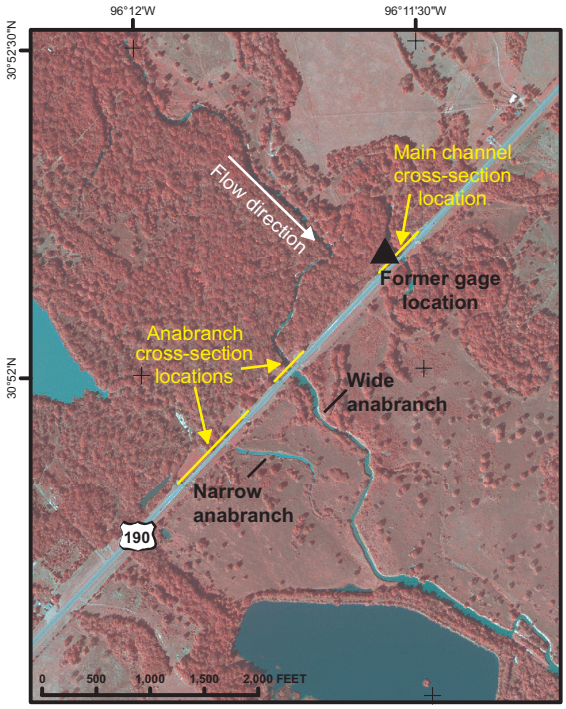


2004 National Agriculture Imagery Program color infrared imagery
Projection: Universal Transverse Mercator Zone 14 North
Datum: North American Datum 1983

Figure 50. U.S. Geological Survey streamflow-gaging station 08111000 Navasota River near Bryan, Texas, 2004 digital orthophoto quarter-quadrangle.

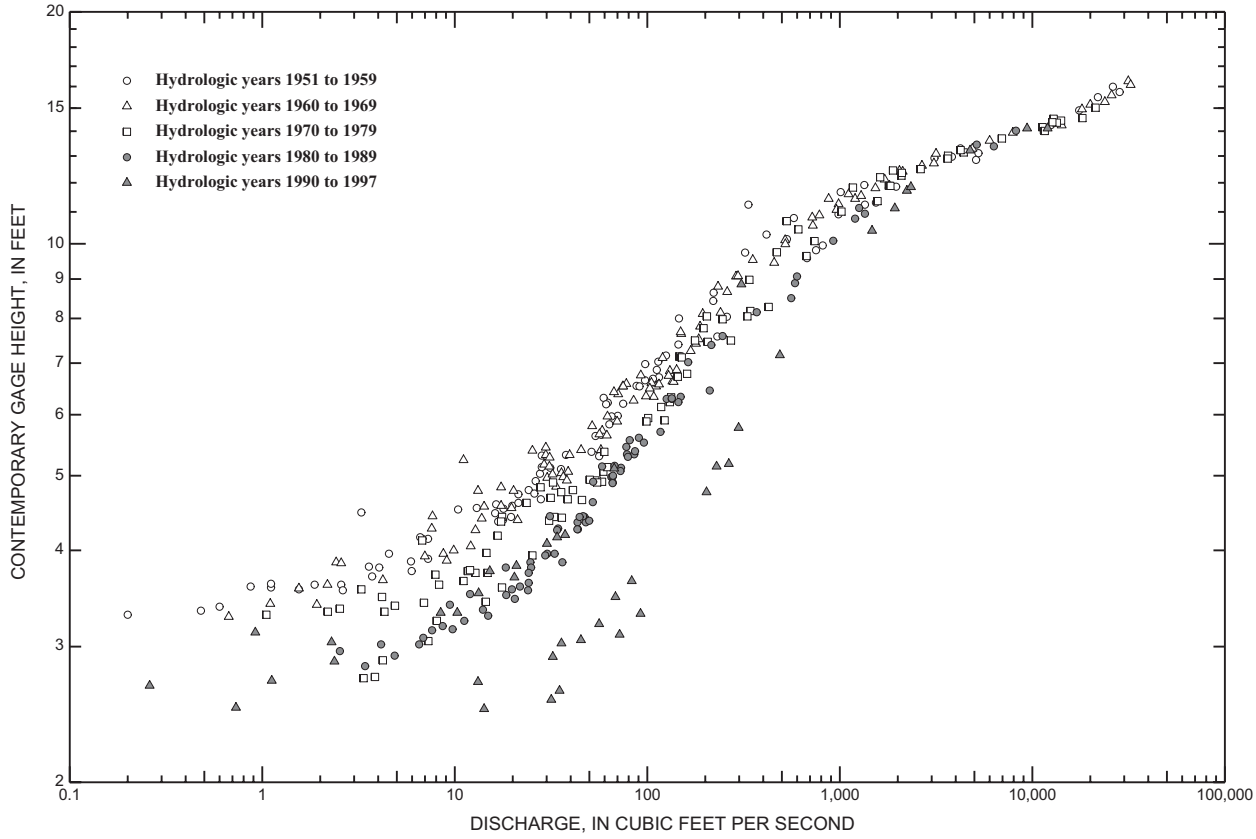


Figure 51. Stage-discharge relations of field measurements for U.S. Geological Survey streamflow-gaging station 08111000 Navasota River near Bryan, Texas, 1951–December 1996.

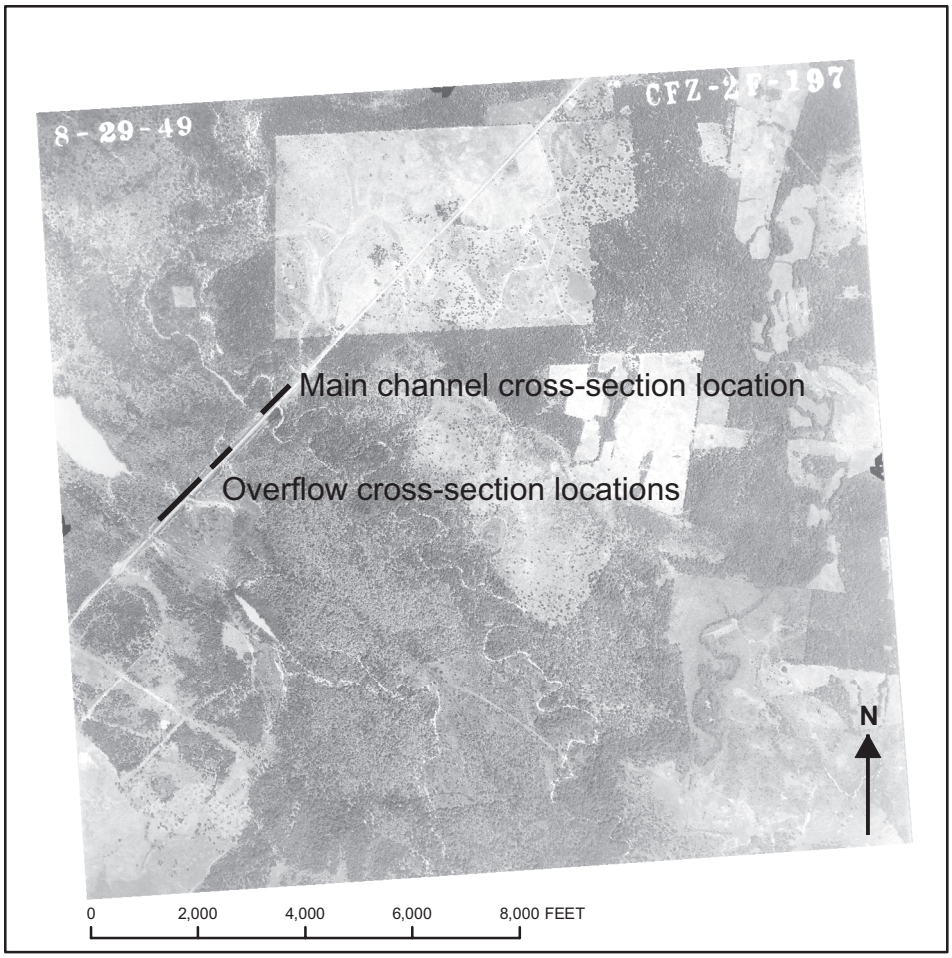


Figure 52. 1949 Aerial photograph of U.S. Geological Survey streamflow-gaging station 08111000 Navasota River near Bryan, Texas, and vicinity.

(A)



(B)



Figure 53. U.S. Geological Survey streamflow-gaging station 08111000 Navasota River near Bryan, Texas, (A) looking upstream from U.S. Highway 190 bridge, August 27, 1975; (B) looking upstream from left bank of abandoned channel, April 1, 2008; and (C) looking downstream from U.S. Highway 190 bridge, April 1, 2008.

(C)



Figure 53.—Continued.

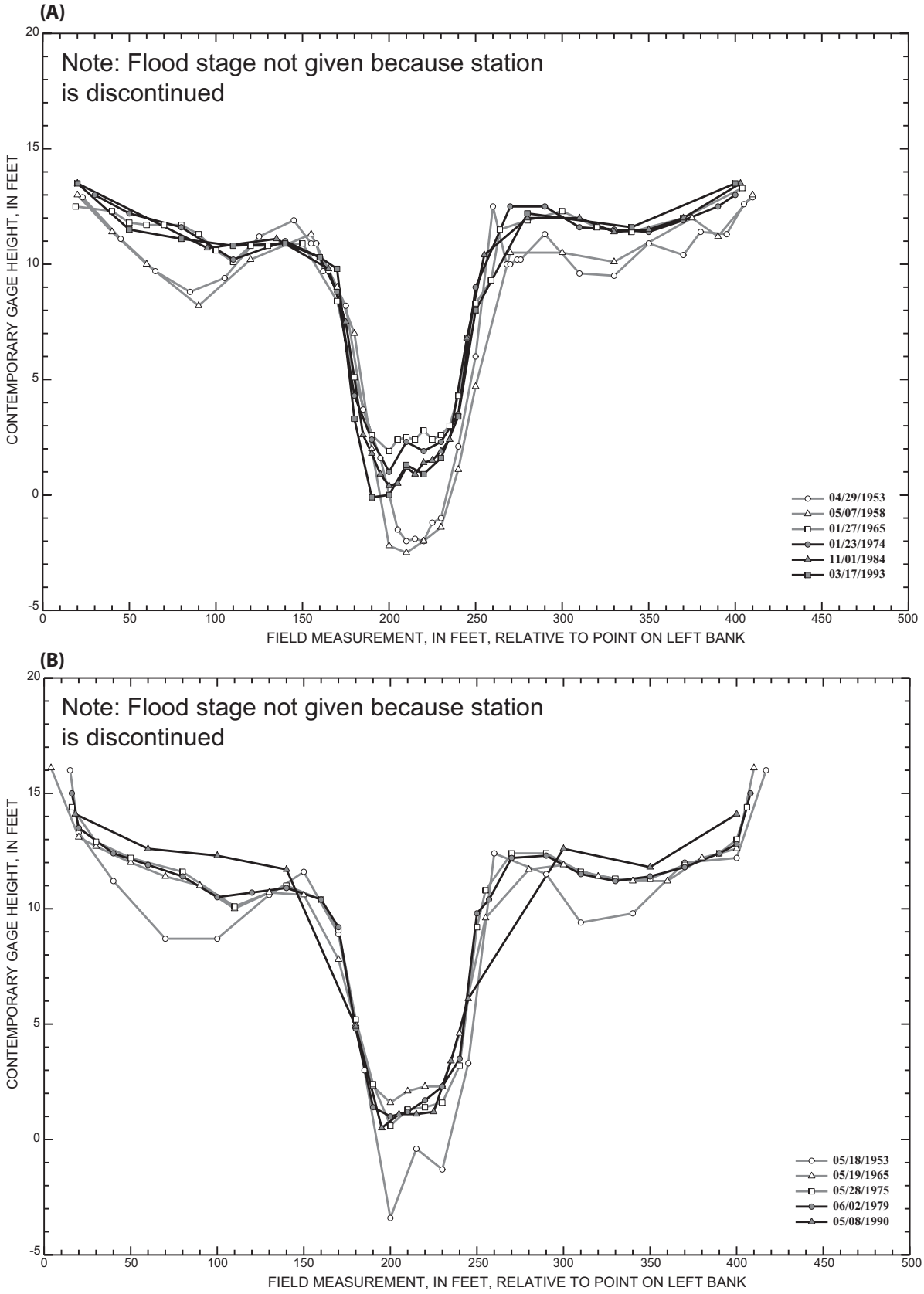


Figure 54. Historical cross-sectional channel geometry for U.S. Geological Survey streamflow-gaging station 08111000 Navasota River near Bryan, Texas, (A) at moderately high-flow conditions (greater than 2,000 cubic feet per second and less than 10,000 cubic feet per second), 1953–93; and (B) at high-flow conditions (greater than 10,000 cubic feet per second), 1953–90.

