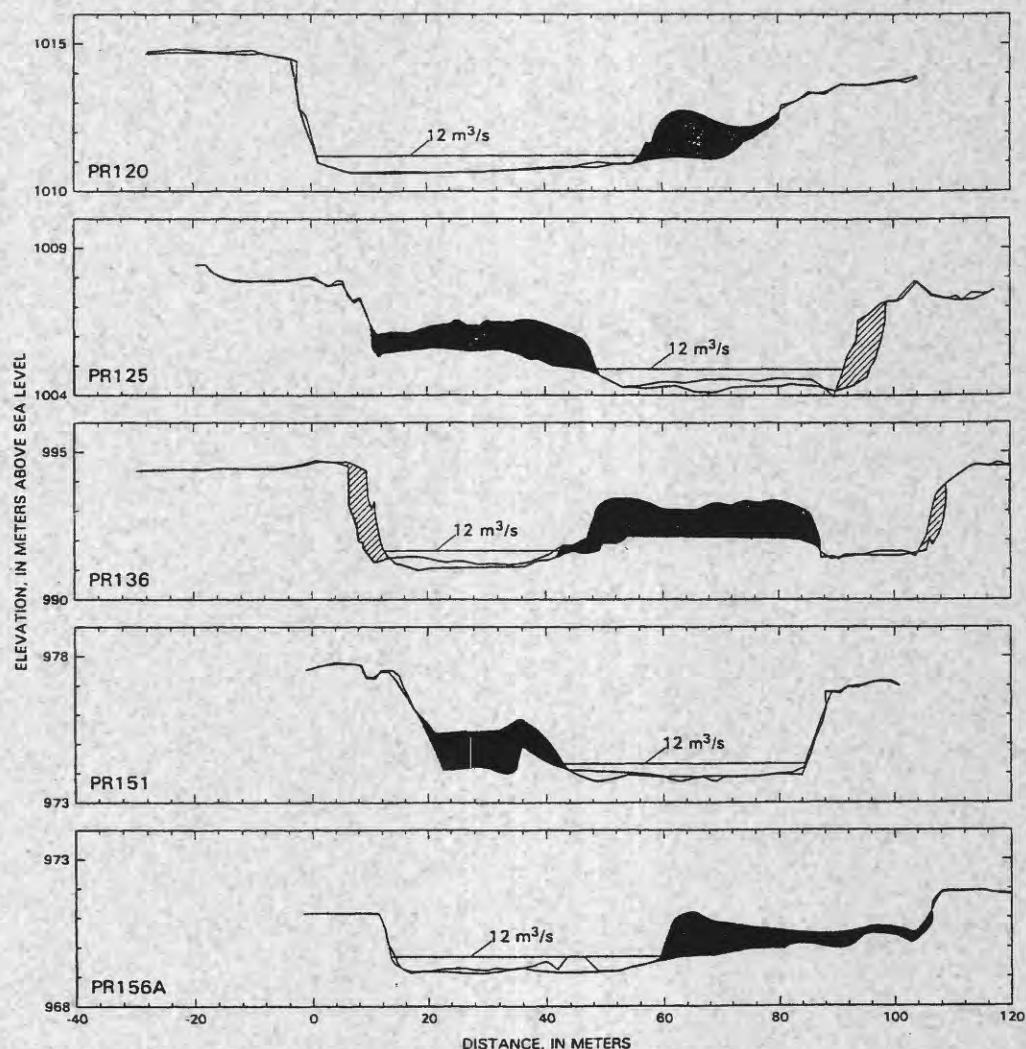


EROSION AND DEPOSITION OF SEDIMENT AT CHANNEL CROSS SECTIONS ON POWDER RIVER BETWEEN MOORHEAD AND BROADUS, MONTANA, 1980-98



U.S. Geological Survey

Water-Resources Investigations Report 02-4219

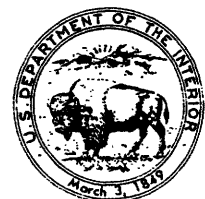


EROSION AND DEPOSITION OF SEDIMENT AT CHANNEL CROSS
SECTIONS ON POWDER RIVER BETWEEN MOORHEAD AND BROADUS,
MONTANA, 1980-98

by John A. Moody, Robert H. Meade, and Holly A. Martinson

U.S. Geological Survey

Water-Resources Investigations Report 02-4219



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CONVERSION FACTORS

Metric units (International System) in this report may be converted to inch-pound units by using the following conversion factors:

<i>Multiply</i>	<i>By</i>	<i>To obtain</i>
<i>Length</i>		
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
<i>Area</i>		
square meter (m ²)	10.76	square foot (ft ²)
square kilometer (km ²)	0.3861	square mile (mi ²)
<i>Volume</i>		
cubic meter (m ³)	1.308	cubic yard (yd ³)
<i>Velocity</i>		
meter per second (m/s)	3.281	foot per second (ft/s)
<i>Flow</i>		
cubic meter per second (m ³ /s)	35.31	cubic foot per second (cfs)
cubic meter per year (m ³ /yr)	35.31	cubic foot per year (ft ³ /yr)
<i>Mass</i>		
kilogram (kg)	2.205	pounds avoirdupois (lb)
<i>Mass Flow</i>		
metric tons per day	1.102	tons per day (tons/d)
metric tons per year	1.102	tons per year (tons/yr)
<i>Mass Yield</i>		
metric tons per square kilometer per year (metric tons/km ² /yr)	2.854	tons per square mile per year (tons/mi ² /yr)

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of both the United State and Canada, formerly called Sea Level Datum of 1929.

Errata

These are corrections for the first Open-File Report 89-407 titled:

**Channel Changes at cross sections of the Powder River between Moorhead and Broadus,
Montana, 1975-88 by John A. Moody and Robert H. Meade.**

p. 6 and 7. Elevation for cross section PR163 is 965.53 meters above sea level.

p. 13. The labels in figure 4 should read Moorhead not Moorehead.

p. 143. Location of bench mark BM-PR156 is shown (not BM-PR151).

p. 244. Bench mark for PR206 is on the right bank (not on the left bank).

EROSION AND DEPOSITION OF SEDIMENT AT CHANNEL CROSS

SECTIONS ON POWDER RIVER BETWEEN

MOORHEAD AND BROADUS, MONTANA, 1980-98

John A. Moody, Robert H. Meade, and Holly A. Martinson

ABSTRACT

Erosion and deposition of sediment and some characteristics of these sediments were measured along a 95-kilometer study reach of Powder River between Moorhead and Broadus, Montana from 1988 to 1998. Suspended-sediment samples were collected at two gaging stations (Moorhead and Broadus, Montana). Sediment samples were also collected from the flood plain and channel within the study reach. Bed elevations were measured each year after the peak runoff at 21 cross sections and for different time intervals at an additional 12 cross sections.

The proportions of sand (particle diameters greater than or equal to 0.063 millimeters) and silt and clay (less than 0.063 millimeters) in the suspended sediment depended upon the type of flood. Ice break-up floods in February and March carried 28 percent sand, snowmelt floods in May and June carried 23 percent sand, and flash floods during the summer carried 7 percent sand. The proportion of sand in the deposited sediment depended upon the distance of the sample from the channel. Samples from the channel contained about 99 percent sand, samples from the flood plain crest adjacent to the channel contained about 70 percent sand, and samples from the flood plain trough farthest from the channel contained about 10 percent sand.

Changes in erosion and deposition of sediment were measured by changes in the minimum riverbed elevation and changes in the cross-sectional area. In general, the minimum riverbed elevation fluctuated from year to year and showed no strong trend toward either increase or decrease. Standard deviations of the minimum riverbed elevation ranged from 0.01 to 0.30 meter. Areas of erosion and deposition were calculated for successive years at each cross section and subjectively assigned to four features where erosional and depositional processes were active: 1) bank, 2) flood plain, 3) channel, and 4) point bar. Erosion exceeded deposition by 47 percent at one cross section and deposition exceeded erosion by 41 percent at another cross section. However, the average of all the cross sections indicated, in general, that the erosion of sediment was balanced by the deposition of sediment.

INTRODUCTION

Powder River flows east and northeast from the Bighorn Mountains in north-central Wyoming through northeastern Wyoming and southeastern Montana (fig. 1). At its confluence with the Yellowstone River, Powder River drains an area of 34,706 km² and has an average discharge of about 500 million m³/yr or 16m³/s. Near the Wyoming-Montana State line (at the gaging station at Moorhead, Montana), Powder River discharges an average of 2 to 3 million metric tons of suspended sediment per year, which corresponds to a sediment yield of about 400 metric tons/km²/yr. The Powder River drainage basin includes areas of conventional production of oil and coal (Teapot Dome oil fields and part of the Gillette coal field) and areas of coal-bed methane production. At the present time, the primary use of river water in the basin is for irrigation. No dams or other large engineering structures obstruct the flow of Powder River or its principal tributaries.

Three types of floods occur on Powder River: ice break-up floods, snowmelt floods, and flash floods (figs. 2 and 3). Ice break-up floods are caused by snowmelt or rain at low elevation in February or March. They occur along most of the mainstem and last a few days to a week, often breaking up the ice cover and creating ice dams, which amplify the flooding in localized areas. Snowmelt floods are caused by snowmelt at higher elevations, primarily in the Bighorn Mountains. Snowmelt floods usually are larger than the ice break-up floods, typically occur in May or June along the entire mainstem, and may last several weeks. Flash floods are caused by localized summer (June through September) convective rain storms. They affect only a few tributaries and often only part of the mainstem Powder River.

In 1975, a program of measurements was begun to define long-term sediment budgets and channel changes along a study reach of Powder River. This river was selected for several reasons. First, Powder River carries a large load of suspended sediment (Hembree and others, 1952), which is an indication of active sedimentary processes in the river and in its drainage basin. Second, Powder River is one of the few remaining rivers of its size in the region that is not controlled by a dam (in contrast with the neighboring Bighorn, Tongue, and Belle Fourche Rivers). Third, a major flood occurred on the river in 1978, and these post-flood measurements continue a long-term record (Moody and Meade, 1990) of how an active river-floodplain system adjusts to a major disturbance.

Purpose and Scope

The purpose of this report is to present measurements of the erosion and deposition of sediment at channel cross sections following a major flood in a river that carries a large sediment load. The reach selected for detailed study was the 95-km reach of Powder River between Moorhead and Broadus, Montana (fig. 1). Samples of suspended sediment (eroded sediment) were collected at the gaging stations at Moorhead and Broadus, and samples of sediment deposited on the flood plain were collected at various locations. Data are presented that describe the characteristics of this eroded and deposited sediment. The amounts of erosion and deposition of sediment at channel cross sections were computed from the distances and elevations listed in this report and subjectively assigned to four features where erosional and depositional processes were active: 1) bank, 2) flood plain, 3) channel, and 4) point bar.

Acknowledgments

We thank the ranchers and landowners along Powder River for their hospitality and their continuing courtesy in allowing us repeated access to the river. They are, in downstream order: Hugh and Cheri Fulton, George and Evelene Fulton, Larry and Linda Thomas, Jim and Ellie Bowers, Tom and Carla Bowers, Jim and Sherry Bowers, Bill and Dinah Gay, Glenn Gay, Hubert and Mary Gay, Bunk Huckins, Gary Huckins, Floyd and Dora Huckins, Butch Samuelson, the late

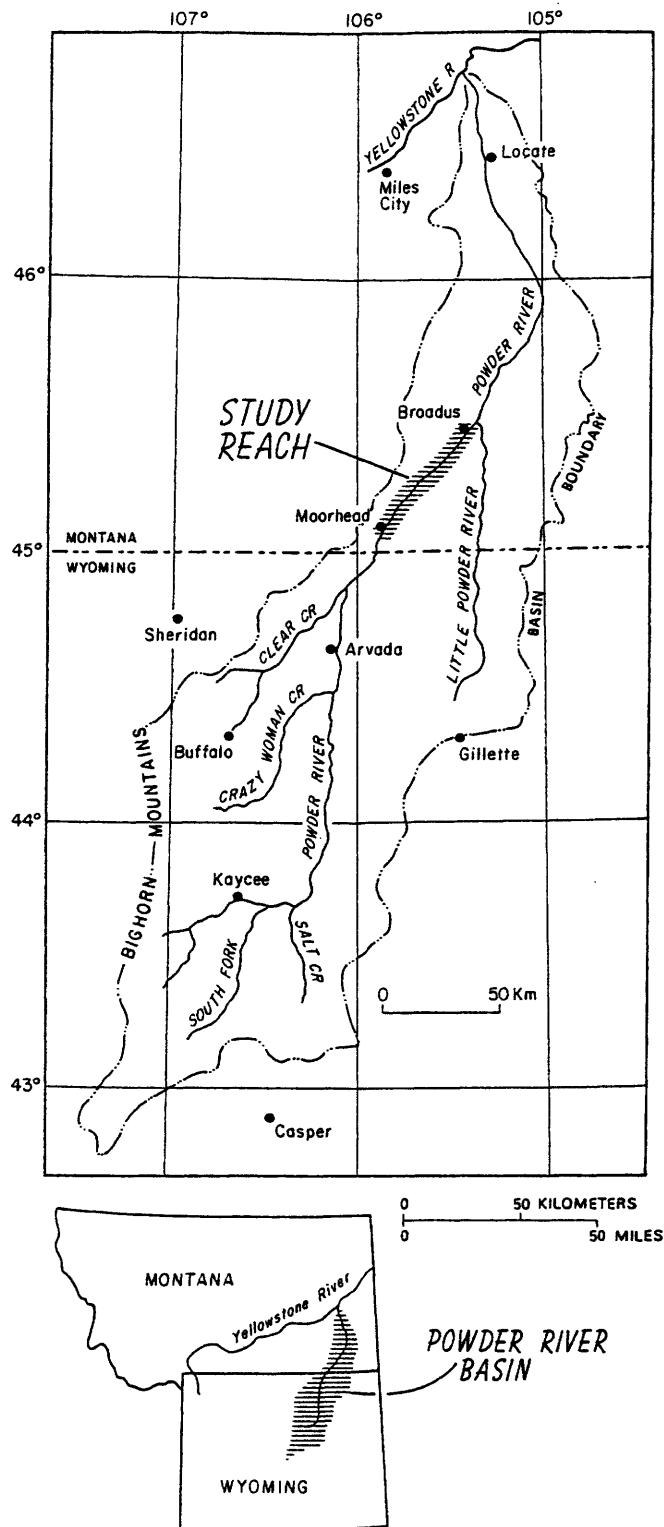


Figure 1.--Location of Powder River drainage basin and the study reach.

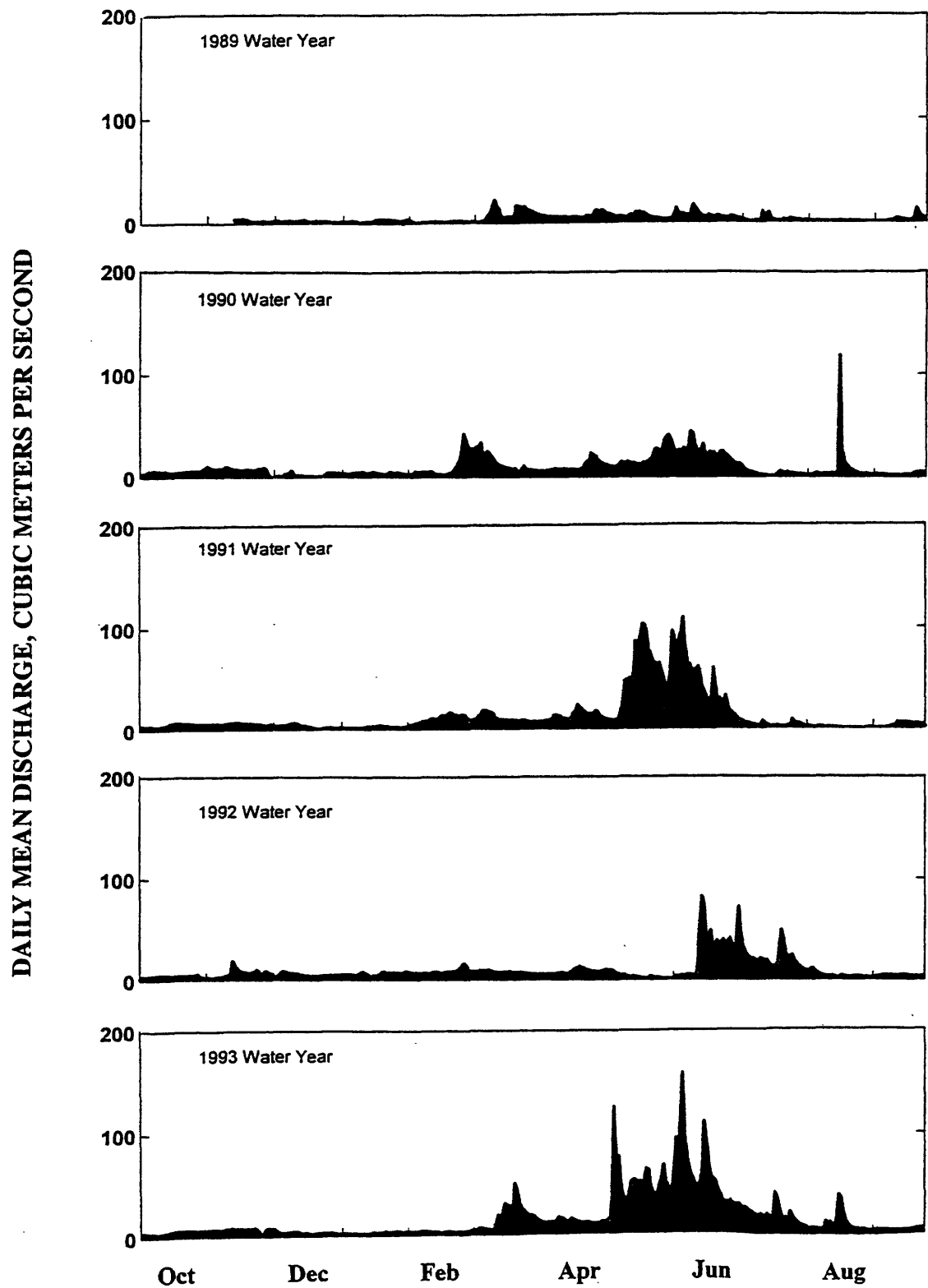


Figure 2. Daily mean water discharge for Powder River at Moorhead, Montana, for each water year 1989, 1990, 1991, 1992, and 1993.

DAILY MEAN DISCHARGE, CUBIC METERS PER SECOND

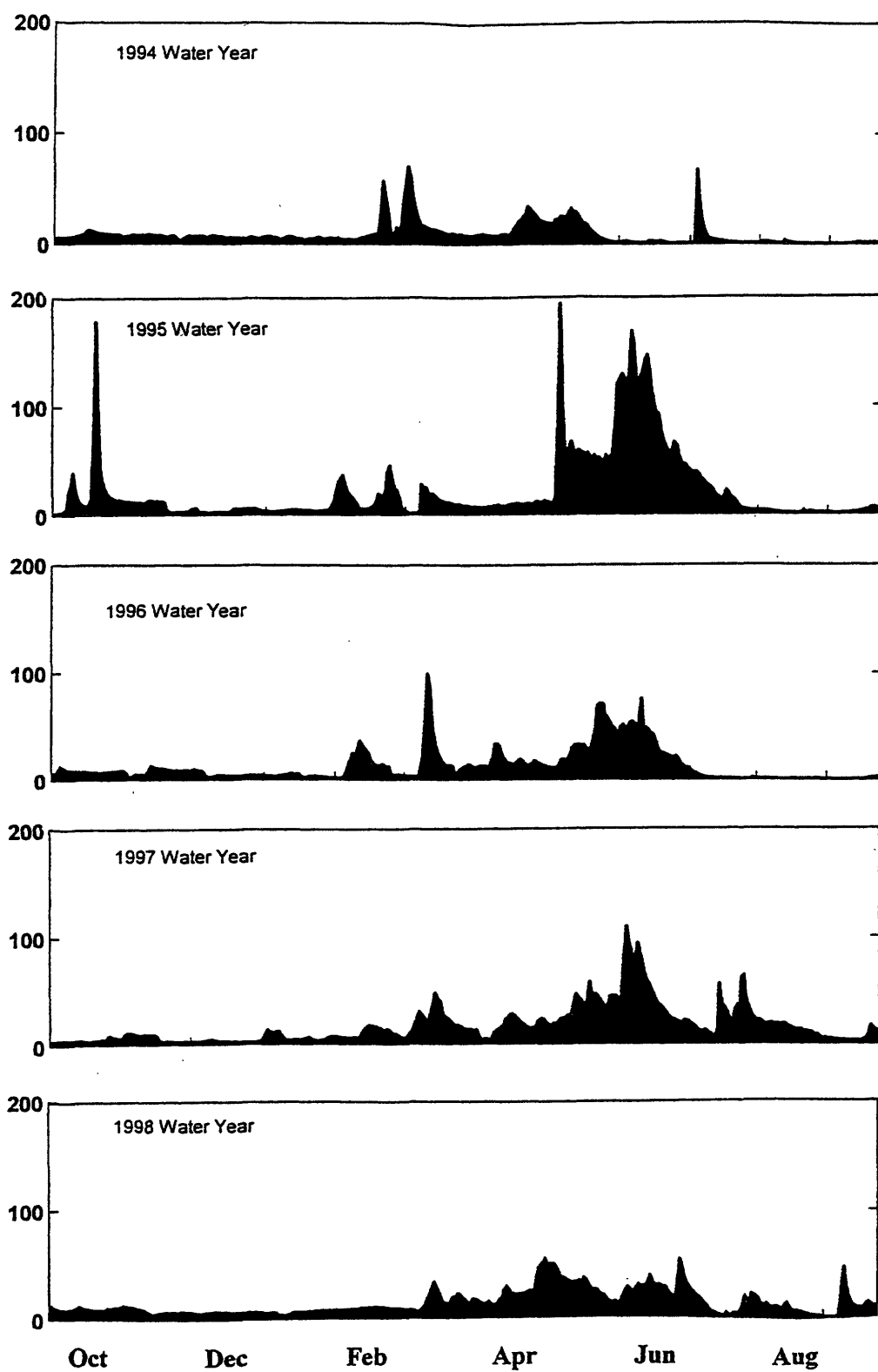


Figure 3. Daily mean water discharge for Powder River at Moorhead, Montana, for each water year 1994, 1995, 1996, 1997, and 1998.

