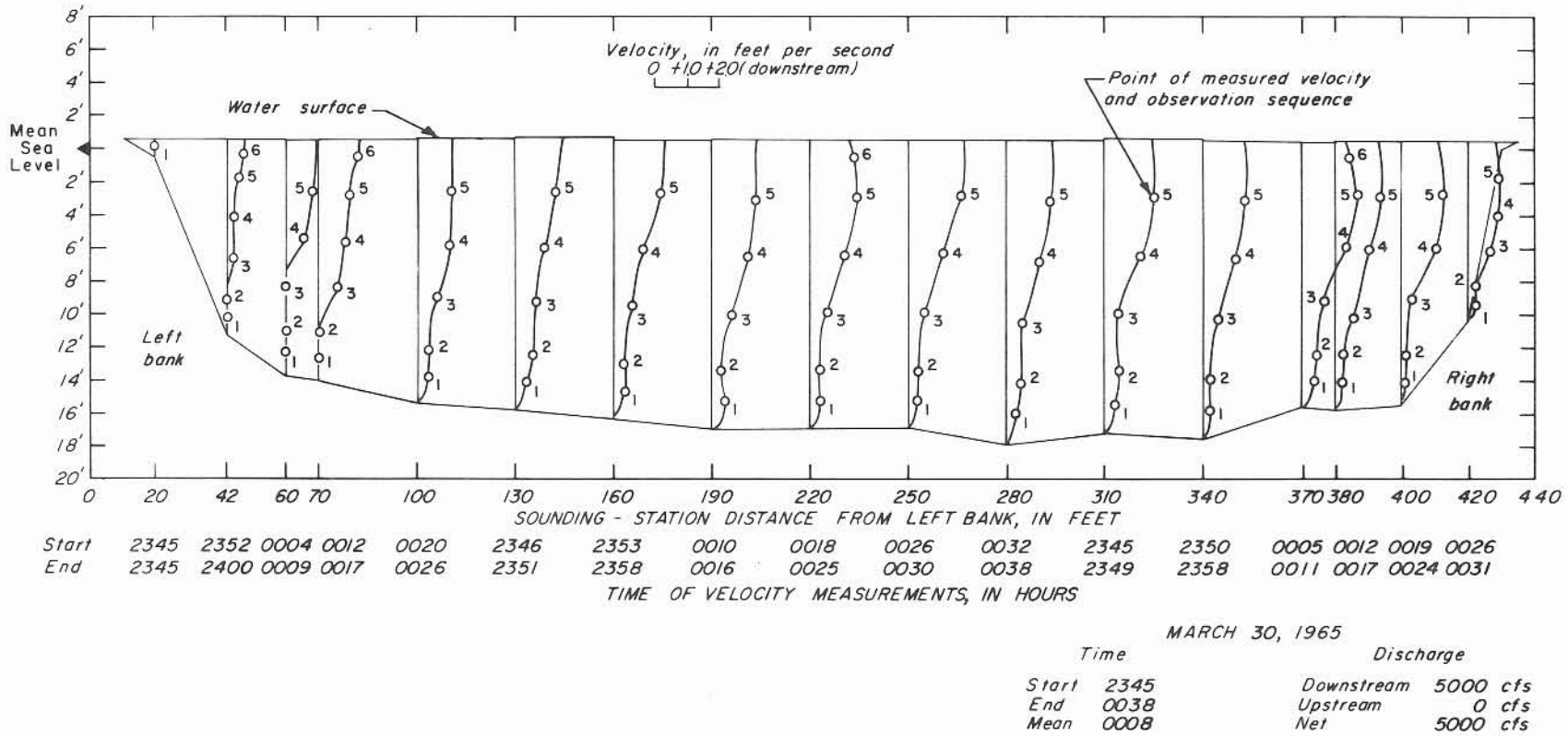


Figure 7 (Measurement 10 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

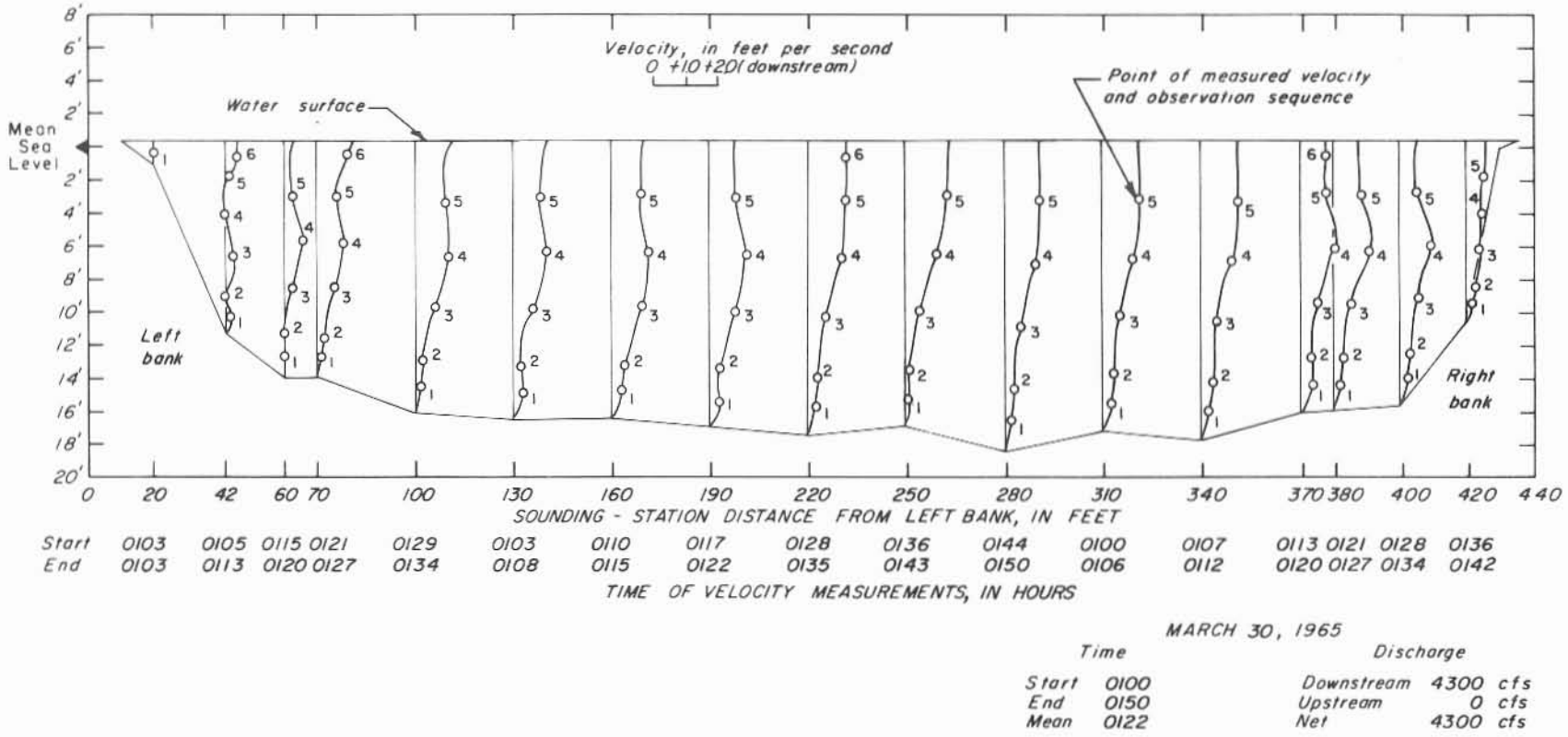


Figure 7 (Measurement 11 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

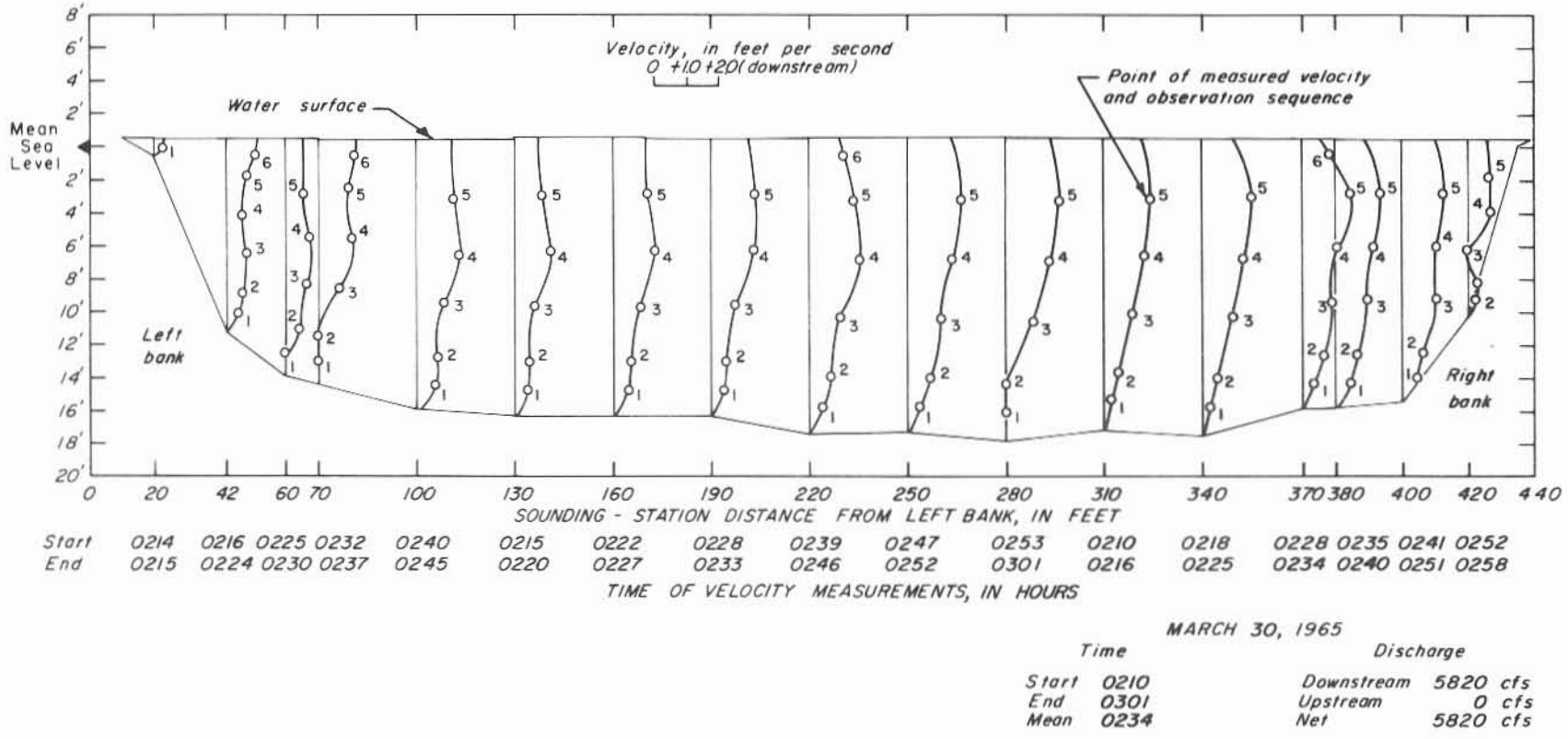


Figure 7 (Measurement 12 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

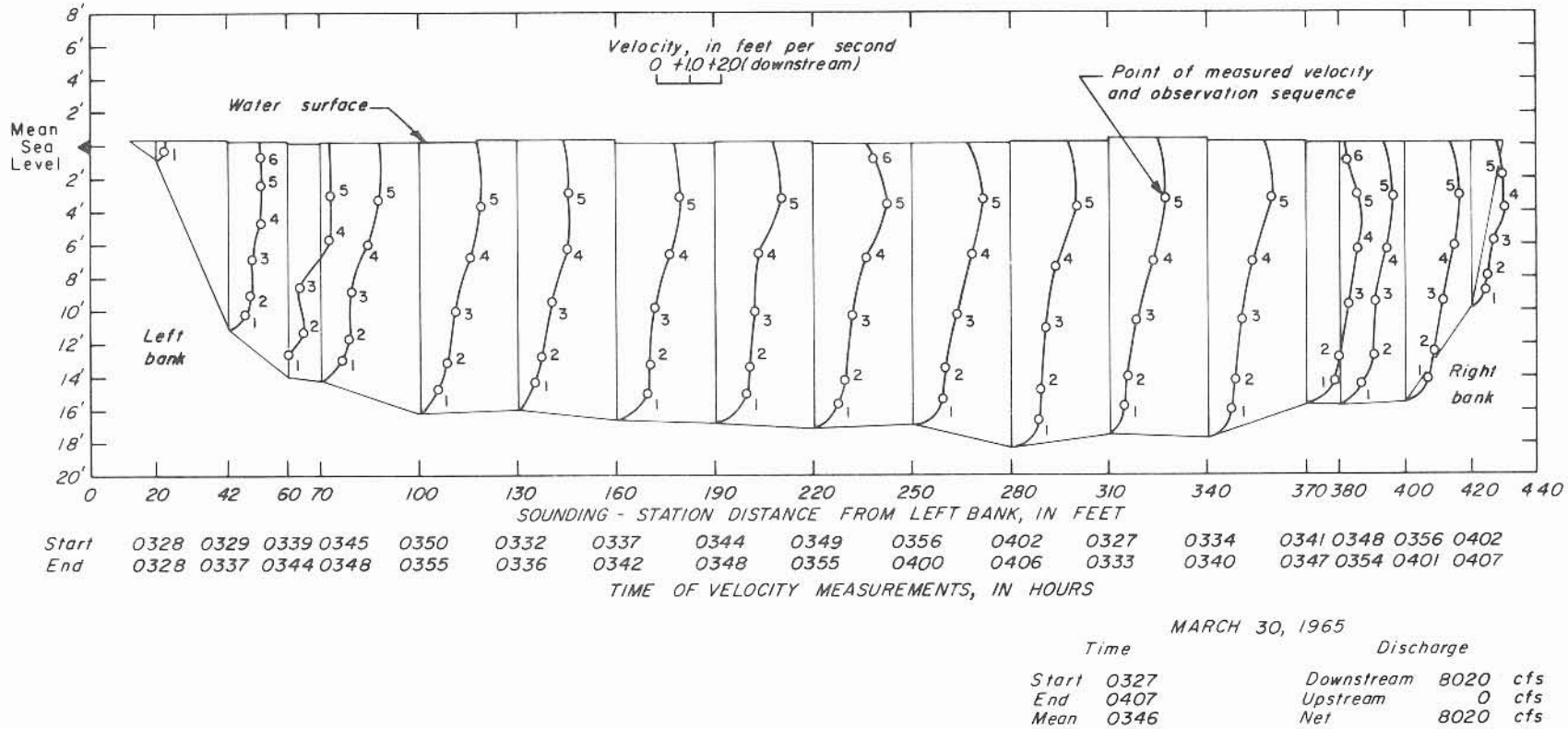


Figure 7 (Measurement 13 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

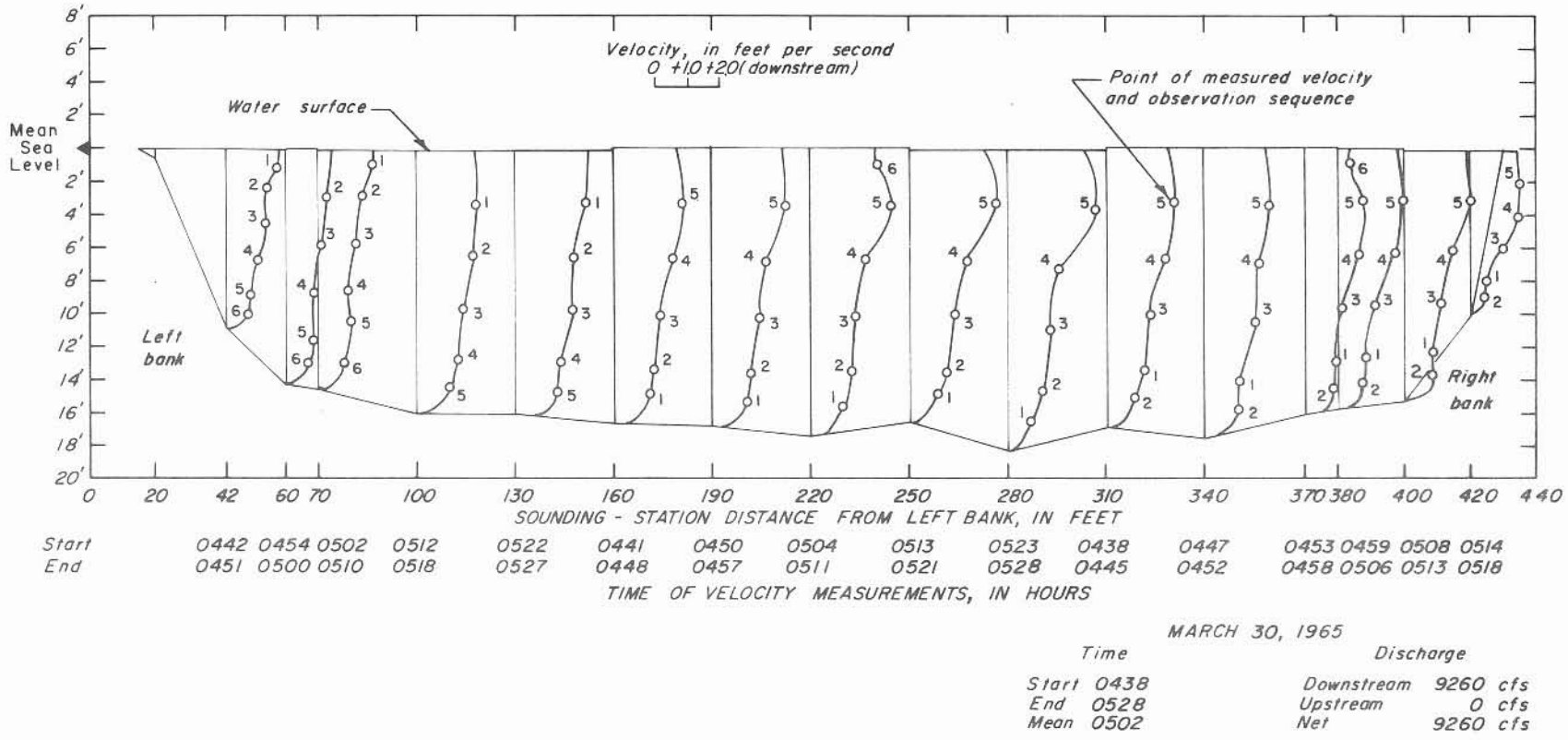