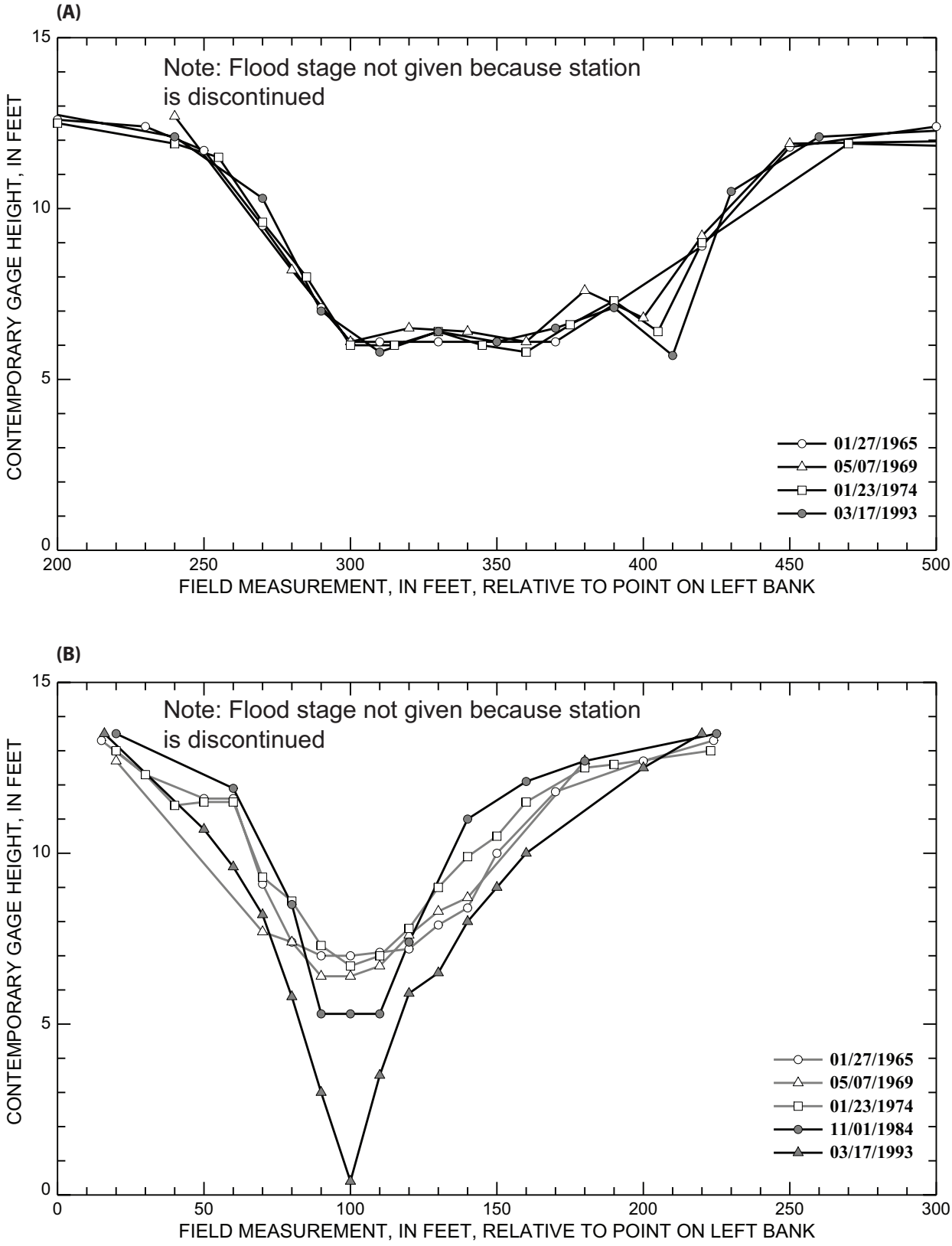


Figure 55. Historical cross-sectional channel geometry for the of U.S. Geological Survey streamflow-gaging station 08111000 Navasota River near Bryan, Texas, (A) wide anabranch, 1965–93; and (B) narrow anabranch, 1965–93.

Table 26. Hydraulic computations for historical cross sections of U.S. Geological Survey streamflow-gaging station 08111000, Navasota River near Bryan, Texas, 1953–93.

[ft, feet; ft^3/s, cubic feet per second; ft^2, square feet; ft/s, feet per second; lb/ft^2, pounds per square foot; >, greater than; <, less than]

Date	Contemporary stage (ft)	Discharge[1] (ft^3/s)	Width[2] (ft)	Hydraulic depth[2, 3] (ft)	Cross-sectional area[2] (ft^2)	Mean velocity[2] (ft/s)	Bed shear stress[2] (lb/ft^2)	Froude number[2]
Moderately high flow (>2,000 ft^3/s, <10,000 ft3/s)								
10.0-foot target stage								
Apr. 29, 1953	10.0	5,100	95.2	7.18	683.1	1.36	0.21	0.09
May 7, 1958	10.0	3,820	104.8	7.28	763.2	1.08	.22	.07
Jan. 27, 1965	9.9	4,880	102.4	5.00	511.3	1.08	.15	.09
Jan. 23, 1974	10.0	3,650	93.7	5.78	541.7	1.00	.17	.07
Nov. 1, 1984	9.9	5,140	90.9	6.13	557.5	1.15	.18	.08
Mar. 17, 1993	9.9	5,190	95.6	6.40	612.0	.99	.19	.07
High flow (>10,000 ft^3/s)								
10.0-foot target stage								
May 18, 1953	10.1	26,200	95.1	7.79	740.9	1.96	.23	.12
May 19, 1965	10.1	32,400	107.4	5.16	554.4	2.44	.16	.19
May 28, 1975	10.1	13,400	90.5	6.24	564.6	2.02	.19	.14
June 2, 1979	10.0	21,300	89.0	6.17	548.9	2.47	.19	.18
May 8, 1990	10.0	12,000	128.0	5.07	649.4	1.38	.16	.11

[1] Discharge is for measurement, not a subdivided estimate based on hydraulic analyses.

[2] Hydraulic computations before October 16, 1978, are pre-regulation of flow by reservoirs or other structures.

[3] Hydraulic depth is ratio of cross-sectional area to width, equivalent to mean depth.

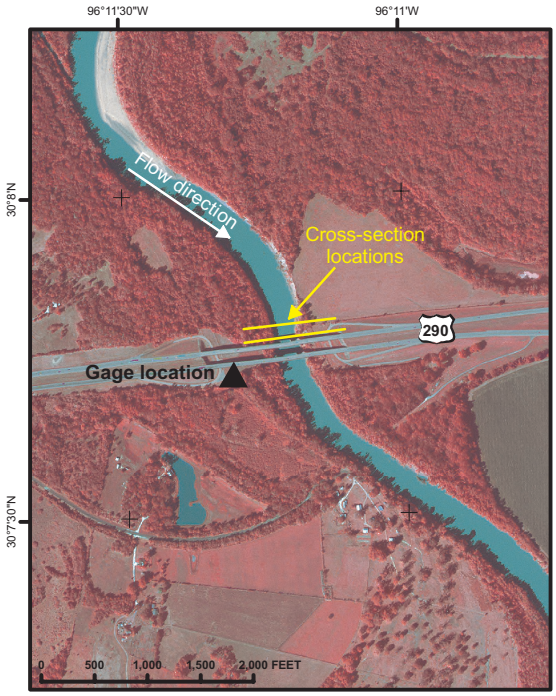


Figure 56. U.S. Geological Survey streamflow-gaging station 08111500 Brazos River near Hempstead, Texas, 2004 digital orthophoto quarter-quadrangle.

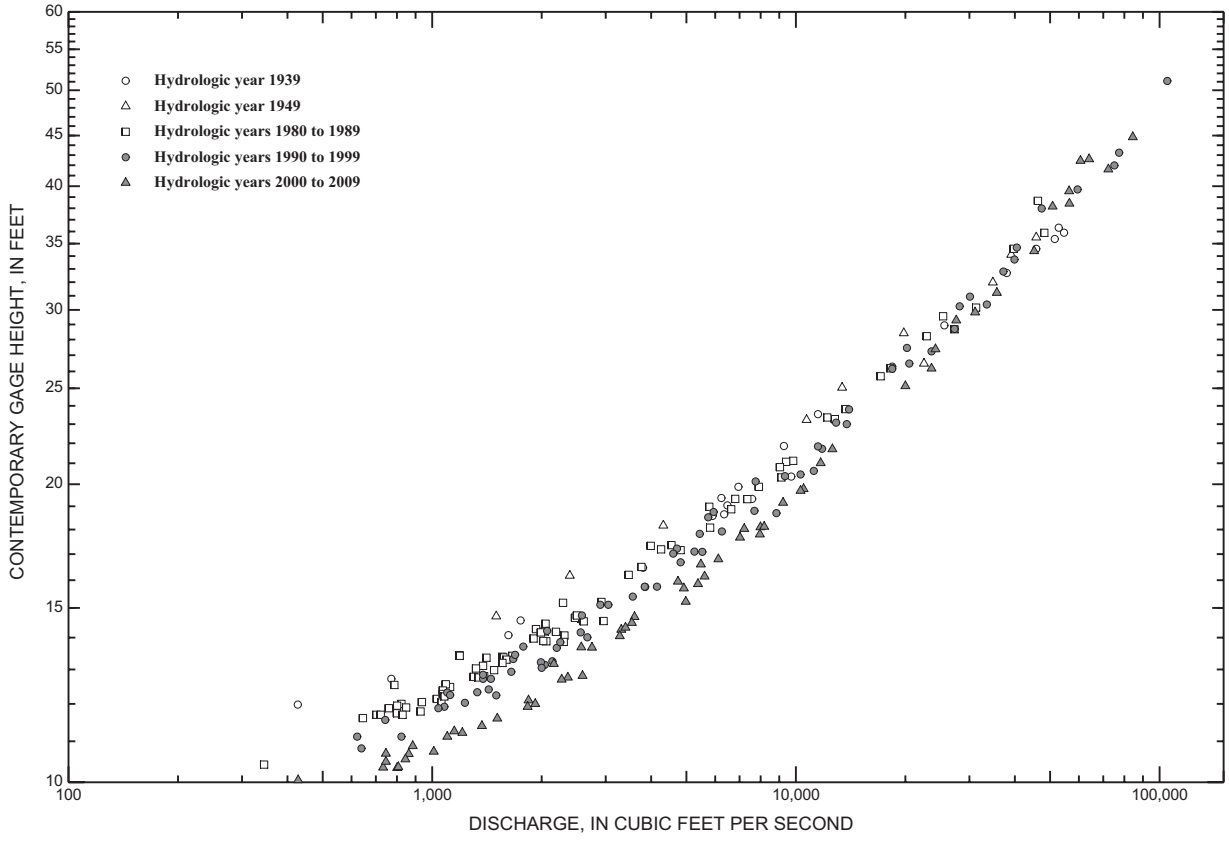


Figure 57. Stage-discharge relations of field measurements for U.S. Geological Survey streamflow-gaging station 08111500 Brazos River near Hempstead, Texas, December 1938–2009. (Much of period of record not shown because data are not digitally available.)