John Daily, James Cossitt, the late J.L. Wilson and his wife Phyllis, Dick and Connie Wilson, Craig and Jackee Randall, Doug and Lucille Randall, the late Shirley Stuver, John and Diane Stuver, Charlie and Shirley Russell, Ron and Twila Talcott, and Jean Hough. We also acknowledge the stimulating conversations and encouragement, along the banks of the Powder River, with Jim Pizzuto, Nick Allmendinger, Koichi Fujita, Nicole Surian, and J. Dungan Smith. Deborah Martin was instrumental in helping with the GPS measurements in 1998, which provided accurate locations of the cross sections on Powder River for geomorphological research in the future. Jim Pizzuto provided some sediment data for this report. Deborah Martin and Jim Pizzuto provided useful suggestions to improve the original report.

SUSPENDED-SEDIMENT

Depth-integrated samples of suspended sediment were collected from bridges near the gaging stations at Moorhead, Montana, from 1975 through 1997 and at Broadus, Montana, from 1975 through 1995. These samples represent typical sediment eroded from the banks and bed of Powder River. Particle-size analyses of 305 of these samples included either a determination of sand fraction and silt and clay fraction by sieve analyses at whole phi intervals [$\phi = -\log_2$ (particle diameter in millimeters)], or a determination of sand fraction, silt fraction, and clay fraction by settling analyses at whole phi intervals (U.S. Geological Survey, 1975-97). These analyses were sorted first by the type of flood and then by whether or not the mean daily discharge was increasing (rising stage), at a maximum, decreasing (falling stage), or at a minimum. From the 305 samples, 51 samples were collected during ice break-up floods, 47 samples were collected during snowmelt floods, 17 were collected during flash floods, and 190 samples were collected during other times of the year. Because all analyses (115 samples, see Appendix) obtained data for the percent sand (>0.063 mm) and for the percent silt and clay (<0.063 mm), the sediment characteristics of the three types of floods are summarized by these two size classes (table 1).

The maximum total suspended-sediment concentration and the relative proportions of sand versus silt and clay were different for the three types of floods. Snowmelt floods carried the greatest maximum concentration (52,200 mg/L), followed by flash floods (49,700 mg/L), and ice break-up floods (26,000 mg/L). Ice break-up floods carried a greater percentage of sand (28 percent) than either the snowmelt floods (23 percent) or the flash floods (7 percent). In ice break-up floods, the greatest mean concentration of sand (3,820 mg/L) occurred during falling stages, whereas in snowmelt and flash floods, the greatest mean concentrations (3,160 and 2,880 mg/L, respectively) occurred during maximum stage. Flash floods during maximum and falling stages (no samples were collected during rising stages) carried a greater percentage of silt and clay (90-96 percent) than ice break-up floods (66-81 percent) and snowmelt floods (75-79 percent). Mean concentrations of silt and clay (15,300-24,300 mg/L) during the maximum and falling stages of flash floods were also greater than those measured for ice break-up floods (5,110-5,120 mg/L) and for snowmelt floods (6,130-16,600 mg/L).

Many samples were collected during a snowmelt flood (13 May 1981 to 6 July 1981) and during an ice break-up flood (19-21 March 1997). Both data sets were collected at the gage at Moorhead, Montana. For the snowmelt flood (fig. 4A), the silt and clay concentration indicated a clockwise loop relation with discharge. The maximum concentration of silt and clay (18,200 mg/L) occurred during the rising stage ($33.1 \text{ m}^3/\text{s}$) before the maximum discharge ($56.9 \text{ m}^3/\text{s}$). The sand concentration approximated a linear relation with discharge and reached a maximum at maximum discharge (3,580 mg/L at $56.9 \text{ m}^3/\text{s}$). During the ice break-up flood (fig. 4B), in contrast, the silt and clay concentration showed a counterclockwise hysteresis loop and reached a maximum concentration (7,680 mg/L) on the falling stage ($63.1 \text{ m}^3/\text{s}$) after the maximum discharge ($129 \text{ m}^3/\text{s}$). The sand concentrations showed a similar relation with discharge but a greater con-

Table 1. Suspended-sediment characteristics of samples collected during floods on Powder River at Moorhead and Broadus, Montana

[Data source is annual publications (U.S. Geological Survey, 1975-97); mm, millimeter; %, percent of total concentration; mg/L, milligram per liter; Slope, slope of linear regression of concentration and water discharge in cubic meters per second (m^3/s); Intercept, intercept of linear regression of concentration and water discharge in cubic meters per second; r^2 , coefficient of determination; nr, insufficient data or coefficient of determination is less than 0.1]

Characteristic	Silt and Clay (<0.063 mm)					Sand (>0.063 mm)				
	Rising	Maximum	Falling	Minimum	Total	Rising	Maximum	Falling	Minimum	Total
Ice break-up floods										
Number samples	14	5	32	2	53	14	5	32	2	53
Mean (%)	82	81	66	78	72	18	19	34	22	28
Mean concentration (mg/L)	2,610	5,110	5,120	2,390	4,350	570	1,240	3,820	1,010	2,610
Slope (mg/L per m^3/s)	24	-25	nr	nr	nr	11	nr	100	nr	551
Slope for intercept = 0	41	nr	nr	nr	nr	9.7	nr	80	nr	
Intercept (mg/L)	1,200	6,300	nr	nr	nr	-110	nr	-1,500	nr	-200
Intercept set = 0	0	nr	nr	nr	nr	0	nr	0	nr	0
r^2	0.56	0.68	nr	nr	nr	0.54	nr	0.48	nr	0.19
r^2 for intercept = 0	0.24	nr	nr	nr	nr	0.53	nr	0.44	nr	0.19
Snowmelt floods										
Number samples	13	14	17	4	48	13	14	17	4	48
Mean (%)	79	79	75	68	77	21	21	25	32	23
Mean concentration (mg/L)	8,940	16,600	6,130	1,180	9,590	1,740	3,160	1,570	488	2,000
Slope (mg/L per m^3/s)	92	240	63	52	120	14	34	9.6	37	19
Slope for intercept = 0	133	210	79	62	140	25	37	nr	33	27
Intercept (mg/L)	3,700	-3,000	2,000	320	1,700	940	360	930	-130	750
Intercept set = 0	0	0	0	0	0	0	0	nr	0	0
r^2	0.30	0.67	0.20	0.92	0.38	0.34	0.70	0.28	0.98	0.43
r^2 for intercept = 0	0.20	0.66	0.21	0.85	0.37	0.05	0.69	nr	0.96	0.34
Flash floods										
Number samples	0	4	13	1	18	0	4	13	1	18
Mean (%)	--	90	96	68	93	---	10	4	32	7
Mean concentration (mg/L)	--	24,300	15,300	2,260	16,600	---	2,880	583	1,070	1,120
Slope (mg/L per m^3/s)	nr	130	700	nr	150	nr	20	51	nr	22
Slope for intercept = 0	nr	190	850	nr	210	nr	24	44	nr	25
Intercept (mg/L)	nr	11,000	3,600	nr	10,000	nr	940	-150	nr	410
Intercept set = 0	nr	0	0	nr	0	nr	0	0	nr	0
r^2	nr	0.60	0.42	nr	0.43	nr	0.82	0.86	nr	0.84
r^2 for intercept = 0	nr	0.40	0.39	nr	0.10	nr	0.73	0.84	nr	0.80

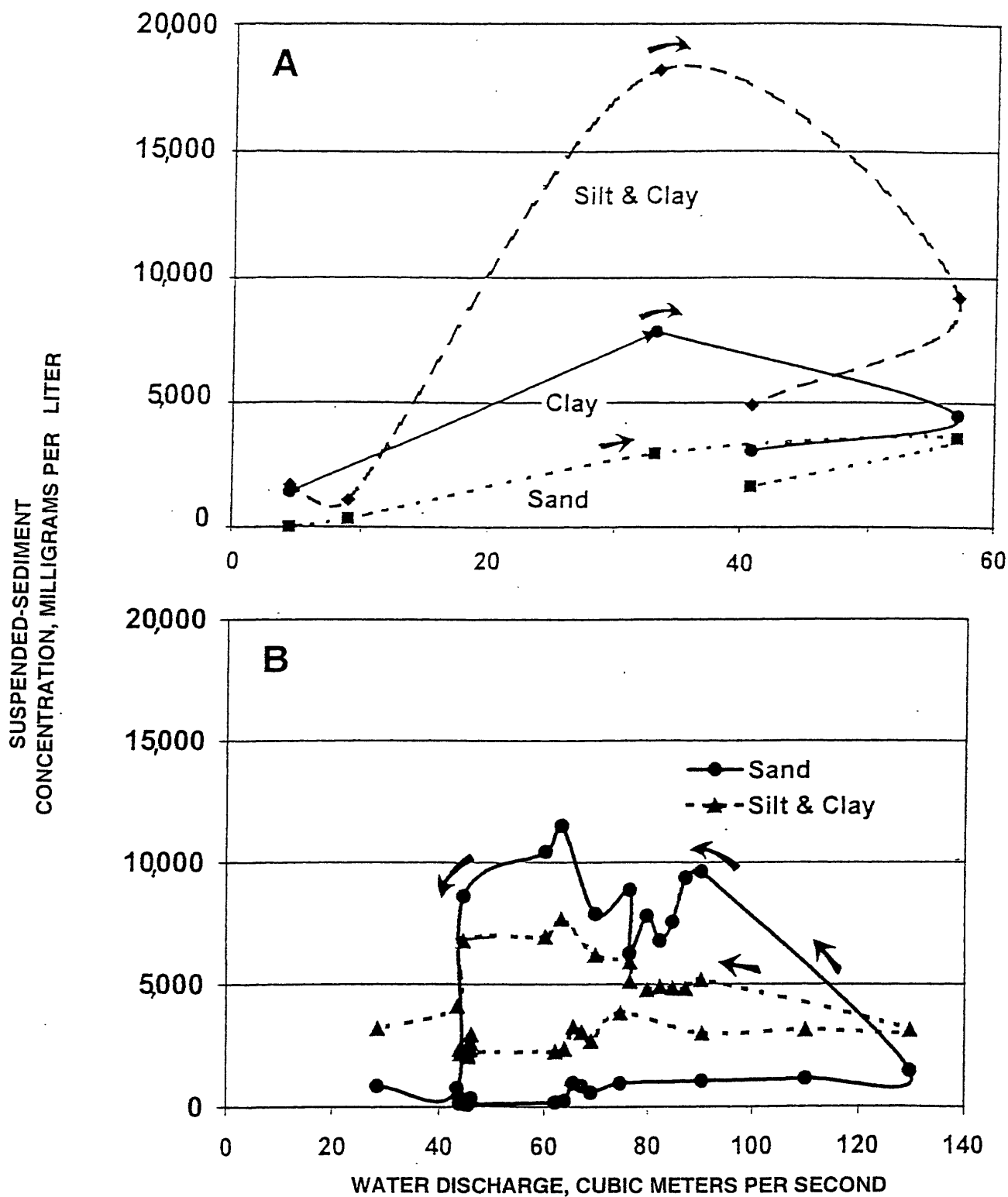


Figure 4. Relations between suspended-sediment concentration and water discharge for single floods. A. Snowmelt flood samples collected between 13 May 1981 and 6 July 1981. The clay value was not determined for the second sample on 19 May 1981 but was certainly less than the silt and clay value. B. Ice break-up flood samples collected between 19 and 21 March 1997.

centration (11,500 mg/L) during the falling stage ($63.1 \text{ m}^3/\text{s}$).

The relation between suspended-sediment concentration and discharge was variable for the three types of floods. Visual inspection of the patterns of the data indicated that linear regressions would approximate the relations as well as more complex equations. Thus, two straight lines were fit to the data for each flood and for each stage category (rising, maximum, falling, and minimum). One line allowed the concentration at zero discharge to differ from zero and the other line set the concentration at zero discharge equal to zero (table 1). Most of the linear relations had coefficients of determination (r^2) less than 0.50. However, the relations between the concentration of silt and clay and maximum discharge and the relations between the concentration of sand and the maximum discharge had coefficients of determination greater than 0.50 (see lines in figure 5). The one exception was for ice break-up floods where the concentration of silt and clay decreased with increase in the maximum discharge. During falling discharge in ice break-up floods, sand concentrations were the largest (fig. 5A, right panel), but the relation with discharge had a correlation coefficient of only 0.48 and 0.44 for the two linear regressions.

DEPOSITED SEDIMENT

Samples of the sediment deposited on the flood plains and in the channels were collected over several years at different cross sections. Some samples were sediment cores, some were composite samples collected from the sides of holes dug in the flood plain, some were surficial samples, and one sample was collected underwater from newly deposited sediment adjacent to the river bank. All samples were processed by either wet sieving or dry sieving on a Ro-Tap for 20 minutes to determine the sand fractions ($>0.063 \text{ mm}$) and the silt and clay fraction ($<0.063 \text{ mm}$). The silt and clay fraction, in some cases, was further analyzed by settling in a solution of sodium hexametaphosphate and using standard pipette methods (Guy, 1969) to separate the silt fraction and the clay fraction.

Sample collection was concentrated on examples of the channel-expansion flood plains (PR120, PR125, PR136, PR151, and PR156A), which developed slowly in annual increments following the 1978 flood (Moody and others, 1999). The percentage of sand in sediment deposited on the flood plain crest at PR120 (table 2) decreased in the downstream direction. At 400 m upstream from the cross section, sand comprised 87.3 percent and decreased to 68.4 percent at 200 m downstream. In general, after many floods, the sediments on the flood-plain crest adjacent to the channel at other cross sections were mostly sand (38.5-87.3 percent) and the average of 12 samples in table 2 was 72.2 percent. Sediments in the flood-plain trough were mostly clay (36.7-52.0 percent) with an average sand content of 13.2 percent for 6 samples in table 2. Sediment deposited after a single flood in October 1994 was coarser (80 percent sand) at the flood-plain crest of PR156A and finer (24.1 percent sand) in the flood-plain trough (table 2).

The channel banks and beds are sources of sediment that may be eroded or resuspended and deposited on the flood plain. The bank sediment was mostly sand (60.8 percent) in the top layer (0-0.30 m) and mostly silt and clay (59.6-89.9 percent) in the remaining layers, down to a basal gravel layer (table 2). The bed of Powder River is mostly sand and gravel (99.2 percent sand). Patches of sand move over the top of the gravel and change location along the cross sections from year to year. The sand is mostly fine and medium sand (77.3-95.8 percent). However, newly deposited sediment on the bed can be finer. For example, sediment deposited adjacent to the bank of cross section PR125 during a snowmelt flood in 1996 contained 99 percent silt and clay and 1 percent sand. The particle-size distribution of these deposited sediments is compared with the suspended or eroded sediments in figure 6.

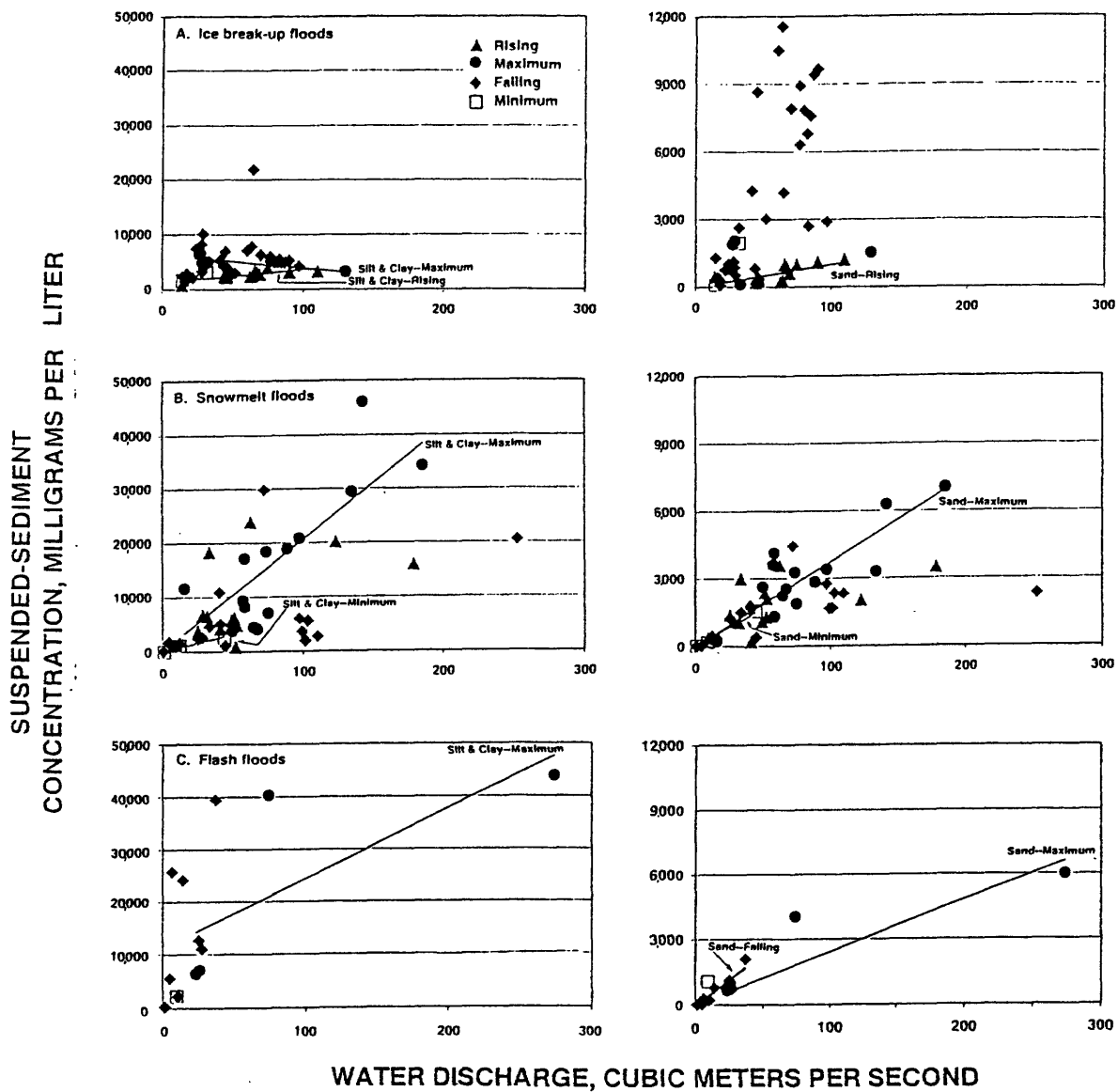


Figure 5. Relations between suspended-sediment concentration and water discharge for multiple floods. A. Ice break-up floods B. Snowmelt floods and C. Flash floods.