Figure 7 (Measurement 14 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

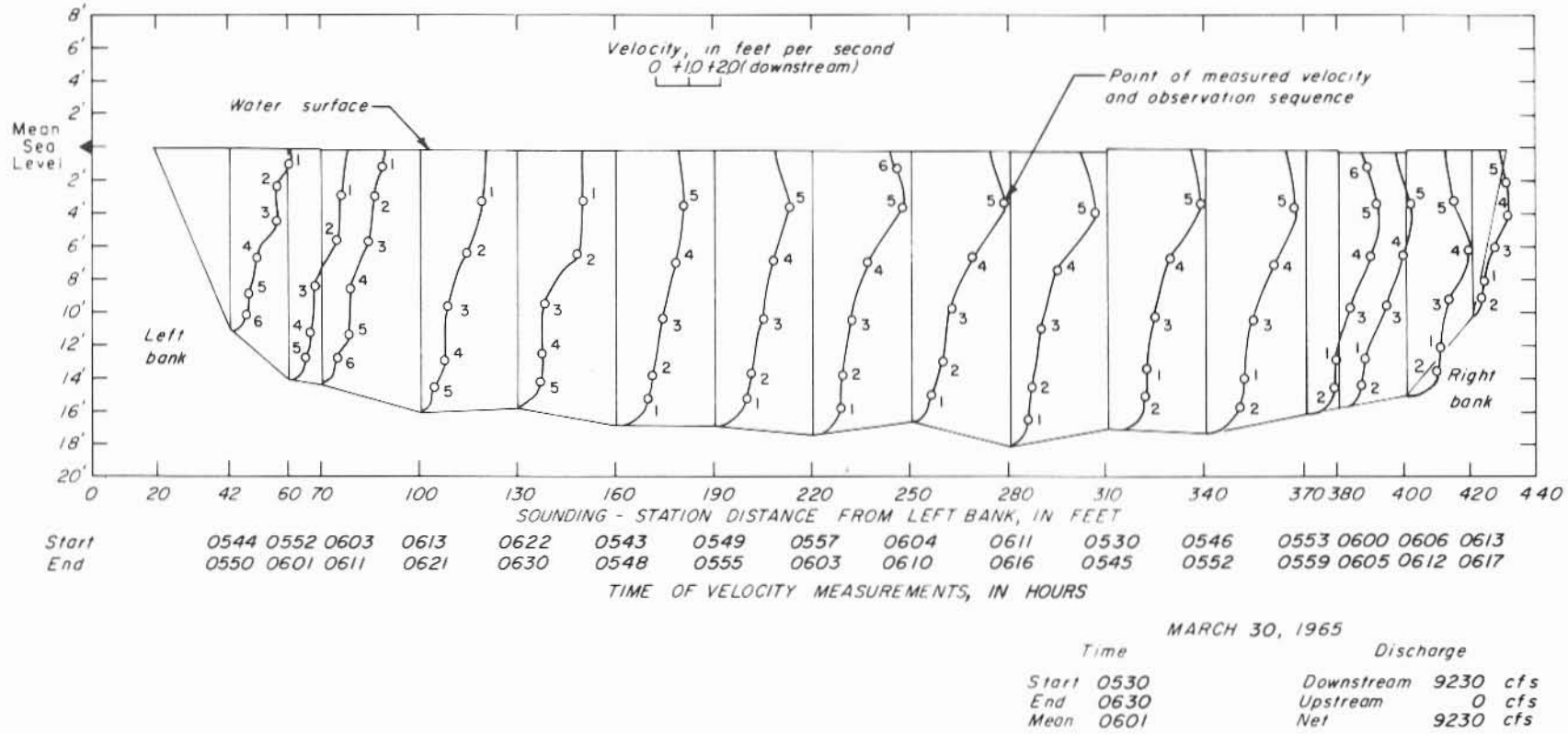


Figure 7 (Measurement 15 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

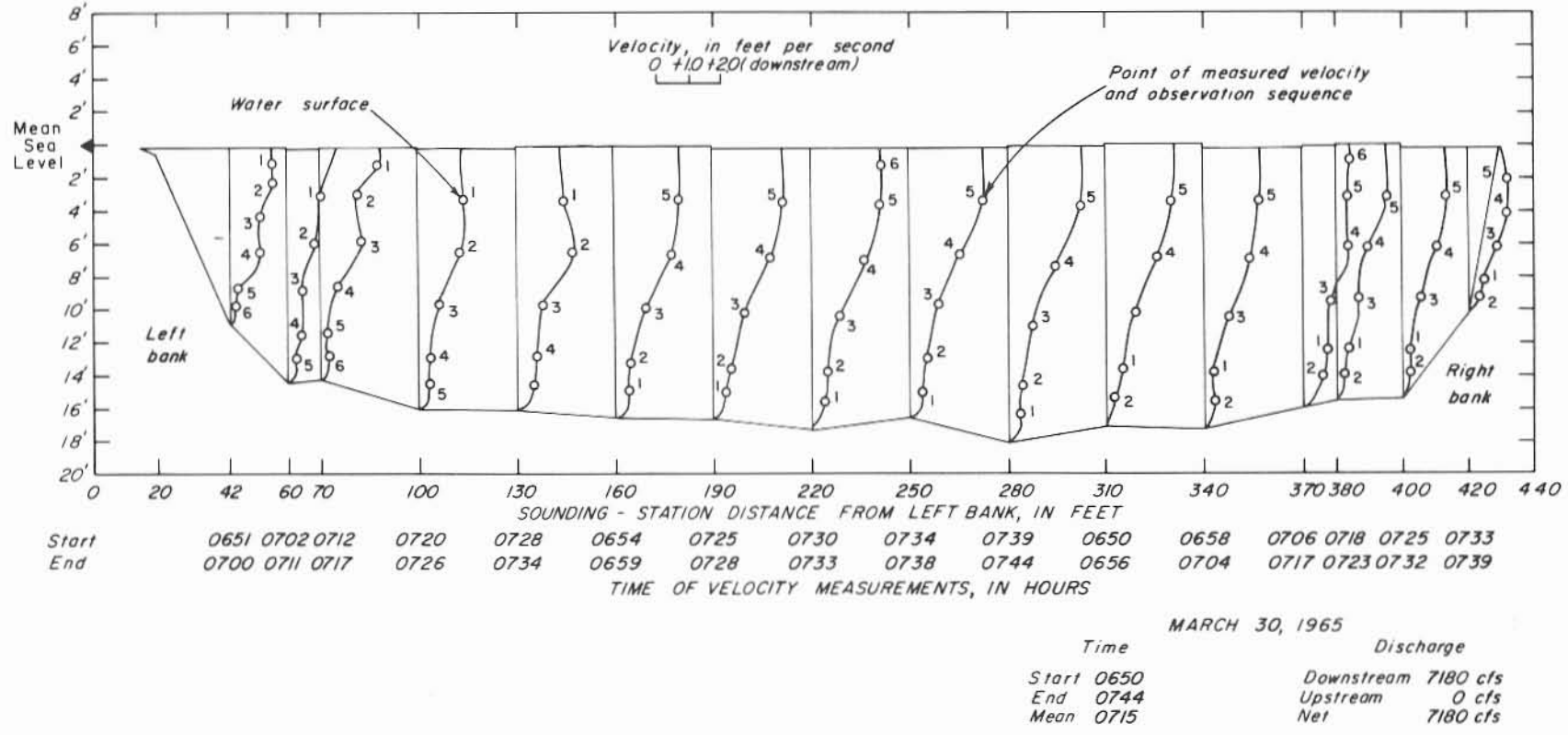
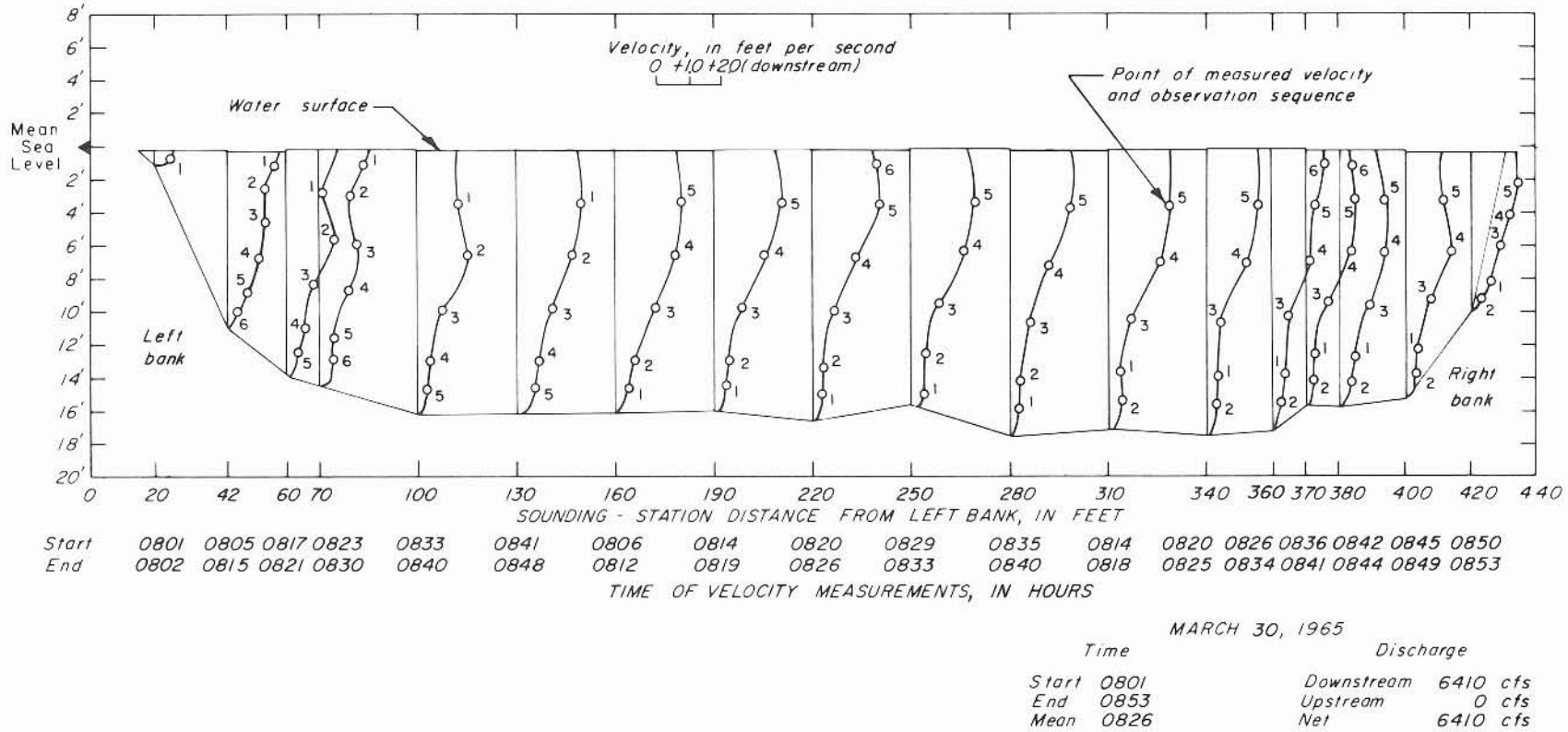


Figure 7 (Measurement 16 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board



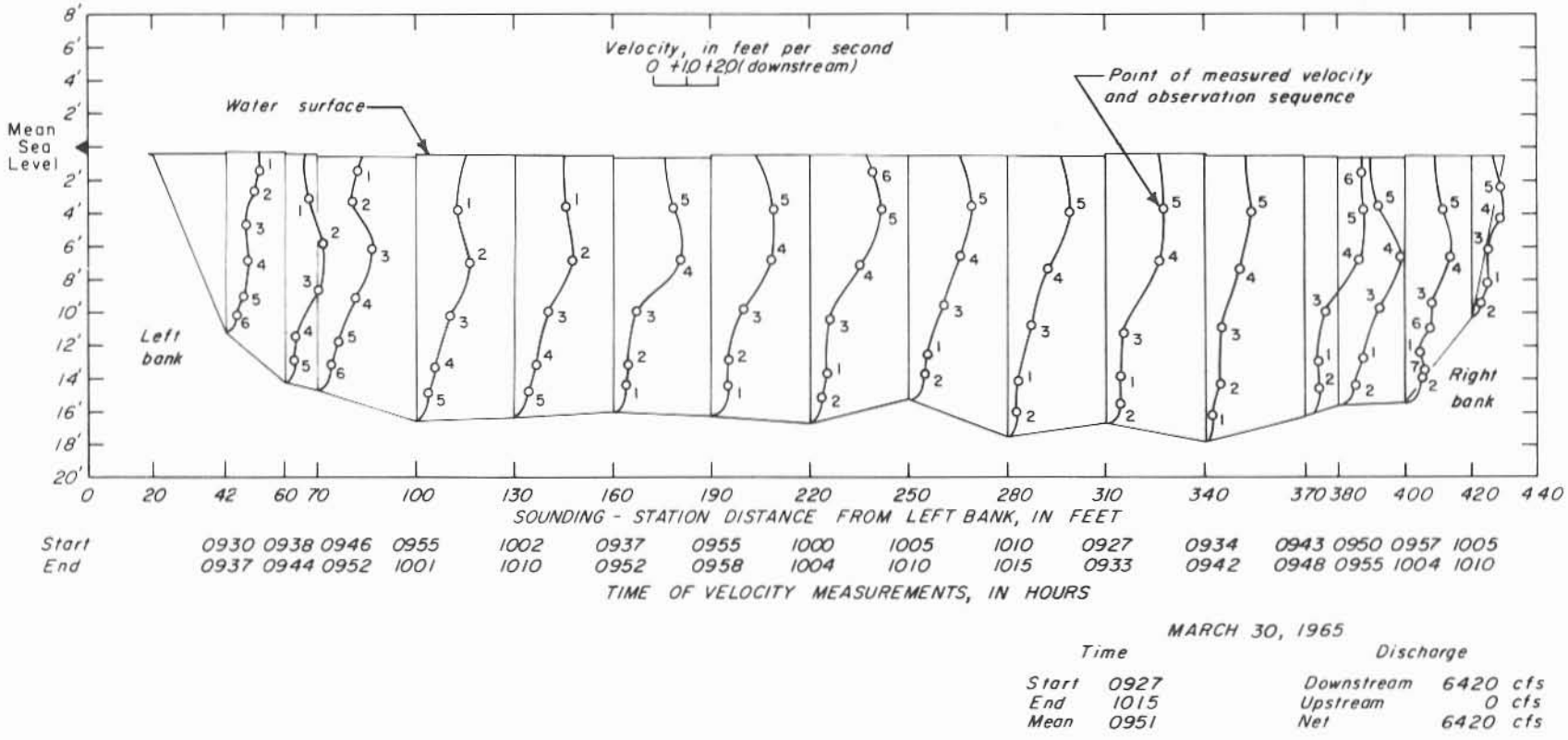
MARCH 30, 1965

Time		Discharge	
Start	0801	Downstream	6410 cfs
End	0853	Upstream	0 cfs
Mean	0826	Net	6410 cfs