(A)



(B)



Figure 58. U.S. Geological Survey streamflow-gaging station 08111500 Brazos River near Hempstead, Texas, looking downstream from U.S. Highway 290 bridge, (A) December 15, 1975, and (B) April 2, 2008.

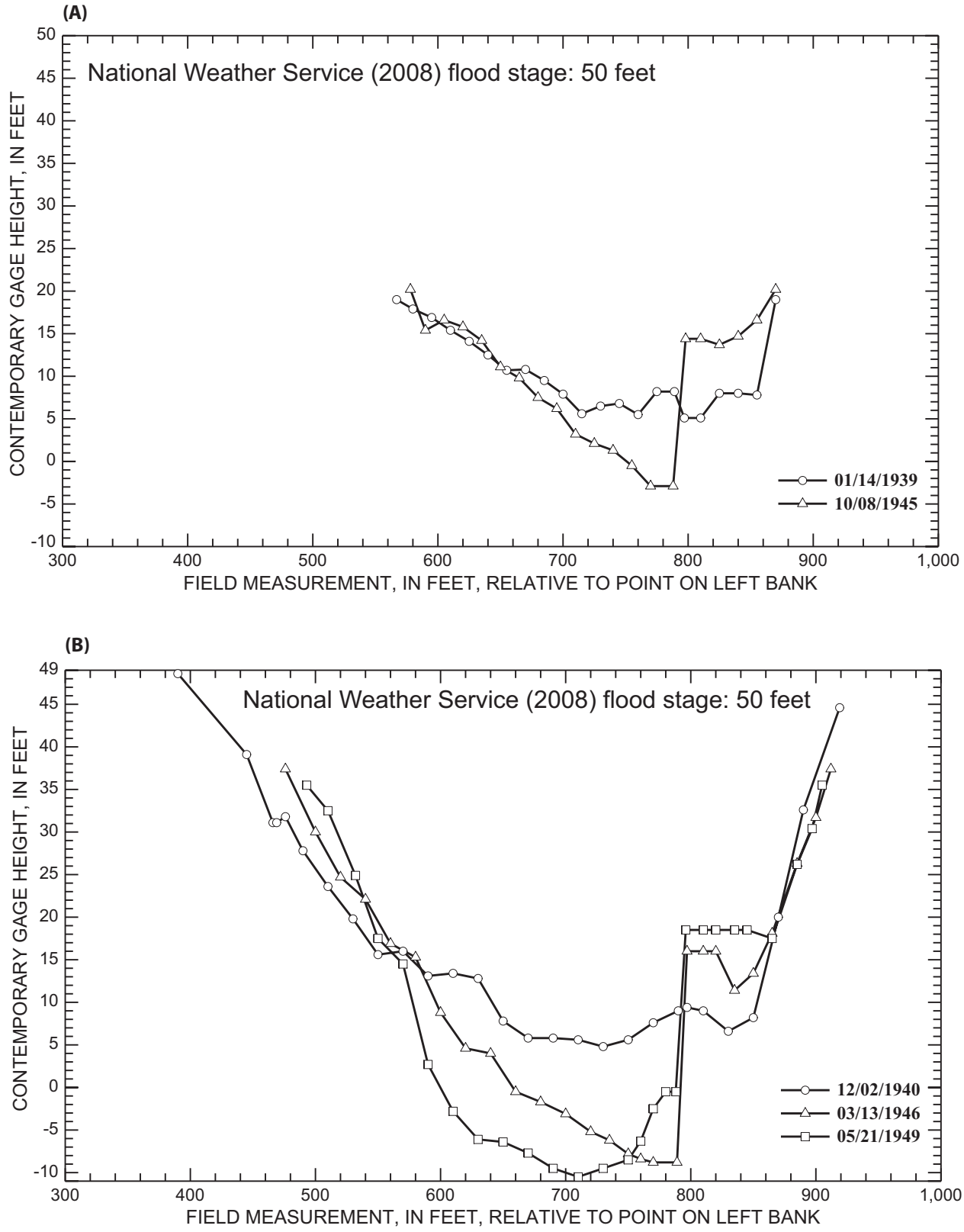
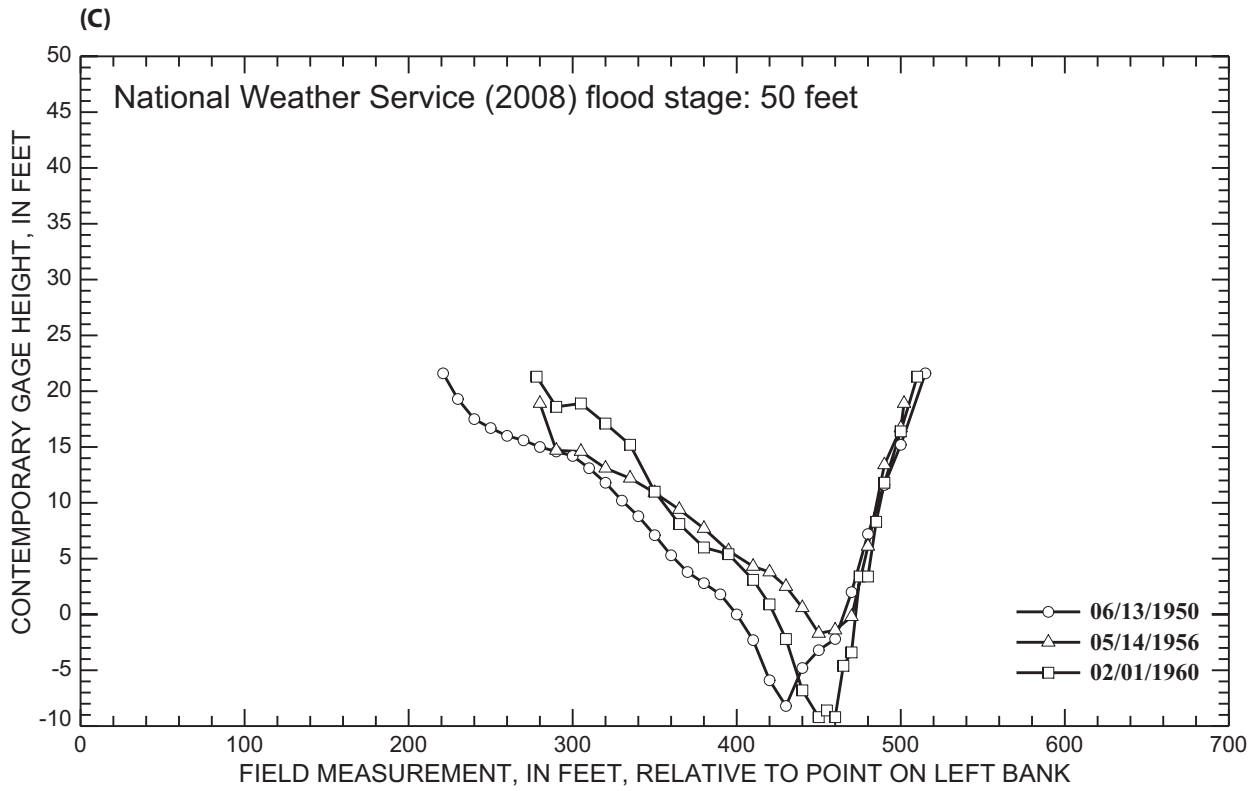


Figure 59. Historical cross-sectional channel geometry for U.S. Geological Survey streamflow-gaging station 08111500 Brazos River near Hempstead, Texas, (A) at moderate-flow conditions (greater than 5,000 cubic feet per second and less than 10,000 cubic feet per second), 1939–45; (B) at high-flow conditions (greater than 40,000 cubic feet per second), 1940–49; (C) at moderate-flow conditions, 1950–60; (D) at high-flow conditions (greater than 20,000 cubic feet per second), 1950–59; (E) at moderate-flow conditions, 1980–85; and (F) at high-flow conditions (greater than 20,000 cubic feet per second), 1981–2000.