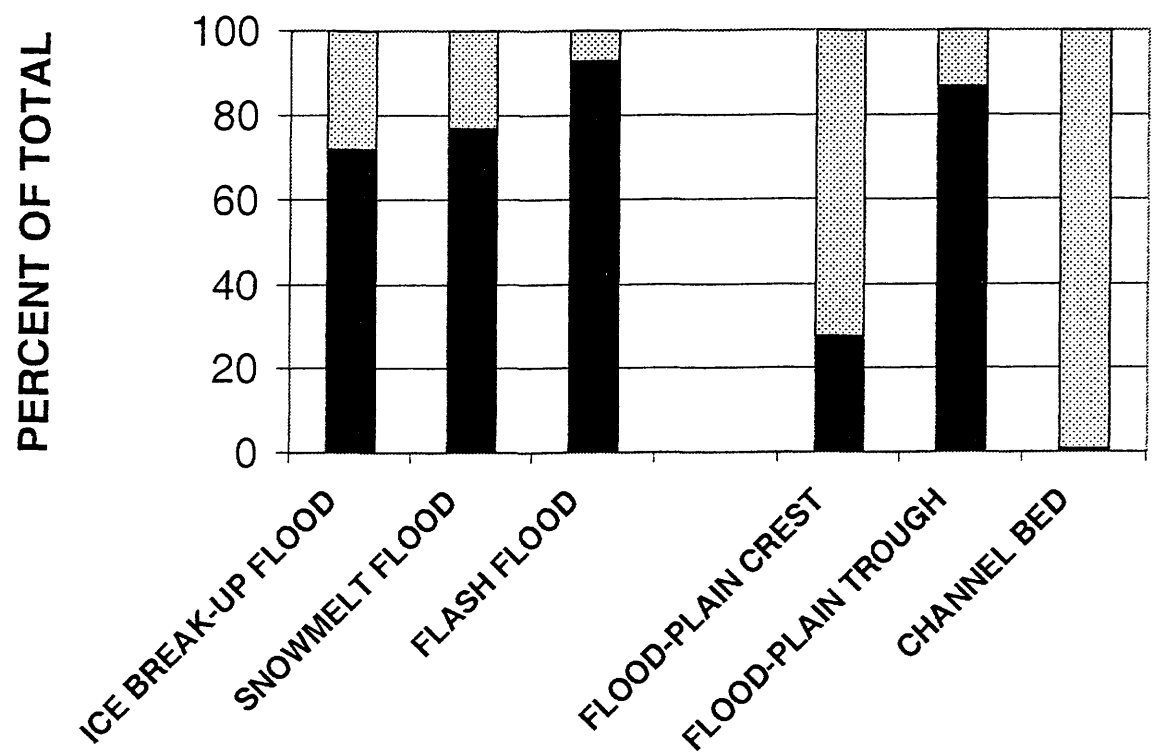


Figure 6. Percentages of sand and silt and clay in eroded and deposited sediments. Sand is shown by the stippled bar and silt and clay by the black bar.

Table 2. Particle-size analysis of sediment deposited on the flood plain and on the bed of Powder River

[mm, millimeter; m, meter; <, less than; >, greater than; Location is given by the cross section number followed by the distance in meters upstream (negative) or downstream (positive); sta., station)]

Date	Location	Sta.	Depth	Percent of total sample										Total percentage		
				Clay	Silt				Sand							
				(m)	(m)	<0.004 (mm)	0.004- 0.008 (mm)	0.008- 0.016 (mm)	0.016- 0.032 (mm)	0.032- 0.063 (mm)	0.063- 0.125 (mm)	0.125- 0.250 (mm)	0.250- 0.500 (mm)	0.500- 1.00 (mm)	>1.00 (mm)	Clay
1992 ^a																
10 Aug.	PR120-400	crest	0-0.25	2.7			10.0		36.1	48.4	2.4	0.4	0.0	2.7	10.0	87.3
	PR120-330	crest	0-0.25	3.0			11.8		39.5	43.0	2.3	0.3	0.0	3.0	11.8	85.1
	PR120-220	crest	0-0.25	6.2			20.2		44.2	27.9	1.2	0.4	0.0	6.2	20.2	73.7
	PR120-110	crest	0-0.25	4.9			23.3		40.2	30.4	0.9	0.3	0.0	4.9	23.3	71.8
	PR120+70	crest	0-0.25	3.9			18.9		43.9	32.2	0.9	0.2	0.0	3.9	18.9	77.2
	PR120+200	crest	0-0.25	5.1			26.7		44.1	23.5	0.7	0.1	0.0	5.1	26.7	68.4
	PR120+8	56	0-0.25	8.1			57.4		25.8	7.3	1.0	0.3	0.0	8.1	57.4	34.4
	PR120+8	58	0-0.25	1.5			4.3		24.1	67.3	2.3	0.4	0.0	1.5	4.3	94.1
	PR120+8	65	0-0.25	5.2			30.4		44.2	19.3	0.7	0.1	0.0	5.2	30.4	64.3
	PR120+8	72	0-0.25	41.0			46.3		7.2	4.8	0.6	0.0	0.0	41.0	46.3	12.6
1994																
24 Sept.	PR120-220	bed	0-0.25			0.2			0.9	22.5	58.5	13.4	4.5	0.2		99.8
	PR120-170	bed	0-0.25			0.4			0.7	29.2	55.9	9.3	4.5	0.4		99.6
	PR120-110	bed	0-0.25			0.8			2.2	48.1	47.7	0.9	0.2	0.8		99.1
	PR120	bed	0-0.25			0.3			4.9	77.7	15.6	0.9	0.5	0.3		99.6
	PR120+35	bed	0-0.25			2.2			19.2	68.0	9.3	0.6	0.6	2.2		97.7
5 Nov.	PR120+2	60.0	0-1.15	7.4	1.2	1.9	5.5	14.4	31.0	37.2	1.2	0.1	0.0	7.4	23.0	69.5
		62.0	0-1.00	4.6	0.7	2.1	5.2	8.5	35.4	43.0	0.3	0.0	0.0	4.6	16.5	78.7
		65.0	0-1.00	12.0	1.1	5.4	10.7	21.6	23.8	23.5	1.9	0.0	0.0	12.0	38.8	49.2
		69.0	0-1.00	25.0	5.8	14.2	24.0	15.7	10.9	4.4	0.0	0.0	0.0	25.0	59.7	15.3
		75.0	0-0.40	36.7	6.4	15.2	15.9	13.2	7.2	5.0	0.4	0.0	0.0	36.7	50.7	12.6
5 Nov.	PR125+2	12.0	0-0.40	38.9	3.1	13.5	20.4	16.5	5.5	1.8	0.2	0.0	0.0	38.9	53.5	7.5
		30.0	0-0.95	13.9	2.2	4.7	11.4	18.5	29.9	18.2	1.1	0.1	0.0	13.9	36.8	49.3
		36.0	0-1.00	13.6	1.9	4.7	11.8	23.2	23.9	18.0	2.3	0.6	0.0	13.6	41.6	44.8
		42.0	0-1.00	10.3	1.6	3.9	9.9	19.5	30.2	23.8	0.7	0.0	0.0	10.3	34.9	54.7
5 Nov.	PR136+2	51.0	0-0.95	7.7	0.7	2.8	5.1	10.0	18.0	44.1	10.8	0.7	0.0	7.7	18.6	73.6
		57.0	0-1.00	15.6	1.4	6.7	13.3	22.7	22.4	14.6	2.7	0.6	0.0	15.6	44.1	40.3
		65	0-0.85	14.0	1.6	5.6	9.4	15.1	21.3	28.3	3.2	1.3	0.2	14.0	31.7	54.3
6 Nov.	PR151+2	22.0	0-0.60	37.1	3.4	14.8	16.8	16.1	10.6	1.1	0.0	0.0	0.0	37.1	51.1	11.7
		30.0	0-1.00	19.5	2.9	5.9	15.1	25.6	20.7	9.3	0.9	0.0	0.0	19.5	49.5	30.9
		37.0	0-0.80	15.7	2.0	6.5	12.7	24.6	25.7	12.2	0.6	0.0	0.0	15.7	45.8	38.5

Table 2. (Continued) Particle-size analysis of sediment deposited on the flood plain and on the bed of Powder River

Date	Location	Sta.	Depth	Percent of total sample										Total percentage		
				Clay	Silt				Sand							
				(m)	(m)	<0.004 (mm)	0.004- 0.008 (mm)	0.008- 0.016 (mm)	0.016- 0.032 (mm)	0.032- 0.063 (mm)	0.063- 0.125 (mm)	0.125- 0.250 (mm)	0.250- 0.500 (mm)	0.500- 1.00 (mm)	>1.00 (mm)	Clay
6 Nov.	PR156A+2	61.0 ^b	0-0.02	3.4	0.7	1.7	4.1	10.1	31.4	48.1	0.5	0.0	0.0	3.4	16.6	80.0
		61.5	0-0.95	12.9	1.8	6.3	12.9	20.4	26.0	19.3	0.5	0.0	0.0	12.9	41.4	45.8
		64.0	0-1.00	13.8	1.8	4.3	11.0	21.7	32.8	14.1	0.5	0.0	0.0	13.8	38.8	47.4
		64.5 ^b	0-0.02	10.8	2.5	5.6	10.8	18.1	42.7	9.3	0.1	0.0	0.0	10.8	37.0	52.1
		67.0 ^b	0-0.05	19.1	1.7	7.1	13.1	19.1	31.3	8.5	0.0	0.0	0.0	19.1	41.0	39.8
		67.0	0-0.98	16.3	1.6	6.4	14.9	28.1	22.8	9.3	0.6	0.0	0.0	16.3	51.0	32.7
		80.0	0-0.45	42.0	7.2	16.2	17.5	11.4	4.4	1.2	0.0	0.0	0.0	42.0	52.3	5.6
		90.0 ^b	0-0.05	42.2	1.4	12.0	12.2	8.0	15.1	8.8	0.2	0.0	0.0	42.2	33.6	24.1
		90.0	0-0.45	52.0	5.9	13.3	11.3	6.7	8.3	2.1	0.4	0.0	0.0	52.0	37.2	10.8
1996																
28 May	PR125	28.0 ^c	0-0.10			99					1			99		1
2001																
26 Sept.	PR125+2	101.0 ^d	0.00-0.30			39.2			37.1	19.9	3.6	0.2	0.0	39.2		60.8
	PR125+2	101.0 ^d	0.30-0.65			65.2			34.7	0.0	0.0	0.0	0.0	65.2		34.7
	PR125+2	101.0 ^d	0.65-0.76			79.9			20.1	0.0	0.0	0.0	0.0	79.9		20.1
	PR125+2	101.0 ^d	0.76-0.81			72.2			27.8	0.0	0.0	0.0	0.0	72.2		27.8
	PR125+2	101.0 ^d	0.81-0.91			87.4			12.6	0.1	0.0	0.0	0.0	87.4		12.7
	PR125+2	101.0 ^d	0.91-0.94			89.9			10.0	0.1	0.0	0.0	0.0	89.9		10.1
	PR125+2	101.0 ^d	0.94-0.99			74.4			23.1	2.4	0.0	0.0	0.0	74.4		25.5
	PR125+2	101.0 ^d	0.99-1.14			59.6			40.1	0.2	0.1	0.0	0.0	59.6		40.4

^aSediment data was provided by Jim Pizzuto and interpreted by Pizzuto (1994).

^bDeposited during a flood in October 1994 according to Tori Franklin.

^cNewly deposited sediment collected during a snowmelt flood adjacent to the bank.

^dSediment was collected from a cut bank.

CROSS SECTIONS

Ten cross sections (identified as PR113 to PR151) were established during 1975 to monitor the erosion and deposition of sediment and channel changes (fig. 7). The section number, for example 113 or 151 (table 3), is the river distance in kilometers downstream from the mouth of Crazy Woman Creek near Arvada, Wyoming, as shown in the U.S. Geological Survey river-survey maps of 1946 (Martinson and Meade, 1983). The first cross section was located about 3 km upstream from the Moorhead gaging station, and the remaining sections were located 2 to 6 km apart for 39 km (river distance) downstream from the Moorhead gaging station (table 3). Ten more cross sections (PR156 to PR206) were established during 1977 from 43 km to about 95 km (river distance) downstream from the Moorhead gaging station. These sections were spaced farther apart (3 to 8 km), and the last section was about 1 km downstream from the U.S. Highway 212 bridge, where the Broadus gaging station was located.

After intense rainfall, a major flood occurred on Powder River between 17 May and 23 May 1978 (Parrett and others, 1984) bringing peak discharges of water and suspended sediment at Moorhead of 800 m³/s and 2 million metric tons per day, respectively. Two cross sections (PR122 and PR141) located on bends of the river were cut off from the main channel during the flood, and new measurement sections (PR122A and PR141A) were established in 1979 on the new cutoffs. These cutoffs shortened the total river distance of the study reach by about 2.7 km. All reference marks for section PR200 were completely obliterated in the flood, and a new measurement section (PR200A) was established in approximately the same location as the old section in the fall of 1978. One section (PR156) was believed to have been lost during the flood, and a new section (PR156A) was established about 40 m upstream for the location of the original section. Later, the original metal reference monuments were found using a metal detector, and both sections have been resurveyed regularly since 1978. Cross-sectional measurements, from 1975 to 1988, for these 23 cross sections are listed in U.S. Geological Survey Open-File Report 89-407 (Moody and Meade, 1990).

Additional cross sections have been added after the 1978 flood. Nine "cut-off" cross sections were established in 1980 and 1986 on a meander bend that was nearly cut off by the 1978 flood. The "cut-off" cross sections were spaced about 0.5-1.0 km apart to monitor the potential channel changes upstream from, along, and downstream from the meander bend between PR163 and PR175 (figs. 7 and 8). These cross sections were not resurveyed annually but resurveyed about every 5-7 years. One "ice-deposit" section was established in 1994 on a bend where an ice-jam flood had deposited sediment. The single "ice-deposit" cross section (PR141.7) has been resurveyed at varying time intervals to monitor the fate of these ice-deposited sediments.

There are now 33 cross sections along Powder River spanning a total river distance of 92.4 km. In the "CROSS-SECTION DATA" section at the back of this report, the township location, U.S. Geological Survey quadrangle map, access, and landowners are listed for each cross section. The horizontal location and average elevation (above sea level) for the horizontal reference monuments (1/2-inch- or 12-mm-diameter, pieces of 4-foot long rebar) also are listed. The location of the original 23 cross sections is shown on part of a U.S. Geological Survey 7.5-minute topographical map (1:24,000) and the locations of the 10 additional cross sections are shown in figure 8. The bench mark location at each cross section is shown on a more detailed map, which includes surrounding local landmarks. All azimuths are reported in degrees magnetic. Profiles of each cross section have been plotted in the "CROSS-SECTION DATA" section in pairs of successive surveys to provide a general indication of the areas of erosion and deposition and are not meant to provide actual data. Following these section profiles is a listing of the actual stations and elevations for each cross-section profile.

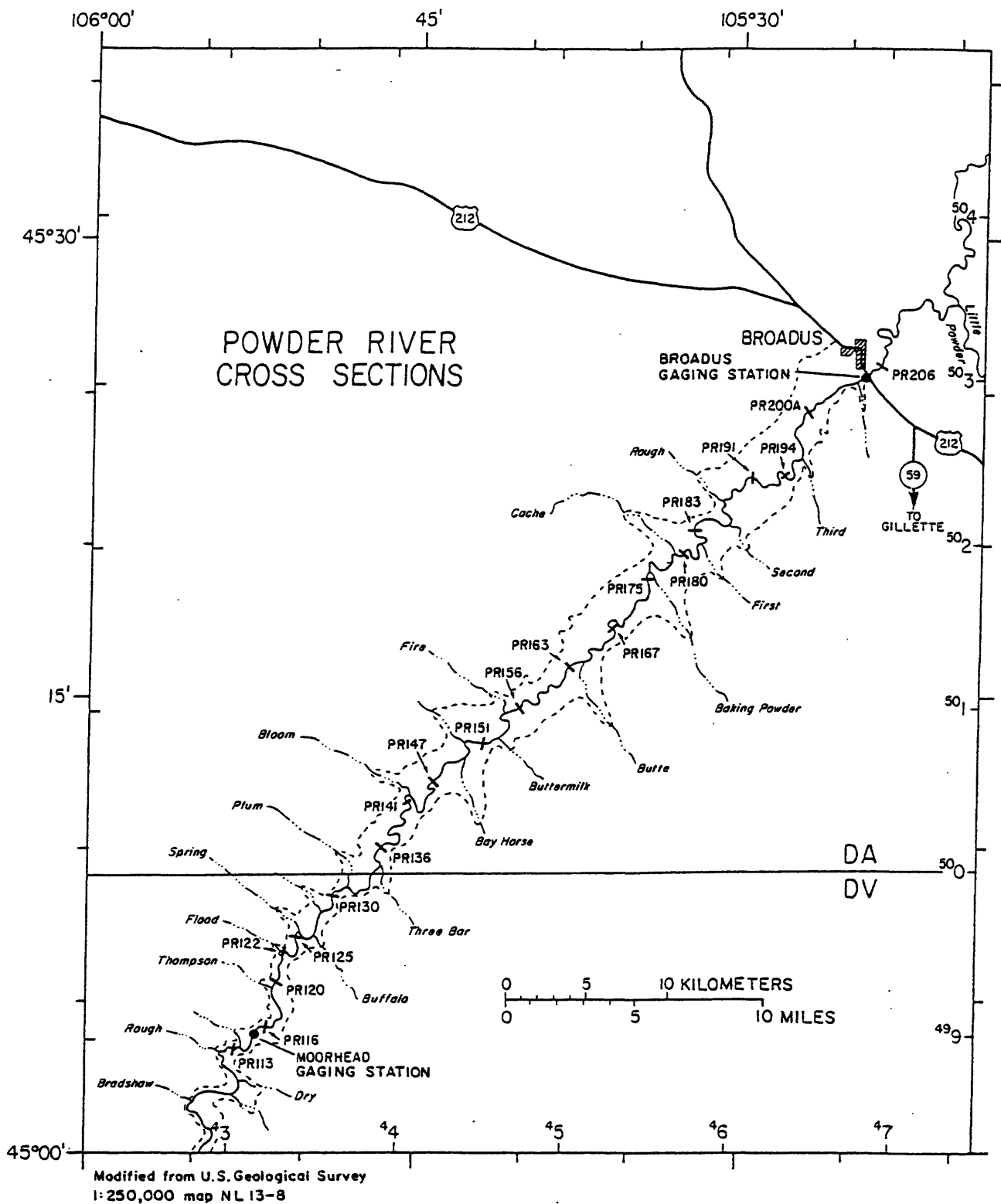


Figure 7. Locations of 20 channel cross sections and the tributaries of Powder River in the study reach. The dashed line indicates the approximate boundary of the visually-obvious valley. Longitude and latitude tick marks are on the outside of the border, and tick marks for the universal transverse mercator (UTM) grid are on the inside of the border. DA and DV are the identification letters for the 100,000-meter-square grid. PR113 is the cross section identification.

Table 3. Vertical and geographical locations of bench marks or reference monuments for cross sections of Powder River between Moorhead and Broadus, Montana

[The bench mark is a brass circular plate embedded in concrete unless other wise noted. Distance is measured from the Moorhead gaging station and based on aerial photographs taken after 1978 (from Martinson, 1983); km, kilometer; Elevation is meters above sea level; m, meter; Azimuth is in degrees magnetic]

Cross section	Distance (km)	Elevation (m)	Azimuth (°)	Bench mark location			
				Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)
PR113	-2.23	1023.34	171.5	45° 03' 21.49"	105° 53' 03.31"	0.412	0.432
PR116	0.65	1020.00	187.5	45° 04' 07.22"	105° 51' 46.75"	0.548	0.554
PR120	4.68	1014.70	114.5	45° 05' 32.49"	105° 51' 14.17"	0.619	0.624
PR122A ^a	6.60	1010.37	133.5	45° 06' 29.84"	105° 50' 47.05"	0.356	0.551
PR122 ^b	7.07	1014.56	135.5	45° 06' 37.88"	105° 51' 00.00"	0.280	0.500
PR125	8.61	1008.45	084.5	45° 07' 06.40"	105° 50' 17.91"	0.193	0.608
PR130	13.92	1002.67	075	45° 08' 23.46"	105° 48' 39.01"	0.554	0.922
PR136	20.19	994.30	129	45° 10' 05.91"	105° 46' 26.89"	0.283	0.433
PR141	26.10	988.93	021	45° 11' 35.80"	105° 45' 09.56"	0.336	0.486
PR141A ^a	26.22	986.99	181.5	45° 11' 38.08"	105° 44' 47.90"	0.443	0.425
PR141.7	26.9	987.34	240.5	45° 11' 20.20"	105° 44' 44.86"	0.527	0.759
PR147	30.24	983.92	130	45° 12' 19.56"	105° 44' 06.61"	0.557	0.460
PR151	36.27	977.46	176.5	45° 13' 32.83"	105° 41' 47.36"	0.251	0.531
PR156A	40.24	972.17	124.5	45° 14' 44.90"	105° 39' 56.56"	1.241	0.637
PR156	40.28	972.17	109.5	45° 14' 44.90"	105° 39' 56.56"	1.241	0.637
PR163	48.30	965.53	151	45° 16' 12.70"	105° 37' 52.08"	0.191	0.532
PR164.8 ^a	49.6	962.75	185	45° 16' 39.98"	105° 36' 35.00"	0.413	0.475
PR165.6 ^a	50.4	961.60	105	45° 16' 49.90"	105° 36' 13.39"	0.334	0.513
PR166.0 ^a	50.8	960.47	150	45° 17' 00.10"	105° 35' 59.67"	0.290	0.622
PR166.6 ^a	51.2	960.62	078	45° 17' 07.49"	105° 35' 45.17"	1.313	0.701
PR167	51.77	959.79	006	45° 17' 21.96"	105° 35' 49.97"	0.527	0.490
PR167.5	52.3	963.34	057	No measurements were made in 1998.			
PR168.5 ^a	53.3	958.61	221	45° 17' 34.14"	105° 35' 34.22"	0.257	0.772
PR169.2 ^a	54.0	957.69	114	45° 17' 24.67"	105° 35' 23.82"	0.466	0.495
PR169.8 ^a	54.6	958.45	127	45° 17' 41.85"	105° 35' 16.46"	0.268	0.779
PR170.5	55.3	957.07	101	45° 17' 57.44"	105° 35' 00.38"	0.523	0.711
PR175	58.32	953.58	058	45° 18' 59.74"	105° 34' 37.31"	0.468	0.546
PR180 ^a	63.10	950.15	103	45° 19' 51.46"	105° 32' 38.16"	0.615	0.711
PR183	67.85	945.89	059	45° 20' 33.33"	105° 32' 10.76"	0.531	0.504
PR191	76.53	938.00	177	45° 22' 18.87"	105° 29' 27.95"	0.166	0.521
PR194	80.08	934.41	225	45° 22' 17.71"	105° 27' 51.05"	0.409	0.765
PR200A	86.28	927.80	140	45° 24' 32.43"	105° 27' 02.73"	0.223	0.652
PR206 ^a	92.19	921.00	266	45° 26' 03.23"	105° 23' 33.50"	0.404	0.434

^aThis is a 12-mm-diameter steel rod or 1/2-inch rebar.