Figure 7 (Measurement 17 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board



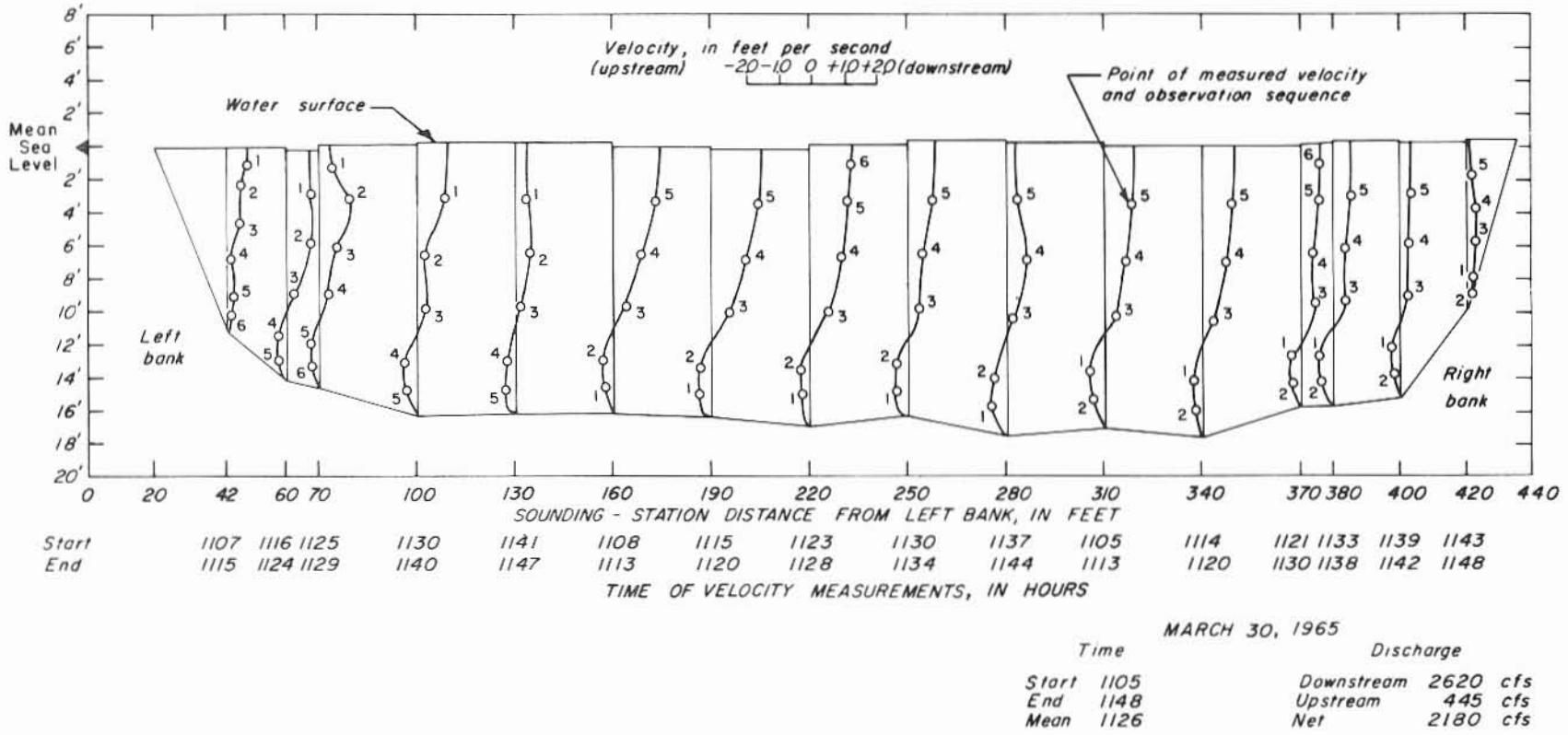
MARCH 30, 1965

Time		Discharge	
Start	0927	Downstream	6420 cfs
End	1015	Upstream	0 cfs
Mean	0951	Net	6420 cfs

Figure 7 (Measurement 18 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board



MARCH 30, 1965

Time		Discharge	
Start	1105	Downstream	2620 cfs
End	1148	Upstream	445 cfs
Mean	1126	Net	2180 cfs

Figure 7 (Measurement 19 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

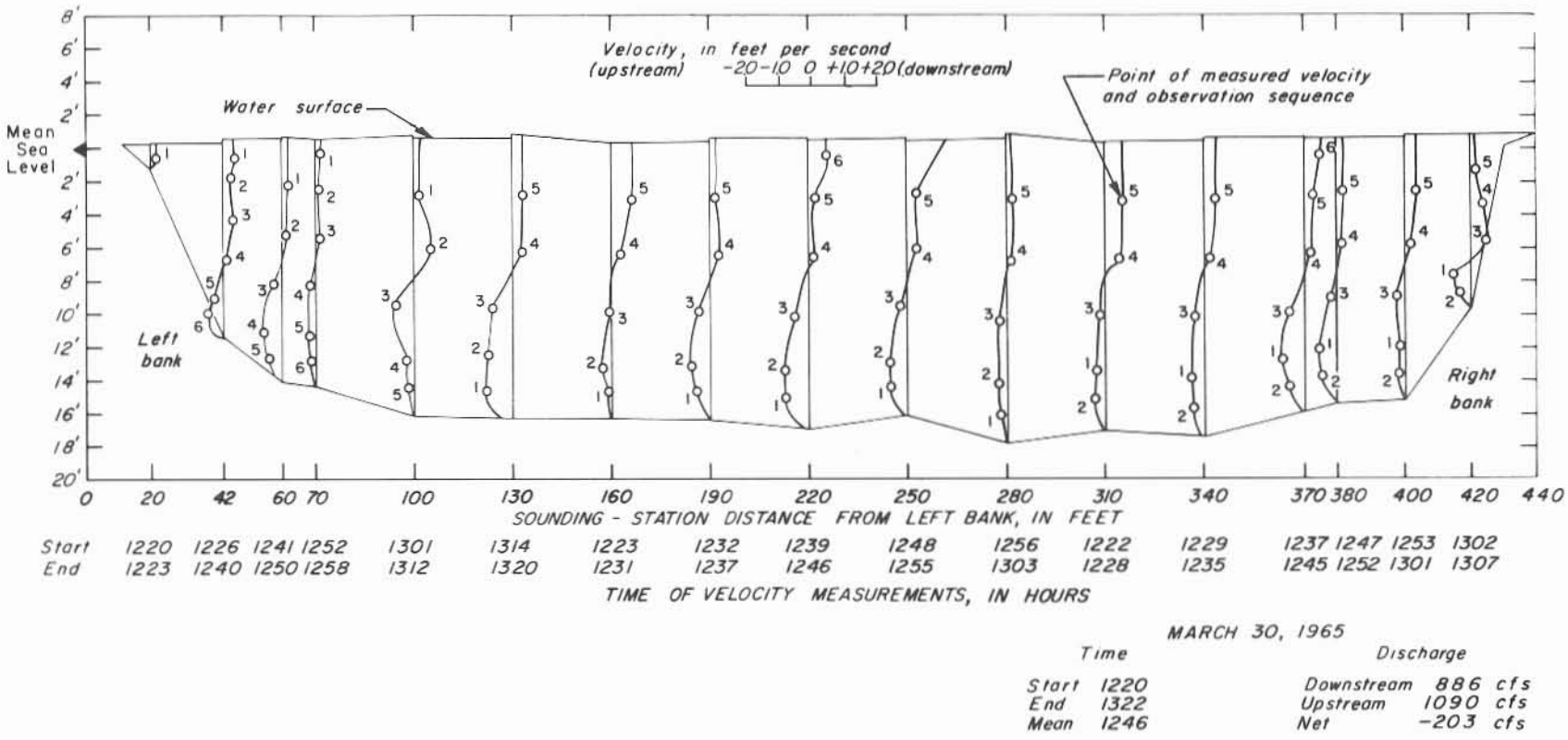
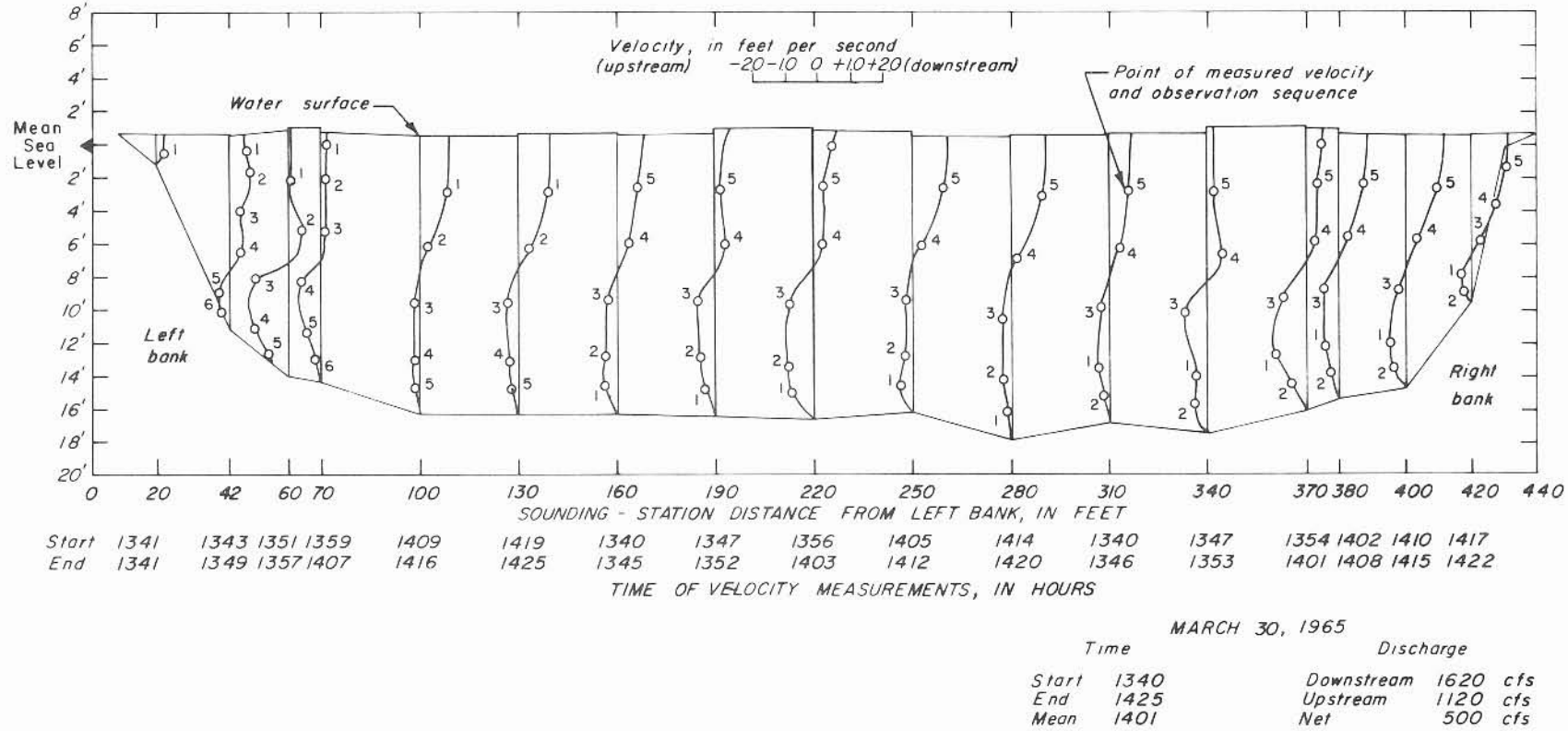


Figure 7 (Measurement 20 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board



MARCH 30, 1965

Time		Discharge	
Start	1340	Downstream	1620 cfs
End	1425	Upstream	1120 cfs
Mean	1401	Net	500 cfs

Figure 7 (Measurement 21 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

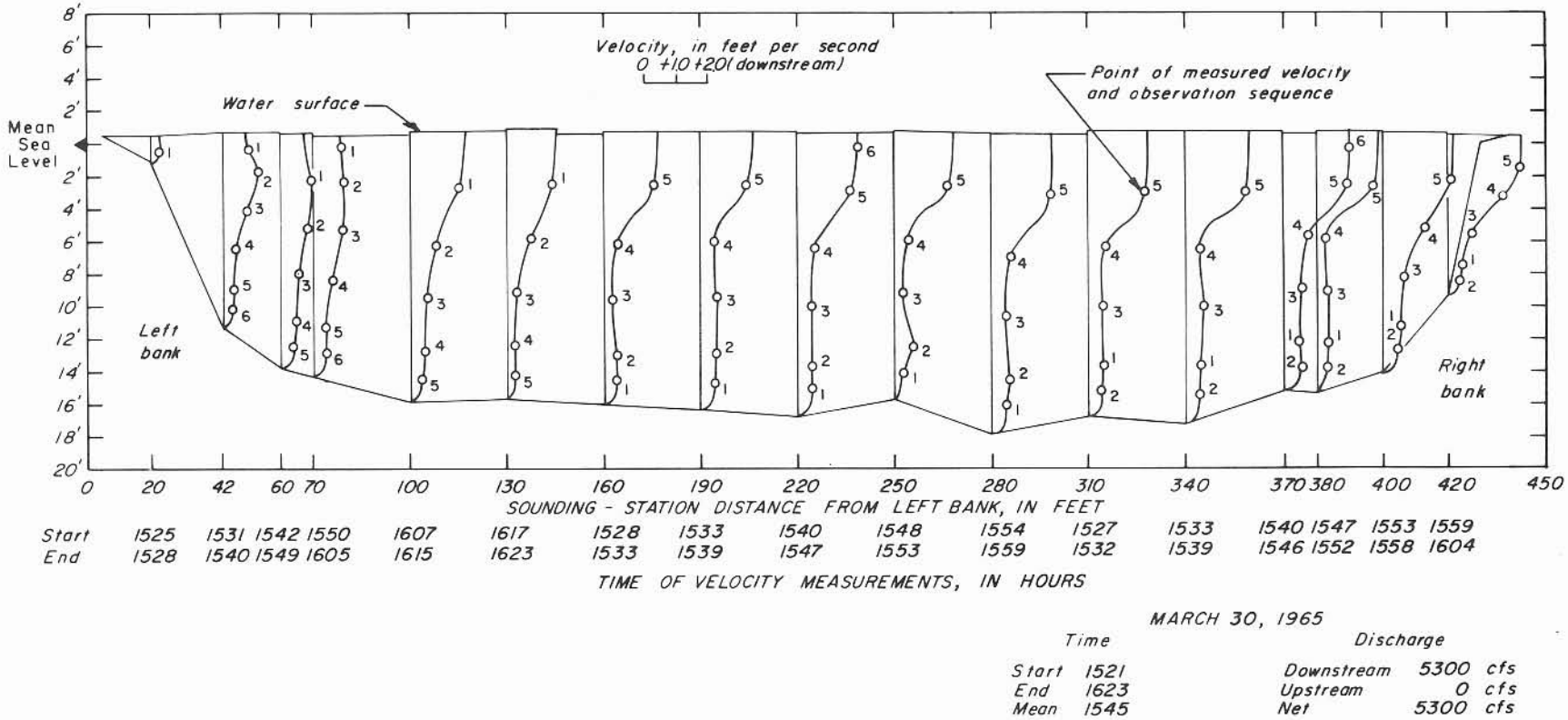


Figure 7 (Measurement 22 of 22)

Section Showing Velocity Distribution Curves and Data Obtained for Discharge Measurements