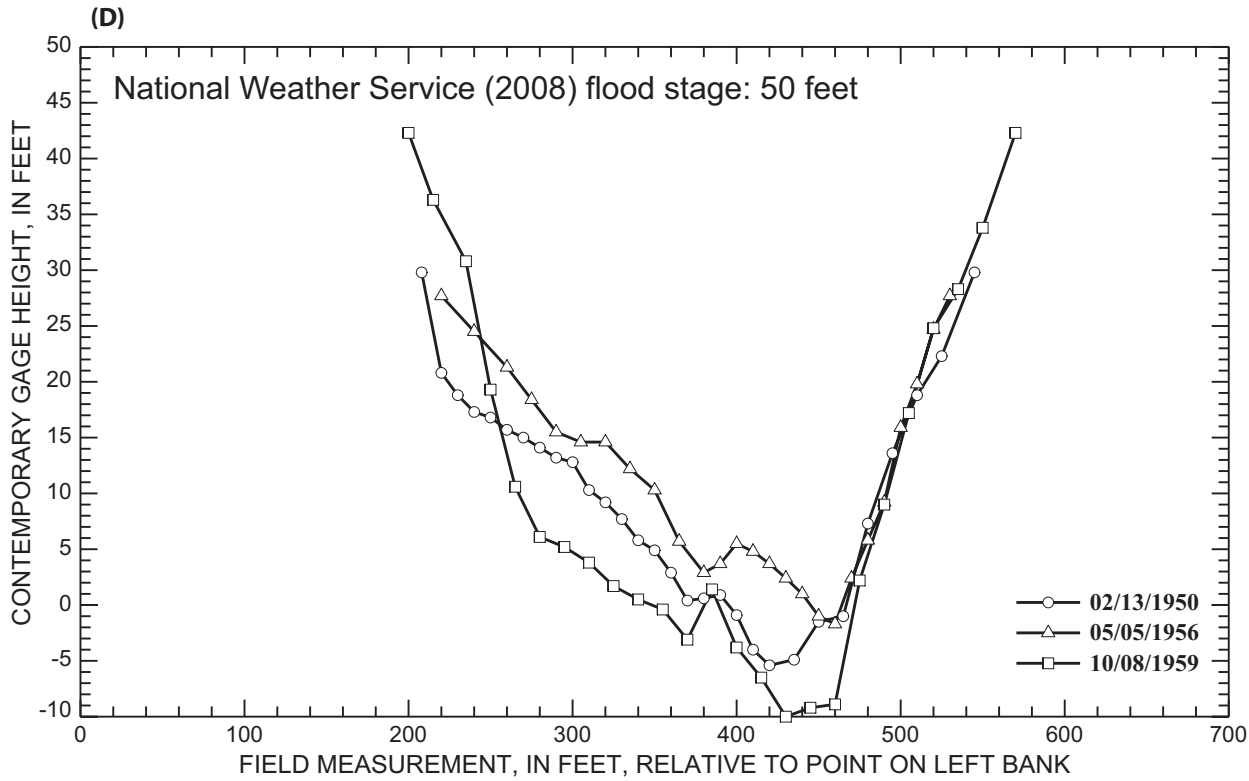
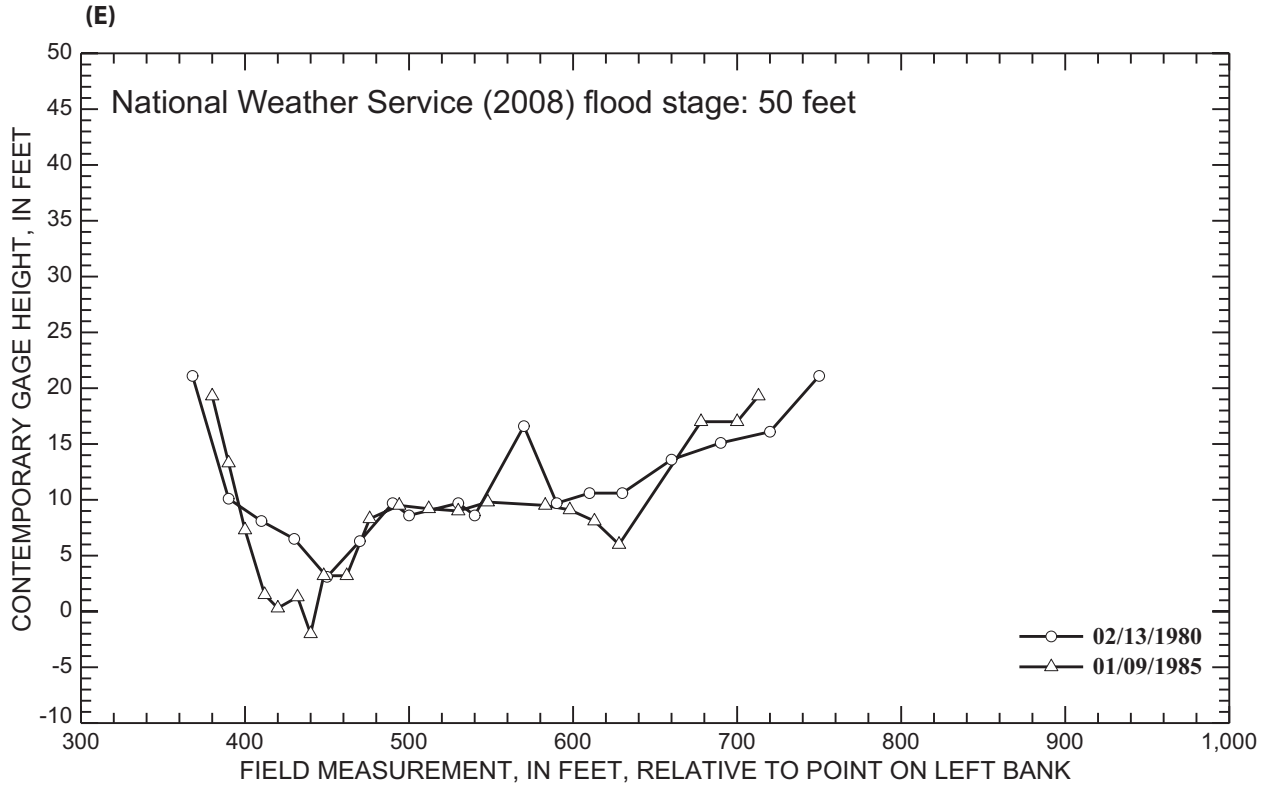


Figure 59.—Continued.



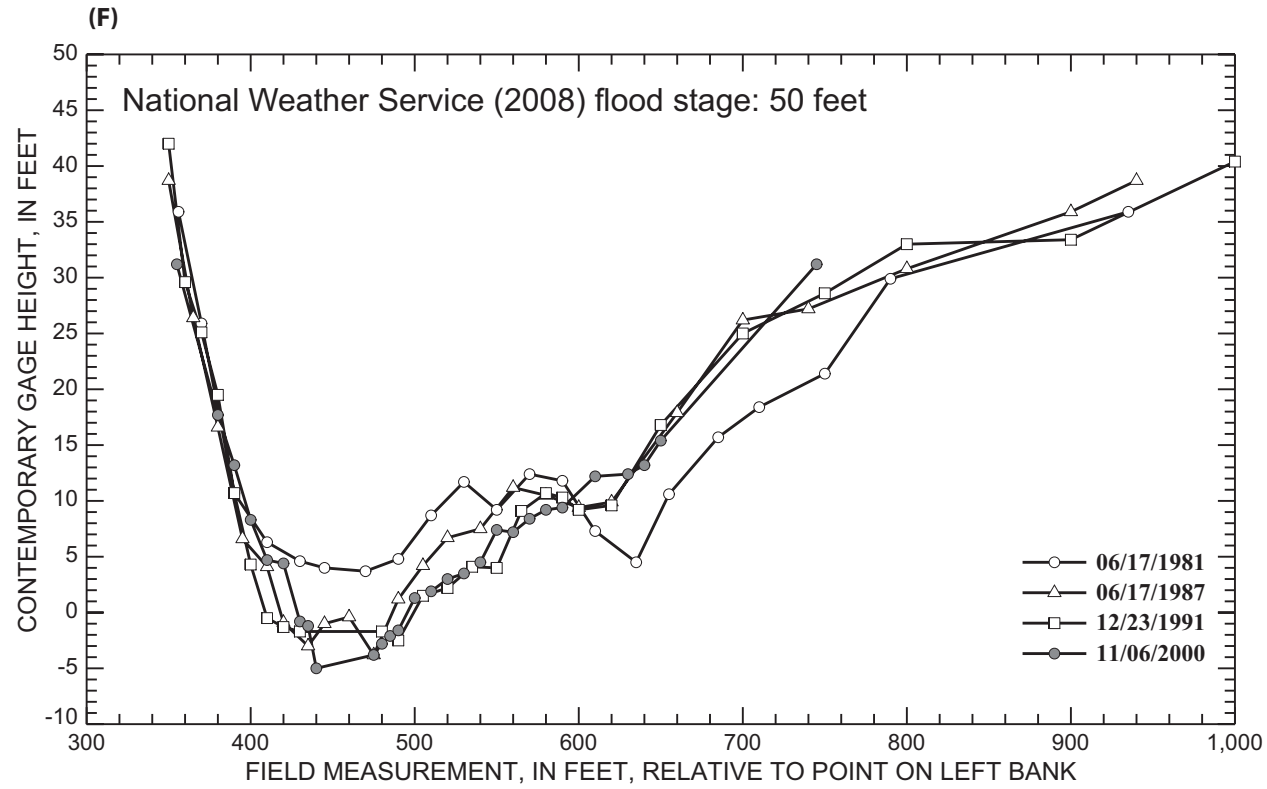


Figure 59.—Continued.

Table 27. Hydraulic computations for historical cross sections of U.S. Geological Survey streamflow-gaging station 08111500, Brazos River near Hempstead, Texas, 1939–49.

[ft, feet; ft^3/s, cubic feet per second; ft^2, square feet; ft/s, feet per second; lb/ft^2, pounds per square foot; >, greater than; <, less than]

Date	Contemporary stage (ft)	Discharge[1] (ft^3/s)	Width[2] (ft)	Hydraulic depth[2, 3] (ft)	Cross-sectional area[2] (ft^2)	Mean velocity[2] (ft/s)	Bed shear stress[2] (lb/ft^2)	Froude number[2]
Moderate flow (>5,000 ft^3/s, <10,000 ft^3/s)								
10.0-foot target stage								
Jan. 14, 1939	10.1	6,480	180.0	2.97	534.3	1.00	0.03	0.10
Oct. 8, 1945	10.1	7,940	134.0	7.43	995.1	1.79	.07	.12
15.0-foot target stage								
Jan. 14, 1939	15.1	6,480	251.3	6.52	1,639	1.80	.06	.12
Oct. 8, 1945	15.1	7,940	216.6	8.32	1,803	2.01	.07	.12
High flow (>40,000 ft^3/s)								
20.0-foot target stage								
Dec. 2, 1940	19.8	73,900	339.7	10.0	3,396	1.98	.09	.11
Mar. 13, 1946	20.2	51,900	322.8	15.6	5,022	2.95	.14	.13
May 21, 1949	20.0	45,800	326.8	17.5	5,729	2.84	.15	.12
25.0-foot target stage								
Dec. 2, 1940	24.8	73,900	373.3	13.9	5,180	2.52	.13	.12
Mar. 13, 1946	25.2	51,900	364.2	18.5	6,733	3.36	.16	.14
May 21, 1949	25.0	45,800	350.5	21.2	7,423	3.26	.19	.12

[1] Discharge is for measurement, not a subdivided estimate based on hydraulic analyses.

[2] Hydraulic computations before March 21, 1941, are pre-regulation of flow by reservoirs or other structures.

[3] Hydraulic depth is ratio of cross-sectional area to width, equivalent to mean depth.

Table 28. Hydraulic computations for historical cross sections of U.S. Geological Survey streamflow-gaging station 08111500, Brazos River near Hempstead, Texas, 1950–60.

[ft, feet; ft^3/s, cubic feet per second; ft^2, square feet; ft/s, feet per second; lb/ft^2, pounds per square foot; >, greater than; <, less than]

Date	Contemporary stage (ft)	Discharge[1] (ft^3/s)	Width[2] (ft)	Hydraulic depth[2, 3] (ft)	Cross-sectional area[2] (ft^2)	Mean velocity[2] (ft/s)	Bed shear stress[2] (lb/ft^2)	Froude number[2]
Moderate flow (>5,000 ft^3/s, <10,000 ft^3/s)								
10.0-foot target stage								
June 13, 1950	9.8	8,170	153.0	8.76	1,341	1.44	0.08	0.09
May 14, 1956	9.8	5,080	124.1	6.01	745.4	1.31	.05	.09
Feb. 1, 1960	9.8	8,950	130.9	8.70	1,139	1.99	.08	.12
15.0-foot target stage								
June 13, 1950	14.8	8,170	213.9	10.4	2,229	1.64	.09	.09
May 14, 1956	14.8	5,080	204.5	7.49	1,531	1.60	.07	.10
Feb. 1, 1960	14.8	8,950	160.1	11.7	1,868	2.48	.10	.13
High flow (>20,000 ft^3/s)								
20.0-foot target stage								
Feb. 13, 1950	20.1	32,300	292.1	13.1	3,839	3.26	.12	.16
May 5, 1956	19.8	22,100	242.2	11.4	2,774	3.29	.10	.17
Oct. 8, 1959	20.0	72,500	261.4	18.6	4,855	3.92	.17	.16
25.0-foot target stage								
Feb. 13, 1950	25.1	32,300	318.2	16.9	5,375	3.95	.15	.17
May 5, 1956	24.8	22,100	282.2	14.5	4,082	4.09	.13	.19
Oct. 8, 1959	25.0	72,500	278.3	22.3	6,204	4.49	.20	.17

[1] Discharge is for measurement, not a subdivided estimate based on hydraulic analyses.

[2] All hydraulic computations are post regulation of flow by reservoirs or other structures.

[3] Hydraulic depth is ratio of cross-sectional area to width, equivalent to mean depth.

Table 29. Hydraulic computations for historical cross sections of U.S. Geological Survey streamflow-gaging station 08111500, Brazos River near Hempstead, Texas, 1980–2000.