^bThis is the monument at station -1.2 m, the bench mark is a 12-mm-diameter steel rod or 1/2-inch rebar located at station 0.0.

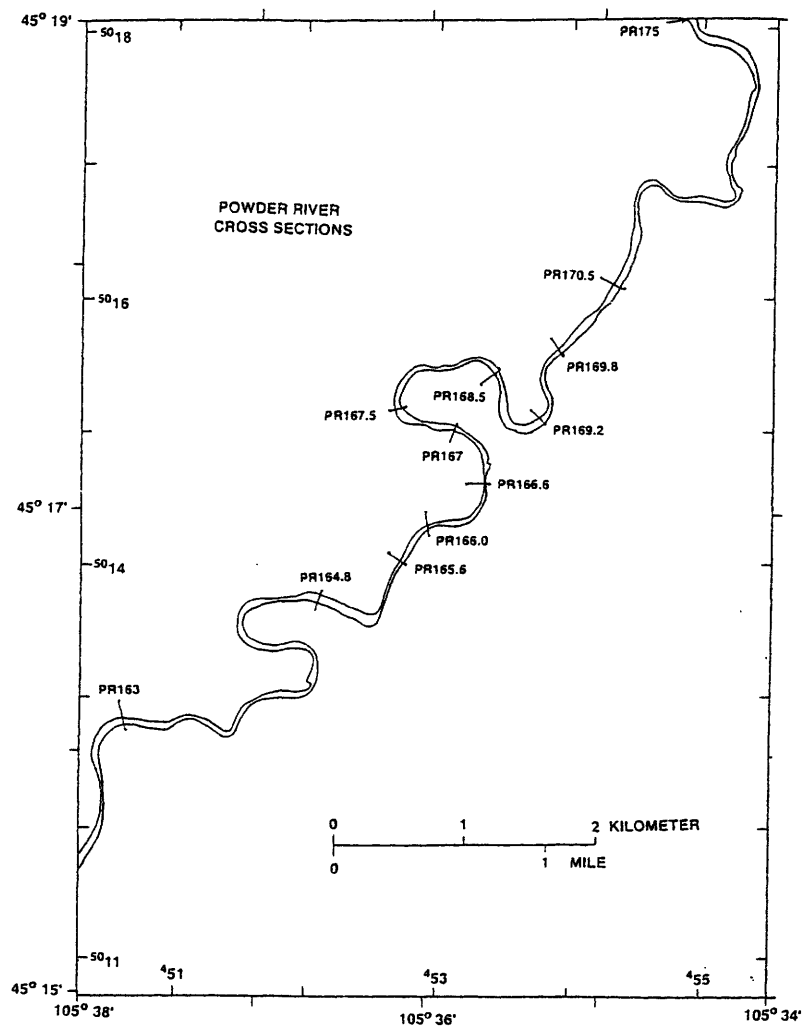


Figure 8. Location of 10 channel cross sections between PR163 and PR175. These sections were established to monitor the evolution of the channel upstream from, along, and downstream from a large river bend that may cut off in the future.

SURVEY METHOD

Initially, at each cross section a steel reference monument (1/2-inch rebar, 12 mm in diameter and about 1.2 m long) was driven almost flush with the ground to mark the horizontal zero point (station 0.0) on the left bank (left when facing downstream), and a second monument was driven in on the right bank to mark a convenient horizontal reference distance. Since the cross sections were established in the 1970s, the river has changed and some of the zero reference monuments have been lost to the river. Therefore, new reference monuments were established with negative values for the station. The reference monuments were resurveyed in 1998 using a GPS (Global Positioning System, Trimble Pro XRS). The coordinates [NAD83 (1992)] and measurement accuracy and precision are listed in the CROSS-SECTION DATA section of this report. The horizontal precision of the GPS measurements ranged from 0.3 to 1.1 m and averaged 0.6 ± 0.2 m. Two additional steel pins were driven into the ground on the line of section but behind the reference monuments to hold the cable clamps used to stretch a steel cable or tagline (150 m long and 3 mm in diameter) across the river. The cable was marked every meter by a brass bead, and horizontal distances were measured to 0.1 m by estimating between beads. Distances between reference monuments (108 to 321 m) were measured using both the GPS and the tagline and the difference between these two methods was ± 0.7 m or about 0.2 to 0.6 percent. Elevations were not measured by the GPS method.

A local vertical bench mark was installed at each cross section, and the elevation above sea level was determined by leveling from U.S. Coast and Geodetic Survey bench marks shown on the U.S. Geological Survey topographic maps. The local bench mark consisted of a brass circular plate embedded in reinforced concrete, which was flush with the ground. The cross-section identification number (for example, PR113) is stamped into the plate, and an arrow in the center of the brass plate points to station 0.0. The location of each bench mark is shown in a figure in the CROSS-SECTION DATA section. Typical errors in the measurement of elevation (1.4-1.9 cm) and change in cross-sectional area (0.6 - 1.2 m²) are discussed by Moody and Meade (1990) and applied to this report because the same methods were used.

CHANNEL CHANGE

Two measurements of the changes in erosion and deposition have been used for this report: (1) changes in the minimum riverbed elevation, and (2) changes in the cross-sectional area. These are net annual changes between the time of two successive cross-section surveys and do not represent the total amount of erosion or deposition. For example, during an ice break-up flood, sediment may be deposited on the banks and adjacent flood plain. A later snowmelt flood may erode these sediment deposits and perhaps some of the bank. A late summer flash flood may deposit some sediment in the area where the bank existed before the snowmelt flood. The net result, when measured in the fall, may therefore indicate only erosion near the bank while in reality there may have been substantially more of both deposition and erosion.

Minimum Riverbed Elevation

The minimum riverbed elevations for each cross section are listed in table 4. These data were combined with similar data for 1975-1988 (Moody and Meade, 1990) and linear trends were calculated for 20 years (table 5). The minimum riverbed elevation decreased with time for 8 cross sections and increased with time for 15 cross sections. However, only 5 of the linear trends had coefficients of determination greater than or equal to 0.50. Two sections, PR122 ($r^2=0.92$) and PR141 ($r^2=0.50$), were cut off and abandoned during the 1978 flood. Of the remaining 3 cross

sections, two (PR120, $r^2=0.53$ and PR151, $r^2=0.68$) showed a decrease in the minimum riverbed elevation and one (PR122A, $r^2=0.70$) showed an increase in the minimum riverbed elevation. In general, the minimum riverbed elevation was stable and simply fluctuated from year to year as indicated by the standard deviation of the elevation, which ranged from 0.01 to 0.30 m (table 5).

Area of Erosion and Deposition

The cross-sectional area of erosion and deposition was computed for successive surveys by linearly interpolating the elevations between horizontal measurements at every 0.1 m. Then the positive (deposition) and negative (erosion) differences were summed separately between a starting station and an ending station. The starting and ending stations corresponded to four features where erosional and depositional processes were active: 1) bank, 2) flood plain, 3) channel, and 4) point bar. Sometimes distinguishing between features (for example, where the channel ended and the point bar started, or whether deposition was on a point bar or flood plain) was sufficiently difficult that the identification of these features must be considered subjective. This method of calculation approximated the cross-sectional area as a sum of narrow (0.1 m wide) rectangular strips. The error in this approximation was estimated by calculating the exact areas as sums of triangles and by subtracting the areas computed using the rectangular approximation. The difference, for one cross section, was 0.01 m^2 for the area of deposition and 0.11 m^2 for the area of erosion. This was a 1.4-percent difference for the total area of channel change. The field-leveling error was determined by computing the area of erosion and deposition for duplicate surveys of cross sections PR141A, PR163, and PR206 (Moody and Meade, 1990). The average error (for the six values of erosion and deposition) was 0.88 m^2 per 100 horizontal meters of surveyed cross section.

During the 10 years from 1988 to 1998, the erosion of sediment balanced the deposition of sediment in the study reach of Powder River (table 6). The average ratio of the net erosion divided by the net deposition for the 21 cross sections surveyed annually was 1.02. The 2 percent difference is less than the error of the measurements. Erosion was greater than deposition at 10 cross sections. Cross section PR122A, on a new channel formed during the 1978 flood, had the largest ratio (1.47), but for PR141A, the other cross section on a new channel, the ratio (1.08) was less. PR200A had the second largest ratio (1.39) but this section was influenced by human activity. Cross sections PR163 and PR180 with evolving point bars also had large ratios (1.38 and 1.32, respectively). Deposition was greater than erosion at 11 cross sections (ratios less than 1). The greatest deposition (smallest ratio) was at PR175 (0.59) followed by PR130 (0.61) and PR120 (0.66). PR120 is an example of a channel-expansion flood plain (Moody and others, 1999), which is still evolving by vertical accretion 20 years after the 1978 flood. The other examples of channel-expansion flood plains (PR125, PR136, PR151, and PR156A) had ratios of 1.04, 0.92, 0.90, and 1.11.

The greatest amounts of bank erosion during the 10 years occurred at cross sections with point bars. This excludes PR200A, which had the greatest erosion (253.9 m^2), but may have been affected by human changes made in the channel upstream from the cross section. However, the sections with the next greatest bank erosion, PR141A (94.9 m^2), PR113 (92.1 m^2), and PR180 (89.8 m^2), all contained active point bars. At these three cross sections most of the bank erosion between 1988 and 1998 occurred during two years, 1991 and 1995.

The greatest amount of flood plain deposition during the 10 years occurred where the channel had shifted and the old channel was being filled in to create a flood plain. At PR200A (235.9 m^2), the main channel shifted from the left bank to a secondary channel on the right bank and deposition may have been influenced by human activity. At PR206 (135.6 m^2), the main

Table 4. Minimum riverbed elevation at the end of the water year for 1989-1998

[--, cross section was not surveyed]

Cross sections	Minimum riverbed elevation (meters above sea level)									
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
PR113	1019.64	1019.51	1019.59	1019.63	1019.63	1019.64	1019.14	1019.56	1019.48	1019.60
PR116	1015.56	1015.57	1015.48	1015.45	1015.58	1015.40	1015.21	1015.38	1015.31	1015.43
PR120	1010.65	1010.65	1010.62	1010.63	1010.60	1010.59	1010.63	1010.62	1010.62	1010.60
PR122	--	--	--	--	1008.28	--	1008.39	--	--	--
PR122A	1006.58	1006.55	1006.58	1006.59	1006.62	1006.62	1006.81	1006.83	1006.86	1006.86
PR125	1004.20	1004.18	1004.33	1004.07	1004.15	1004.22	1004.19	1004.12	1004.14	1004.22
PR130	998.39	998.45	998.31	998.40	998.32	998.33	998.41	998.30	998.32	998.17
PR136	991.15	991.09	991.03	991.16	991.25	991.15	990.69	991.14	991.14	991.09
PR141	--	--	--	--	--	--	--	--	--	987.08
PR141A	984.83	984.61	984.72	984.72	984.55	984.69	984.61	984.58	984.58	984.62
PR147	980.19	980.20	980.15	980.19	980.11	980.19	980.12	979.89	979.89	979.90
PR151	973.72	973.73	973.76	973.73	973.70	973.68	973.64	973.70	973.49	973.62
PR156A	969.17	969.00	969.06	969.20	969.14	969.11	969.08	969.09	969.13	969.09
PR156	969.16	968.98	969.16	969.15	969.12	969.16	969.18	969.06	969.18	968.89
PR163	961.64	961.65	961.83	961.94	961.72	961.92	961.82	961.92	961.96	961.65
PR167	956.97	956.70	956.96	956.75	956.72	956.93	956.68	956.77	957.02	956.67
PR175	950.65	950.79	950.68	950.80	950.83	950.49	950.81	950.98	950.68	950.70
PR180	946.35	946.33	946.37	946.39	946.20	946.24	946.48	946.46	946.42	946.22
PR183	942.82	942.82	942.91	942.71	942.77	942.87	942.66	942.83	942.72	942.60
PR191	934.54	934.46	934.50	934.44	934.61	934.50	934.59	934.61	934.69	934.51
PR194	931.40	931.26	931.28	931.27	931.28	931.24	931.01	931.08	931.18	931.22
PR200A	924.39	923.90	924.24	924.29	924.56	924.49	923.59	924.21	924.18	924.17
PR206	917.42	917.29	916.64	916.95	916.33	916.88	917.19	917.22	917.38	917.23

Table 5. Changes in the minimum riverbed elevation for 1978-1998[m, meter; m/yr, meter per year; r^2 , coefficient of determination]

Cross sections	Number of measurements	Standard deviation (m)	Linear trend		r^2
			Slope of trend (m/yr)	Intercept (m)	
PR113	19	0.12	-0.001	1019.54	0.00
PR116	18	0.12	-0.011	1015.61	0.28
PR120	19	0.02	-0.003	1010.66	0.53
PR122	8	0.10	0.016	1008.08	0.92
PR122A	18	0.17	0.025	1006.33	0.70
PR125	19	0.09	0.004	1004.12	0.07
PR130	19	0.08	0.001	998.33	0.01
PR136	19	0.13	0.007	990.99	0.11
PR141	6	0.01	0.001	987.06	0.50
PR141A	18	0.15	0.009	984.52	0.11
PR147	18	0.12	0.005	979.99	0.05
PR151	19	0.09	-0.012	973.85	0.68
PR156A	19	0.07	0.000	969.12	0.00
PR156	19	0.08	0.001	969.113	0.00
PR163	19	0.12	0.011	961.63	0.31
PR167	19	0.17	-0.010	956.98	0.13
PR175	19	0.17	0.018	950.47	0.43
PR180	19	0.14	0.015	946.12	0.42
PR183	19	0.10	-0.003	942.82	0.05
PR191	19	0.10	0.007	934.45	0.18
PR194	19	0.16	-0.008	931.37	0.09
PR200A	19	0.21	-0.004	924.27	0.01
PR206	19	0.30	0.000	917.08	0.00

Table 6. Erosion and deposition of sediment at channel cross sections on the Powder River

[Bank includes both left and right banks and width is variable; flood plain, represents vertical erosion or deposition on the flood plain within the channel widened by the 1978 flood and older flood plains adjacent to the river; Eros., erosion; Depo., deposition; m, meter; m², square meters]

Water Year	Bank			Flood plain			Channel			Point bar			Total		
	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)
PR113															
1989	5.5	0.3	0.0	46.5	1.1	0.8	33.5	0.5	3.1	24.5	4.8	0.0	110.0	6.7	3.9
1990	6.0	6.9	0.0	53.0	0.0	2.5	28.0	2.3	0.1	23.0	0.0	11.1	110.0	9.2	13.7
1991	15.0	27.4	0.0	57.0	0.1	2.6	30.5	0.0	2.9	19.5	8.1	0.0	122.0	35.6	5.5
1992	11.0	4.0	0.0	48.0	0.3	0.5	39.5	0.9	1.8	26.5	0.4	0.6	125.0	5.6	2.9
1993	14.0	19.6	0.0	48.0	0.1	2.6	26.0	0.1	1.4	44.0	0.0	23.2	132.0	19.8	27.2
1994	4.0	2.8	0.0	68.5	1.3	2.6	34.0	0.9	1.1	25.5	0.1	4.9	132.0	5.1	8.6
1995	11.5	19.5	0.0	58.0	0.0	14.0	25.5	0.9	1.2	45.0	2.7	16.5	140.0	23.1	31.7
1996	4.5	4.7	0.0	90.0	0.7	1.6	27.5	2.1	1.6	18.0	0.3	4.2	140.0	7.8	7.4
1997	10.0	5.2	0.0	90.0	1.4	2.8	19.0	0.1	0.3	23.0	0.8	1.3	142.0	7.5	4.4
1998	5.0	1.7	0.1	108.0	0.7	1.8	30.0	0.1	4.0	0.0	0.0	0.0	143.0	2.5	5.9
Total	--	92.1	0.1	--	5.7	31.8	--	7.9	17.5	--	17.2	61.8	--	122.9	111.2
Bank erosion is approximately balanced by point-bar and flood-plain deposition															
PR116															
1989	16.5	0.8	0.1	0.0	0.0	0.0	66.5	4.6	2.5	0.0	0.0	0.0	83.0	5.4	2.6
1990	17.5	0.1	1.4	0.0	0.0	0.0	65.5	6.2	6.6	0.0	0.0	0.0	83.0	6.3	8.0
1991	17.5	0.8	0.3	0.0	0.0	0.0	65.5	4.6	3.4	0.0	0.0	0.0	83.0	5.4	3.7
1992	17.0	0.2	0.3	0.0	0.0	0.0	66.0	4.6	4.4	0.0	0.0	0.0	83.0	4.8	4.7
1993	17.0	0.7	0.5	0.0	0.0	0.0	66.0	5.2	3.2	0.0	0.0	0.0	83.0	5.9	3.7
1994	16.5	0.5	0.8	0.0	0.0	0.0	66.5	2.9	5.6	0.0	0.0	0.0	83.0	3.4	6.4
1995	16.5	0.7	0.2	0.0	0.0	0.0	66.5	15.5	5.3	0.0	0.0	0.0	83.0	16.2	5.5
1996	16.5	1.1	0.4	0.0	0.0	0.0	66.5	1.9	6.7	0.0	0.0	0.0	83.0	3.0	7.1
1997	17.0	0.9	0.7	0.0	0.0	0.0	66.0	6.4	4.1	0.0	0.0	0.0	83.0	7.3	4.8
1998	17.0	1.8	0.0	0.0	0.0	0.0	66.0	2.6	6.4	0.0	0.0	0.0	83.0	4.4	6.4
Total	--	7.6	4.7	--	0.0	0.0	--	54.5	48.2	0.0	0.0	0.0	--	62.1	52.9
Cross section was stable. It is in a bedrock reach.															
PR120															
1989	6.0	0.3	0.0	32.0	0.1	0.4	57.0	1.2	1.0	0.0	0.0	0.0	95.0	1.6	1.4
1990	6.0	0.1	0.4	34.0	0.1	2.7	55.0	0.6	2.7	0.0	0.0	0.0	95.0	0.8	5.8
1991	6.0	0.2	0.1	34.0	0.6	0.2	55.0	2.9	0.1	0.0	0.0	0.0	95.0	3.7	0.4
1992	6.0	0.1	0.4	34.0	0.2	0.7	55.0	0.5	0.4	0.0	0.0	0.0	95.0	0.8	1.5
1993	11.5	0.0	0.9	34.0	0.0	2.6	49.5	0.4	2.1	0.0	0.0	0.0	95.0	0.4	5.6
1994	10.0	0.7	0.0	34.0	0.1	0.7	51.0	1.3	2.4	0.0	0.0	0.0	95.0	2.1	3.1
1995	6.5	0.3	0.3	33.5	0.4	3.4	55.0	4.5	0.2	0.0	0.0	0.0	95.0	5.2	3.9
1996	6.0	0.3	0.2	33.5	0.2	0.9	55.5	0.4	0.6	0.0	0.0	0.0	95.0	0.9	1.7
1997	6.5	0.1	0.0	34.0	0.4	0.1	54.5	0.5	0.4	0.0	0.0	0.0	95.0	1.0	0.5
1998	6.5	0.0	0.2	34.0	0.1	0.4	54.5	0.2	0.8	0.0	0.0	0.0	95.0	0.3	1.4
Total	--	2.1	2.5	--	2.2	12.1	--	12.5	10.7	0.0	0.0	0.0	--	16.8	25.3
Channel and bank erosion and deposition are balanced. The net increase at the section is a result of new flood-plain deposition															
PR122															
1988- 1993	8.5	0.4	0.2	0.0	0.0	0.0	82.0	0.0	2.7	28.0	0.4	0.2	118.5	0.8	3.1
1994- 1995	8.5	1.2	0.3	0.0	0.0	0.0	82.0	0.1	4.4	28.0	0.4	0.4	118.5	1.7	5.1
Total	--	1.6	0.5	0.0	0.0	0.0	--	0.1	7.1	--	0.8	0.6	--	2.5	8.2

This cutoff channel filled during ice jams.