U S Geological Survey in cooperation with the Texas Water Development Board

Table 3. Elevation of tide stages at upstream and downstream gages

Time in hours	Elevation, in feet, above (+) or below (-) mean sea level		Time in hours	Elevation, in feet, above (+) or below (-) mean sea level		Time in hours	Elevation, in feet, above (+) or below (-) mean sea level		Time in hours	Elevation, in feet, above (+) or below (-) mean sea level	
	Downstream gage	Upstream gage		Downstream gage	Upstream gage		Downstream gage	Upstream gage		Downstream gage	Upstream gage
	March 29, 1965										
1130	+0.33	+0.24	1400	+0.87	+0.88	1630	+0.84	+0.85	1900	+0.53	+0.71
35	+ .30	+ .30	05	+ .74	+ .97	35	+ .78	+ .82	05	+ .62	+ .71
40	+ .40	+ .23	10	+ .85	+ .94	40	+ .98	+ .91	10	+ .64	+ .72
45	+ .51	+ .35	15	+ .89	+ .91	45	+ .93	+1.00	15	+ .59	+ .73
50	+ .70	+ .38	20	+ .92	+ .88	50	+ .82	+ .88	20	+ .67	+ .64
55	+ .60	+ .42	25	+ .85	+ .84	55	+ .86	+ .88	25	+ .71	+ .58
1200	+ .55	+ .50	30	+ .84	+ .90	1700	+ .85	+1.04	30	+ .56	+ .69
05	+ .52	+ .63	35	+ .92	+ .96	05	+ .81	+ .98	35	+ .50	+ .62
10	+ .50	+ .64	40	+ .88	+ .95	10	+ .77	+ .91	40	+ .65	+ .64
15	+ .40	+ .65	45	+ .95	+ .93	15	+ .74	+ .95	45	+ .56	+ .71
20	+ .68	+ .60	50	+ .84	+ .96	20	+ .75	+ .87	50	+ .48	+ .63
25	+ .65	+ .50	55	+ .90	+1.00	25	+ .83	+ .90	55	+ .42	+ .56
30	+ .66	+ .50	1500	+ .83	+ .98	30	+ .75	+ .87	2000	+ .54	+ .63
35	+ .76	+ .71	05	+ .85	+ .93	35	+ .70	+ .83	05	+ .35	+ .61
40	+ .76	+ .69	10	+ .79	+ .97	40	+ .74	+ .82	10	+ .43	+ .55
45	+ .71	+ .67	15	+ .83	+ .95	45	+ .75	+ .89	15	+ .40	+ .49
50	+ .77	+ .73	20	+ .86	+ .90	50	+ .73	+ .80	20	+ .47	+ .54
55	+ .68	+ .79	25	+ .90	+ .94	55	+ .64	+ .81	25	+ .46	+ .44
1300	+ .72	+ .75	30	+ .94	+ .86	1800	+ .69	+ .80	30	+ .38	+ .50
05	+ .80	+ .77	35	+ .97	+ .93	05	+ .65	+ .81	35	+ .34	+ .49
10	+ .80	+ .78	40	+ .90	+ .95	10	+ .60	+ .78	40	+ .38	+ .47
15	+ .78	+ .74	45	+ .77	+1.01	15	+ .55	+ .72	45	+ .40	+ .42
20	+ .73	+ .83	50	+ .86	+1.02	20	+ .48	+ .75	50	+ .45	+ .38
25	+ .85	+ .85	55	+ .78	+1.00	25	+ .58	+ .75	55	+ .33	+ .40
30	+ .68	+ .80	1600	+ .80	+ .91	30	+ .56	+ .65	2100	+ .35	+ .42
35	+ .83	+ .79	05	+ .88	+ .91	35	+ .62	+ .61	05	+ .31	+ .48
40	+ .89	+ .88	10	+ .80	+ .96	40	+ .65	+ .63	10	+ .34	+ .38
45	+ .81	+ .78	15	+ .74	+ .87	45	+ .66	+ .60	15	+ .29	+ .36
50	+ .94	+ .86	20	+ .67	+ .98	50	+ .65	+ .68	20	+ .25	+ .37
55	+ .84	+ .91	25	+ .92	+ .92	55	+ .58	+ .70	25	+ .23	+ .36

Table 3. Elevation of tide stages at upstream and downstream gages--Continued

Time in hours	Elevation, in feet, above (+) or below (-) mean sea level		Time in hours	Elevation, in feet, above (+) or below (-) mean sea level		Time in hours	Elevation, in feet, above (+) or below (-) mean sea level		Time in hours	Elevation, in feet, above (+) or below (-) mean sea level	
	Downstream gage	Upstream gage		Downstream gage	Upstream gage		Downstream gage	Upstream gage		Downstream gage	Upstream gage
	March 29, 1965										
2130	+0.21	+0.35	2400	+0.49	+0.53	0220	+0.45	+0.58	0450	-0.08	+0.15
35	+ .27	+ .33				25	+ .41	+ .67	55	+ .02	+ .12
40	+ .28	+ .32		March 30, 1965		30	+ .43	+ .59	0500	- .03	+ .04
45	+ .27	+ .30	0005	+ .31	+ .51	35	+ .40	+ .54	05	- .09	+ .03
50	+ .26	+ .28	10	+ .31	+ .56	40	+ .33	+ .51	10	- .15	+ .03
55	+ .23	+ .31	15	+ .38	+ .54	45	+ .35	+ .49	15	- .21	+ .08
2200	+ .28	+ .30	20	+ .48	+ .46	50	+ .36	+ .47	20	- .23	+ .03
05	+ .22	+ .29	25	+ .41	+ .38	55	+ .36	+ .44	25	- .21	- .02
10	+ .28	+ .31	30	+ .43	+ .38	0300	+ .37	+ .41	30	- .20	- .06
15	+ .20	+ .29	35	+ .44	+ .48	05	+ .33	+ .41	35	- .22	- .11
20	+ .14	+ .30	40	+ .44	+ .51	10	+ .40	+ .44	40	- .28	- .12
25	+ .28	+ .31	45	+ .45	+ .44	15	+ .32	+ .43	45	- .33	- .12
30	+ .24	+ .28	50	+ .48	+ .46	20	+ .42	+ .44	50	- .30	- .13
35	+ .19	+ .23	55	+ .56	+ .49	25	+ .40	+ .48	55	- .28	- .15
40	+ .35	+ .32	0100	+ .50	+ .51	30	+ .35	+ .46	0600	- .30	- .23
45	+ .40	+ .30	05	+ .49	+ .52	35	+ .25	+ .43	05	- .40	- .23
50	+ .40	+ .27	10	+ .49	+ .53	40	+ .12	+ .50	10	- .32	- .24
55	+ .36	+ .33	15	+ .48	+ .54	45	+ .12	+ .45	15	- .30	- .24
2300	+ .31	+ .39	20	+ .55	+ .56	50	+ .17	+ .39	20	- .32	- .25
05	+ .42	+ .45	25	+ .47	+ .55	55	+ .10	+ .31	25	- .29	- .32
10	+ .43	+ .46	30	+ .51	+ .55	0400	+ .04	+ .25	30	- .26	- .26
15	+ .44	+ .41	35	+ .55	+ .60	05	+ .20	+ .28	35	- .26	- .24
20	+ .38	+ .41	40	+ .61	+ .58	10	+ .18	+ .23	40	- .30	- .22
25	+ .45	+ .48	45	+ .52	+ .54	15	+ .05	+ .17	45	- .36	- .21
30	+ .49	+ .50	50	+ .60	+ .58	20	.00	+ .18	50	- .25	- .22
35	+ .52	+ .46	55	+ .45	+ .63	25	- .05	+ .31	55	- .18	- .24
40	+ .47	+ .51	0200	+ .51	+ .64	30	+ .06	+ .22	0700	- .11	- .27
45	+ .48	+ .54	05	+ .63	+ .56	35	0	+ .17	05	- .28	- .20
50	+ .47	+ .58	10	+ .55	+ .63	40	- .05	+ .12	10	- .28	- .12
55	+ .50	+ .56	15	+ .48	+ .52	45	- .09	+ .07	15	- .13	- .13

Table 3. Elevation of tide stages at upstream and downstream gages--Continued

Time in hours	Elevation, in feet, above (+) or below (-) mean sea level		Time in hours	Elevation, in feet, above (+) or below (-) mean sea level		Time in hours	Elevation, in feet, above (+) or below (-) mean sea level		Time in hours	Elevation, in feet, above (+) or below (-) mean sea level	
	Downstream gage	Upstream gage		Downstream gage	Upstream gage		Downstream gage	Upstream gage		Downstream gage	Upstream gage
0720	-0.05	-0.13	0955	-0.54	-0.30	1230	+0.43	+0.38	1505	+0.71	+0.98
25	- .15	- .25	1000	- .37	- .27	35	+ .50	+ .39	10	+ .80	+ .96
30	- .30	- .17	05	- .46	- .37	40	+ .75	+ .41	15	+ .74	+ .93
35	- .23	- .10	10	- .34	- .47	45	+ .61	+ .53	20	+ .62	+ .85
40	- .32	- .06	15	- .31	- .42	50	+ .73	+ .68	25	+ .47	+ .78
45	- .22	- .19	20	- .25	- .32	55	+ .53	+ .65	30	+ .57	+ .79
50	- .30	- .22	25	- .36	- .40	1300	+ .68	+ .58	35	+ .63	+ .68
55	- .35	- .19	30	- .18	- .27	05	+ .92	+ .70	40	+ .58	+ .56
0800	- .18	- .25	35	- .25	- .24	10	+ .60	+ .51	45	+ .43	+ .58
05	- .20	- .31	40	- .48	- .24	15	+ .66	+ .73	50	+ .67	+ .55
10	- .30	- .28	45	- .42	- .28	20	+ .92	+ .88	55	+ .58	+ .61
15	- .35	- .17	50	- .35	- .12	25	+1.05	+ .59	1600	+ .45	+ .59
20	- .30	- .11	55	- .30	- .22	30	+ .55	+ .81	05	+ .37	+ .48
25	- .19	- .19	1100	- .31	- .39	35	+ .75	+1.03	10	+ .60	+ .66
30	- .31	- .28	05	- .10	- .28	40	+ .83	+ .74	15	+ .63	+ .57
35	- .25	- .22	10	+ .03	- .32	45	+ .67	+ .58	20	+ .75	+ .50
40	- .30	- .14	15	- .05	- .31	50	+ .85	+ .80	25	+ .83	+ .46
45	- .36	- .18	20	- .12	- .22	55	+1.21	+ .61	30	+ .70	+ .58
50	- .40	- .23	25	- .21	- .12	1400	+1.12	+ .87			
55	- .30	- .19	30	+ .07	+ .03	05	+ .85	+1.13			
0900	- .38	- .26	35	+ .38	- .07	10	+ .57	+1.04			
05	- .43	- .30	40	+ .17	- .06	15	+ .63	+ .89			
10	- .36	- .30	45	+ .25	- .02	20	+ .70	+ .75			
15	- .38	- .26	50	+ .36	+ .18	25	+ .84	+ .61			
20	- .48	- .34	55	+ .30	+ .38	30	+ .70	+ .62			
25	- .52	- .34	1200	+ .24	+ .20	35	+ .90	+ .70			
30	- .45	- .26	05	+ .30	+ .40	40	+1.25	+ .77			
35	- .40	- .34	10	+ .05	+ .34	45	+1.09	+ .98			
40	- .32	- .44	15	+ .11	+ .32	50	+ .88	+1.25			
45	- .36	- .44	20	+ .25	+ .35	55	+ .96	+1.10			
50	- .48	- .35	25	+ .40	+ .23	1500	+ .86	+ .98			

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence
Discharge Measurement 1					Discharge Measurement 1					Discharge Measurement 1				
20 (1203)	1.1	.5	+ .15	1	130 (1204-18)	17.5	3.5	+ .20	5	310 (1200-05)	17.7	3.4	+ .21	5
							7.0	+ .77	4			6.8	+ .71	4
							10.5	+ .26	3			10.4	± .27	3
42 (1210-20)	11.5	2.3	+ .18	5			14.0	± .28	2			13.7	± .29	1
		4.6	± .33	4			15.7	- .28	1			15.4	- .21	2
		6.9	± .25	3										
		9.2	- .24	2	160 (1222-31)	18.5	3.7	+ .28	5	340 (1207-13)	17.9	3.6	+ .31	5
		10.3	- .17	1			7.4	+ .62	4			7.2	+ .85	4
							11.1	± .25	3			10.8	± .35	3
60 (1225-38)	14.7	2.9	+ .28	5			14.8	± .22	2			14.3	± .19	1
		5.8	+ .15	4			16.6	- .27	1			16.1	- .14	2
		8.7	± .17	3										
		11.6	± .18	2	190 (1235-45)	17.6	3.5	+ .15	5	370 (1215-20)	16.6	3.4	+ .26	5
		13.5	- .16	1			7.0	+ .63	4			6.8	+ .30	4
							10.5	± .34	3			10.2	± .20	3
70 (1242-52)	15.0	3.0	+ .11	5			14.0	± .24	2			13.2	± .19	1
		6.0	+ .23	4			15.8	- .22	1			14.9	- .16	2
		9.0	± .20	3										
		12.0	± .18	2	220 (1245-55)	18.3	3.7	+ .27	5	380 (1222-27)	16.2	3.2	+ .27	5
		13.5	- .14	1			7.4	+ .59	4			6.4	+ .28	4
							11.1	± .26	3			9.6	± .16	3
100 (1255-1303)	16.5	3.3	+ .17	5			14.8	± .14	2			13.1	± .09	1
		6.6	+ .40	4			16.5	- .20	1			14.7	- .06	2
		9.9	± .30	3										
		13.2	± .21	2	250 (1259-1306)	17.8	3.6	+ .26	5	400 (1228-35)	16.0	3.2	+ .38	5
		14.9	- .17	1			7.2	+ .51	4			6.4	+ .18	4
							10.8	± .23	3			9.6	± .19	3
							14.2	± .18	2			12.9	- .09	1
							16.0	+ .14	1			14.5	- .05	2
					280 (1308-15)	19.3	3.9	+ .21	5	420 (1236-43)	10.3	2.1	+ .35	5
							7.7	+ .53	4			4.2	+ .15	4
							11.6	± .21	3			6.2	± .07	3
							15.5	± .30	2			8.3	± .05	1
							17.4	- .38	1			9.3	- .10	2
										430 (1244)	.06	0	0	-

a/ + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence
Discharge Measurement 2					Discharge Measurement 2					Discharge Measurement 2				
20 (1340)	1.5	.8	.05	1	130 (1340-48)	17.1	3.4	+ .26	5	310 (1340-48)	18.0	3.6	+ .17	5
							6.8	+ .44	4			7.2	+ .40	4
							10.2	+ .34	3			10.8	+ .19	3
42 (1346-58)	12.0	2.4	+ .11	5			13.7	+ .27	2			14.5	+ .16	1
		4.8	+ .14	4			15.4	+ .17	1			16.3	+ .15	2
		7.2	+ .11	3										
		9.6	+ .15	2	160 (1350-56)	17.6	3.5	+ .27	5	340 (1351-1404)	18.2	.6	+ .16	9
		10.8	+ .08	1			7.0	+ .56	4			3.6	+ .31	5
							10.5	+ .34	3			7.3	+ .31	4
60 (1400-10)	15.0	3.0	+ .17	5			14.0	+ .18	2			9.1	+ .38	8
		6.0	+ .40	4			15.8	+ .16	1			10.9	+ .22	3
		9.0	+ .33	3								12.7	+ .22	6
		12.0	+ .32	2	190 (1358-1408)	18.0	3.6	+ .44	5			14.5	+ .13	1
		13.5	+ .20	1			7.2	+ .69	4			15.5	+ .11	7
							10.8	+ .50	3			16.3	+ .16	2
70 (1412-18)	15.0	3.0	+ .16	5			14.4	+ .16	2					
		6.0	+ .31	4			16.2	+ .14	1	370 (1406-12)	16.0	3.2	+ .31	5
		9.0	+ .25	3								6.4	+ .52	4
		12.0	+ .20	2	220 (1410-15)	18.3	3.7	+ .47	5			9.6	+ .39	3
		13.5	+ .16	1			7.4	+ .50	4			13.0	+ .29	1
							11.1	+ .38	3			14.6	+ .24	2
100 (1422-30)	16.5	3.3	+ .26	5			14.8	+ .20	2					
		6.6	+ .33	4			16.5	+ .20	1	380 (1413-18)	16.8	3.4	+ .15	5
		9.9	+ .27	3								6.8	+ .26	4
		13.2	+ .29	2	250 (1417-24)	18.0	3.6	+ .51	5			10.2	+ .24	3
		14.9	+ .18	1			7.2	+ .50	4			13.4	+ .19	1
							10.8	+ .40	3			15.1	+ .16	2
							13.9	+ .20	2					
							16.2	+ .18	1	400 (1419-26)	15.7	3.1	+ .10	5
												6.2	+ .37	4
					280 (1425-1431)	19.3	3.9	+ .02	5			9.3	+ .29	3
							7.7	+ .45	4			12.5	+ .22	1
							11.6	+ .37	3			14.1	+ .18	2
							15.5	+ .17	2					
							17.1	+ .17	1					