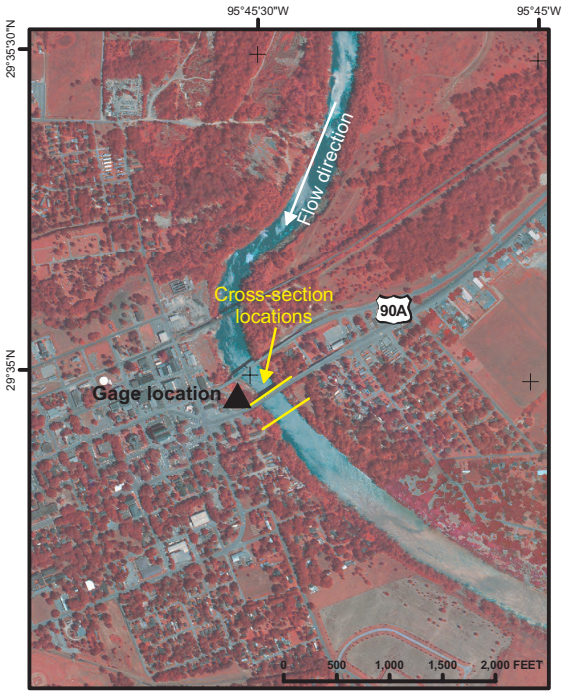
[ft, feet; ft^3/s, cubic feet per second; ft^2, square feet; ft/s, feet per second; lb/ft^2, pounds per square foot; >, greater than; <, less than]

Date	Contemporary stage (ft)	Discharge[1] (ft^3/s)	Width[2] (ft)	Hydraulic depth[2, 3] (ft)	Cross-sectional area[2] (ft^2)	Mean velocity[2] (ft/s)	Bed shear stress[2] (lb/ft^2)	Froude number[2]
Moderate flow (>5,000 ft^3/s, <10,000 ft^3/s)								
10.0-foot target stage								
Feb. 13, 1980	10.1	9,830	165.7	2.33	385.7	0.95	0.02	0.11
Jan. 9, 1985	10.0	7,350	250.7	3.00	752.0	.90	.03	.09
15.0-foot target stage								
Feb. 13, 1980	15.1	9,830	300.0	5.26	1,577	1.69	.05	.13
Jan. 9, 1985	15.0	7,350	281.7	7.39	2,083	1.69	.07	.11
High flow (>20,000 ft^3/s)								
20.0-foot target stage								
June 17, 1981	20.2	48,200	356.5	10.4	3,704	2.78	.10	.15
June 17, 1987	20.2	46,300	296.6	13.2	3,903	2.77	.12	.13
Dec. 23, 1991	20.0	75,100	290.4	14.3	4,155	3.52	.13	.16
Nov. 6, 2000	20.0	35,700	301.9	13.4	4,055	3.21	.12	.15
25.0-foot target stage								
June 17, 1981	25.2	48,200	397.0	14.1	5,607	3.54	.13	.17
June 17, 1987	25.2	46,300	328.3	16.6	5,465	3.30	.15	.14
Dec. 23, 1991	25.0	75,100	329.8	17.3	5,706	4.14	.16	.18
Nov. 6, 2000	25.0	35,700	341.2	16.6	5,662	3.78	.15	.16

[1] Discharge is for measurement, not a subdivided estimate based on hydraulic analyses.

[2] All hydraulic computations are post regulation of flow by reservoirs or other structures.

[3] Hydraulic depth is ratio of cross-sectional area to width, equivalent to mean depth.



2004 National Agriculture Imagery Program color infrared imagery
Projection: Universal Transverse Mercator Zone 15 North
Datum: North American Datum 1983

Figure 60. U.S. Geological Survey streamflow-gaging station 08114000 Brazos River at Richmond, Texas, 2004 digital orthophoto quarter-quadrangle.

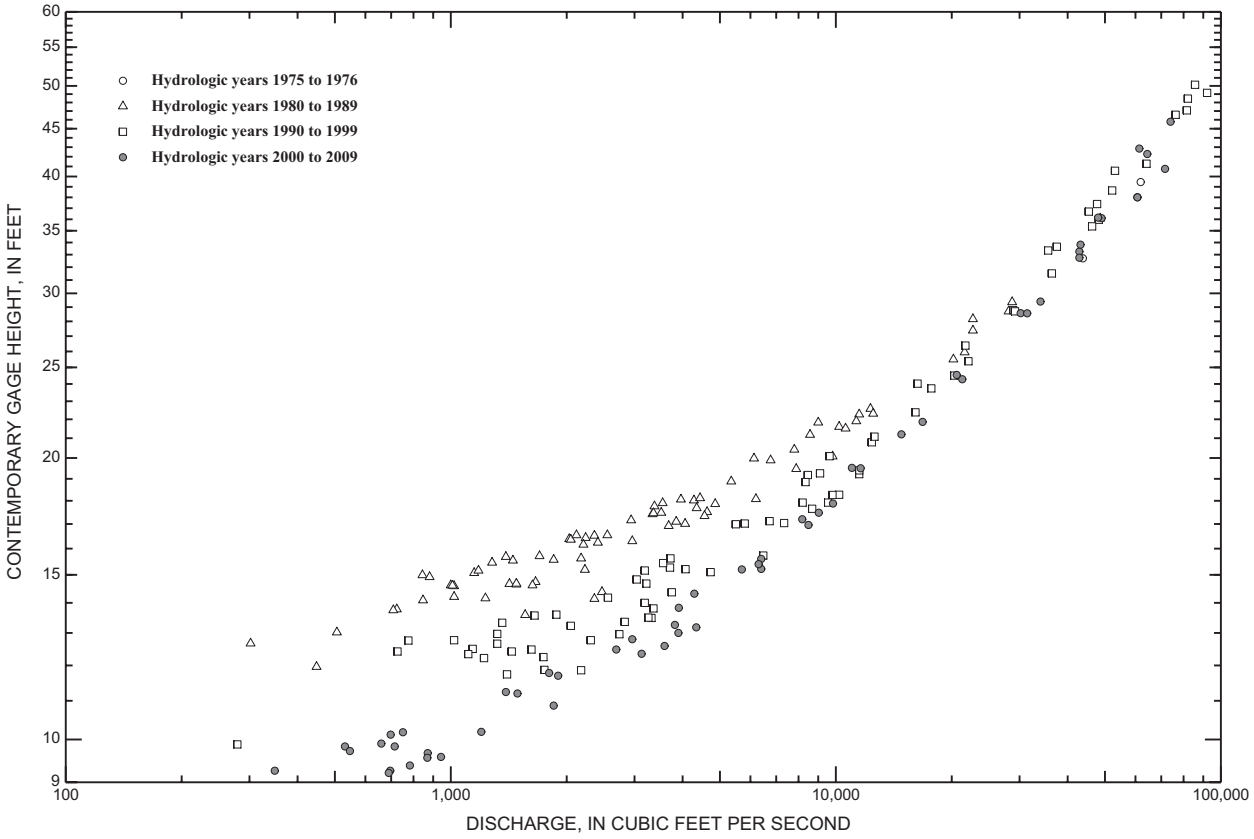


Figure 61. Stage-discharge relations of field measurements for U.S. Geological Survey streamflow-gaging station 08114000 Brazos River at Richmond, Texas, 1975–2009. (Much of period of record not shown because data are not digitally available.)

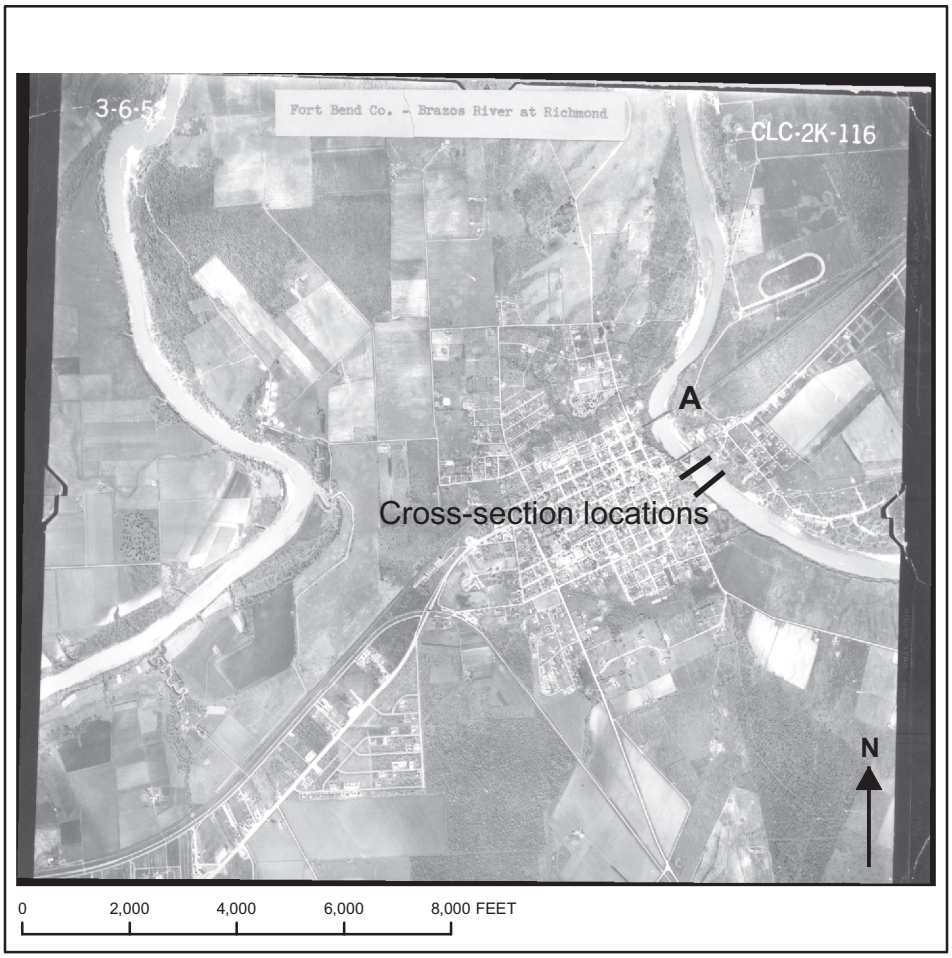
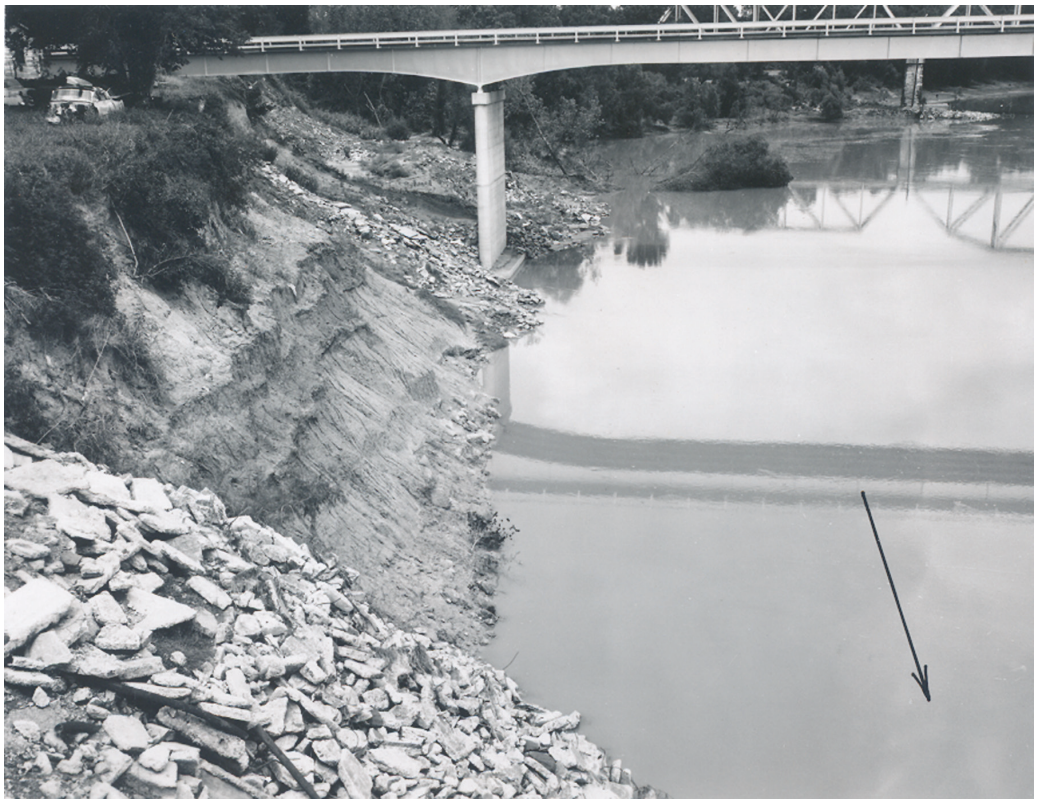


Figure 62. 1952 aerial photograph showing U.S. Geological Survey streamflow-gaging station 08114000 Brazos River at Richmond, Texas, and vicinity. ("A" denotes meander bend.)