Table 6. (Continued) Erosion and deposition of sediment at channel cross sections on the Powder River

Water Year	Bank			Flood plain			Channel			Point bar			Total		
	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)
PR122A															
1989	8.5	0.8	0.2	21.5	1.0	0.7	36.0	0.2	0.4	4.0	0.0	0.5	70.0	2.0	1.8
1990	11.5	0.8	0.1	20.5	0.0	3.4	30.0	1.9	0.2	8.0	0.1	0.8	70.0	2.8	4.5
1991	11.5	1.4	0.3	12.5	0.0	0.8	28.5	0.1	0.6	17.5	3.3	0.0	70.0	4.8	1.7
1992	7.5	0.2	0.2	12.0	0.0	0.2	32.5	0.6	0.5	18.0	0.2	0.2	70.0	1.0	1.1
1993	14.0	10.8	0.0	13.0	0.0	2.2	23.0	1.6	0.1	24.0	0.5	2.8	74.0	12.9	5.1
1994	10.5	1.6	0.1	37.0	0.0	2.3	27.5	0.1	1.2	0.0	0.0	0.0	75.0	1.7	3.5
1995	18.5	21.2	0.2	11.0	0.0	3.2	16.5	0.6	0.0	37.0	0.3	14.0	83.0	22.1	17.3
1996	14.5	5.4	0.0	10.0	0.0	0.1	27.5	0.3	1.4	35.0	0.5	1.1	87.0	6.2	2.6
1997	12.0	3.3	0.1	15.0	0.1	0.1	30.0	0.4	0.4	30.0	0.4	0.5	87.0	4.2	1.1
1998	7.5	0.5	0.1	45.0	0.2	0.7	34.5	0.2	0.4	0.0	0.0	0.0	87.0	0.9	1.2
Total	--	46.0	1.1	--	1.3	13.7	--	6.0	5.2	--	5.3	19.9		58.6	39.9
Erosion on the left bank was partly balanced by deposition on the point bar and on the new flood plain.															
PR125															
1989	4.0	0.4	0.0	40.0	0.4	0.4	42.0	3.1	0.2	0.0	0.0	0.0	86.0	3.9	0.6
1990	4.0	0.5	0.0	40.0	0.0	2.4	42.0	3.9	0.8	0.0	0.0	0.0	86.0	4.4	3.2
1991	4.0	1.1	0.0	40.0	0.2	1.5	42.0	0.8	6.3	0.0	0.0	0.0	86.0	2.1	7.8
1992	4.0	0.1	0.0	40.0	0.2	0.5	42.0	4.4	0.3	0.0	0.0	0.0	86.0	4.7	0.8
1993	5.0	2.5	0.0	40.0	0.0	5.0	42.0	1.0	2.1	0.0	0.0	0.0	87.0	3.5	7.1
1994	5.0	0.2	0.2	40.0	0.2	1.0	42.0	4.5	1.2	0.0	0.0	0.0	87.0	4.9	2.4
1995	5.0	2.1	0.0	38.0	0.2	6.2	46.0	1.1	6.7	0.0	0.0	0.0	89.0	3.4	12.9
1996	10.0	4.5	0.0	38.0	0.3	0.9	41.0	3.7	0.1	0.0	0.0	0.0	89.0	8.5	1.0
1997	4.5	0.8	0.0	38.0	0.5	0.4	47.0	2.4	0.5	0.0	0.0	0.0	89.5	3.7	0.9
1998	4.0	0.5	0.0	38.0	0.4	0.4	47.0	1.2	2.6	0.0	0.0	0.0	89.0	2.1	3.0
Total	--	12.7	0.2	--	2.4	18.7	--	26.1	20.8	--	0.0	0.0	--	41.2	39.7
Bank erosion was balanced by flood-plain deposition. Erosion approximately balances deposition.															
PR130															
1989	6.0	0.1	0.1	45.0	0.1	1.1	46.5	1.9	1.1	0.0	0.0	0.0	97.5	2.1	2.3
1990	6.0	0.0	0.8	37.0	0.0	1.3	50.5	1.0	1.8	4.0	0.0	1.3	97.5	1.0	5.2
1991	6.0	0.7	0.0	39.0	0.3	1.4	51.5	1.8	0.5	1.0	0.2	0.0	97.5	3.0	1.9
1992	6.0	0.0	0.6	39.0	0.1	0.7	49.5	0.6	1.2	3.0	0.0	0.6	97.5	0.7	3.1
1993	5.5	0.2	0.3	42.0	0.1	3.4	50.0	1.7	1.5	0.0	0.0	0.0	97.5	2.0	5.2
1994	5.0	0.6	0.1	42.0	0.2	0.9	50.5	1.8	1.0	0.0	0.0	0.0	97.5	2.6	2.0
1995	5.5	0.4	0.5	42.0	0.1	8.2	50.0	1.2	1.5	0.0	0.0	0.0	97.5	1.7	10.2
1996	5.0	0.4	0.1	42.0	0.4	0.6	50.5	1.4	0.3	0.0	0.0	0.0	97.5	2.2	1.0
1997	5.0	0.4	0.1	42.0	0.4	0.2	50.5	3.4	0.4	0.0	0.0	0.0	97.5	4.2	0.7
1998	5.0	0.4	0.1	42.0	0.1	0.4	50.5	0.8	2.0	0.0	0.0	0.0	97.5	1.3	2.5
Total	--	3.2	2.7	--	1.8	18.2	--	15.6	11.3	--	0.2	1.9	--	20.8	31.1

Bank erosion was balanced by deposition on flood plain at bottom of bank. Channel was approximately in equilibrium.

Table 6. (Continued) Erosion and deposition of sediment at channel cross sections on the Powder River

Water Year	Bank			Flood plain			Channel			Point bar			Total		
	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)
PR136															
1989	17.5	0.7	0.3	40.5	0.3	0.4	52.0	3.6	0.7	0.0	0.0	0.0	110.0	4.6	1.4
1990	17.0	0.1	0.0	41.5	0.2	2.1	51.5	2.4	3.3	0.0	0.0	0.0	110.0	2.7	5.4
1991	17.5	0.5	0.3	41.0	0.6	0.7	51.5	3.9	2.5	0.0	0.0	0.0	110.0	5.0	3.5
1992	15.5	0.4	0.3	39.5	0.1	0.9	52.0	0.3	6.4	3.0	0.2	0.0	110.0	1.0	7.6
1993	16.0	1.2	0.1	40.0	0.1	5.2	45.0	4.6	0.7	9.0	0.0	2.4	110.0	5.9	8.4
1994	15.5	1.6	0.2	45.0	0.2	2.0	49.5	2.0	3.9	0.0	0.0	0.0	110.0	3.8	6.1
1995	18.0	8.2	0.0	45.0	0.2	11.9	48.0	6.3	1.6	0.0	0.0	0.0	111.0	14.7	13.5
1996	15.0	6.4	0.0	37.0	0.2	0.2	50.0	1.9	5.1	8.0	0.4	1.9	110.0	8.9	7.2
1997	11.5	5.3	0.1	41.0	0.3	0.7	44.0	0.5	5.7	3.5	0.6	0.0	110.0	6.7	6.5
1998	10.0	1.3	0.3	39.0	0.2	0.4	57.0	5.4	6.8	4.0	1.8	0.0	110.0	8.7	7.5
Total	--	25.7	1.6	--	2.4	24.5	--	30.9	36.7	--	3.0	4.3	--	62.0	67.1
Bank erosion was balanced by deposition on flood plain in the middle of the channel. Erosion approximately balanced deposition															
PR141															
1984- 1998	18.9	0.4	0.4	32.1	0.2	0.2	49.0	0.2	1.1	0.0	0.0	0.0	100.0	0.8	1.7
This section was cut off by the 1978 flood and these changes have occurred over 14 years.															
PR141A															
1989	11.0	0.4	0.2	82.0	0.4	4.6	37.0	3.8	3.0	0.0	0.0	0.0	130.0	4.6	7.8
1990	11.0	0.2	0.2	82.0	0.5	7.0	26.5	3.5	0.2	10.5	0.0	4.0	130.0	4.2	11.4
1991	11.0	4.7	0.0	91.0	7.2	4.4	28.0	0.1	3.4	0.0	0.0	0.0	130.0	12.0	7.8
1992	5.0	0.2	0.1	61.5	0.2	1.2	33.5	2.3	0.7	30.0	1.1	0.5	130.0	3.8	2.5
1993	4.3	4.2	0.0	60.0	0.0	4.8	33.7	1.3	4.7	32.0	2.1	2.1	130.0	7.6	11.6
1994	4.5	2.0	0.0	78.5	0.0	7.1	56.5	4.5	6.7	10.5	0.0	2.9	150.0	6.5	16.7
1995	23.5	39.6	0.1	71.0	0.2	10.5	9.5	0.0	3.5	46.0	0.0	26.9	150.0	39.8	41.0
1996	13.5	22.4	0.0	87.5	1.5	7.5	19.0	0.2	2.4	15.0	1.7	2.4	135.0	25.8	12.3
1997	10.5	14.6	0.0	77.5	0.2	5.5	22.5	1.0	1.0	29.5	4.5	1.1	140.0	20.3	7.6
1998	8.0	6.6	0.0	101.0	1.7	2.6	29.0	0.4	3.0	5.0	1.3	0.0	143.0	10.0	5.6
Total	--	94.9	0.6	--	11.9	55.2	--	17.1	28.6	--	10.7	39.9	--	134.6	124.3
Left bank retreated and the point bar on the right bank advanced.															
PR141.7															
1995	17.5	21.7	0.4	48.0	0.1	7.9	64.0	0.4	14.6	0.0	0.0	0.0	129.5	22.2	22.9
1996	10.4	7.9	0.2	48.0	0.2	0.6	72.0	2.9	3.6	0.0	0.0	0.0	130.4	11.0	4.4
1997	3.0	0.0	0.1	47.0	0.5	0.4	partial survey			0.0	0.0	0.0	50.0	0.5	0.5
1998	3.0	0.2	0.0	47.0	0.5	0.3	partial survey			0.0	0.0	0.0	50.0	0.7	0.3

This section was established in 1994 after an ice jam deposited sediment on the left bank. The surveys are focused on the left bank

Table 6. (Continued) Erosion and deposition of sediment at channel cross sections on the Powder River

Water Year	Bank			Flood plain			Channel			Point bar			Total		
	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)
PR147															
1989	11.0	0.3	0.2	15.0	0.1	0.8	59.0	1.1	1.0	0.0	0.0	0.0	85.0	1.5	2.0
1990	11.0	0.3	0.2	17.5	0.2	2.3	56.5	1.4	1.5	0.0	0.0	0.0	85.0	1.9	4.0
1991	11.5	1.4	0.2	19.0	0.0	7.0	54.5	4.5	0.2	0.0	0.0	0.0	85.0	5.9	7.4
1992	11.0	0.2	0.4	18.0	0.3	0.2	56.0	0.6	1.4	0.0	0.0	0.0	85.0	1.1	2.0
1993	4.0	0.1	0.0	14.5	0.0	3.6	61.0	3.0	1.2	0.0	0.0	0.0	79.5	3.1	4.8
1994	14.5	0.1	0.2	14.0	0.1	0.2	61.5	1.2	1.7	0.0	0.0	0.0	90.0	1.4	2.1
1995	15.0	7.7	0.1	11.0	0.0	2.0	64.0	5.5	4.1	0.0	0.0	0.0	90.0	13.2	6.2
1996	10.0	1.0	0.1	11.0	0.1	0.1	69.0	4.3	4.3	0.0	0.0	0.0	90.0	5.4	4.5
1997	10.5	0.2	0.4	9.0	0.0	0.1	70.5	2.1	2.4	0.0	0.0	0.0	90.0	2.3	2.9
1998	9.5	0.8	0.2	10.0	0.1	0.5	70.5	1.2	2.5	0.0	0.0	0.0	90.0	2.1	3.2
Total	--	12.1	2.0	--	0.9	16.8	--	24.9	20.3	--	0.0	0.0	--	37.9	39.1
Some bank erosion occurred on the right bank and a floodplain evolved on the left bank.															
PR151															
1989	24.5	0.4	0.2	24.0	0.2	0.2	41.0	0.7	0.9	0.0	0.0	0.0	89.5	1.3	1.3
1990	27.5	0.3	0.9	24.0	0.0	1.6	38.0	1.8	0.1	0.0	0.0	0.0	89.5	2.1	2.6
1991	28.5	0.5	0.4	24.0	0.2	0.4	37.0	0.3	0.7	0.0	0.0	0.0	89.5	1.0	1.5
1992	29.0	0.5	0.7	22.0	0.0	0.6	38.5	1.0	0.1	0.0	0.0	0.0	89.5	1.5	1.4
1993	27.0	0.6	0.3	22.5	0.1	2.1	41.0	0.6	0.4	0.0	0.0	0.0	89.5	1.3	2.8
1994	27.5	0.5	0.5	22.0	0.3	0.2	40.0	1.2	0.4	0.0	0.0	0.0	89.5	2.0	1.1
1995	27.5	1.2	0.2	21.0	0.2	3.7	41.0	1.3	1.2	0.0	0.0	0.0	89.5	2.7	5.1
1996	24.0	0.1	0.6	22.5	0.8	0.6	41.0	1.4	0.8	0.0	0.0	0.0	87.5	2.3	2.0
1997	24.5	0.3	0.5	21.5	0.4	0.1	41.5	0.9	0.4	0.0	0.0	0.0	87.5	1.6	1.0
1998	24.5	0.4	0.2	21.0	0.4	0.2	42.0	0.8	0.2	0.0	0.0	0.0	87.5	1.6	0.6
Total	--	4.8	4.5	--	2.6	9.7	--	10.0	5.2	--	0.0	0.0	--	17.4	19.4
Vertical floodplain accretion on the left bank.															

Table 6. (Continued) Erosion and deposition of sediment at channel cross sections on the Powder River

Water Year	Bank			Flood plain			Channel			Point bar			Total		
	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)
PR156A															
1989	5.0	0.2	0.1	60.0	0.5	1.0	45.0	0.7	1.9	0.0	0.0	0.0	110.0	1.4	3.0
1990	5.0	0.1	0.1	60.0	0.2	1.9	45.0	10.6	0.5	0.0	0.0	0.0	110.0	10.9	2.5
1991	5.0	0.0	0.2	60.0	0.4	0.6	45.0	0.3	9.0	0.0	0.0	0.0	110.0	0.7	9.8
1992	5.0	0.1	0.2	60.0	0.6	0.4	45.0	4.4	1.3	0.0	0.0	0.0	110.0	5.1	1.9
1993	5.0	0.1	0.1	60.0	0.3	4.7	45.0	1.8	2.0	0.0	0.0	0.0	110.0	2.2	6.8
1994	5.0	0.1	0.1	60.0	0.5	0.8	45.0	2.9	4.0	0.0	0.0	0.0	110.0	3.5	4.9
1995	5.0	0.5	0.0	60.0	0.2	6.1	45.0	4.1	2.8	0.0	0.0	0.0	110.0	4.8	8.9
1996	5.0	0.9	0.0	60.0	1.0	0.3	45.0	3.8	1.1	0.0	0.0	0.0	110.0	5.7	1.4
1997	5.0	1.0	0.2	60.0	0.3	0.8	45.0	0.1	2.9	0.0	0.0	0.0	110.0	1.4	3.9
1998	5.0	0.8	0.0	60.0	0.5	0.7	45.0	3.7	0.1	0.0	0.0	0.0	110.0	5.0	0.8
Total	--	3.8	1.0	--	4.5	17.3	--	32.4	25.6	--	0.0	0.0	--	40.7	43.9
Vertical accretion on the flood plain adjacent to the right bank. Channel is approximately in equilibrium every two years.															
PR156															
1989	30.0	0.7	0.2	14.5	0.1	0.4	75.5	1.6	2.5	0.0	0.0	0.0	120.0	2.4	3.1
1990	30.0	0.2	0.4	14.5	0.1	0.4	75.5	8.8	0.4	0.0	0.0	0.0	120.0	9.1	1.2
1991	30.0	0.3	0.5	18.5	0.1	2.2	71.5	0.1	6.3	0.0	0.0	0.0	120.0	0.5	9.0
1992	29.0	0.4	0.8	18.5	1.3	0.3	72.5	2.3	0.2	0.0	0.0	0.0	120.0	4.0	1.3
1993	29.0	0.6	0.5	18.5	0.2	1.1	72.5	0.8	1.6	0.0	0.0	0.0	120.0	1.6	3.2
1994	29.0	0.3	0.5	15.0	0.3	0.3	76.0	2.9	3.2	0.0	0.0	0.0	120.0	3.5	4.0
1995	29.0	0.6	0.5	15.0	0.3	2.7	76.0	3.4	3.3	0.0	0.0	0.0	120.0	4.3	6.5
1996	29.5	1.0	0.8	14.5	0.3	0.2	76.0	3.2	1.1	0.0	0.0	0.0	120.0	4.5	2.1
1997	30.5	0.6	0.3	14.5	0.4	0.3	75.0	1.6	3.1	0.0	0.0	0.0	120.0	2.6	3.7
1998	30.5	0.8	0.4	14.5	0.4	0.3	75.0	5.4	0.4	0.0	0.0	0.0	120.0	6.6	1.1
Total	--	5.5	4.9	--	3.5	8.2	--	30.1	22.1	--	--	--	--	39.1	35.2
Vertical accretion of the flood plain along the right bank. In 1994 and 1995 a stump was on section in the channel. After 10 years net erosion is approximately equal to net deposition.															
PR163															
1989	12.0	0.8	0.0	52.0	0.2	1.4	36.0	2.5	0.5	0.0	0.0	0.0	100.0	3.5	1.9
1990	12.0	0.5	0.1	58.0	0.2	6.3	30.0	1.6	1.2	0.0	0.0	0.0	100.0	2.3	7.6
1991	13.5	7.3	0.0	44.0	0.4	0.5	31.0	0.0	6.2	11.5	3.8	0.0	100.0	11.5	6.7
1992	9.0	0.6	0.0	47.5	0.2	0.7	43.5	5.9	1.5	0.0	0.0	0.0	100.0	6.7	2.2
1993	9.0	6.9	0.1	45.5	0.0	2.0	24.5	1.8	1.6	21.0	0.1	5.5	100.0	8.8	9.2
1994	6.5	1.2	0.2	45.5	0.1	0.8	27.0	2.4	2.4	21.0	0.0	2.8	100.0	3.7	6.2
1995	9.0	12.1	0.1	45.0	0.0	7.5	27.5	0.4	2.8	21.0	0.2	4.2	102.5	12.7	14.6
1996	12.0	17.9	0.0	45.0	0.1	1.7	33.0	1.1	3.6	20.0	2.2	0.1	110.0	21.3	5.4
1997	7.0	4.7	0.0	45.5	0.1	1.1	38.0	2.5	2.7	19.5	1.5	0.2	110.0	8.8	4.0
1998	4.5	3.3	0.0	44.5	0.5	0.3	40.5	2.7	2.5	20.5	0.0	1.6	110.0	6.5	4.4
Total	--	55.3	0.5	--	1.8	22.3	--	20.9	25.0	--	7.8	14.4	--	85.8	62.2
Left bank retreated about 15 m. On right bank, the point bar accreted laterally and the flood plain farther to the right accreted vertically.															
PR164.8															
1986-1992	9.0	2.7	0.1	45.0	0.2	6.6	40.0	1.6	1.3	0.0	0.0	0.0	94.0	4.5	8.0
1992-1998	8.0	11.6	0.0	43.5	1.1	16.9	42.5	7.6	3.6	0.0	0.0	0.0	94.0	20.3	20.5
Total	--	14.3	0.1	--	1.3	23.5	--	9.2	4.9	0.0	0.0	0.0	--	24.8	28.5
Left bank erosion balanced by vertical accretion of flood plain on the right bank.															