a/ + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence
Discharge Measurement 2--Continued					Discharge Measurement 2--Continued					Discharge Measurement 2--Continued				
										420 (1427-33)	10.3	2.1	+ .19	5
												4.2	+ .33	4
												6.3	+ .37	3
												8.3	+ .18	1
												9.3	+ .15	2
										430	.8	0	0	-
Discharge Measurement 3					Discharge Measurement 3					Discharge Measurement 3				
20 (1522-24)	1.5	.9	+ .29	1	130 (1523-30)	17.1	3.4	+ .56	5	310 (1524-31)	18.0	3.6	+ .78	5
							6.8	+ .79	4			7.2	+ .60	4
							10.2	+ .65	3			10.8	+ .51	3
42 (1526-34)	12.5	2.5	+ .52	5			13.7	+ .58	2			14.5	+ .51	1
		5.0	+ .51	4			15.4	+ .54	1			16.3	+ .38	2
		7.5	+ .41	3										
		10.0	+ .23	2	160 (1532-38)	17.6	3.5	+ .75	5	340 (1532-37)	18.7	3.8	+ .83	5
		11.2	+ .23	1			7.0	+ .74	4			7.5	+ .55	4
							10.5	+ .56	3			11.3	+ .43	3
60 (1536-42)	15.2	3.0	+ .46	5			14.0	+ .54	2			15.0	+ .41	1
		6.0	+ .50	4			15.8	+ .46	1			16.9	+ .41	2
		9.0	+ .51	3										
		12.0	+ .44	2	190 (1540-45)	18.0	3.6	+ .92	5	370 (1538-44)	16.6	3.3	+ .96	5
		13.5	+ .48	1			7.2	+1.02	4			6.5	+ .83	4
							10.8	+ .88	3			9.8	+ .66	3
70 (1544-50)	15.0	3.0	+ .77	5			14.4	+ .70	2			13.3	+ .59	1
		6.0	+ .77	4			16.2	+ .53	1			15.0	+ .61	2
		9.0	+ .71	3										
		12.0	+ .71	2	220 (1546-53)	18.2	3.6	+ .98	5	380 (1545-50)	16.5	3.3	+ .87	5
		13.5	+ .66	1			7.3	+1.02	4			6.5	+ .78	4
							10.9	+ .70	3			9.8	+ .66	3
100 (1552-58)	16.0	3.2	+ .81	5			14.5	+ .79	2			13.3	+ .81	1
		6.4	+ .81	4			16.4	+ .66	1			14.9	+ .68	2
		9.6	+ .78	3										
		12.8	+ .71	2										
		14.4	+ .68	1										

a/ + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence
Discharge Measurement 3--Continued					Discharge Measurement 3--Continued					Discharge Measurement 3--Continued				
					250 (1555-1600)	17.9	3.6	+1.14	5	400 (1552-57)	16.2	3.2	+ .81	5
							7.2	+1.21	4			6.5	+ .85	4
							10.8	+1.02	3			9.7	+ .57	3
							14.4	+ .80	2			12.9	+ .58	1
							16.1	+ .64	1			14.5	+ .53	2
					280 (1602-07)	19.2	3.8	+1.07	5	420 (1558-1603)	10.5	2.1	+ .23	5
							7.6	+1.00	4			4.2	+ .52	4
							11.4	+ .82	3			6.3	+ .52	3
							15.2	+ .72	2			8.4	+ .27	1
							17.3	+ .58	1			9.4	+ .28	2
										430	.8	0	0	-
Discharge Measurement 4					Discharge Measurement 4					Discharge Measurement 4				
20 (1627-30)	1.6	1.0	+ .12	1	130 (1628-33)	17.1	3.4	+1.16	5	310 (1627-33)	18.0	3.6	+1.20	6
							6.8	+1.09	4			7.2	+ .98	5
							10.2	+1.12	3			9.8	+ .73	3
							13.6	+1.02	2			10.8	+ .96	4
							15.4	+ .80	1			14.3	+ .74	1
												16.1	+ .66	2
42 (1632-38)	12.0	2.4	+ .72	1	160 (1635-40)	17.5	3.5	+ .85	5	340 (1634-40)	18.6	3.7	+ .91	5
		4.8	+ .72	2			7.0	+ .98	4			7.4	+ .57	4
		7.2	+ .60	3			10.5	+1.16	3			11.1	+ .74	3
		9.6	+ .46	4			14.0	+ .95	2			14.8	+ .74	1
		10.8	+ .38	5			15.7	+ .90	1			16.7	+ .58	2
60 (1641-48)	15.2	3.0	+ .68	1	190 (1641-47)	17.9	3.6	+1.09	5	400 (1642-47)	16.5	3.3	+ .76	5
		6.0	+ .48	2			7.2	+1.09	4			6.6	+ .68	4
		9.0	+ .41	3			10.8	+ .95	3			9.9	+ .56	3
		12.0	+ .53	4			14.4	+ .74	2			13.2	+ .44	1
		13.5	+ .61	5			16.1	+ .62	1			14.8	+ .46	2
70 (1652-59)	15.0	3.0	+ .96	1										
		6.0	+ .94	2										
		9.0	+ .69	3										
		12.0	+ .77	4										
		13.5	+ .66	5										

[a] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a/]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a/]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a/]	Observation sequence
Discharge Measurement 4--Continued					Discharge Measurement 4--Continued					Discharge Measurement 4--Continued				
100 (1700-05)	16.0	3.2	+1.09	1	220 (1648-53)	18.4	3.7	+1.16	5	370 (1650-55)	16.7	3.3	+ .82	5
		4.8	+1.19	6			7.4	+1.37	4			6.6	+ .87	4
		6.4	+ .83	2			11.1	+1.14	3			10.0	+ .66	3
		9.6	+1.02	3			14.8	+ .98	2			13.4	+1.01	1
		12.8	+1.09	4			16.6	+ .79	1			15.1	+ .74	2
		14.4	+1.02	5	250 (1655-1700)	17.9	3.6	+1.09	5	380 (1656-1701)	16.4	3.3	+ .81	5
							7.2	+1.45	4			6.6	+ .91	4
							10.8	+1.07	3			9.9	+ .74	3
							14.4	+ .82	2			13.1	+ .76	1
							16.1	+ .75	1			17.4	+ .68	2
					280 (1702-08)	19.2	3.8	+1.39	5	420 (1702-08)	10.6	2.1	+ .35	5
							7.6	+1.33	4			4.2	+ .73	4
							11.4	+1.19	3			6.3	+ .68	3
							15.2	+1.09	2			8.4	+ .40	1
							17.3	+ .92	1			9.5	+ .20	2
										430	.8	0	0	-
Discharge Measurement 5					Discharge Measurement 5					Discharge Measurement 5				
20 (1725-27)	1.5	.9	+ .06	1	130 (1722-27)	17.0	3.4	+1.02	5	310 (1727-32)	18.0	3.6	+1.38	5
							6.8	+1.21	4			7.2	+1.47	4
							10.2	+1.12	3			10.8	+1.11	3
42 (1729-34)	12.0	2.4	+ .75	1			13.6	+1.09	2			14.4	+ .73	1
		4.8	+ .77	2			15.3	+1.02	1			16.2	+ .74	2
		7.2	+ .88	3										
		9.6	+ .52	4	160 (1728-33)	17.4	3.5	+1.33	5	340 (1733-39)	18.6	3.7	+1.65	5
		10.8	+ .39	5			7.0	+1.68	4			7.4	+1.05	4
							10.5	+1.39	3			11.1	+ .78	3
60 (1737-44)	15.0	3.0	+1.19	1			14.0	+1.12	2			14.9	+ .88	1
		4.8	+1.22	6			15.7	+ .98	1			16.8	+ .76	2
		6.0	+ .98	2										
		9.0	+ .57	3										
		12.0	+ .75	4										
		13.5	+ .59	5										

[a/] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station	Initial depth below water surface in feet (Time in vertical in hours)	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station	Initial depth below water surface in feet (Time in vertical in hours)	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station	Initial depth below water surface in feet (Time in vertical in hours)	Depth of observation in feet	Velocity (fps) a/	Observation sequence
Discharge Measurement 5--Continued					Discharge Measurement 5--Continued					Discharge Measurement 5--Continued				
70	15.0	3.0	+1.33	1	190	17.5	3.5	+1.33	5	370	16.3	3.3	+1.50	5
(1746-52)		6.0	+1.14	2	(1735-40)		7.0	+1.63	4	(1740-46)		6.5	+1.28	4
		9.0	+ .57	3			10.5	+1.39	3			7.7	+ .92	6
		12.0	+ .77	4			14.0	+1.12	2			9.8	+ .66	3
		13.5	+ .58	5			15.7	+ .79	1			13.1	+ .81	1
												14.7	+ .64	2
100	16.5	3.3	+1.63	1	220	18.2	3.6	+1.45	5					
(1754-1800)		6.6	+1.07	2	(1743-47)		7.2	+1.60	4	380	16.4	3.3	+1.34	5
		9.9	+1.12	3			10.8	+1.30	3	(1747-52)		6.6	+ .98	4
		13.2	+1.07	4			14.4	+1.14	2			9.9	+ .78	3
		14.9	+ .98	5			16.4	+ .95	1			13.1	+ .68	1
												14.7	+ .60	2
					250	17.3	3.5	+1.78	5					
					(1751-57)		7.0	+1.81	4	400	16.2	3.2	+1.69	5
							10.5	+1.09	3	(1754-59)		6.5	+1.15	4
							14.0	+ .81	2			9.7	+ .74	3
							15.6	+ .70	1			13.0	+ .71	1
												14.6	+ .58	2
					280	19.0	3.8	+1.98	5					
					(1759-1805)		7.6	+1.39	4	420	10.8	2.1	+ .89	5
							11.4	+1.12	3	(1800-05)		4.2	+1.03	4
							14.2	+ .92	2			6.3	+ .64	3
							17.1	+ .75	1			8.4	+ .29	1
												9.5	+ .37	2
Discharge Measurement 6					Discharge Measurement 6					Discharge Measurement 6				
20	1.5	.6	+ .17	1	130	17.0	3.4	+1.74	5	290	17.8	3.6	+1.76	5
(1835)					(1835-43)		6.8	+1.42	4	(1834-43)		7.1	+1.41	4
							10.2	+1.24	3			10.7	+ .92	3
42	11.5	1.2	+1.02	5			13.6	+1.09	2			14.2	+ .70	2
(1837-42)		2.3	+1.22	4			15.3	+ .90	1			16.0	+ .60	1
		4.6	+1.37	3										
		6.9	+ .61	2										
		9.2	+ .26	1										

a/ + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence
(Time in vertical in hours)					(Time in vertical in hours)					(Time in vertical in hours)				
Discharge Measurement 6--Continued					Discharge Measurement 6--Continued					Discharge Measurement 6--Continued				
60 (1845-50)	14.3	1.4	+1.24	5	160 (1850-56)	18.0	3.6	+1.74	5	320 (1845-53)	17.7	3.5	+1.83	5
		2.9	+1.02	4			7.2	+1.56	4			7.1	+1.44	4
		5.8	+1.27	3			10.8	+1.07	3			10.6	+ .84	3
		8.6	+ .36	2			14.4	+ .75	2			14.1	+ .85	2
		11.4	+ .50	1			16.2	+ .56	1			15.9	+ .59	1
70 (1852-57)	14.9	1.5	+1.4	5	190 (1858-1904)	17.0	3.4	+1.85	5	350 (1855-1906)	19.2	3.8	+2.00	5
		3.0	+1.36	4			6.8	+1.74	4			7.7	+1.18	4
		6.0	+1.52	3			10.2	+1.27	3			11.5	+ .76	3
		9.0	+ .43	2			13.6	+1.07	2			15.3	+ .66	2
		11.9	+ .62	1			15.3	+ .86	1			17.3	+ .63	1
80 (1900-06)	15.5	1.6	+1.59	5	220 (1906-12)	18.0	3.6	+1.78	5	360 (1913-20)	17.8	3.6	+1.79	5
		3.1	+1.52	4			7.2	+1.85	4			7.1	+1.41	4
		6.2	+1.49	3			10.8	+1.02	3			10.6	+ .56	3
		9.3	+ .50	2			14.4	+ .74	2			14.2	+ .46	2
		12.4	+ .75	1			16.2	+ .59	1			16.0	+ .32	1
100 (1910-17)	16.7	1.7	+1.55	5	250 (1914-20)	17.2	3.4	+1.71	5	380 (1922-28)	16.7	3.3	+1.65	5
		3.3	+1.67	4			6.9	+1.68	4			6.7	+1.23	4
		6.6	+1.07	3			10.3	+1.14	3			10.0	+ .48	3
		10.0	+ .77	2			13.8	+ .74	2			13.4	+ .24	2
		13.4	+ .75	1			15.5	+ .56	1			15.0	+ .28	1
					280 (1922-28)	19.0	3.8	+1.89	5	400 (1929-35)	16.1	3.2	+1.91	5
							7.6	+1.27	4			6.4	+ .79	4
							11.4	+ .81	3			9.6	+ .47	3
							15.2	+ .57	2			12.9	+ .36	2
							17.1	+ .45	1			14.5	+ .40	1
										400	0	-	-	-

[a] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence
Discharge Measurement 7					Discharge Measurement 7					Discharge Measurement 7				
20 (1957-2000)	1.0	.6	+ .24	1	130 (2000-07)	17.0	3.4	+1.52	5	290 (2000-06)	18.2	3.6	+1.72	5
							6.8	+1.81	4			7.3	+1.79	4
							10.2	+1.21	3			10.9	+ .98	3
42 (2004-08)	11.2	1.1	+1.59	5			13.6	+ .88	2			14.5	+ .67	2
		2.2	+1.45	4			15.3	+ .70	1			16.3	+ .51	1
		4.5	+1.30	3										
		6.7	+ .85	2	160 (2008-12)	17.0	3.4	+1.60	5	320 (2007-12)	17.4	3.5	+1.83	5
		9.0	+ .38	1			6.8	+1.85	4			7.0	+1.91	4
							10.2	+1.30	3			10.4	+1.23	3
60 (2011-15)	14.5	1.4	+1.49	5			13.6	+1.04	2			13.9	+ .81	2
		2.9	+1.27	4			15.3	+ .90	1			15.7	+ .60	1
		5.8	+1.40	3										
		8.7	+ .72	2	190 (2013-19)	17.5	3.5	+1.60	5	350 (2014-19)	19.1	3.8	+1.95	5
		11.6	+ .33	1			7.0	+1.74	4			7.6	+1.57	4
							10.5	+1.27	3			11.5	+ .76	3
70 (2017-22)	14.5	1.4	+1.49	5			14.0	+ .80	2			15.3	+ .53	2
		2.9	+1.30	4			15.8	+ .77	1			17.2	+ .40	1
		5.8	+1.93	3										
		8.7	+ .79	2	220 (2027-31)	18.0	3.6	+2.17	5	360 (2020-26)	17.8	3.6	+1.76	5
		11.6	+ .33	1			7.2	+1.81	4			7.1	+1.87	4
							10.8	+1.14	3			10.7	+1.08	3
100 (2027-32)	16.4	1.6	+1.40	5			14.4	+ .79	2			14.2	+ .74	2
		3.3	+1.68	4			16.2	+ .51	1			16.0	+ .56	1
		6.6	+1.89	3										
		9.8	+1.14	2	250 (2032-38)	17.0	3.4	+2.02	5	380 (2028-34)	16.1	3.2	+1.91	5
		13.1	+ .74	1			6.8	+1.85	4			6.4	+1.72	4
							10.2	+1.30	3			9.6	+ .94	3
							13.6	+ .85	2			12.9	+ .73	2
							15.3	+ .58	1			14.5	+ .70	1
					280 (2040-46)	18.5	3.7	+2.07	5	400 (2036-43)	16.0	3.2	+1.65	5
							7.4	+1.78	4			6.4	+1.65	4
							11.1	+1.02	3			9.6	+ .94	3
							14.8	+ .56	2			12.9	+ .37	2
							16.6	+ .42	1			14.5	+ .31	1