(A)



(B)



Figure 63. U.S. Geological Survey streamflow-gaging station 08114000 Brazos River at Richmond, Texas, (A) looking upstream from eastbound U.S. Highway 90-A bridge, August 10, 1965; (B) looking upstream from eastbound U.S. Highway 90-A bridge, August 7, 2008; (C) looking downstream from cableway, May 21, 1965; and (D) looking downstream from eastbound U.S. Highway 90-A bridge, August 7, 2008.

(C)



(D)



Figure 63.—Continued.

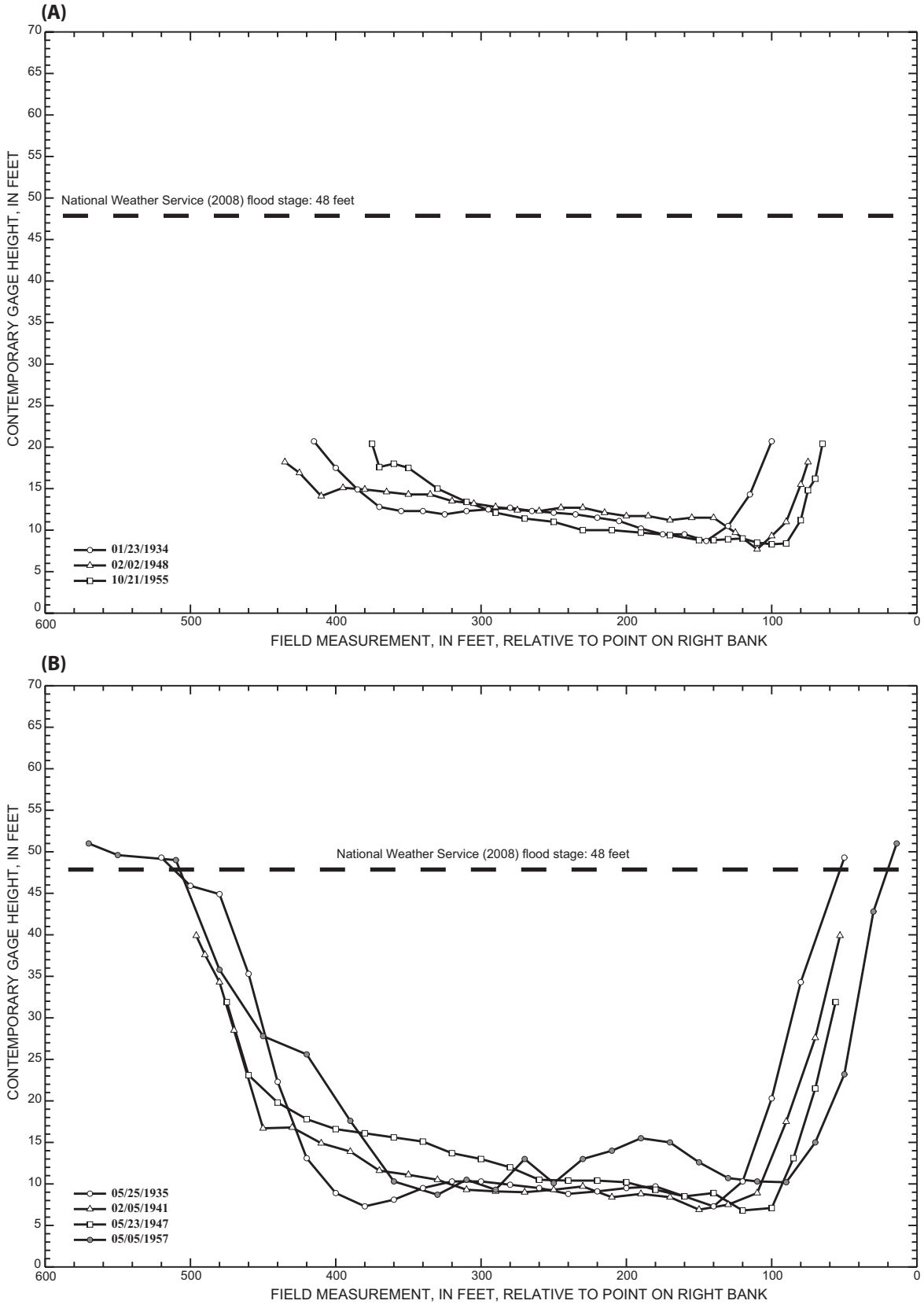


Figure 64. Historical cross-sectional channel geometry for U.S. Geological Survey streamflow-gaging station 08114000 Brazos River at Richmond, Texas, (A) at moderate-flow conditions (greater than 2,000 cubic feet per second and less than 10,000 cubic feet per second), 1934–55; (B) at high-flow conditions (greater than 20,000 cubic feet per second), 1935–57; (C) at moderate-flow conditions, 1957–98; and (D) at high-flow conditions, 1958–2004.

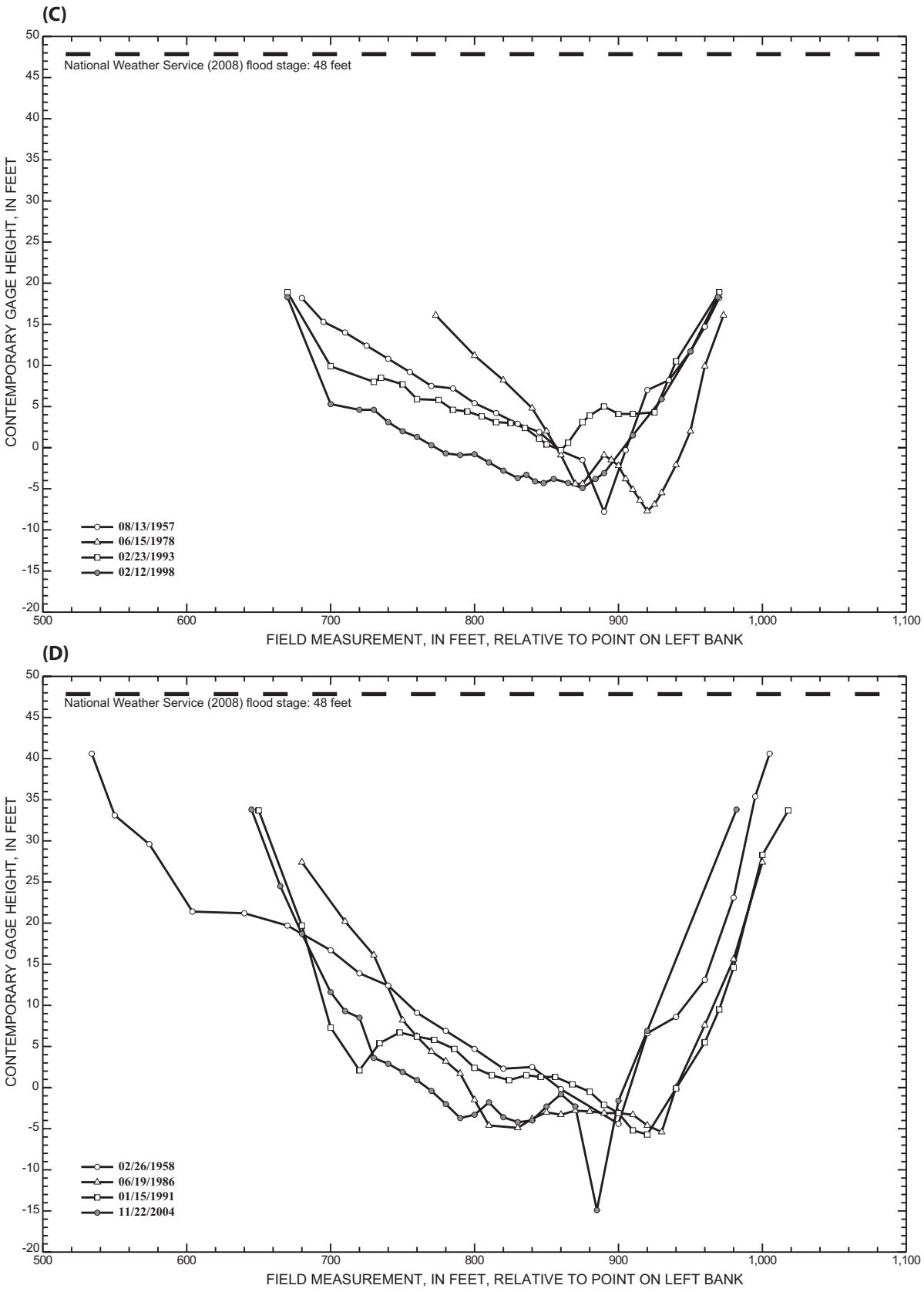


Figure 64.—Continued.

Table 30. Hydraulic computations for historical cross sections of U.S. Geological Survey streamflow-gaging station 08114000, Brazos River at Richmond, Texas, 1934–57.

[ft, feet; ft^3/s, cubic feet per second; ft^2, square feet; ft/s, feet per second; lb/ft^2, pounds per square foot; >, greater than; <, less than]

Date	Contemporary stage (ft)	Discharge[1] (ft^3/s)	Width[2] (ft)	Hydraulic depth[2, 3] (ft)	Cross-sectional area[2] (ft^2)	Mean velocity[2] (ft/s)	Bed shear stress[2] (lb/ft^2)	Froude number[2]
Moderate flow (>2,000 ft^3/s, <10,000 ft^3/s)								
18.0-foot target stage								
Jan. 23, 1934	18.2	6,130	297.4	6.16	1,832	1.92	0.06	0.14
Feb. 2, 1948	18.2	2,250	360.0	5.40	1,944	1.16	.05	.09
Oct. 21, 1955	17.8	6,080	293.3	6.56	1,922	1.80	.06	.12
High flow (>20,000 ft^3/s)								
30.0-foot target stage								
May 25, 1935	29.8	89,700	365.1	18.7	6,812	3.96	.17	.16
Feb. 5, 1941	29.9	60,100	405.6	17.8	7,238	3.90	.16	.16
May 23, 1947	29.8	38,500	412.6	16.2	6,700	4.71	.15	.21
May 5, 1957	30.2	118,000	416.1	15.5	6,460	4.24	.14	.19
35.0-foot target stage								
May 25, 1935	34.8	89,700	380.2	22.8	8,674	4.62	.21	.17
Feb. 5, 1941	34.9	60,100	421.9	22.1	9,305	4.58	.20	.17
May 5, 1957	35.2	118,000	440.0	19.6	8,601	5.08	.18	.20

[1] Discharge is for measurement, not a subdivided estimate based on hydraulic analyses.