Table 6. (Continued) Erosion and deposition of sediment at channel cross sections on the Powder River

Water Year	Bank			Flood plain			Channel			Point bar			Total		
	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)
PR165.6															
1980-1985	5.5	0.3	0.1	14.0	0.1	3.3	65.5	3.9	14.6	0.0	0.0	0.0	85.0	4.3	18.0
1985-1992	7.0	0.1	0.6	14.0	0.7	0.9	64.0	7.8	8.9	0.0	0.0	0.0	85.0	8.6	10.4
1992-1998	7.0	0.5	0.5	14.0	1.5	1.5	64.0	5.8	3.8	0.0	0.0	0.0	85.0	7.8	5.8
Total	--	0.9	1.2	--	2.3	5.7	--	17.5	27.3	--	0.0	0.0	--	20.7	34.2
The channel aggraded.															
PR166.0															
1980-1985	5.5	7.9	0.0	92.5	1.2	7.6	47.0	3.8	4.8	0.0	0.0	0.0	145.0	12.9	12.4
1985-1992	6.0	11.9	0.0	86.5	0.4	7.4	52.5	2.6	2.2	0.0	0.0	0.0	145.0	14.9	9.6
1992-1998	11.5	17.5	0.1	78.0	0.8	20.0	55.5	2.1	6.0	0.0	0.0	0.0	145.0	20.4	26.1
Total	--	37.3	0.1	--	2.4	35.0	--	8.5	13.0	--	0.0	0.0	--	48.2	48.1
Sediment lost by 15 m of erosion of the left bank was balanced by deposition of the right bank flood plain and aggradation of the channel.															
PR166.6															
1980-1985	3.0	1.9	0.0	6.0	0.1	0.0	55.0	0.6	3.8	29.0	0.1	5.1	93.0	2.7	8.9
1985-1992	1.5	0.9	0.0	dirt pile from ramp excavation			353.5	4.3	8.5	31.5	2.0	4.0	86.5	7.2	12.5
1992-1998	1.5	0.8	0.0	dirt pile from ramp excavating			54.0	9.5	6.9	31.0	0.8	6.0	86.5	11.1	12.9
Total	--	3.6	0.0	--	0.1	0.0	--	14.4	19.2	--	2.9	15.1	--	21.0	34.3
Right bank eroded and the point bar aggraded															
PR167															
1989	4.0	0.1	0.0	56.5	0.6	0.5	54.5	3.7	8.2	0.0	0.0	0.0	115.0	4.4	8.7
1990	4.0	0.2	0.0	55.5	0.4	0.5	13.5	3.6	0.0	42.0	0.0	20.8	115.0	4.2	21.3
1991	4.0	0.4	0.1	12.5	0.1	0.1	33.5	5.2	1.6	65.0	9.9	1.0	115.0	15.6	2.8
1992	4.5	0.4	0.1	58.5	0.5	0.5	51.0	5.2	3.2	1.0	0.1	0.0	115.0	6.2	3.8
1993	4.5	0.1	0.1	61.0	0.5	3.6	49.5	3.2	7.4	0.0	0.0	0.0	115.0	3.8	11.1
1994	3.0	3.1	0.0	54.5	0.7	0.7	57.5	2.8	8.6	0.0	0.0	0.0	115.0	6.6	9.3
1995	8.5	10.5	0.0	62.0	0.2	14.6	44.5	6.6	4.3	0.0	0.0	0.0	115.0	17.3	18.9
1996	6.5	3.2	0.0	65.0	0.3	4.0	43.5	4.7	2.5	0.0	0.0	0.0	115.0	8.2	6.5
1997	4.5	0.4	0.1	66.0	1.7	0.5	44.5	3.2	1.9	0.0	0.0	0.0	115.0	5.3	2.5
1998	5.5	0.2	0.4	64.5	0.9	0.8	45.0	6.5	3.2	0.0	0.0	0.0	115.0	7.6	4.4
Total	--	18.6	0.8	--	5.9	25.8	--	44.7	40.9	--	10.0	21.8	--	79.2	89.3
Point bar appeared but became one of those point-bar flood plains with vertical rather than sloping bank															
PR167.5															
1980-1985	12.0	0.8	0.8	0.0	0.0	0.0	218.0	9.0	11.6	0.0	0.0	0.0	230.0	9.8	12.4
1985-1992	13.0	0.7	1.3	0.0	0.0	0.0	48.0	1.9	3.4	0.0	0.0	0.0	61.0	--	--

Island section had mostly deposition in a secondary channel. Did not survey from station 149 to 259 in 1992. Did not survey in 1998.

Table 6. (Continued) Erosion and deposition of sediment at channel cross sections on the Powder River

Water Year	Bank			Flood plain			Channel			Point bar			Total		
	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)
PR168.5															
1980-1985	5.0	4.1	0.0	0.0	0.0	0.0	28.0	0.6	4.4	61.0	0.9	5.3	94.0	5.6	9.7
1985-1992	8.5	9.9	0.0	0.0	0.0	0.0	23.5	1.7	2.9	66.5	0.1	17.5	98.5	11.7	20.4
1992-1998	17.0	33.8	0.0	0.0	0.0	0.0	15.0	0.0	5.9	77.0	0.1	37.5	109.0	33.9	43.4
Total	--	47.8	0.0	0.0	0.0	0.0	--	2.3	13.2	--	1.1	60.3	--	51.2	73.5
Left bank retreated about 15 m and right bank point bar advanced and aggraded.															
PR169.2															
1980-1985	4.5	2.9	0.0	0.0	0.0	0.0	59.0	1.7	6.7	32.5	0.3	1.6	96.0	4.9	8.3
1985-1992	4.5	4.0	0.0	40.5	0.1	5.2	52.0	2.6	2.1	0.0	0.0	0.0	97.0	6.7	7.3
1992-1998	7.5	5.7	0.0	42.0	0.6	5.8	49.0	4.2	1.9	0.0	0.0	0.0	98.5	10.5	7.7
Total	--	12.6	0.0	--	0.7	11.0	--	8.5	10.7	--	0.3	1.6	--	22.1	23.3
The right bank eroded about 4 m and sediment was deposited on the point bar in the form of a scroll bar or bench															
PR169.8															
1980-1985	6.0	1.5	0.0	(51.0)	0.0	4.4	51.0	4.6	0.0	33.0	0.4	0.6	90.0	6.5	5.0
1985-1992	7.0	5.1	0.0	(48.5)	0.0	2.8	48.5	3.1	0.0	35.5	0.0	2.2	91.0	8.2	5.0
1992-1998	9.0	13.0	0.0	(51.5)	0.0	1.9	51.5	9.6	0.0	35.5	1.2	1.1	96.0	23.8	3.0
Total	--	19.6	0.0	--	0.0	9.1	--	17.3	0.0	--	1.6	3.9	--	38.5	13.0
Left bank eroded while a possible channel-expansion floodplain was deposited on the right bank side of the channel															
Widths in the () represent the same location as widths in the channel but sediment was deposited on a low floodplain rather than in the channel.															
PR170.5															
1980-1985	5.5	3.2	0.0	9.5	0.0	2.0	68.0	4.9	8.8	0.0	0.0	0.0	83.0	8.1	10.8
1985-1992	5.0	2.2	0.0	9.5	0.0	1.9	69.5	9.1	0.9	0.0	0.0	0.0	84.0	11.3	2.8
1992-1998	5.0	4.1	0.0	9.5	0.0	1.6	71.0	13.2	0.4	0.0	0.0	0.0	85.5	17.3	2.0
Total	--	9.5	0.0	--	0.0	5.5	--	27.2	10.1	--	0.0	0.0	--	36.7	15.6
Right bank eroded while a small bench was deposited on the left bank															
PR175															
1989	21.5	0.3	0.3	0.0	0.0	0.0	55.0	9.7	0.8	43.5	0.5	2.5	120.0	10.5	3.6
1990	21.5	0.1	0.5	0.0	0.0	0.0	57.0	1.9	6.3	41.5	0.1	6.5	120.0	2.1	13.3
1991	22.0	0.2	0.7	0.0	0.0	0.0	55.0	1.3	7.2	43.0	11.5	2.1	120.0	13.0	10.0
1992	21.0	0.1	0.5	0.0	0.0	0.0	70.0	3.1	5.6	29.0	0.5	1.0	120.0	3.7	7.1
1993	28.0	0.2	4.0	0.0	0.0	0.0	54.5	5.1	2.3	37.5	0.0	8.4	120.0	5.3	14.7
1994	20.0	0.2	0.3	0.0	0.0	0.0	62.5	8.8	3.8	37.5	0.0	3.8	120.0	9.0	7.9
1995	20.0	0.0	2.4	0.0	0.0	0.0	73.0	6.5	19.6	27.0	0.0	7.9	120.0	6.5	29.9
1996	20.0	0.2	0.7	0.0	0.0	0.0	73.0	2.3	9.0	27.0	0.7	1.3	120.0	3.2	11.0
1997	20.0	0.3	0.2	0.0	0.0	0.0	73.0	14.2	18.1	27.0	0.3	1.4	120.0	14.8	19.7
1998	22.0	2.3	0.1	0.0	0.0	0.0	60.5	2.0	3.5	37.5	0.4	1.6	120.0	4.7	5.2
Total	--	3.9	9.7	--	0.0	0.0	--	54.9	76.2	--	14.0	36.5	--	72.8	122.4
Left bank retreated a little and the point bar grew episodically by vertical accretion in different locations at different times.															

Table 6. (Continued) Erosion and deposition of sediment at channel cross sections on the Powder River

Water Year	Bank			Flood plain			Channel			Point bar			Total		
	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)
PR180															
1989	8.0	2.2	0.0	0.0	0.0	0.0	22.0	1.4	1.1	58.0	0.7	3.6	88.0	4.3	4.7
1990	13.0	6.8	0.0	0.0	0.0	0.0	17.5	0.6	1.4	57.5	0.6	4.4	88.0	8.0	5.8
1991	15.0	29.0	3.8	0.0	0.0	0.0	33.0	0.0	7.8	50.0	0.5	4.1	98.0	29.5	15.7
1992	9.0	2.3	0.1	0.0	0.0	0.0	39.0	0.5	4.8	50.0	0.1	2.5	98.0	2.9	7.4
1993	14.0	15.5	0.0	0.0	0.0	0.0	24.0	0.3	3.1	65.0	0.7	7.6	103.0	16.5	10.7
1994	6.5	0.8	0.1	0.0	0.0	0.0	31.5	2.7	0.8	65.0	1.3	2.1	103.0	4.8	3.0
1995	11.0	14.1	0.0	0.0	0.0	0.0	29.0	0.9	5.7	68.0	0.0	16.9	108.0	15.0	22.6
1996	10.0	8.9	0.0	0.0	0.0	0.0	33.0	3.9	3.7	70.0	1.8	1.9	113.0	14.6	5.6
1997	7.0	7.9	0.0	0.0	0.0	0.0	36.0	3.6	3.2	70.0	1.0	1.7	113.0	12.5	4.9
1998	6.5	2.3	0.0	0.0	0.0	0.0	33.5	2.0	1.2	73.0	0.1	3.2	113.0	4.4	4.4
Total	--	89.8	4.0	--	0.0	0.0	--	15.9	32.8	--	6.8	48.0	--	112.5	84.8
Left bank retreated about 30 m and point bar advanced															
PR183															
1989	11.0	0.4	0.1	30.0	0.4	0.6	39.0	0.5	4.0	0.0	0.0	0.0	80.0	1.3	4.7
1990	11.0	0.1	0.4	30.0	0.1	2.0	39.0	4.0	0.2	0.0	0.0	0.0	80.0	4.2	2.6
1991	11.5	0.4	0.1	30.0	0.5	0.9	38.5	0.7	1.8	0.0	0.0	0.0	80.0	1.6	2.8
1992	11.0	0.1	0.2	30.0	0.1	0.5	39.0	1.7	1.9	0.0	0.0	0.0	80.0	1.9	2.6
1993	11.0	0.7	0.1	30.0	0.2	2.5	39.0	4.4	1.8	0.0	0.0	0.0	80.0	5.3	4.4
1994	9.5	0.7	0.1	30.0	0.2	0.4	40.5	0.2	3.1	0.0	0.0	0.0	80.0	1.1	3.6
1995	9.5	1.3	0.4	30.0	0.4	4.6	40.5	4.3	2.7	0.0	0.0	0.0	80.0	6.0	7.7
1996	8.0	0.4	0.0	30.0	0.4	0.2	42.0	2.5	4.2	0.0	0.0	0.0	80.0	3.3	4.4
1997	9.5	0.3	0.1	30.0	0.4	0.2	40.5	4.2	2.8	0.0	0.0	0.0	80.0	4.9	3.1
1998	8.0	0.2	0.1	30.0	0.3	0.8	42.0	5.0	1.3	0.0	0.0	0.0	80.0	5.5	2.2
Total	--	4.6	1.6	--	3.0	12.7	--	27.5	23.8	--	0.0	0.0	--	35.1	38.1
Vertical accretion on the left bank flood plain.															
PR191															
1989	13.0	0.2	0.3	79.0	0.5	0.3	33.0	0.1	2.4	0.0	0.0	0.0	125.0	0.8	3.0
1990	10.5	0.6	0.2	79.0	0.0	1.2	35.5	7.9	0.0	0.0	0.0	0.0	125.0	8.5	1.4
1991	11.5	0.7	0.4	89.0	0.6	0.3	34.5	0.1	7.2	0.0	0.0	0.0	135.0	1.4	7.9
1992	12.0	0.2	0.2	88.5	0.6	0.6	34.5	0.6	0.5	0.0	0.0	0.0	135.0	1.4	1.3
1993	12.0	2.0	0.4	88.5	0.1	8.9	34.5	1.5	2.4	0.0	0.0	0.0	135.0	3.6	11.7
1994	9.0	0.2	0.3	89.0	1.7	0.7	37.0	5.6	0.2	0.0	0.0	0.0	135.0	7.5	1.2
1995	7.5	2.5	0.2	90.5	0.1	15.5	37.0	0.1	8.9	0.0	0.0	0.0	135.0	2.7	24.6
1996	12.0	2.2	0.1	83.5	0.6	1.4	39.5	1.7	1.3	0.0	0.0	0.0	135.0	4.5	2.8
1997	10.0	1.0	0.3	85.5	0.2	1.0	39.5	5.0	2.6	0.0	0.0	0.0	135.0	6.2	3.9
1998	10.0	0.9	0.1	85.0	0.9	0.6	40.0	4.4	0.1	0.0	0.0	0.0	135.0	6.2	0.8
Total	--	10.5	2.5	--	5.3	30.5	--	27.0	25.6	--	0.0	0.0	--	42.8	58.6
Vertical accretion on both the left and right bank flood plains.															

Table 6. (Continued) Erosion and deposition of sediment at channel cross sections on the Powder River

Water Year	Bank			Flood plain			Channel			Point bar			Total		
	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)	Width (m)	Eros. (m ²)	Depo. (m ²)
PR194															
1989	14.0	0.1	1.1	38.5	0.1	0.2	52.5	3.7	3.7	0.0	0.0	0.0	105.0	3.9	5.0
1990	14.0	0.7	1.5	38.5	0.1	0.4	52.5	9.0	1.6	0.0	0.0	0.0	105.0	9.8	3.5
1991	14.5	1.4	2.7	38.0	0.5	0.1	52.5	0.3	1.9	0.0	0.0	0.0	105.0	2.2	4.7
1992	15.5	0.0	1.9	37.5	0.2	0.6	52.0	2.3	2.9	0.0	0.0	0.0	105.0	2.5	5.4
1993	13.5	0.9	0.7	39.5	0.1	1.2	52.0	3.3	1.2	0.0	0.0	0.0	105.0	4.3	3.1
1994	14.5	0.7	1.0	39.0	0.2	0.6	51.5	1.8	1.4	0.0	0.0	0.0	105.0	2.7	3.0
1995	16.5	4.4	0.3	37.0	0.3	1.8	51.5	3.6	4.2	0.0	0.0	0.0	105.0	8.3	6.3
1996	16.5	2.1	0.2	36.0	0.2	0.3	52.5	3.2	3.6	0.0	0.0	0.0	105.0	5.5	4.1
1997	16.0	1.5	0.5	35.5	0.0	0.4	53.5	5.6	0.8	0.0	0.0	0.0	105.0	7.1	1.7
1998	16.5	0.9	0.3	35.5	0.3	0.0	53.0	2.8	1.5	0.0	0.0	0.0	105.0	4.0	1.8
Total	--	12.7	10.2	--	2.0	5.6	--	35.6	22.8	--	0.0	0.0	--	50.3	38.6
Flood plain accretion on the left bank.															
PR200A															
1989	19.0	0.9	1.0	170.5	1.3	4.2	38.0	1.4	0.7	0.0	0.0	0.0	227.5	3.6	5.9
1990	16.5	7.6	0.5	184.5	1.2	12.7	27.0	6.4	0.8	0.0	0.0	0.0	228.0	15.2	14.0
1991	26.0	24.3	0.3	192.0	2.4	26.8	11.0	8.4	0.0	0.0	0.0	0.0	229.0	35.1	27.1
1992	33.5	52.9	0.2	195.5	1.2	35.7	0.0	0.0	0.0	0.0	0.0	0.0	229.0	54.1	35.9
1993	39.0	64.5	0.0	195.0	3.5	61.6	0.0	0.0	0.0	0.0	0.0	0.0	234.0	68.0	61.6
1994	24.0	28.3	0.0	216.0	1.8	23.8	0.0	0.0	0.0	0.0	0.0	0.0	240.0	30.1	23.8
1995	43.5	66.6	0.0	159.0	0.5	40.3	50.0	10.2	1.9	0.0	0.0	0.0	252.5	77.3	42.2
1996	7.0	5.3	0.0	170.0	2.4	11.6	77.0	11.2	6.7	0.0	0.0	0.0	254.0	18.9	18.3
1997	3.5	0.5	0.3	190.0	2.0	17.5	61.5	38.0	0.0	0.0	0.0	0.0	255.0	40.5	17.8
1998	23.0	3.0	0.3	179.5	2.7	1.7	52.5	0.9	2.1	0.0	0.0	0.0	255.0	6.6	4.1
Total	--	253.9	2.6	--	19.0	235.9	--	76.5	12.2	--	0.0	0.0	--	349.4	250.7
Left bank retreated. The channel along the left bank filled. The secondary channel shifted toward the left bank (this appears as bank erosion and no apparent channel activity, see 1992-1994 above) and evolved into the main channel with some human assistance.															
PR206															
1989	10.0	0.5	0.0	23.5	0.0	0.6	77.5	0.6	3.1	0.0	0.0	0.0	111.0	1.1	3.7
1990	15.5	21.2	0.0	23.5	0.1	0.4	77.5	2.9	8.1	0.0	0.0	0.0	116.5	24.2	8.5
1991	13.5	21.4	0.4	45.5	0.1	22.1	65.0	24.2	5.1	0.0	0.0	0.0	124.0	45.7	27.6
1992	7.5	0.5	0.0	63.5	0.6	3.2	54.0	5.1	4.4	0.0	0.0	0.0	125.0	6.2	7.6
1993	6.5	1.3	0.6	53.5	0.0	13.8	65.0	10.1	0.5	0.0	0.0	0.0	125.0	11.4	14.9
1994	6.5	0.0	0.3	54.5	0.1	2.3	65.0	0.6	6.4	0.0	0.0	0.0	126.0	0.7	9.0
1995	6.5	0.4	0.0	93.5	0.0	74.9	27.0	26.9	0.1	0.0	0.0	0.0	127.0	27.3	75.0
1996	13.5	10.1	0.1	98.5	4.1	4.9	15.0	0.2	3.6	0.0	0.0	0.0	127.0	14.4	8.6
1997	15.5	16.4	0.2	92.0	3.5	9.0	19.5	0.0	5.2	0.0	0.0	0.0	127.0	19.9	14.4
1998	9.5	3.3	0.3	93.5	1.8	4.4	24.0	4.7	0.0	0.0	0.0	0.0	127.0	9.8	4.7
Total	--	75.1	1.9	--	10.3	135.6	--	75.3	36.5	--	0.0	0.0	--	160.7	174.0
Left bank retreated about 15 m. A flood plain developed adjacent to the left bank and was larger than the flood plain that developed on the right bank.															

channel also shifted from the left bank to the right bank. The shift at PR206 primarily occurred in just two years (1991 and 1995) when 71.5 percent of the sediment was deposited. This contrasts with PR200A where the shift was more gradual and never exceeded 30 percent in any year.

SUMMARY

This report represents the second decade (1988-1998) of measurements of erosion and deposition at cross sections on Powder River following the major flood in 1978. Snowmelt floods carried the greatest maximum sediment concentration (52,200 mg/L), followed by flash floods (49,700 mg/L) and ice break-up floods (26,000 mg/L). The proportion of sand in the suspended sediment or eroded sediment also depended upon the type of flood (ice break-up, 28-percent; snowmelt, 23-percent; and flash, 7-percent). Sediment deposited on the flood-plain trough averaged 13 percent sand, while sediment deposited on the flood-plain crest averaged 72 percent sand. The finer-grained sediment sampled from the bed of the channel averaged 99 percent sand.

The minimum riverbed elevation decreased with time at 8 cross sections and increased with time at 15 cross sections. However, there was no consistent trend. The minimum riverbed elevation fluctuated from year to year as indicated by the standard deviation of the elevation, which ranged from 0.01 to 0.30 m.

Likewise, the areas of erosion of sediment and areas of deposition of sediment fluctuated from year to year. At some specific cross sections, erosion of sediment exceed deposition of sediment by 47 percent and at the other sections, deposition exceeded erosion by 41 percent. However, in general in this study reach of Powder River, the sedimentary processes were in equilibrium such that erosion balanced deposition during the second decade after the 1978 flood.