[a] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence
Discharge Measurement 8					Discharge Measurement 8					Discharge Measurement 8				
20 (2058)	1.0	.6	+ .13	1	130 (2058-2103)	16.5	3.3	+1.74	5	310 (2100-06)	17.5	3.5	+2.04	5
							6.6	+1.98	4			7.0	+1.65	4
							9.9	+1.04	3			10.5	+1.03	3
42 (2100-05)	11.3	1.1	+1.40	5			13.2	+ .72	2			14.0	+ .61	2
		2.3	+1.40	4			14.8	+ .65	1			15.7	+ .55	1
		4.6	+1.12	3										
		6.8	+ .85	2	160 (2104-09)	17.0	3.4	+1.98	5	340 (2107-13)	17.9	3.6	+2.00	5
		9.0	+ .60	1			6.8	+1.89	4			7.2	+1.65	4
							10.2	+1.07	3			10.7	+ .98	3
60 (2107-12)	14.3	1.4	+1.40	5			13.6	+ .77	2			14.3	+ .56	2
		2.9	+1.19	4			15.3	+ .63	1			16.1	+ .40	1
		5.8	+1.55	3										
		8.6	+1.07	2	190 (2111-17)	17.0	3.4	+1.98	5	370 (2115-21)	16.1	3.2	+1.79	5
		11.4	+ .57	1			6.8	+2.07	4			6.4	+1.63	4
							10.2	+1.16	3			9.6	+1.25	3
70 (2114-19)	14.3	1.4	+1.45	5			13.6	+ .77	2			12.9	+ .53	2
		2.9	+1.24	4			15.3	+ .57	1			14.5	+ .37	1
		5.8	+1.36	3										
		8.6	+1.09	2	220 (2118-24)	17.5	3.5	+2.17	5	380 (2122-28)	16.4	3.3	+2.04	5
		11.4	+ .69	1			7.0	+1.89	4			6.6	+1.65	4
							10.5	+1.09	3			9.8	+1.05	3
100 (2122-26)	15.5	1.6	+1.63	5			14.0	+ .77	2			13.1	+ .61	2
		3.1	+1.40	4			15.8	+ .52	1			14.7	+ .38	1
		6.2	+1.82	3										
		9.3	+1.19	2	250 (2126-31)	17.0	3.4	+2.26	5	400 (2129-34)	16.0	3.2	+1.47	5
		12.4	+ .71	1			6.8	+1.98	4			6.4	+1.38	4
							10.2	+1.21	3			9.6	+ .92	3
							13.6	+ .74	2			12.9	+ .38	2
							15.3	+ .46	1			14.5	+ .30	1
					280 (2133-40)	18.5	3.7	+2.36	5	420 (2135-41)	10.5	2.1	+1.11	5
							7.4	+1.56	4			4.2	+1.15	4
							11.1	+ .95	3			6.3	+ .83	3
							14.8	+ .48	2			8.4	+ .40	2
							16.6	+ .41	1			9.5	+ .38	1

[a] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence
(Time in vertical in hours)					(Time in vertical in hours)					(Time in vertical in hours)				
Discharge Measurement 9					Discharge Measurement 9					Discharge Measurement 9				
20 (2106)	1.0	.6	+ .13	1	130 (2206-12)	16.5	3.3	+1.85	5	310 (2210-15)	17.5	3.5	+2.09	5
							6.6	+1.74	4			7.0	+1.61	4
							9.9	+ .98	3			10.5	+1.01	3
							13.2	+ .51	2			14.0	+ .56	2
							14.8	+ .42	1			15.8	+ .33	1
42 (2207-17)	11.2	1.1	+1.19	5	160 (2213-19)	17.0	3.4	+1.98	5	340 (2216-22)	17.8	3.6	+2.38	5
		2.2	+1.07	4			6.8	+1.85	4			7.1	+1.65	4
		4.5	+ .96	3			10.2	+1.14	3			10.7	+1.11	3
		6.7	+ .62	2			13.6	+ .62	2			14.2	+ .51	2
		9.0	+ .38	1			15.3	+ .46	1			16.0	+ .38	1
60 (2219-20)	14.0	8.4	+ .54	2	190 (2220-25)	17.0	3.4	+1.81	5	370 (2223-25)	16.1	9.6	+ .96	3
		11.2	+ .42	1			6.8	+1.63	4			12.9	+ .56	2
							10.2	+ .98	3			14.5	+ .31	1
							13.6	+ .64	2					
							15.3	+ .48	1					
(barge passed measuring section)					(barge passed measuring section)					(barge passed measuring section)				
60 (2234-37)	14.0	1.4	+1.49	5	220 (2244-51)	17.5	1.0	+1.56	6	370 (2235-37)	16.1	1.0	+1.61	6
		2.8	+1.49	4			3.5	+1.68	5			3.2	+1.91	5
		5.6	+ .71	3			7.0	+1.07	4			6.4	+1.65	4
70 (2239-45)	14.5	1.0	+1.27	6			10.5	+ .90	3					
		1.4	+1.00	5			14.0	+ .28	2	380 (2238-45)	16.1	3.2	+1.32	5
		2.9	+ .88	4			15.8	+ .24	1			6.4	+ .89	4
		5.8	+ .49	3								9.6	+ .71	3
		8.7	+ .30	2	250 (2253-2300)	17.0	3.4	+1.60	5			12.9	+ .28	2
		11.6	+ .21	1			6.8	+1.09	4			14.5	+ .25	1
100 (2250-56)	16.5	1.6	+1.04	5			10.2	+ .70	3					
		3.3	+1.17	4			13.6	+ .31	2	400 (2250-55)	16.0	3.2	+1.05	5
		6.6	+ .64	3			15.3	+ .24	1			6.4	+1.03	4
		9.9	+ .33	2								9.6	+ .83	3
		13.2	+ .19	1	280 (2302-08)	18.5	3.7	+1.63	5			12.9	+ .24	2
							7.4	+ .83	4			14.5	+ .23	1
							11.1	+ .63	3					
							14.8	+ .26	2					
							16.6	+ .26	1					

[a] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station	Initial depth below water surface in feet (Time in vertical in hours)	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station	Initial depth below water surface in feet (Time in vertical in hours)	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station	Initial depth below water surface in feet (Time in vertical in hours)	Depth of observation in feet	Velocity (fps) [a]	Observation sequence
Discharge Measurement 9--Continued					Discharge Measurement 9--Continued					Discharge Measurement 9--Continued				
										420 (2256-2302)	10.8	2.2	+ .98	5
												4.3	+1.05	4
												6.5	+1.11	3
												8.6	+ .53	2
												9.7	+ .24	1
Discharge Measurement 10					Discharge Measurement 10					Discharge Measurement 10				
20 (2345)	1.0	.6	0	1	130 (2346-51)	16.5	3.3	+1.24	5	310 (2345-49)	17.8	3.6	+1.54	5
							6.6	+ .92	4			7.1	+1.11	4
							9.9	+ .60	3			10.7	+ .47	3
42 (2352-2400)	12.0	1.0	+ .52	6			13.2	+ .55	2			14.2	+ .47	2
		2.4	+ .43	5			14.8	+ .33	1			16.0	+ .34	1
		4.8	+ .29	4										
		7.2	+ .24	3	160 (2353-58)	17.0	3.4	+1.45	5	340 (2350-58)	18.2	3.6	+1.28	5
		7.6	0	2			6.8	+ .92	4			7.3	+ .98	4
		10.8	0	1			10.2	+ .59	3			10.9	+ .47	3
							13.6	+ .34	2			14.6	+ .26	2
60 (0004-09)	14.4	3.2	+ .84	5			15.3	+ .38	1			16.4	+ .23	1
		6.0	+ .56	4										
		8.8	0	3	190 (0010-16)	17.5	3.5	+1.39	5	370 (0005-11)	16.1	1.0	+1.41	6
		11.6	0	2			7.0	+1.12	4			3.2	+1.65	5
		13.0	0	1			10.5	+ .63	3			6.4	+1.31	4
							14.0	+ .26	2			9.6	+ .70	3
70 (0012-17)	14.5	1.0	+1.24	6			15.8	+ .45	1			12.9	+ .47	2
		3.3	+ .98	5								14.5	+ .37	1
		6.1	+ .84	4	220 (0018-25)	15.4	1.0	+1.33	6					
		8.9	+ .60	3			3.5	+1.42	5	380 (0012-17)	16.2	3.2	+1.34	5
		11.7	0	2			7.0	+1.09	4			6.4	+1.01	4
		15.1	0	1			10.5	+ .54	3			9.6	+ .51	3
							14.0	+ .31	2			12.9	+ .26	2
100 (0020-26)	16.0	3.2	+1.07	5			15.8	+ .31	1			14.5	+ .21	1
		6.4	+1.02	4										
		9.6	+ .61	3										
		12.0	+ .35	2										
		14.4	+ .32	1										

[a] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence
Discharge Measurement 10--Continued					Discharge Measurement 10--Continued					Discharge Measurement 10--Continued				
					250 (0026-30)	17.5	3.5	+1.60	5	400 (0019-24)	16.0	3.2	+1.23	5
							7.0	1.09	4			6.4	+1.05	4
							10.5	+ .51	3			9.6	+ .33	3
							14.0	+ .34	2			12.9	+ .14	2
							15.8	+ .27	1			14.5	+ .13	1
					280 (0032-38)	18.5	3.7	+1.37	5	420 (0026-31)	10.9	2.2	+ .92	5
							7.4	+1.02	4			4.4	+ .92	4
							11.1	+ .46	3			6.5	+ .70	3
							14.8	+ .45	2			8.7	+ .26	2
							16.6	+ .27	1			9.8	+ .28	1
Discharge Measurement 11					Discharge Measurement 11					Discharge Measurement 11				
20 (0103)	1.3	.6	0	-	130 (0103-08)	17.0	3.4	+ .88	5	310 (0100-06)	17.8	3.6	+1.11	5
							6.8	+1.02	4			7.1	+ .94	4
							10.2	+ .63	3			10.7	+ .56	3
42 (0105-13)	11.8	1.0	+ .38	6			13.6	+ .23	2			14.2	+ .39	2
		2.2	+ .15	5			15.3	+ .31	1			16.0	+ .28	1
		4.6	0	4										
		7.0	+ .29	3	160 (0110-15)	17.0	3.4	+ .92	5	340 (0107-12)	18.3	3.6	+1.11	5
		9.4	0	2			6.8	+1.16	4			7.3	+ .96	4
		10.7	± .08	1			10.2	+ .95	3			10.9	+ .55	3
							13.6	+ .42	2			14.6	+ .38	2
60 (0115-20)	14.5	3.3	+ .29	5			15.3	+ .34	1			16.4	+ .28	1
		6.1	+ .60	4										
		8.9	+ .26	3	190 (0117-22)	17.5	3.5	+ .88	5	370 (0113-20)	16.5	1.0	+ .74	6
		11.7	0	2			7.0	+1.14	4			3.3	+ .79	5
		13.1	0	1			10.5	+ .82	3			6.6	+1.03	4
							14.0	+ .39	2			9.9	+ .56	3
70 (0121-27)	14.5	1.0	+ .96	6			15.8	+ .36	1			13.2	+ .37	2
		3.3	+ .62	5								14.8	+ .38	1
		6.1	+ .84	4										
		8.9	+ .57	3										
		11.7	+ .22	2										
		13.1	+ .14	1										

a/ + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence
Discharge Measurement 11--Continued					Discharge Measurement 11--Continued					Discharge Measurement 11--Continued				
100 (0129-34)	16.5	3.7	+ .90	5	220 (0128-35)	18.0	1.0	+1.19	6	380 (0121-27)	16.4	3.4	+ .81	5
		6.9	+1.02	4			3.6	+1.19	5			6.6	+1.08	4
		10.1	+ .60	3			7.2	+1.09	4			9.9	+ .56	3
		13.3	+ .23	2			10.8	+ .60	3			13.2	+ .36	2
		14.9	+ .23	1			14.4	+ .34	2			14.8	+ .27	1
							16.2	+ .30	1					
					250 (0136-43)	17.5	3.5	+1.24	5	400 (0128-34)	16.1	3.2	+ .50	5
							7.0	+ .93	4			6.4	+ .96	4
							10.5	+ .43	3			9.6	+ .53	3
							14.0	+ .14	2			12.9	+ .33	2
							15.8	+ .12	1			14.5	+ .26	1
					280 (0144-50)	19.0	3.8	+1.07	5	420 (0136-42)	11.0	2.2	+ .53	5
							7.6	+ .98	4			4.4	+ .43	4
							11.4	+ .48	3			6.6	+ .39	3
							15.2	+ .30	2			8.8	+ .28	2
							17.1	+ .23	1			9.9	+ .15	1
Discharge Measurement 12					Discharge Measurement 12					Discharge Measurement 12				
20 (0214)	1.0	.6	+ .28	1	130 (0215-20)	17.0	3.4	+ .88	5	310 (0210-16)	17.8	3.6	+1.41	5
							6.8	+1.19	4			7.1	+1.25	4
							10.2	+ .62	3			10.7	+ .89	3
							13.6	+ .43	2			14.2	+ .44	2
							15.3	+ .38	1			16.0	+ .26	1
42 (0216-24)	11.8	1.0	+ .84	6	160 (0222-27)	17.0	3.4	+1.09	5	340 (0218-25)	18.2	3.6	+1.50	5
		2.2	+ .63	5			6.8	+1.30	4			7.3	+1.25	4
		4.6	+ .50	4			10.2	+ .86	3			10.9	+ .94	3
		7.0	+ .60	3			13.6	+ .54	2			14.6	+ .45	2
		9.4	+ .50	2			15.3	+ .48	1			16.4	+ .24	1
		10.6	+ .36	1										
60 (0225-30)	14.5	3.3	+ .57	5										
		6.1	+ .79	4										
		8.9	+ .67	3										
		11.7	+ .43	2										
		13.1	0	1										

a/ + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence
Discharge Measurement 12--Continued					Discharge Measurement 12--Continued					Discharge Measurement 12--Continued				
70 (0232-37)	15.0	1.0	+1.17	6	190 (0228-33)	17.0	3.4	+1.37	5	370 (0228-34)	16.5	1.0	+ .82	6
		3.0	+ .94	5			6.8	+1.37	4			3.3	+1.44	5
		6.0	+1.04	4			10.2	+ .77	3			6.6	+1.08	4
		9.0	+ .63	3			13.6	+ .46	2			9.9	+ .90	3
		12.0	0	2			15.3	+ .39	1			13.2	+ .63	2
		13.5	0	1								14.9	+ .33	1
100 (0240-45)	16.5	3.7	+1.12	5	220 (0239-46)	18.0	1.0	+1.09	6	380 (0235-40)	16.4	3.3	+1.31	5
		6.9	+1.36	4			3.6	+1.37	5			6.6	+1.16	4
		10.1	+ .84	3			7.2	+1.56	4			9.9	+ .96	3
		13.3	+ .65	2			10.8	+ .95	3			13.2	+ .67	2
		14.9	+ .54	1			14.4	+ .64	2			14.9	+ .43	1
							16.2	+ .39	1					
					250 (0247-52)	18.0	3.6	+1.63	5	400 (0241-51)	16.0	3.2	+1.28	5
							7.2	+1.37	4			6.4	+1.04	4
							10.8	+1.00	3			9.6	+1.05	3
							14.4	+ .70	2			12.9	+ .62	2
							16.2	+ .37	1			14.5	+ .49	1
					280 (0253-0301)	18.5	3.7	+1.63	5	420 (0252-58)	10.8	2.2	+ .62	5
							7.4	+1.30	4			4.3	+ .70	4
							11.1	+ .83	3			6.5	0	3
							14.8	0	2			8.6	± .28	2
							16.6	0	1			9.7	± .24	1
Discharge Measurement 13					Discharge Measurement 13					Discharge Measurement 13				
20 (0328)	1.0	.6	+ .29	1	130 (0332-36)	16.5	3.3	+1.56	5	210 (0327-33)	18.0	3.6	+1.76	5
							6.6	+1.52	4			7.3	+1.34	4
42 (0329-37)	11.5	1.0	+ .98	6			9.9	+1.02	3			11.0	+ .82	3
		2.7	+ .98	5			13.2	+ .74	2			14.4	+ .56	2
		4.9	+ .98	4			14.8	+ .54	1			16.2	+ .46	1
		7.1	+ .72	3										
		9.3	+ .67	2										
		10.4	+ .44	1										

a/ + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence
Discharge Measurement 13--Continued					Discharge Measurement 13--Continued					Discharge Measurement 13--Continued				
60 (0339-44)	14.3	3.1	+1.36	5	160 (0337-42)	17.0	3.4	+1.93	5	340 (0334-40)	18.2	3.6	+2.00	5
		5.9	+1.24	4			6.8	+1.63	4			7.3	+1.38	4
		8.7	+ .35	3			10.2	+1.19	3			10.9	+1.05	3
		11.5	+ .43	2			13.6	+ .92	2			14.6	+ .85	2
		12.9	0	1			15.3	+ .64	1			16.4	+ .71	1
70 (0345-48)	14.5	3.3	+1.75	5	190 (0344-48)	17.0	3.4	+2.02	5	370 (0341-47)	16.0	1.0	+1.25	6
		6.1	+1.40	4			6.8	+1.37	4			3.2	+1.57	5
		8.9	+ .96	3			10.2	+1.27	3			6.4	+1.57	4
		11.7	+ .81	2			13.6	+1.04	2			9.6	+1.28	3
		13.1	+ .65	1			15.3	+ .95	1			12.9	+ .96	2
												14.5	+ .87	1
100 (0350-55)	16.5	3.7	+1.85	5	220 (0349-55)	17.5	1.0	+1.81	6	380 (0348-54)	16.1	3.2	+1.65	5
		6.9	+1.59	4			3.5	+2.22	5			6.4	+1.44	4
		10.1	+1.09	3			7.0	+1.56	4			7.6	+1.08	3
		13.3	+ .85	2			10.5	+1.19	3			12.9	+1.03	2
		14.9	+ .54	1			14.4	+ .95	2			14.5	+ .67	1
							15.8	+ .75	1					
					250 (0356-0400)	17.0	3.4	+2.17	5	400 (0356-0401)	15.9	3.2	+1.65	5
							6.8	+1.81	4			6.4	+1.50	4
							10.2	+1.37	3			9.6	+1.11	3
							13.6	+1.00	2			12.7	+ .87	2
							15.3	+ .90	1			14.3	+ .68	1
					280 (0402-06)	18.5	3.7	+2.02	5	420 (0402-07)	10.0	2.0	+ .92	5
							7.4	+1.37	4			4.0	+1.01	4
							11.1	+1.07	3			6.0	+ .68	3
							14.8	+ .90	2			8.0	+ .48	2
							16.6	+ .81	1			9.0	+ .45	1