[2] Hydraulic computations before June 5, 1961, are pre-regulation of flow by reservoirs or other structures.

[3] Hydraulic depth is ratio of cross-sectional area to width, equivalent to mean depth.

Table 31. Hydraulic computations for historical cross sections of U.S. Geological Survey streamflow-gaging station 08114000, Brazos River at Richmond, Texas, 1957–2004.

[ft, feet; ft^3/s, cubic feet per second; ft^2, square feet; ft/s, feet per second; lb/ft^2, pounds per square foot; >, greater than; <, less than]

Date	Contemporary stage (ft)	Discharge[1] (ft^3/s)	Width[2] (ft)	Hydraulic depth[2, 3] (ft)	Cross-sectional area[2] (ft^2)	Mean velocity[2] (ft/s)	Bed shear stress[2] (lb/ft^2)	Froude number[2]
Moderate flow (>2,000 ft^3/s, <10,000 ft^3/s)								
15.0-foot target stage								
Aug. 13, 1957	15.2	2,360	265.3	9.36	2,483	0.62	0.09	0.04
June 15, 1978	14.8	2,100	190.1	12.2	2,317	.78	.11	.04
Feb. 23, 1993	15.2	8,340	274.4	9.30	2,554	1.87	.09	.11
Feb. 12, 1998	15.1	9,800	282.4	13.3	3,765	1.85	.12	.09
High flow (>20,000 ft^3/s)								
25.0-foot target stage								
Feb. 26, 1958	25.1	75,100	392.0	14.5	5,677	3.90	.13	.18
June 19, 1986	25.1	22,700	306.5	20.6	6,304	3.08	.19	.12
Jan. 15, 1991	24.8	37,500	325.8	20.3	6,625	3.22	.18	.13
Nov. 22, 2004	25.1	43,200	298.2	21.1	6,299	3.90	.19	.15
30.0-foot target stage								
Feb. 26, 1958	30.1	75,100	418.0	18.4	7,698	4.64	.17	.19
Jan. 15, 1991	29.8	37,500	346.6	24.0	8,301	3.64	.21	.13
Nov. 22, 2004	30.1	43,200	320.5	24.5	7,846	4.39	.21	.16

[1] Discharge is for measurement, not a subdivided estimate based on hydraulic analyses.

[2] Hydraulic computations before June 5, 1961, are pre-regulation of flow by reservoirs or other structures.

[3] Hydraulic depth is ratio of cross-sectional area to width, equivalent to mean depth.

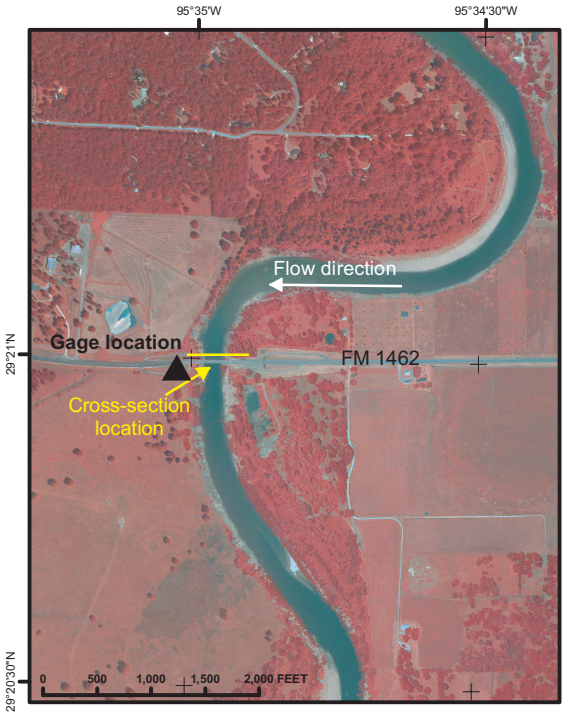


Figure 65. U.S. Geological Survey streamflow-gaging station 08116650 Brazos River near Rosharon, Texas, 2004 digital orthophoto quarter-quadrangle.

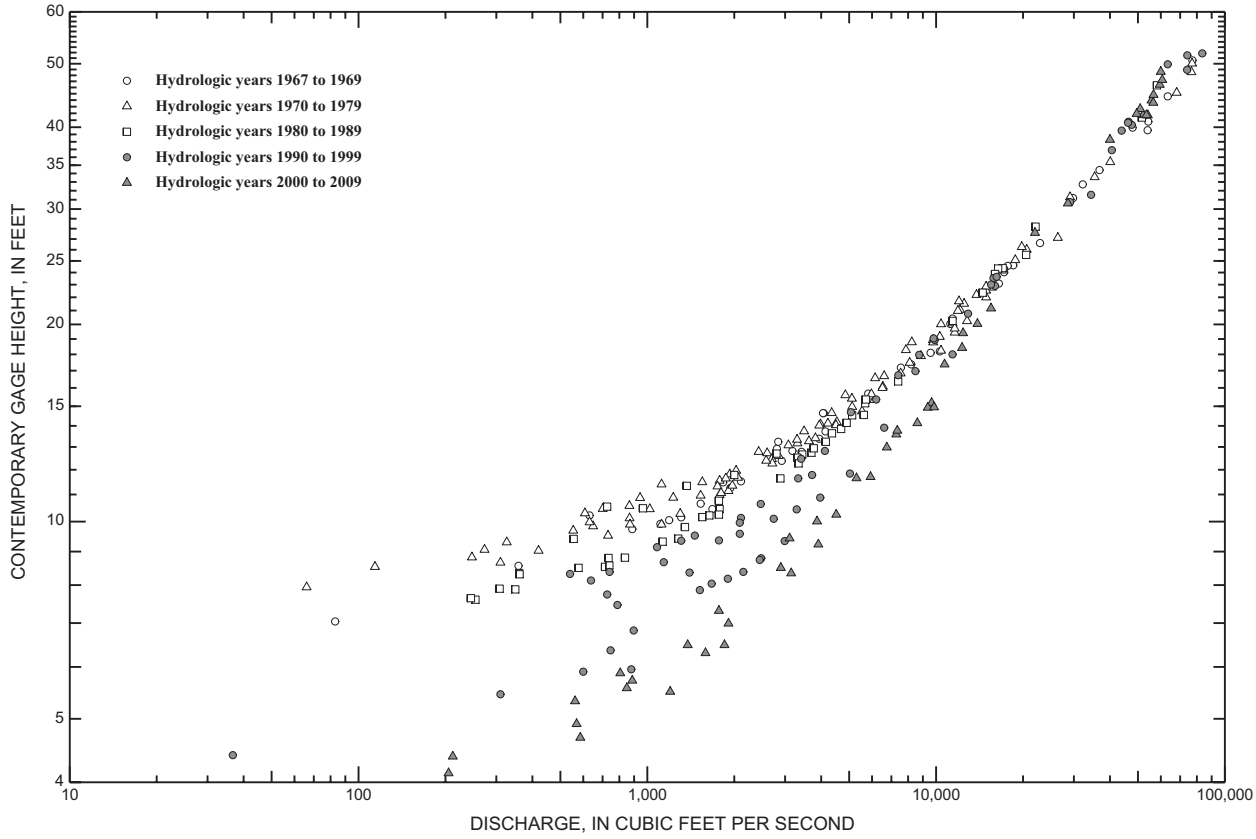


Figure 66. Stage-discharge relations of field measurements for U.S. Geological Survey streamflow-gaging station 08116650 Brazos River near Rosharon, Texas, 1967–2009.

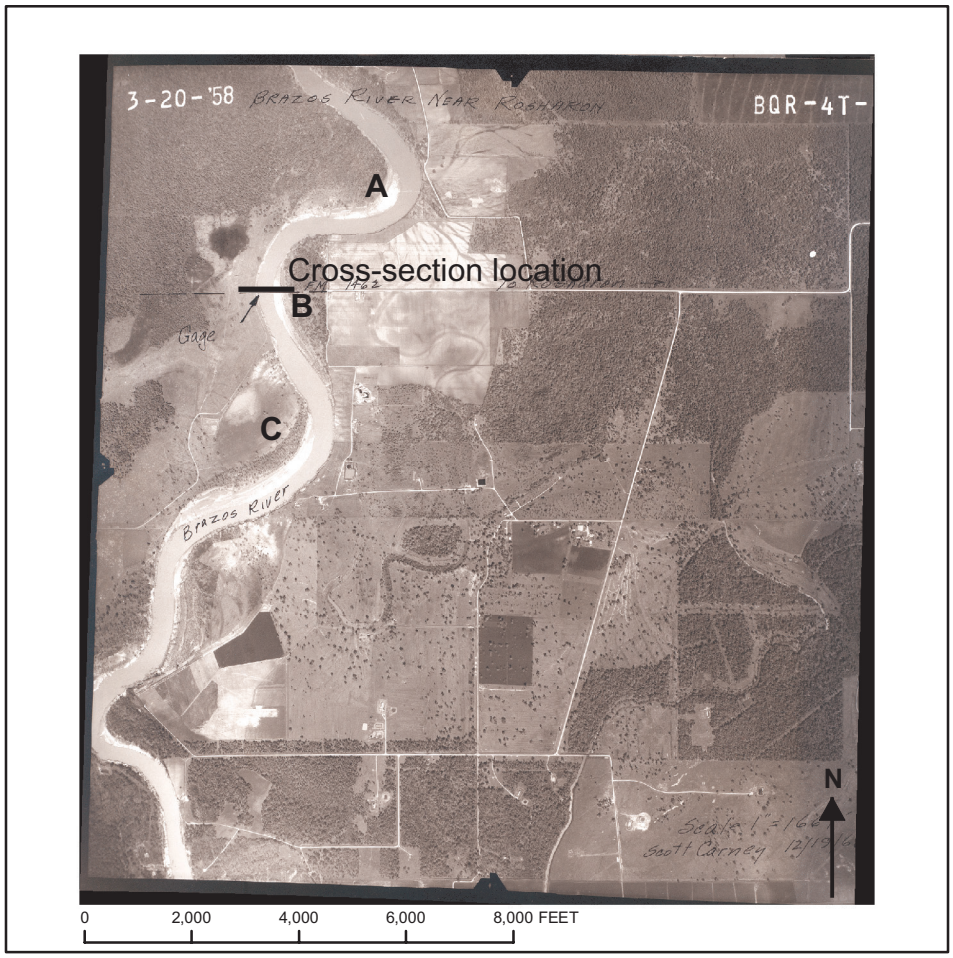


Figure 67. 1958 Aerial photograph showing U.S. Geological Survey streamflow-gaging station 08116650 Brazos River near Rosharon, Texas, and vicinity. ("A," "B," and "C" denote meander bends.)

(A)



(B)



Figure 68. U.S. Geological Survey streamflow-gaging station 08116650 Brazos River near Rosharon, Texas, (A) looking upstream from right bank, April 2, 1967 (not known if pilings visible at base of bridge pier are result of channel-bed incision); (B) looking upstream from right bank, August 7, 2008; (C) looking upstream from Farm-to-Market Road (FM) 1462 bridge, August 28, 1973; (D) looking upstream from FM 1462 bridge, August 7, 2008; (E) looking downstream from FM 1462 bridge, August 28, 1973; and (F) looking downstream from FM 1462 bridge, August 7, 2008.