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CROSS-SECTION DATA

Description of Cross Section PR113

Location: Township 9 South/Range 48 East--section 18

U. S. Geological Survey quadrangle (1:24,000): Bradshaw Creek

Landowners--left bank: Lloyd Sams (Moorhead Cattle Company)

--right bank: U. S. Government

Access: Right bank

Permission from: None necessary

Distance from Moorhead Gaging Station: -2.23 kilometers

Azimuth of Section (degrees magnetic): 171.5

Reference Monuments

[Monuments at stations 100.0, 100.4, and 114.7 were closest to the leveling instrument]

Description	Station (m)	GPS-NAD83(1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.14 meter above 1998 ground level; under 3-strand barbed- wire fence with all wooden posts	-83.9	45°03'28.78"	105°53'02.22"	0.225	0.496	1024.02
1/2-inch-rebar; 0.16 m above 1998 ground level	-60.0					1023.05
1/2-inch-rebar; 0.17 meter above 1998 ground level	70.0					1022.08
1/2-inch-rebar; 0.04 meter below 1998 ground level	100.0					1023.02
1/2-inch-rebar; 0.06 meter above 1998 ground level	100.4					1023.18
1/2-inch-rebar; 0.12 meter above 1998 ground level; under 3-strand, barbed- wire fence with all metal posts	114.7					1023.57
Benchmark--brass circular plate	142.0	45°03'21.49"	105°53'03.31"	0.412	0.432	1023.34

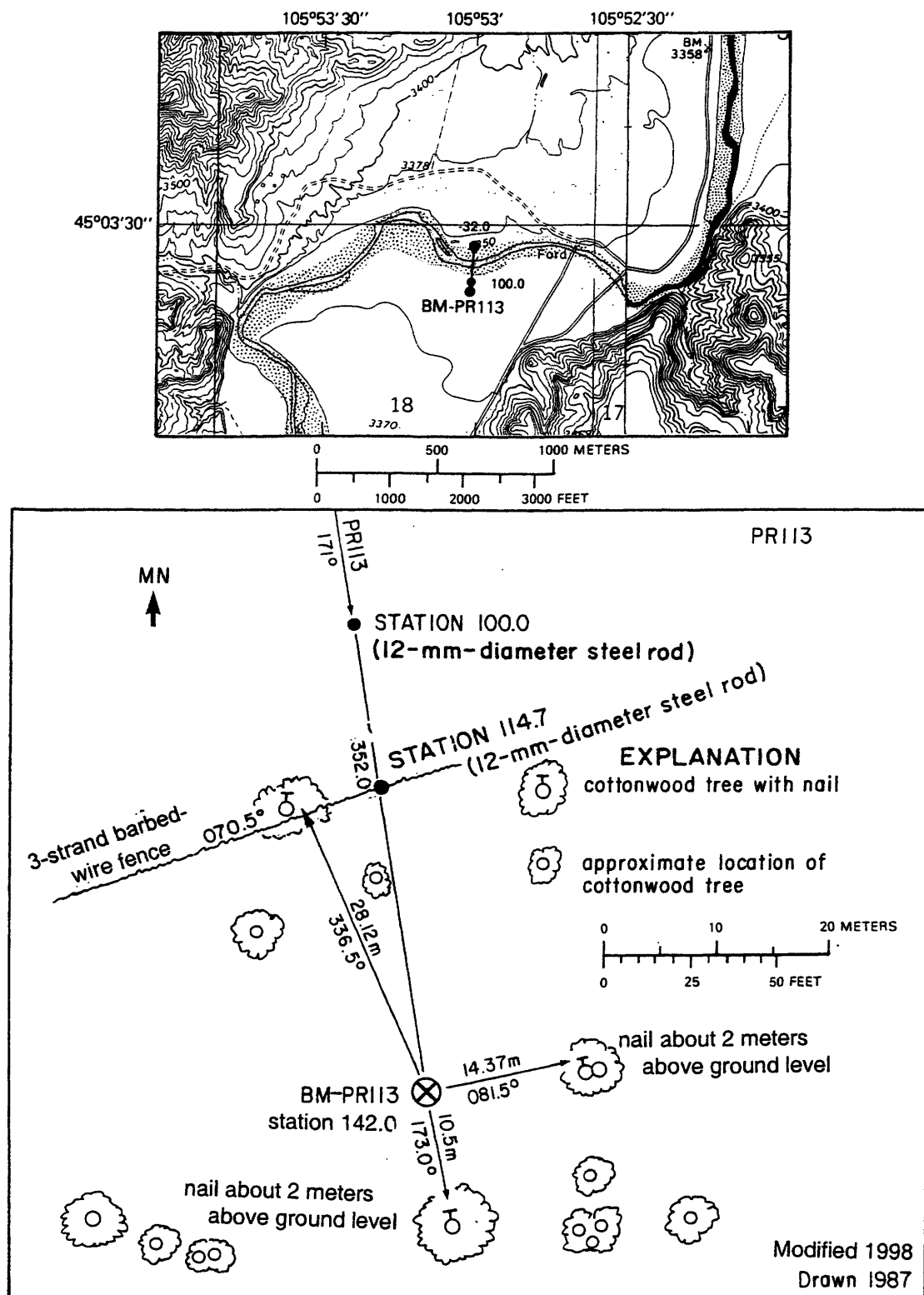


Figure 9. Upper: Location of cross section PR113, bench mark BM-PR113, and left and right bank reference monuments in the Bradshaw Creek quadrangle. Lower: Location of the bench mark on the right bank. MN is magnetic north.

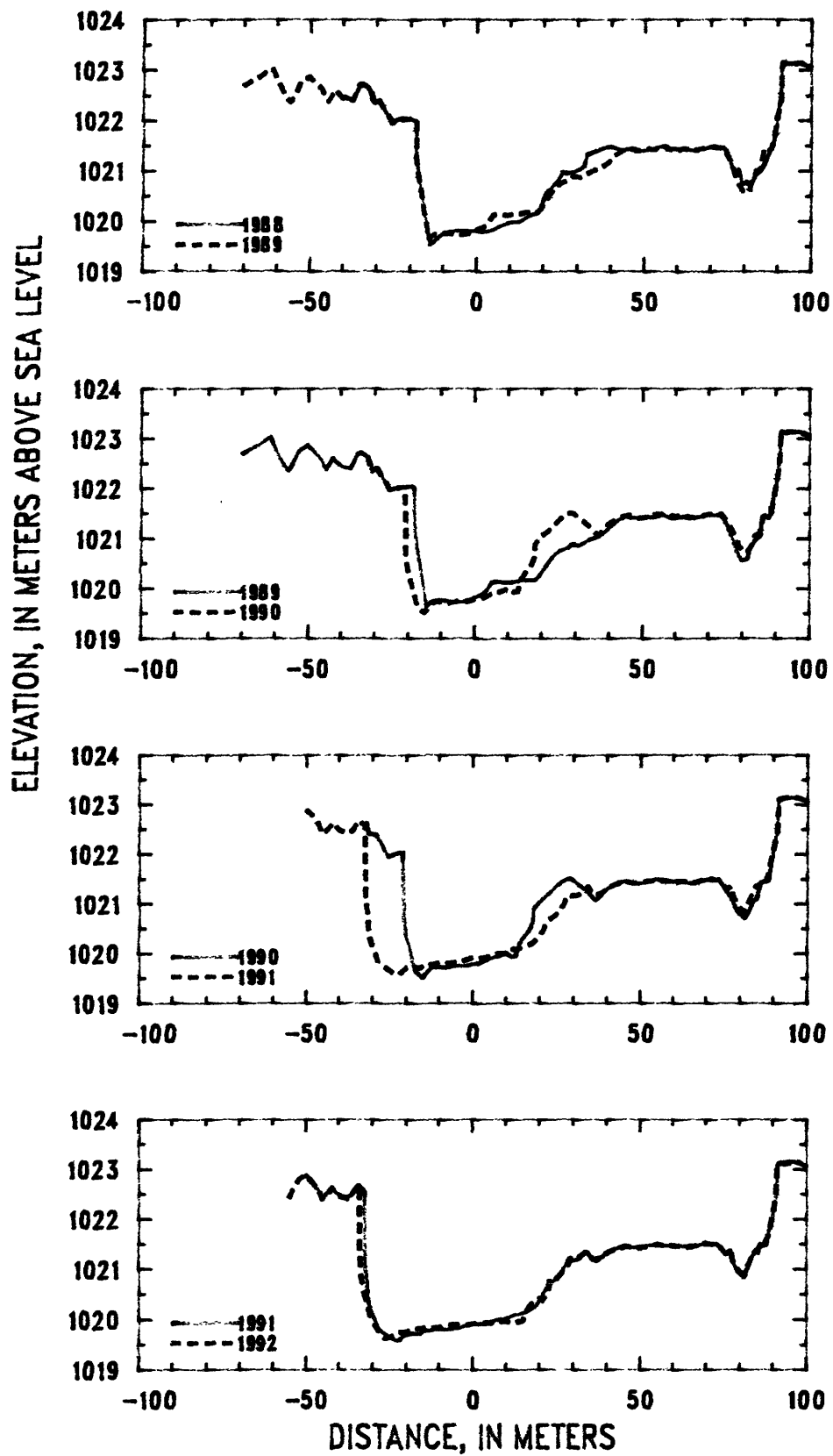


Figure 10. Profiles of cross section PR113 from 1988 to 1992.

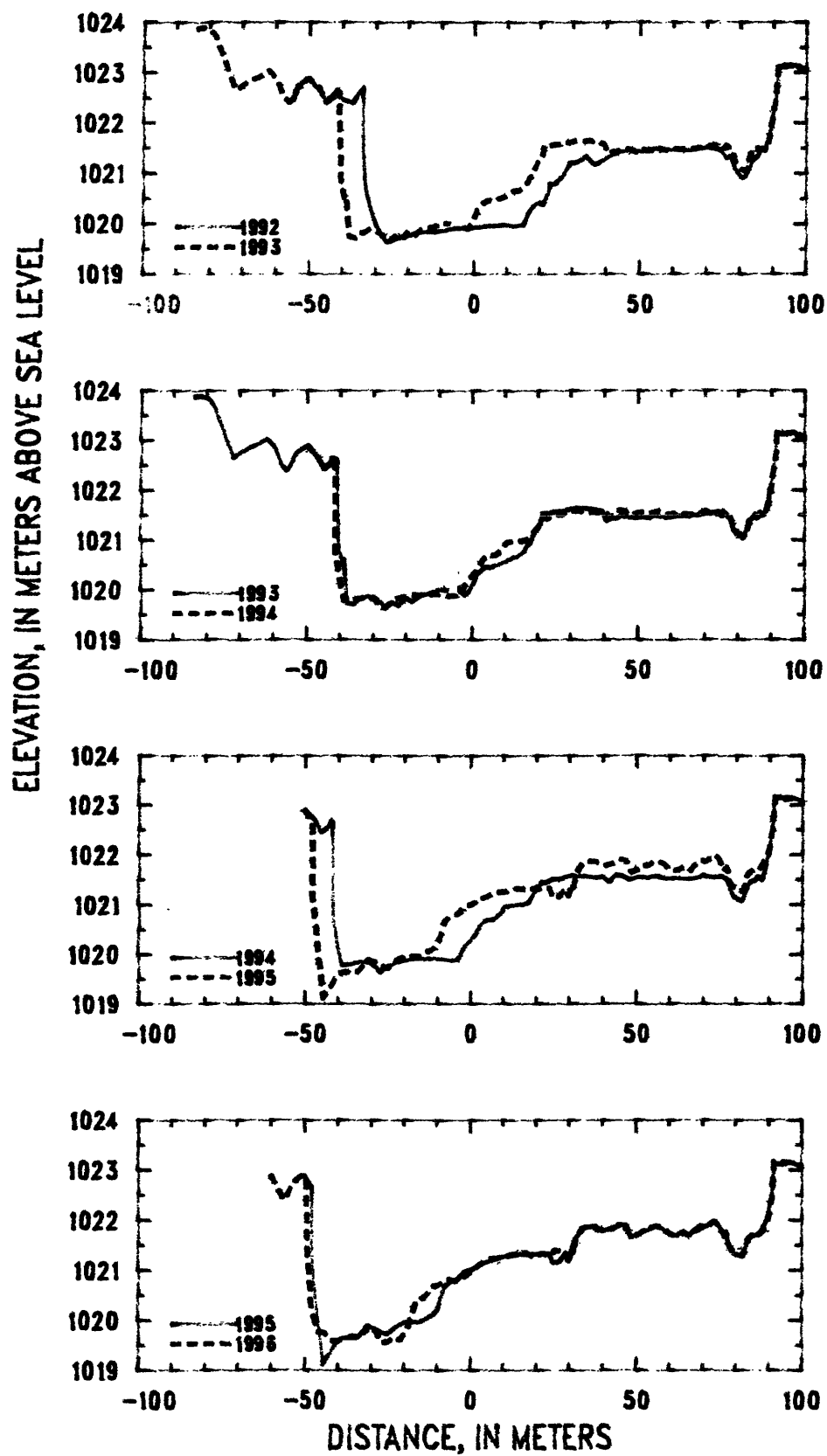


Figure 11. Profiles of cross section PR113 from 1992 to 1996.

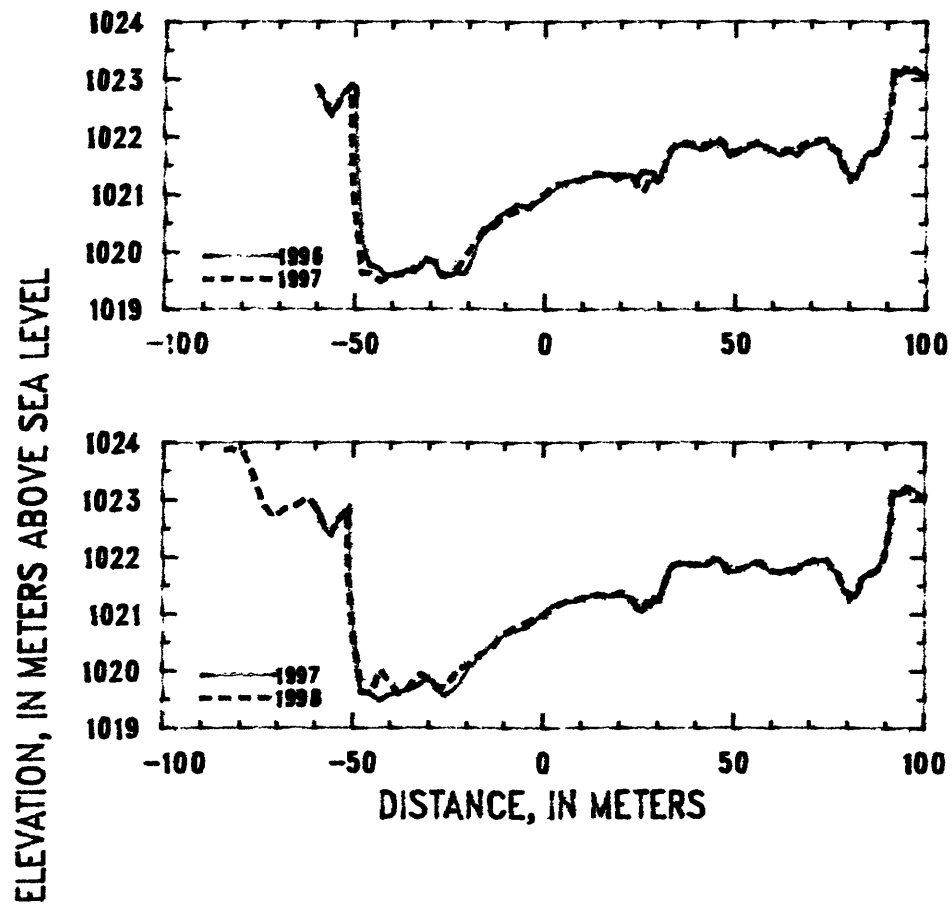


Figure 12. Profiles of cross section PR113 from 1996 to 1998.

Table 7. Listing of horizontal stations and elevations for cross section PR113

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1989		1990		1990	
16 September		16 September		16 September		13 September		13 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-70.0	1022.70	19.3	1020.24	97.0	1023.15	-32.0	1022.63	44.0	1021.44
-65.0	1022.89	21.0	1020.45	99.0	1023.07	-31.0	1022.41	46.0	1021.48
-61.4	1023.04	23.0	1020.62	100.0	1023.05	-29.0	1022.39	48.0	1021.41
-57.5	1022.48	25.0	1020.76	100.4	1023.08	-27.0	1022.18	50.0	1021.41
-55.9	1022.37	28.0	1020.82	102.8	1023.07	-25.3	1021.95	52.0	1021.45
-54.9	1022.45	29.0	1020.89	105.0	1023.31	-23.0	1022.02	54.0	1021.49
-53.0	1022.75	31.0	1020.87	107.0	1023.21	-21.0	1022.04	56.0	1021.49
-50.2	1022.88	33.0	1020.94	110.0	1023.42	-20.6	1020.58	58.0	1021.45
-46.7	1022.65	35.0	1021.01	114.7	1023.40	-19.5	1020.22	60.0	1021.45
-44.5	1022.39	37.0	1021.05			-16.9	1019.62	62.0	1021.49
-42.5	1022.61	39.0	1021.14			-15.0	1019.51	64.0	1021.44
-40.0	1022.45	41.0	1021.30			-14.0	1019.59	66.0	1021.41
-37.0	1022.40	43.0	1021.38			-12.0	1019.74	68.0	1021.45
-35.0	1022.71	45.0	1021.45			-10.0	1019.73	70.0	1021.49
-34.0	1022.72	48.0	1021.40			-8.0	1019.71	72.0	1021.50
-32.0	1022.64	51.0	1021.44			-5.0	1019.76	74.0	1021.48
-30.5	1022.35	53.0	1021.41			-2.0	1019.75	76.0	1021.28
-29.4	1022.41	56.0	1021.48			0.0	1019.78	77.8	1021.05
-28.0	1022.26	59.0	1021.40			2.0	1019.81	78.7	1020.93
-26.0	1022.05	62.0	1021.45			5.0	1019.90	79.0	1020.85
-25.0	1021.98	65.0	1021.40			8.0	1019.95	81.5	1020.71
-23.0	1022.03	67.0	1021.44			10.0	1020.01	83.0	1020.87
-21.0	1022.03	70.0	1021.48			12.0	1019.94	84.0	1021.06
-19.0	1022.05	72.0	1021.47			13.0	1019.95	85.2	1021.10
-18.1	1022.02	74.0	1021.45			14.0	1020.20	86.2	1021.44
-18.0	1021.24	76.0	1021.21			16.0	1020.39	88.0	1021.46
-17.0	1020.77	78.0	1020.82			17.0	1020.49	88.6	1021.48
-15.8	1020.26	80.0	1020.56			17.9	1020.63	90.0	1022.03
-14.2	1019.64	81.8	1020.59			18.0	1020.91	91.0	1022.43
-13.0	1019.72	82.3	1020.76			20.0	1021.05	91.5	1023.10
-11.0	1019.76	84.0	1020.98			22.0	1021.17	93.0	1023.13
-9.0	1019.76	85.4	1021.05			24.0	1021.30	95.0	1023.14
-6.0	1019.73	86.1	1021.43			26.0	1021.43	97.0	1023.14
-3.0	1019.73	87.0	1021.46			28.0	1021.51	100.0	1023.05
0.0	1019.82	88.0	1021.41			29.0	1021.52	100.4	1023.09
3.0	1019.92	88.6	1021.47			31.0	1021.42	114.7	1023.41
5.0	1020.13	90.0	1022.05			33.0	1021.31		
7.0	1020.15	91.1	1022.42			35.0	1021.20		
9.0	1020.12	91.4	1023.10			36.5	1021.07		
12.0	1020.14	91.6	1023.15			38.0	1021.14		
15.0	1020.17	93.0	1023.12			40.0	1021.31		
18.0	1020.16	95.0	1023.13			42.0	1021.39		