[a] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence
Discharge Measurement 14					Discharge Measurement 14					Discharge Measurement 14				
20	0.4	-	0	-	160	16.7	3.4	+2.07	5	310	17.0	3.4	+2.09	5
					(0441-48)		6.8	+1.85	4	(0438-45)		6.8	+1.79	4
42	11.0	1.0	+1.52	1			10.2	+1.45	3			10.2	+1.31	3
(0442-51)		2.2	+1.24	2			13.6	+1.21	2			13.5	+1.13	1
		4.4	+1.19	3			15.0	+1.07	1			15.2	+ .87	2
		6.6	+ .96	4										
		8.8	+ .72	5	190	16.9	3.4	+2.22	5	340	17.7	3.5	+1.87	5
		9.9	+ .61	6	(0450-57)		6.8	+1.63	4	(0447-52)		7.0	+1.61	4
							10.2	+1.45	3			10.5	+1.50	3
60	14.3	2.9	+1.24	1			13.6	+1.16	2			14.1	+1.03	1
(0454-0500)		5.8	+1.07	2			15.2	+1.02	1			15.9	+1.01	2
		8.7	+ .81	3										
		11.6	+ .82	4	220	17.4	1.0	+2.02	6	370	16.3	1.0	+1.34	6
		13.0	+ .67	5	(0504-11)		3.4	+2.41	5	(0453-58)		3.3	+1.76	5
							6.8	+1.68	4			6.5	+1.61	4
70	14.6	1.0	+1.67	1			10.2	+1.37	3			9.8	+1.11	3
(0502-10)		2.9	+1.30	2			13.6	+1.24	2			13.0	+ .96	1
		5.8	+1.17	3			15.7	+ .93	1			14.6	+ .87	2
		8.7	+ .88	4										
		11.6	+ .98	5	250	16.6	3.4	+2.64	5	380	15.9	3.2	+1.95	5
		13.1	+ .74	6	(0513-21)		6.8	+1.74	4	(0459-0506)		6.4	+1.72	4
							10.2	+1.37	3			9.6	+1.11	3
100	16.0	3.2	+1.78	1			13.6	+1.12	2			12.7	+ .87	1
(0512-18)		6.4	+1.67	2			14.9	+ .83	1			14.3	+ .76	2
		9.6	+1.42	3										
		12.8	+1.24	4	280	18.2	3.6	+2.64	5	400	15.4	3.1	+2.00	5
		14.4	+ .98	5	(0523-28)		7.2	+1.52	4	(0508-13)		6.2	+1.44	4
							10.2	+1.30	3			9.3	+1.11	3
130	16.0	3.2	+2.17	1			14.4	+1.02	2			12.3	+ .83	1
(0522-27)		6.4	+1.78	2			16.4	+ .69	1			13.8	+ .81	2
		9.6	+1.71	3										
		12.8	+1.36	4						420	10.0	2.0	+1.47	5
		14.4	+1.27	5						(0514-18)		4.0	+1.41	4
												6.0	+ .96	3
												8.0	+ .42	1
												9.0	+ .38	2

a/ + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence
Discharge Measurement 15					Discharge Measurement 15					Discharge Measurement 15				
20	0	-	-	-	160 (0543-48)	16.8	3.4	+2.07	5	310 (0535-45)	16.9	3.4	+2.86	5
							6.8	+1.81	4			6.8	+1.91	4
42 (0544-50)	11.0	1.0	+1.82	1			10.2	+1.49	3			10.2	+1.47	3
		2.2	+1.49	2			13.6	+1.21	2			13.4	+1.20	1
		4.4	+1.45	3			15.1	+ .93	1			15.1	+1.11	2
		6.6	+ .82	4										
		8.8	+ .61	5	190 (0549-55)	16.7	3.4	+2.31	5	340 (0546-52)	17.2	3.4	+2.67	5
		9.9	+ .50	6			6.8	+1.81	4			6.9	+2.09	4
							10.2	+1.52	3			10.3	+1.47	3
60 (0552-0601)	14.0	2.8	+1.63	1			13.6	+1.12	2			13.8	+1.16	1
		5.6	+1.49	2			15.0	+ .98	1			15.5	+1.01	2
		8.4	+ .81	3										
		11.2	+ .69	4	220 (0557-0603)	17.3	1.0	+2.58	6	370 (0553-59)	16.0	1.0	+1.87	6
		12.6	+ .51	5			3.4	+2.71	5			3.2	+2.14	5
							6.8	+1.68	4			6.4	+2.00	4
70 (0603-11)	14.2	1.0	+1.89	1			10.2	+1.21	3			9.6	+1.34	3
		2.8	+1.63	2			13.6	+ .93	2			12.7	+ .96	1
		5.6	+1.45	3			15.6	+ .82	1			14.3	+ .89	2
		8.4	+ .92	4										
		11.2	+ .81	5	250 (0604-10)	16.4	3.2	+2.83	5	380 (0600-05)	15.7	3.1	+2.14	5
		12.6	+ .50	6			6.4	+1.89	4			6.2	+1.91	4
							9.6	+1.21	3			9.3	+1.44	3
100 (0613-21)	16.0	3.2	+1.93	1			12.8	+ .95	2			12.6	+ .78	1
		6.4	+1.45	2			14.8	+ .59	1			14.2	+ .66	2
		9.6	+ .87	3										
		12.8	+ .77	4	280 (0611-16)	18.0	3.6	+2.64	5	400 (0606-12)	14.8	3.0	+1.44	5
		14.4	+ .45	5			7.2	+1.45	4			5.9	+1.91	4
							10.8	+ .98	3			8.9	+1.28	3
130 (0622-30)	15.7	3.1	+2.02	1			14.4	+ .68	2			11.8	+1.05	1
		6.2	+1.85	2			16.2	+ .56	1			13.3	+ .94	2
		9.3	+ .82	3										
		12.4	+ .77	4						420 (0613-17)	10.0	2.0	+1.01	5
		14.0	+ .71	5								4.0	+1.05	4
												6.0	+ .67	3
												8.0	+ .37	1
												9.0	+ .30	2

[a] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence
Discharge Measurement 16					Discharge Measurement 16					Discharge Measurement 16				
20	4	-	-	-	160	16.5	3.3	+1.98	5	310	17.0	3.4	+2.00	5
42 (0651-0700)	10.7	1.0	+1.33	1	(0654-59)		6.6	+1.71	4	(0650-56)		6.8	+1.57	4
		2.1	+1.33	2			9.9	+ .98	3			10.2	+ .92	3
		4.2	+ .98	3			13.2	+ .48	2			13.6	+ .52	1
		6.4	+ .94	4			14.9	+ .41	1			15.3	+ .28	2
		8.5	+ .28	5	190	16.7	3.4	+2.12	5	340	17.4	3.5	+1.69	5
		9.6	+ .23	6	(0725-28)		6.8	+1.74	4	(0658-0704)		7.0	+1.38	4
60 (0702-11)	14.3	2.9	+1.02	1			10.2	+ .95	3			10.5	+ .76	3
		5.8	+ .84	2			13.6	+ .46	2			13.9	+ .29	1
		8.7	+ .48	3			15.0	+ .38	1			15.6	+ .33	2
		11.4	+ .46	4	220	17.1	1.0	+2.17	6	370	15.8	1.0	+1.44	6
		12.8	+ .26	5	(0730-33)		3.4	+2.12	5	(0706-17)		3.2	+1.38	5
70 (0712-17)	14.0	1.0	+1.75	1			6.8	+1.63	4			6.3	+1.38	4
		2.8	+1.14	2			10.2	+ .85	3			9.5	+ .84	3
		5.6	+1.30	3			13.6	+ .52	2			12.5	+ .76	1
		8.4	+ .52	4			15.4	+ .38	1			14.1	+ .59	2
		11.2	+ .22	5	250	16.4	3.2	+2.26	5	380	15.5	3.1	+1.54	5
		12.6	+ .25	6	(0734-38)		6.4	+1.52	4	(0718-23)		6.2	+ .96	4
100 (0720-26)	16.0	3.2	+1.40	1			9.6	+ .88	3			9.3	+ .70	3
		6.4	+1.27	2			12.8	+ .51	2			12.4	+ .37	1
		9.6	+ .62	3			14.8	+ .42	1			14.0	+ .24	2
		12.8	+ .37	4	280	17.9	3.6	+2.26	5	400	15.5	3.1	+1.34	5
		14.4	+ .32	5	(0739-44)		7.2	+1.49	4	(0725-32)		6.2	+1.04	4
130 (0728-34)	16.0	3.2	+1.45	1			10.8	+ .79	3			9.3	+ .56	3
		6.4	+1.71	2			14.4	+ .46	2			12.5	+ .26	1
		9.6	+ .82	3			16.1	+ .38	1			14.0	+ .22	2
		12.8	+ .62	4						420 (0733-39)	10.1	2.0	+1.17	5
		14.4	+ .50	5								4.0	+1.20	4
												6.1	+ .85	3
												8.1	+ .47	1
												9.1	+ .34	2

a/ + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence
Discharge Measurement 17					Discharge Measurement 17					Discharge Measurement 17				
42 (0805-15)	10.8	1.0	+1.49	1	160 (0806-12)	16.0	3.2	+2.02	5	310 (0814-18)	16.9	3.4	+1.83	5
		2.2	+1.19	2			6.4	+1.81	4			6.8	+1.52	4
		4.3	+1.17	3			9.6	+1.16	3			10.2	+ .67	3
		6.5	+ .94	4			12.8	+ .58	2			13.5	+ .39	1
		8.6	+ .62	5			14.4	+ .39	1			15.2	+ .38	2
		9.7	+ .33	6										
60 (0817-21)	13.6	2.7	+1.12	1	190 (0814-19)	15.8	3.2	+2.07	5	340 (0820-25)	17.3	3.5	+1.52	5
		5.4	+1.49	2			6.4	+1.56	4			7.0	+1.18	4
		8.1	+ .81	3			9.6	+ .82	3			10.5	+ .37	3
		10.8	+ .53	4			12.8	+ .41	2			13.8	+ .36	1
		12.2	+ .36	5			14.2	+ .37	1			15.5	+ .27	2
70 (0823-30)	14.2	1.0	+1.37	1	220 (0820-26)	16.4	1.0	+1.93	6	360 (0826-34)	17.1	1.0	+1.57	6
		2.8	+ .94	2			3.3	+2.02	5			3.4	+1.28	5
		5.7	+1.12	3			6.6	+1.30	4			6.8	+1.11	4
		8.5	+ .90	4			9.9	+ .63	3			10.2	+ .49	3
		11.4	+ .44	5			13.2	+ .28	2			13.7	+ .34	1
		12.7	+ .40	6			14.8	+ .21	1			15.4	+ .22	2
100 (0833-40)	16.0	3.2	+1.27	1	250 (0829-33)	15.4	3.1	+1.98	5	370 (0836-41)	15.5	1.0	+1.42	6
		6.4	+1.52	2			6.2	+1.60	4			3.1	+1.50	5
		9.6	+ .72	3			9.3	+ .82	3			6.2	+1.34	4
		12.8	+ .40	4			12.4	+ .40	2			9.3	+ .62	3
		14.4	+ .28	5			13.9	+ .37	1			12.5	+ .25	1
												14.0	+ .20	2
130 (0841-48)	16.0	3.2	+1.98	1	280 (0835-40)	17.4	3.5	+1.89	5	380 (0842-44)	15.5	3.1	+1.38	5
		6.4	+1.67	2			7.0	+1.16	4			6.2	+1.38	4
		9.6	+1.07	3			10.5	+ .56	3			9.3	+ .91	3
		12.8	+ .68	4			14.0	+ .28	2			12.5	+ .47	1
		14.4	+ .57	5			15.7	+ .26	1			14.0	+ .31	2
										400 (0845-49)	15.0	3.0	+1.11	5
												6.0	+1.32	4
												9.0	+ .79	3
												12.0	+ .34	1
												13.5	+ .29	2

a/ + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence
Discharge Measurement 17--Continued					Discharge Measurement 17--Continued					Discharge Measurement 17--Continued				
										420 (0850-53)	9.6	1.9	+1.38	5
												3.8	+1.11	4
												5.7	+ .85	3
												7.8	+ .53	1
												8.8	+ .29	2
Discharge Measurement 18					Discharge Measurement 18					Discharge Measurement 18				
42 (0930-37)	10.8	1.0	+1.02	1	160 (0937-52)	15.7	3.2	+1.85	5	310 (0927-33)	16.1	3.2	+1.72	5
		2.2	+ .87	2			6.4	+2.02	4			6.4	+1.61	4
		4.3	+ .61	3			9.6	+ .72	3			10.7	+ .55	3
		6.5	+ .69	4			12.8	+ .48	2			13.3	+ .43	1
		8.6	+ .57	5			14.1	+ .38	1			14.9	+ .44	2
		9.7	+ .37	6										
60 (0938-44)	14.0	2.8	+ .74	1	190 (0955-58)	15.5	3.1	+1.89	5	340 (0934-42)	17.5	3.5	+1.41	5
		5.6	+1.17	2			6.2	+1.85	4			7.0	+1.03	4
		8.4	+1.02	3			9.3	+1.00	3			10.5	+ .49	3
		11.2	+ .34	4			12.4	+ .56	2			14.0	+ .47	1
		12.6	+ .28	5			13.9	+ .50	1			15.8	+ .21	2
70 (0946-52)	14.3	1.0	+1.22	1	220 (1000-04)	16.3	1.0	+1.89	6	370 (0943-48)	15.9	1.0	+1.69	6
		2.9	+1.04	2			3.3	+2.17	5			3.2	+1.79	5
		5.8	+1.63	3			6.6	+1.52	4			6.4	+1.61	4
		8.6	+1.17	4			9.9	+ .62	3			9.5	+ .67	3
		11.4	+ .66	5			13.0	+ .50	2			12.6	+ .40	1
		12.8	+ .44	6			14.7	+ .36	1			14.2	+ .44	2
100 (0955-1001)	16.0	3.2	+1.29	1	250 (1005-10)	14.7	3.0	+1.94	5	380 (0950-55)	15.1	3.0	+1.17	5
		6.4	+1.63	2			6.0	+1.56	4			6.0	+1.83	4
		9.6	+1.02	3			9.0	+1.09	3			9.1	+1.23	3
		12.8	+ .53	4			12.0	+ .56	2			12.2	+ .73	1
		14.4	+ .33	5			13.2	+ .48	1			13.7	+ .49	2

a/ + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence
Discharge Measurement 18--Continued					Discharge Measurement 18--Continued					Discharge Measurement 18--Continued				
130 (1002-10)	16.0	3.2	+1.55	1	280 (1010-15)	17.1	3.4	+1.89	5	400 (0957-1004)	14.9	3.0	+1.17	5
		6.4	+1.75	2			6.8	+1.21	4			6.0	+1.31	4
		9.6	+1.04	3			10.2	+ .71	3			8.9	+ .81	3
		12.8	+ .68	4			13.6	+ .33	2			10.4	+ .74	6
		14.4	+ .44	5			15.4	+ .28	1			11.9	+ .44	1
												13.0	+ .59	7
												13.4	+ .50	2
										420 (1005-10)	9.8	1.9	+ .85	5
												3.8	+ .83	4
												5.7	+ .49	3
												7.8	+ .47	1
												8.8	+ .28	2
Discharge Measurement 19					Discharge Measurement 19					Discharge Measurement 19				
42 (1107-15)	11.2	1.0	+ .63	1	160 (1108-13)	16.1	3.2	+1.30	5	310 (1105-13)	17.0	3.4	+ .89	5
		2.2	+ .47	2			6.4	+ .85	4			6.8	+ .67	4
		4.5	+ .40	3			9.6	± .40	3			10.2	± .36	3
		6.7	± .11	4			12.8	- .33	2			13.5	- .43	1
		9.0	± .21	5			14.4	- .25	1			15.2	- .33	2
		10.1	± .16	6										
60 (1116-24)	14.2	2.8	+ .79	1	190 (1115-20)	16.4	3.3	+1.45	5	340 (1114-20)	17.7	3.5	+ .94	5
		5.7	+ .77	2			6.6	+1.02	4			7.0	+ .74	4
		8.8	± .25	3			9.9	± .51	3			10.6	± .35	3
		11.3	± .25	4			13.2	± .31	2			14.2	- .26	1
		12.8	- .22	5			14.8	- .38	1			16.0	- .20	2
70 (1125-29)	14.5	1.0	+ .42	1	220 (1123-28)	16.8	1.0	+1.27	6	370 (1121-30)	15.8	1.0	+ .57	6
		2.9	+ .96	2			3.4	+1.14	5			3.2	+ .57	5
		5.8	± .54	3			6.8	+ .98	4			6.4	± .38	4
		8.7	± .30	4			10.2	± .56	3			9.5	± .43	3
		11.6	- .27	5			13.6	± .28	2			12.7	- .28	1
		13.1	- .23	6			15.1	- .25	1			14.3	- .25	2