(C)



(D)



Figure 68.—Continued.

(E)



(F)



Figure 68.—Continued.

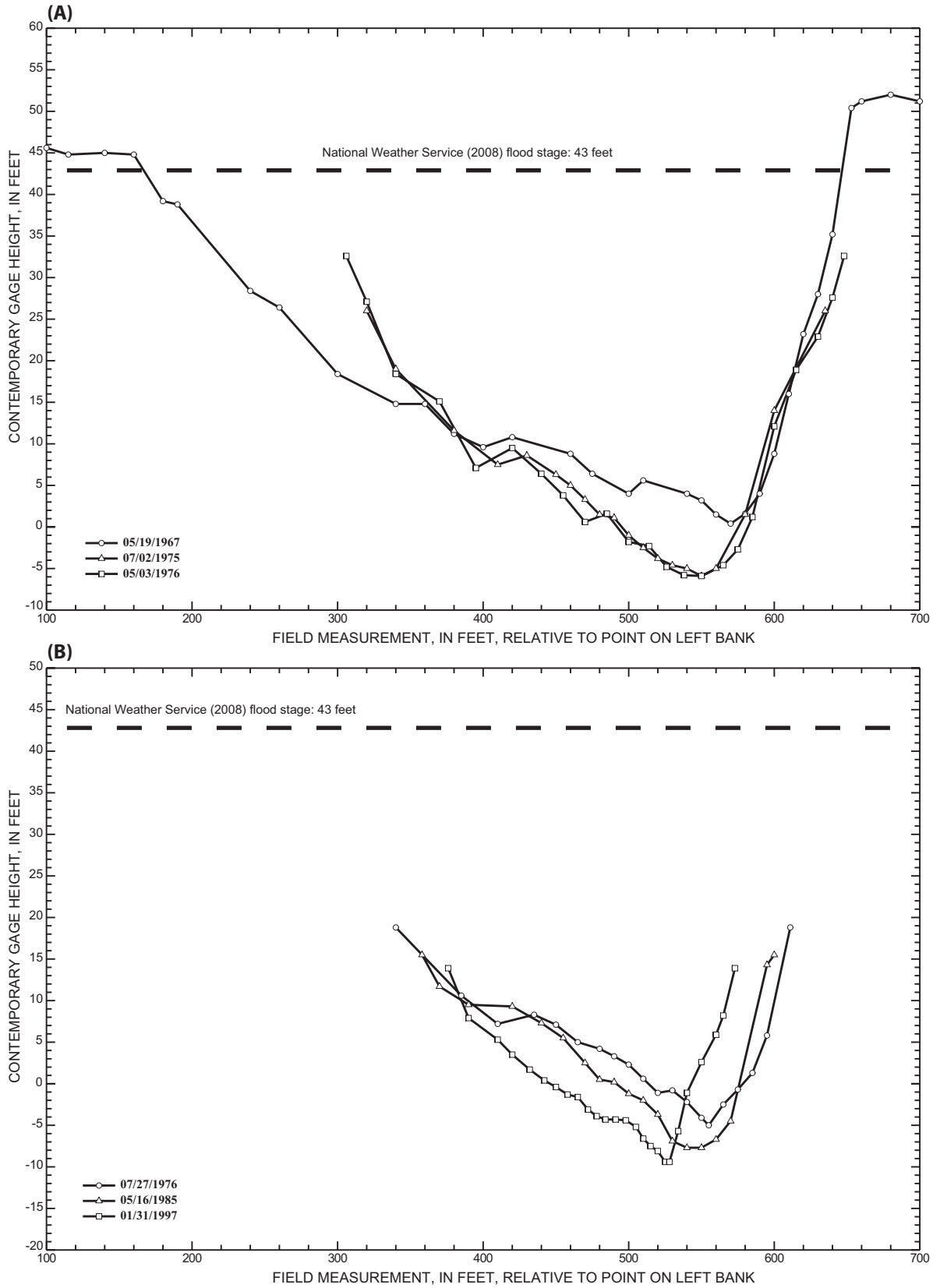


Figure 69. Historical cross-sectional channel geometry for U.S. Geological Survey streamflow-gaging station 08116650 Brazos River near Rosharon, Texas, (A) for one channel survey (1967) or for high-flow conditions (greater than 20,000 cubic feet per second), 1967–76; (B) for moderate-flow conditions (greater than 5,000 cubic feet per second and less than 10,000 cubic feet per second), 1976–97; and (C) for high-flow conditions (greater than 20,000 cubic feet per second), 1986–2000.

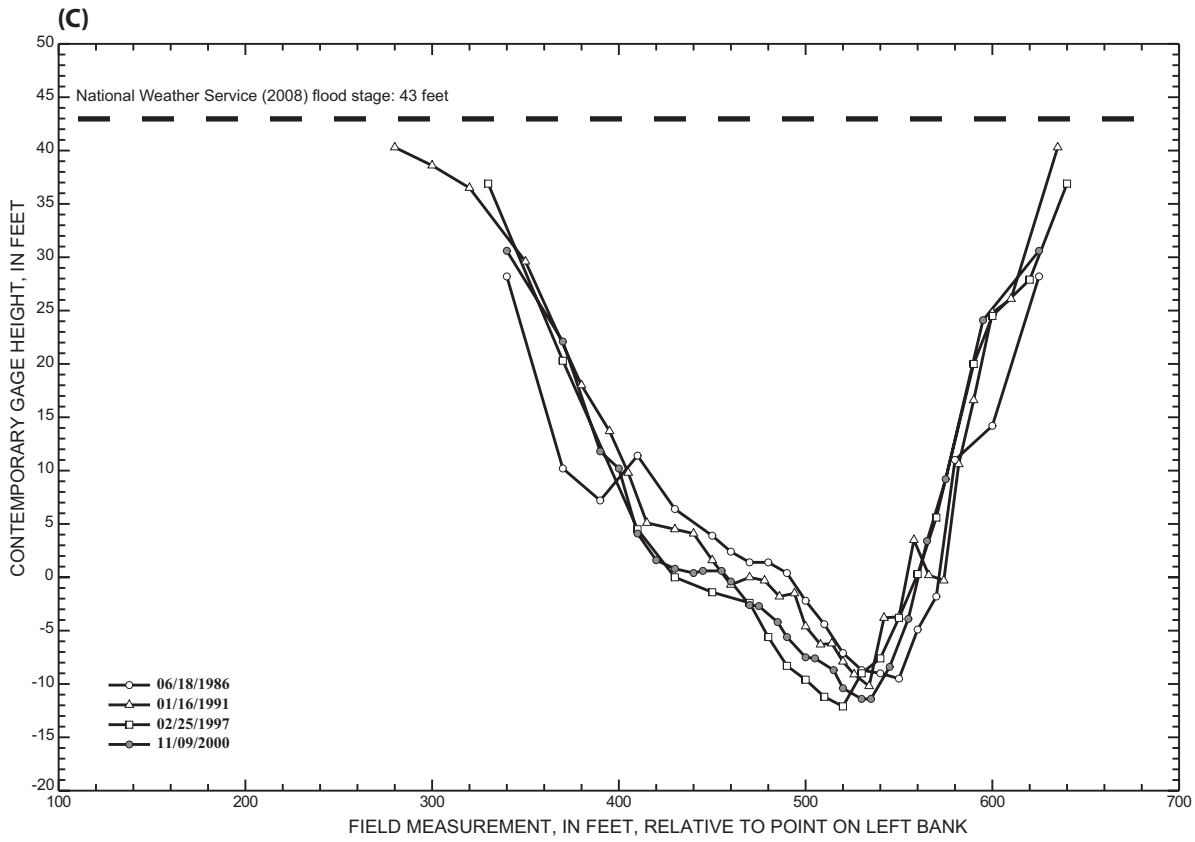


Figure 69.—Continued.

Table 32. Hydraulic computations for historical cross sections of U.S. Geological Survey streamflow-gaging station 08116650, Brazos River near Rosharon, Texas, 1975–76.

[ft, feet; ft^3/s, cubic feet per second; ft^2, square feet; ft/s, feet per second; lb/ft^2, pounds per square foot; >, greater than]

Date	Contemporary stage (ft)	Discharge[1] (ft^3/s)	Width[2] (ft)	Hydraulic depth[2, 3] (ft)	Cross-sectional area[2] (ft^2)	Mean velocity[2] (ft/s)	Bed shear stress[2] (lb/ft^2)	Froude number[2]
High flow (>20,000 ft^3/s)								
20.0-foot target stage								
July 2, 1975	20.1	20,600	280.9	14.5	4,066	2.96	0.13	0.14
May 3, 1976	20.1	35,400	283.4	15.0	4,258	3.02	.14	.14
25.0-foot target stage								
July 2, 1975	25.1	20,600	309.8	17.9	5,543	3.48	.16	.15
May 3, 1976	25.1	35,400	310.1	18.5	5,747	3.55	.17	.15

[1] Discharge is for measurement, not a subdivided estimate based on hydraulic analyses.

[2] All hydraulic computations are post regulation of flow by reservoirs or other structures.

[3] Hydraulic depth is ratio of cross-sectional area to width, equivalent to mean depth.

Table 33. Hydraulic computations for historical cross sections of U.S. Geological Survey streamflow-gaging station 08116650, Brazos River near Rosharon, Texas, 1976–2000.

[ft, feet; ft^3/s, cubic feet per second; ft^2, square feet; ft/s, feet per second; lb/ft^2, pounds per square foot; >, greater than; <, less than]

Date	Contemporary stage (ft)	Discharge[1] (ft^3/s)	Width[2] (ft)	Hydraulic depth[2, 3] (ft)	Cross-sectional area[2] (ft^2)	Mean velocity[2] (ft/s)	Bed shear stress[2] (lb/ft^2)	Froude number[2]
Moderate flow (>5,000 ft^3/s, <10,000 ft^3/s)								
10.0-foot target stage								
July 27, 1976	10.0	9,770	210.8	6.82	1,437	1.65	0.06	0.11
May 16, 1985	9.8	6,600	201.7	8.22	1,658	1.65	.07	.10
Jan. 31, 1997	10.1	6,610	182.8	10.3	1,887	2.11	.09	.12
High flow (>20,000 ft^3/s)								
20.0-foot target stage								
June 18, 1986	20.0	22,100	256.7	16.2	4,163	2.74	.14	.12
Jan. 16, 1991	19.8	47,600	218.6	17.4	3,809	3.56	.15	.15
Feb. 25, 1997	19.9	40,600	218.8	19.6	4,286	3.48	.17	.14
Nov. 9, 2000	20.1	28,600	215.8	19.5	4,214	3.57	.17	.14
25.0-foot target stage								
June 18, 1986	25.0	22,100	274.0	20.0	5,489	3.19	.18	.13
Jan. 16, 1991	24.8	47,600	237.6	20.8	4,950	4.04	.18	.16
Feb. 25, 1997	24.9	40,600	243.4	22.3	5,438	3.84	.20	.14
Nov. 9, 2000	25.1	28,600	240.2	22.2	5,342	3.97	.19	.15

[1] Discharge is for measurement, not a subdivided estimate based on hydraulic analyses.

[2] All hydraulic computations are post regulation of flow by reservoirs or other structures.

[3] Hydraulic depth is ratio of cross-sectional area to width, equivalent to mean depth.