[a] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence
Discharge Measurement 19--Continued					Discharge Measurement 19--Continued					Discharge Measurement 19--Continued				
100 (1130-40)	16.5	3.3	+ .81	1	250 (1130-34)	16.5	3.3	+ .72	5	380 (1133-38)	16.0	3.2	+ .51	5
		6.6	± .24	2			6.6	± .42	4			6.4	+ .33	4
		9.9	± .29	3			9.9	± .36	3			9.6	± .33	3
		13.2	- .40	4			13.2	- .32	2			12.9	- .43	1
		14.9	- .32	5			14.9	- .34	1			14.5	- .40	2
130 (1141-47)	16.5	3.3	+ .35	1	280 (1137-44)	17.9	3.6	+ .32	5	400 (1139-42)	15.7	3.1	+ .33	5
		6.6	+ .44	2			7.2	± .62	4			6.2	+ .26	4
		9.9	± .17	3			10.8	± .20	3			9.4	± .22	3
		13.2	± .24	4			14.4	± .34	2			12.5	- .30	1
		14.9	- .30	5			16.1	- .48	1			14.1	- .20	2
										420 (1143-48)	10.2	2.0	+ .15	5
												4.0	+ .29	4
												6.1	+ .23	3
												8.2	± .18	1
												9.2	± .16	2
										430	.3	-	0	-
Discharge Measurement 20					Discharge Measurement 20					Discharge Measurement 20				
20 (1220-23)	1.5	.9	+ .14	1	160 (1223-31)	16.6	3.4	+ .62	5	310 (1222-28)	17.4	3.5	+ .52	5
							6.8	+ .30	4			7.0	+ .41	4
							10.2	± .09	3			10.4	± .18	3
42 (1226-40)	11.8	1.0	+ .39	1			13.6	- .26	2			13.8	- .28	1
		2.4	+ .22	2			14.9	- .08	1			15.5	- .31	2
		4.8	+ .32	3										
		7.1	± .15	4	190 (1232-37)	16.8	3.4	+ .15	5	340 (1229-35)	17.9	3.6	+ .33	5
		9.4	- .25	5			6.8	± .28	4			7.2	± .16	4
		10.6	- .44	6			10.2	± .32	3			10.7	± .29	3
60 (1241-50)	14.7	2.9	+ .20	1			13.6	- .58	2			14.4	- .38	1
		5.9	± .11	2			15.1	- .40	1			16.2	- .34	2
		8.8	± .24	3										
		11.8	- .57	4										
		13.3	- .41	5										

[a] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence
Discharge Measurement 20--Continued					Discharge Measurement 20--Continued					Discharge Measurement 20--Continued				
70 (1252-58)	15.0	1.0	+ .16	1	220 (1239-46)	17.6	1.0	+ .51	6	370 (1237-45)	16.6	1.0	+ .48	6
		3.0	+ .11	2			3.6	+ .20	5			3.5	+ .28	5
		6.0	± .14	3			7.2	± .16	4			6.0	± .20	8
		9.0	± .14	4			10.8	± .44	3			6.5	± .14	9
		12.0	- .18	5			14.1	- .73	2			7.0	± .18	4
		13.5	- .13	6			15.8	- .70	1			8.0	± .22	7
												10.6	- .46	3
100 (1301-12)	17.0	3.4	± .18	1	250 (1248-55)	16.8	3.4	+ .29	5			13.4	- .68	1
		6.8	+ .50	2			6.8	± .28	4			15.1	- .49	2
		10.2	- .55	3			10.2	± .22	3					
		13.6	- .29	4			13.6	- .54	2	380 (1247-52)	16.1	3.2	+ .13	5
		15.3	- .18	5			15.1	- .51	1			6.4	± .10	4
												9.7	± .20	3
130 (1314-20)	17.0	3.4	+ .31	1	280 (1256-1303)	18.5	3.7	± .17	5			12.8	- .56	1
		6.8	± .30	2			7.4	- .14	4			14.4	- .49	2
		10.2	- .62	3			11.1	- .22	3					
		13.6	- .77	4			14.8	- .24	2	400 (1253-1301)	16.0	3.2	± .34	5
		15.3	- .79	5			16.7	- .19	1			6.4	- .16	4
												9.6	- .22	3
												12.7	- .15	1
												14.3	- .19	2
										420 (1302-07)	10.6	2.1	+ .11	5
												4.2	± .34	4
												6.4	± .45	3
												8.5	± .57	1
												9.6	- .38	2
Discharge Measurement 21					Discharge Measurement 21					Discharge Measurement 21				
20 (1341)	2.0	1.2	+ .21	1	160 (1340-45)	17.1	3.4	+ .62	5	310 (1340-46)	17.8	3.6	+ .60	5
							6.8	± .38	4			7.2	± .33	4
							10.2	± .38	3			10.7	± .26	3
							13.6	- .36	2			14.3	- .34	1
							15.4	- .38	1			16.1	- .20	2

[a] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) [a]	Observation sequence
Discharge Measurement 21--Continued					Discharge Measurement 21--Continued					Discharge Measurement 21--Continued				
42 (1343-49)	12.0	1.0	+ .57	1	190 (1347-52)	17.2	3.4	± .14	5	340 (1347-53)	18.3	3.6	± .20	5
		2.4	+ .64	2			6.8	± .28	4			7.3	± .44	4
		4.8	± .33	3			10.2	- .53	3			10.9	- .66	3
		7.2	± .33	4			13.6	- .44	2			14.7	- .35	1
		9.6	- .30	5			15.5	- .28	1			16.5	- .41	2
		10.8	- .25	6										
60 (1351-57)	15.0	3.0	± .08	1	220 (1356-1403)	17.9	1.0	+ .56	6	370 (1354-1401)	17.3	1.0	+ .45	6
		6.0	± .44	2			3.6	+ .28	5			3.5	± .35	5
		9.0	- .98	3			7.2	± .27	4			6.9	± .26	4
		12.0	-1.02	4			10.8	- .74	3			10.4	- .70	3
		13.5	- .61	5			14.4	- .77	2			13.8	- .92	1
							16.1	- .68	1			15.5	- .48	2
70 (1359-1407)	15.5	1.0	+ .19	1	250 (1405-12)	17.0	3.4	+ .92	5	380 (1402-08)	16.5	3.3	+ .73	5
		3.1	± .16	2			6.8	± .28	4			6.6	± .29	4
		6.2	± .13	3			10.2	± .19	3			9.9	± .50	3
		9.3	- .63	4			13.6	- .21	2			13.2	- .44	1
		12.4	- .46	5			15.3	- .38	1			14.8	- .29	2
		14.0	- .20	6										
100 (1409-16)	17.0	3.4	+ .81	1	280 (1414-20)	18.5	3.7	+ .93	5	400 (1410-15)	15.5	3.1	+ .98	5
		6.8	± .24	2			7.4	± .16	4			6.2	± .35	4
		10.2	± .17	3			11.1	± .22	3			9.3	± .18	3
		13.6	- .16	4			14.8	- .21	2			12.5	- .49	1
		15.3	- .17	5			16.7	- .11	1			14.0	- .34	2
										420 (1417-22)	10.5	2.1	+1.05	5
130 (1419-25)	17.0	3.4	+ .94	1								4.2	+ .76	4
		6.8	± .35	2								6.3	± .26	3
		10.2	± .32	3								7.3	± .28	6
		13.6	- .30	4								8.4	- .29	1
		15.3	- .22	5								9.5	- .27	2

[a] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 4. Records of velocity observations

Boat No. 1					Boat No. 2					Boat No. 3				
Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence	Station (Time in vertical in hours)	Initial depth below water surface in feet	Depth of observation in feet	Velocity (fps) a/	Observation sequence
Discharge Measurement 22					Discharge Measurement 22					Discharge Measurement 22				
20 (1525-28)	1.5	.9	+ .25	1	160 (1528-33)	16.7	3.4	+1.56	5	310 (1527-32)	17.5	3.5	+1.72	5
							6.8	+ .43	4			7.0	+ .51	4
							10.2	+ .27	3			10.5	+ .42	3
42 (1531-40)	12.0	1.0	+ .84	1			13.6	+ .38	2			14.1	+ .43	1
		2.4	+1.12	2			15.0	+ .38	1			15.8	+ .40	2
		4.8	+ .79	3										
		7.2	+ .44	4	190 (1533-39)	17.2	3.4	+1.42	5	340 (1533-39)	18.1	3.6	+1.83	5
		9.6	+ .37	5			6.8	+ .43	4			7.2	+ .40	4
		10.8	+ .30	6			10.2	+ .50	3			10.9	+ .52	3
60 (1542-49)	14.5	2.9	+ .96	1			13.6	+ .45	2			14.4	+ .46	1
		5.8	+ .87	2			15.5	+ .42	1			16.2	+ .43	2
		8.7	+ .56	3	220 (1540-47)	17.6	1.0	+1.85	6	370 (1540-46)	16.1	1.0	+2.00	6
		11.6	+ .47	4			3.6	+1.63	5			3.2	+1.91	5
		13.1	+ .36	5			7.2	+ .53	4			6.4	+ .74	4
70 (1550-1605)	15.0	1.0	+ .90	1			10.8	+ .46	3			9.7	+ .52	3
		3.0	+1.00	2			14.4	+ .46	2			13.0	+ .45	1
		6.0	+ .94	3			15.8	+ .46	1			14.6	+ .51	2
		9.0	+ .61	4	250 (1548-53)	16.5	3.3	+1.63	5	380 (1547-52)	16.1	3.2	+1.72	5
		12.0	+ .38	5			6.6	+ .42	4			6.4	+ .28	4
		13.5	+ .40	6			9.9	+ .25	3			9.7	+ .31	3
100 (1607-15)	16.5	3.3	+1.55	1			13.2	+ .51	2			12.9	+ .32	1
		6.6	+ .84	2			14.9	+ .26	1			14.5	+ .25	2
		9.4	+ .57	3	280 (1554-59)	18.6	3.8	+1.81	5	400 (1553-58)	15.0	3.0	+2.09	5
		13.2	+ .46	4			7.6	+ .60	4			6.0	+1.28	4
		14.9	+ .31	5			11.4	+ .44	3			9.0	+ .67	3
130 (1617-23)	16.5	3.3	+1.42	1			15.2	+ .53	2			12.0	+ .56	1
		6.6	.77	2			16.7	+ .43	1			13.5	+ .47	2
		9.9	+ .32	3						420 (1559-1604)	10.1	2.0	+2.19	5
		13.2	+ .25	4								4.0	+1.66	4
		14.9	+ .24	5								6.1	+ .71	3
												8.2	+ .43	1
												9.2	+ .35	2

a/ + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful.

Table 5. Flow-direction observations

Station (Time in vertical in hours)	Depth of observation in feet	Direction [a]	Station (Time in vertical in hours)	Depth of observation in feet	Direction [a]	Station (Time in vertical in hours)	Depth of observation in feet	Direction [a]
90	2	±	340	16	-	70	15	-
Mar. 29, 1965	5	±	(1332-38)	14	-	Mar. 30, 1965	14	±
(1216-22)	7	+		12	+	(0103-09)	13	+
	9	+		10	+		11	+
	11	+		8	+		9	+
	13	+		6	+		7	+
	15	+		4	+		5	+
				0	+		3	+
185	4	±					0	+
(1247-52)	6	±	350	17	±			
	8	+	(1340-47)	16	+	145	All	+
	10	+		14	+	(0112-13)		
	12	+		12	+			
	14	±		10	+	220	All	+
	16	-		8	+	(0117-23)		
	18	-		6	+			
				4	+	290	All	+
220	18	+		0	±	(0128-30)		
(1300-05)	16	+						
	14	+	420	15	-	370	18	-
	12	+	(1349-55)	13	±	(0132-40)	17	±
	10	+		11	-		16	+
	8	+		9	-		14	+
	6	±		7	±		12	+
	4	-		5	+		10	+
	2	-		3	+		8	+
				0	±		6	+
255	18	+					4	+
(1325-30)	16	+	All observations between 1505 hrs on				2	+
	14	+	Mar. 29 and 0004 hrs on Mar. 30,				0	+
	12	+	1965 = +					
	10	+				All observations between 0213 hrs and		
	8	+				1003 hrs on Mar. 30, 1965 = +		
	6	±						
	4	-						

[a] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful or no velocity.

Table 5. Flow-direction observations--Continued

Station (Time in vertical in hours)	Depth of observation in feet	Direction [a]	Station (Time in vertical in hours)	Depth of observation in feet	Direction [a]	Station (Time in vertical in hours)	Depth of observation in feet	Direction [a]
70	15	±	370	18	-	150	17	-
Mar. 30, 1965	14	+	(1141-50)	17	-	(1235-40)	16	-
(1118-23)	13	+		16	-		15	-
	11	+		15	-		14	-
	9	+		14	±		13	-
	7	+		13	-		12	-
	5	+		12	±		11	-
	3	+		11	±		10	-
	0	+		10	+		9	-
				9	+		8	-
220	18	-		8	+		7	+
(1126-37)	17	-		7	+		6	+
	16	-		6	+		5	+
	15	-		5	+		3	+
	14	-		4	+		0	+
	13	-		3	+			
	12	-		0	+	220	18	-
	11	-				(1244-57)	17	-
	10	+	70	16	±		16	-
	9	-	(1224-32)	15	-		15	-
	8	±		14	-		14	-
	7	+		13	-		13	-
	6	+		12	±		12	-
	5	+		11	±		11	±
	4	+		10	+		10	±
	3	+		9	+		9	-
	0	+		8	+		8	±
				7	+		7	±
				6	+		6	±
				5	+		5	±
				4	+		4	+
				3	+		3	+
				0	+		0	+

[a] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful or no velocity.

Table 5. Flow-direction observations--Continued

Station (Time in vertical in hours)	Depth of observation in feet	Direction [a/]	Station (Time in vertical in hours)	Depth of observation in feet	Direction [a/]	Station (Time in vertical in hours)	Depth of observation in feet	Direction [a/]
280	17	-	70	16	-	220	20	-
(1300-05)	16	-	Mar. 30, 1965	15	-	(1356-1405)	19	-
	15	-	(1340-46)	14	-		18	-
	14	-		13	-		17	-
	13	-		12	-		16	-
	12	-		11	-		15	-
	11	-		10	-		14	-
	10	-		9	-		13	-
	9	-		8	+		12	-
	8	-		7	+		11	-
	7	-		6	+		10	±
	6	-		5	+		9	-
	5	±		4	+		8	+
	4	±		3	+		7	+
	3	+		0	+		6	+
	0	±					5	+
			150	18	-		4	+
370	16	-	(1348-54)	17	-		3	+
(1307-13)	15	-		16	-		2	+
	14	-		15	-		0	+
	13	-		14	-			
	12	-		13	-			
	11	-		12	-			
	10	-		11	-			
	9	-		10	-			
	8	±		9	-			
	7	±		8	-			
	6	+		7	-			
	5	+		6	-			
	4	+		5	±			
	3	+		4	+			
	0	±		3	+			
				0	+			

[a/] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful or no velocity.

Table 5. Flow-direction observations--Continued

Station (Time in vertical in hours)	Depth of observation in feet	Direction [a/]	Station (Time in vertical in hours)	Depth of observation in feet	Direction [a/]	Station (Time in vertical in hours)	Depth of observation in feet	Direction [a/]
280	18	-	370	17	+	All observations between 1525 hrs and		
(1407-11)	17	-	(1413-20)	16	+	1620 hrs were all +		
	16	-		15	+			
	15	-		14	+			
	14	-		13	+			
	13	-		12	±			
	12	-		11	-			
	11	-		10	-			
	10	-		9	-			
	9	-		8	±			
	8	-		7	+			
	7	+		6	+			
	6	+		5	+			
	5	+		4	+			
	4	+		3	+			
	3	+		0	+			
	0	+						

[a/] + flowing in downstream direction, - flowing in upstream direction, ± direction of flow doubtful or no velocity.