Table 7. (Continued) Listing of horizontal stations and elevations for cross section PR113
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1991		1992		1992		1992	
28 August		28 August		25 August		25 August		25 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-50.0	1022.88	30.3	1021.16	-55.0	1022.44	18.0	1020.35	97.0	1023.15
-47.0	1022.69	31.5	1021.19	-52.0	1022.81	20.0	1020.42	100.0	1023.06
-45.0	1022.40	34.4	1021.35	-50.0	1022.88	20.9	1020.38	100.5	1023.10
-42.0	1022.63	35.9	1021.19	-48.0	1022.73	23.0	1020.67		
-40.0	1022.48	38.0	1021.20	-46.0	1022.55	23.0	1020.79		
-38.0	1022.43	40.0	1021.31	-45.0	1022.40	24.8	1020.79		
-36.0	1022.47	42.0	1021.39	-43.0	1022.53	27.0	1020.95		
-34.0	1022.68	45.0	1021.47	-42.0	1022.63	29.0	1021.14		
-32.2	1022.56	48.0	1021.42	-40.0	1022.47	29.1	1021.20		
-32.0	1021.11	51.0	1021.45	-37.0	1022.39	31.0	1021.21		
-31.3	1020.73	54.0	1021.48	-35.0	1022.61	34.0	1021.35		
-31.2	1020.40	57.0	1021.48	-33.8	1022.69	36.0	1021.20		
-29.7	1020.08	60.0	1021.44	-33.7	1021.48	37.0	1021.17		
-28.2	1019.83	63.0	1021.47	-33.3	1020.88	39.0	1021.26		
-26.0	1019.71	66.0	1021.43	-32.0	1020.42	41.0	1021.35		
-24.0	1019.62	69.0	1021.50	-31.0	1020.24	43.5	1021.41		
-22.0	1019.58	71.0	1021.51	-30.5	1020.07	46.0	1021.45		
-20.0	1019.71	72.0	1021.49	-29.0	1019.87	49.0	1021.42		
-18.0	1019.72	73.5	1021.49	-27.0	1019.67	52.0	1021.45		
-16.0	1019.71	75.0	1021.39	-26.0	1019.63	55.0	1021.49		
-14.0	1019.79	76.0	1021.29	-24.0	1019.68	58.0	1021.45		
-12.0	1019.78	77.4	1021.36	-22.0	1019.75	61.0	1021.47		
-10.0	1019.82	78.0	1021.16	-20.0	1019.75	64.0	1021.44		
-8.0	1019.80	80.0	1020.90	-18.0	1019.81	67.0	1021.46		
-6.0	1019.81	81.5	1020.83	-16.0	1019.83	70.0	1021.51		
-4.0	1019.83	84.0	1021.26	-14.0	1019.85	72.0	1021.49		
-2.0	1019.87	85.0	1021.36	-12.0	1019.83	74.0	1021.46		
0.0	1019.91	85.7	1021.32	-10.0	1019.85	76.0	1021.30		
2.0	1019.92	86.2	1021.46	-8.0	1019.89	77.5	1021.36		
4.0	1019.94	88.2	1021.47	-6.0	1019.91	78.2	1021.12		
6.0	1019.98	89.6	1021.96	-4.0	1019.91	80.0	1020.94		
8.0	1020.01	91.1	1022.45	-2.0	1019.90	81.0	1020.90		
10.0	1020.01	91.5	1023.11	0.0	1019.91	82.0	1020.97		
12.0	1020.09	93.0	1023.13	2.0	1019.94	84.0	1021.28		
15.0	1020.12	95.0	1023.15	4.0	1019.94	85.1	1021.32		
18.0	1020.21	97.0	1023.14	6.0	1019.95	86.5	1021.49		
20.0	1020.35	100.0	1023.06	8.0	1019.96	87.5	1021.45		
21.5	1020.57	100.4	1023.10	10.0	1019.98	89.0	1021.72		
23.0	1020.69			-55.0	1022.44	91.0	1022.48		
25.0	1020.80			-52.0	1022.81	91.4	1023.10		
26.0	1020.87			-50.0	1022.88	92.0	1023.14		
28.5	1021.18			-48.0	1022.73	94.0 x	1023.10		

Table 7. (Continued) Listing of horizontal stations and elevations for cross section PR113
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1993		1993		1993		1994		1994	
25 August		25 August		25 August		24 September		24 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-83.9	1023.87	-10.0	1020.02	61.0	1021.48	-50.0	1022.89	40.0	1021.57
-82.0	1023.89	-8.0	1020.00	63.0	1021.48	-48.0	1022.77	42.0	1021.45
-80.0	1023.86	-6.0	1020.92	65.0	1021.47	-47.0	1022.71	44.0	1021.59
-78.0	1023.73	-4.0	1019.98	67.0	1021.50	-45.0	1022.44	46.0	1021.59
-76.0	1023.37	-2.0	1019.88	69.0	1021.51	-43.0	1022.55	48.0	1021.50
-74.0	1022.99	0.0	1020.08	70.0	1021.55	-42.0	1022.69	51.0	1021.56
-71.9	1022.65	1.0	1020.29	71.0	1021.53	-41.5	1022.64	53.0	1021.52
-70.0	1022.74	2.4	1020.38	73.0	1021.56	-41.4	1020.73	56.0	1021.59
-67.5	1022.85	4.0	1020.46	75.0	1021.48	-40.0	1020.17	59.0	1021.52
-65.0	1022.91	6.0	1020.45	76.0	1021.56	-38.7	1019.78	62.0	1021.53
-62.0	1023.03	8.0	1020.50	77.0	1021.47	-36.0	1019.81	65.0	1021.51
-59.5	1022.85	10.0	1020.56	77.9	1021.42	-33.0	1019.85	68.0	1021.52
-57.5	1022.50	12.0	1020.65	78.7	1021.19	-30.0	1019.85	70.0	1021.60
-56.0	1022.39	14.0	1020.67	80.0	1021.09	-27.0	1019.64	72.0	1021.55
-55.0	1022.46	16.0	1020.79	81.6	1021.03	-24.0	1019.79	74.0	1021.56
-53.2	1022.75	17.0	1020.93	82.1	1021.08	-21.0	1019.86	76.0	1021.57
-51.5	1022.84	17.5	1020.93	83.1	1021.39	-18.0	1019.91	77.5	1021.50
-50.0	1022.88	18.5	1021.10	84.2	1021.42	-15.0	1019.91	78.8	1021.21
-48.0	1022.74	19.1	1021.22	84.8	1021.50	-12.0	1019.92	80.0	1021.14
-47.0	1022.70	20.0	1021.24	85.2	1021.52	-9.0	1019.91	82.0	1021.06
-45.0	1022.41	21.0	1021.41	85.5	1021.44	-6.0	1019.87	83.5	1021.38
-43.2	1022.49	21.3	1021.55	87.0	1021.49	-4.0	1019.87	84.5	1021.46
-42.2	1022.65	23.0	1021.55	87.7	1021.50	-1.8	1020.17	85.8	1021.48
-41.0	1022.62	25.0	1021.57	88.6	1021.63	0.0	1020.29	86.6	1021.56
-40.5	1020.92	27.0	1021.58	89.1	1021.78	2.0	1020.45	87.8	1021.51
-39.5	1020.53	29.0	1021.61	90.8	1022.49	3.0	1020.60	89.0	1021.70
-39.0	1020.59	31.0	1021.64	91.4	1023.16	5.0	1020.70	91.3	1022.66
-38.8	1020.41	33.0	1021.64	93.0	1023.13	7.0	1020.69	91.5	1023.16
-38.0	1019.73	35.0	1021.65	95.0	1023.14	9.0	1020.80	93.0	1023.13
-36.0	1019.71	37.0	1021.63	97.0	1023.16	10.5	1020.95	95.0	1023.15
-34.0	1019.81	39.3	1021.58	98.0	1023.06	12.0	1020.98	97.0	1023.15
-32.0	1019.88	40.6	1021.38	100.0	1023.06	15.0	1020.99	100.0	1023.05
-30.0	1019.86	42.0	1021.43	100.4	1023.10	17.5	1021.04	100.4	1023.09
-28.0	1019.78	43.5	1021.43			20.0	1021.29	114.7	1023.43
-26.0	1019.63	45.0	1021.50			21.5	1021.45		
-24.0	1019.75	47.0	1021.47			23.0	1021.44		
-22.0	1019.69	49.0	1021.43			25.0	1021.52		
-20.0	1019.85	51.0	1021.47			27.0	1021.50		
-18.0	1019.76	53.0	1021.44			30.0	1021.59		
-16.0	1019.88	55.0	1021.51			33.0	1021.59		
-14.0	1019.92	57.0	1021.47			36.0	1021.57		
-12.0	1019.93	59.0	1021.44			38.5	1021.53		

Table 7. (Continued) Listing of horizontal stations and elevations for cross section PR113
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1995		1995		1995		1996		1996	
23 September		23 September		23 September		15 October		15 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-50.0	1022.89	29.8	1021.19	91.5	1023.15	-60.0	1022.89	24.5	1021.28
-47.7	1022.67	30.2	1021.25	94.0	1023.09	-56.2	1022.38	25.5	1021.40
-47.6	1021.15	30.9	1021.42	97.0	1023.15	-53.2	1022.76	28.5	1021.38
-46.2	1020.27	31.3	1021.36	100.0	1023.06	-51.5	1022.86	30.0	1021.23
-44.3	1019.14	32.6	1021.69	100.4	1023.08	-50.0	1022.89	32.0	1021.60
-40.0	1019.60	34.0	1021.83	114.7	1023.42	-49.6	1022.87	34.0	1021.83
-38.0	1019.65	36.0	1021.87			-49.1	1021.29	36.0	1021.88
-36.0	1019.64	38.0	1021.88			-47.9	1020.20	39.0	1021.82
-34.0	1019.66	40.0	1021.78			-46.0	1019.78	41.0	1021.78
-32.0	1019.81	42.0	1021.81			-44.0	1019.74	43.5	1021.84
-31.0	1019.91	44.0	1021.85			-42.0	1019.60	45.0	1021.91
-29.0	1019.85	45.0	1021.91			-40.0	1019.59	47.0	1021.86
-27.0	1019.77	47.0	1021.89			-38.0	1019.61	48.5	1021.66
-25.0	1019.72	48.4	1021.65			-36.0	1019.69	50.0	1021.68
-23.0	1019.84	50.0	1021.68			-34.0	1019.66	53.0	1021.79
-21.0	1019.93	52.0	1021.76			-32.0	1019.79	56.0	1021.89
-19.0	1019.97	54.0	1021.80			-31.0	1019.90	58.0	1021.84
-17.0	1019.97	56.0	1021.88			-29.0	1019.83	60.0	1021.73
-15.0	1019.96	58.0	1021.83			-27.0	1019.56	62.0	1021.68
-13.0	1020.05	60.0	1021.71			-25.0	1019.57	64.3	1021.76
-11.0	1020.12	62.0	1021.68			-23.0	1019.66	66.2	1021.67
-9.9	1020.23	64.0	1021.75			-21.0	1019.62	68.0	1021.79
-8.0	1020.68	66.0	1021.67			-19.0	1019.83	70.0	1021.86
-6.0	1020.78	67.0	1021.76			-17.0	1020.23	72.0	1021.91
-4.0	1020.81	69.0	1021.88			-16.0	1020.41	74.0	1021.97
-2.0	1020.98	71.0	1021.86			-15.0	1020.41	76.0	1021.76
0.0	1021.00	73.0	1021.96			-13.0	1020.53	77.2	1021.73
2.0	1021.07	74.0	1021.97			-11.0	1020.68	78.2	1021.45
4.0	1021.14	75.0	1021.90			-9.0	1020.73	80.0	1021.34
6.0	1021.18	75.8	1021.76			-7.0	1020.83	82.0	1021.28
8.0	1021.25	76.5	1021.67			-4.0	1020.78	84.0	1021.63
10.0	1021.25	77.2	1021.75			-2.0	1020.87	85.4	1021.73
12.0	1021.29	78.2	1021.43			0.0	1020.96	86.5	1021.70
14.0	1021.33	79.5	1021.33			3.0	1021.12	88.0	1021.76
16.0	1021.31	82.0	1021.27			6.0	1021.22	89.5	1021.97
18.0	1021.32	83.0	1021.43			9.0	1021.25	91.0	1022.52
20.0	1021.33	83.5	1021.62			12.0	1021.30	91.6	1023.16
22.0	1021.30	85.0	1021.70			15.0	1021.33	93.0	1023.13
24.0	1021.34	87.0	1021.70			17.0	1021.35	95.0	1023.15
25.0	1021.14	88.5	1021.89			19.0	1021.25	97.0	1023.15
27.0	1021.16	89.5	1021.97			20.0	1021.29	100.0	1023.06
29.0	1021.33	91.0	1022.51			22.0	1021.34	100.4	1023.11

Table 7. (Continued) Listing of horizontal stations and elevations for cross section PR113
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1997		1997		1998		1998		1998	
18 September		18 September		25 September		25 September		25 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-60.0	1022.88	28.0	1021.15	-83.9	1023.88	9.0	1021.26	100.0	1023.05
-59.0	1022.79	29.0	1021.29	-82.0	1023.90	12.0	1021.33	100.5	1023.11
-57.0	1022.46	29.5	1021.22	-79.0	1023.83	15.0	1021.34	103.0	1023.11
-56.0	1022.41	30.5	1021.30	-76.5	1023.44	18.0	1021.32	105.0	1023.34
-54.5	1022.58	32.5	1021.73	-74.0	1022.94	20.0	1021.39	106.5	1023.21
-52.5	1022.78	34.0	1021.86	-71.0	1022.71	22.0	1021.31	110.0	1023.38
-50.9	1022.90	35.0	1021.88	-68.0	1022.86	25.0	1021.08	114.7	1023.45
-50.4	1021.12	37.0	1021.90	-65.0	1022.93	26.2	1021.06	120.0	1023.28
-49.0	1020.27	40.0	1021.85	-62.0	1023.06	26.9	1021.22	125.0	1023.24
-48.0	1019.63	43.0	1021.87	-60.0	1022.88	29.2	1021.27	130.0	1023.28
-46.0	1019.63	45.0	1021.99	-58.0	1022.60	30.2	1021.24	135.0	1023.27
-43.0	1019.48	47.0	1021.91	-56.0	1022.41	32.0	1021.60	140.0	1023.26
-41.0	1019.57	48.0	1021.75	-54.0	1022.67	34.0	1021.88	142.5	1023.30
-38.0	1019.62	50.0	1021.73	-51.7	1022.84	36.0	1021.91	145.0	1023.07
-35.0	1019.69	53.0	1021.83	-51.5	1021.83	39.0	1021.88	150.0	1022.86
-33.0	1019.73	56.0	1021.92	-51.1	1021.47	42.0	1021.87	152.0	1022.84
-31.0	1019.87	59.0	1021.78	-49.9	1020.52	45.0	1021.97	155.0	1022.97
-29.0	1019.83	62.0	1021.71	-47.5	1019.62	47.0	1021.93	160.0	1022.72
-28.0	1019.67	64.0	1021.78	-45.0	1019.62	49.0	1021.72	165.0	1022.67
-26.0	1019.57	66.0	1021.73	-43.0	1020.02	51.0	1021.78	170.0	1022.74
-23.0	1019.70	68.0	1021.88	-40.0	1019.79	54.0	1021.86	175.0	1023.09
-20.0	1020.00	70.0	1021.92	-38.0	1019.60	57.0	1021.92	180.0	1023.57
-17.0	1020.25	72.0	1021.94	-36.0	1019.63	60.0	1021.75	185.0	1023.74
-16.0	1020.34	74.0	1021.96	-34.0	1019.84	63.0	1021.73		
-13.0	1020.47	76.0	1021.80	-32.0	1019.95	65.0	1021.78		
-10.0	1020.65	77.5	1021.72	-30.0	1019.88	67.0	1021.81		
-7.0	1020.72	79.0	1021.41	-28.0	1019.71	70.0	1021.92		
-4.0	1020.78	80.0	1021.39	-26.0	1019.71	73.0	1021.98		
-1.0	1020.96	80.5	1021.24	-24.0	1019.87	74.0	1021.99		
1.0	1021.08	81.0	1021.33	-22.0	1020.06	77.0	1021.76		
3.0	1021.17	82.0	1021.32	-20.0	1020.10	79.0	1021.42		
6.0	1021.21	83.0	1021.41	-18.0	1020.21	81.0	1021.32		
9.0	1021.24	84.0	1021.65	-16.0	1020.32	82.4	1021.36		
11.0	1021.30	86.0	1021.72	-14.0	1020.38	83.7	1021.63		
14.0	1021.37	87.0	1021.73	-12.7	1020.46	86.0	1021.73		
17.0	1021.32	89.0	1021.90	-11.0	1020.62	88.0	1021.79		
19.0	1021.34	90.0	1022.15	-8.0	1020.75	89.7	1022.05		
21.0	1021.33	91.2	1022.61	-5.0	1020.84	91.1	1022.61		
23.5	1021.26	91.7	1023.16	-2.5	1020.93	91.5	1023.13		
24.5	1021.09	93.5	1023.11	0.0	1020.98	93.0	1023.12		
26.0	1021.05	95.4	1023.25	3.0	1021.14	95.6	1023.18		
27.0	1021.20	100.0	1023.05	6.0	1021.23	98.0	1023.09		
		100.4	1023.11						

Description of Cross Section PR116

Location: Township 9 South/Range 48 East--section 8

U. S. Geological Survey quadrangle (1:24,000): Moorhead

Landowners--left bank: County road

--right bank: 3 Bar Ranch

Access: Left bank

Permission from: None necessary

Distance from Moorhead Gaging Station: 0.65 kilometer

Azimuth of Section (degrees magnetic): 187.5

Reference Monuments

[Monuments on the left bank were closest to the leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.20 meter above 1998 ground level						1020.36
Benchmark, bolt in downstream concrete footing; about 0.9 meter downstream	-1.3	45°04'07.22"	105°51'46.75"	0.548	0.554	1020.00
Bolt in upstream concrete footing; about 0.9 meter upstream	-1.1					1019.99
1/2-inch-rebar; 0.02 meter above 1998 ground level	0.0	45°04'07.19"	105°51'46.81"	0.441	0.596	1019.69
Metal hoop in concrete deadman	109.1	45°04'03.92	105°51'09.40"	0.135	0.445	----

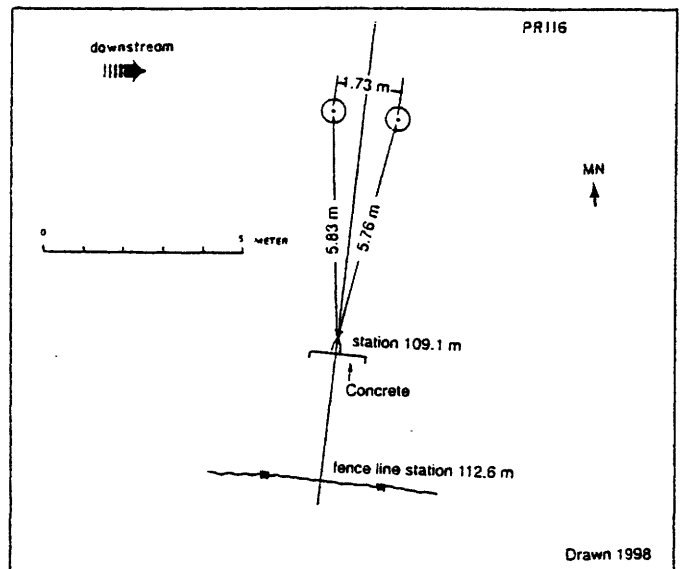
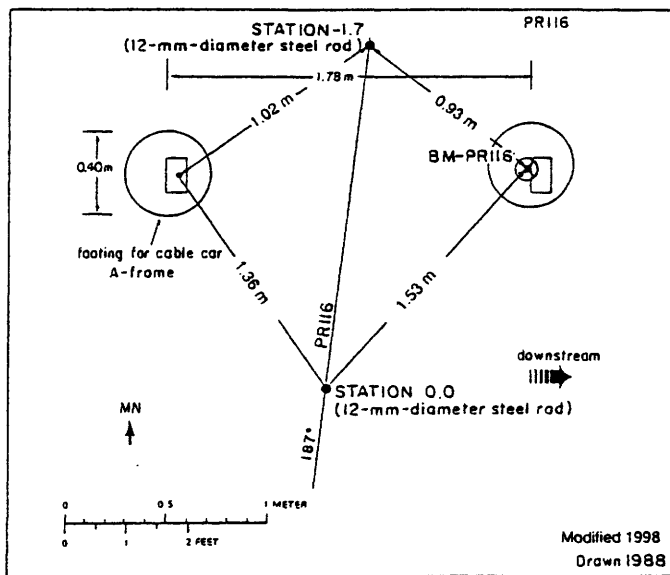
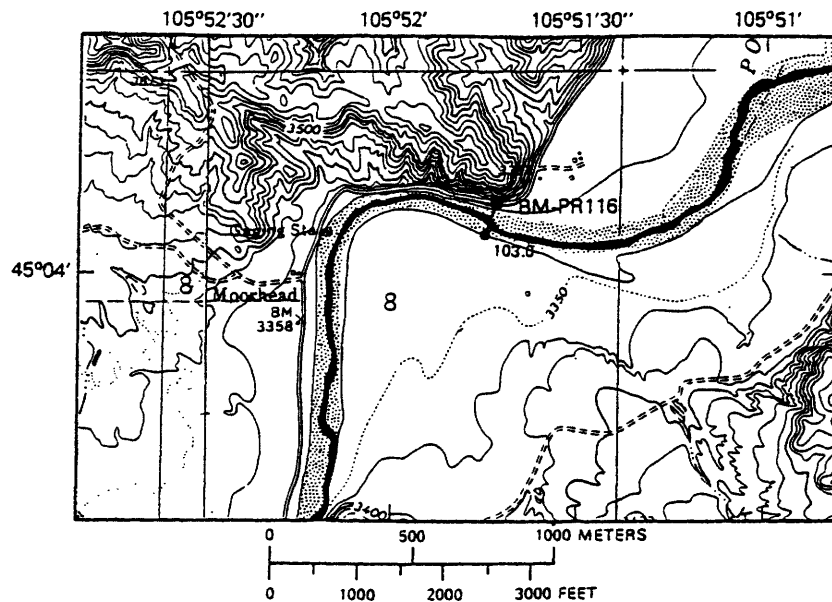


Figure 13. Upper: Location of cross section PR116, bench mark BM-PR113, and left and right bank reference monuments in the Moorhead quadrangle. Lower left: Location of the bench mark on the left bank. Lower right: Location of station 109.1 at the end of a U-shaped steel rod anchored in concrete on the right bank. MN is magnetic north.

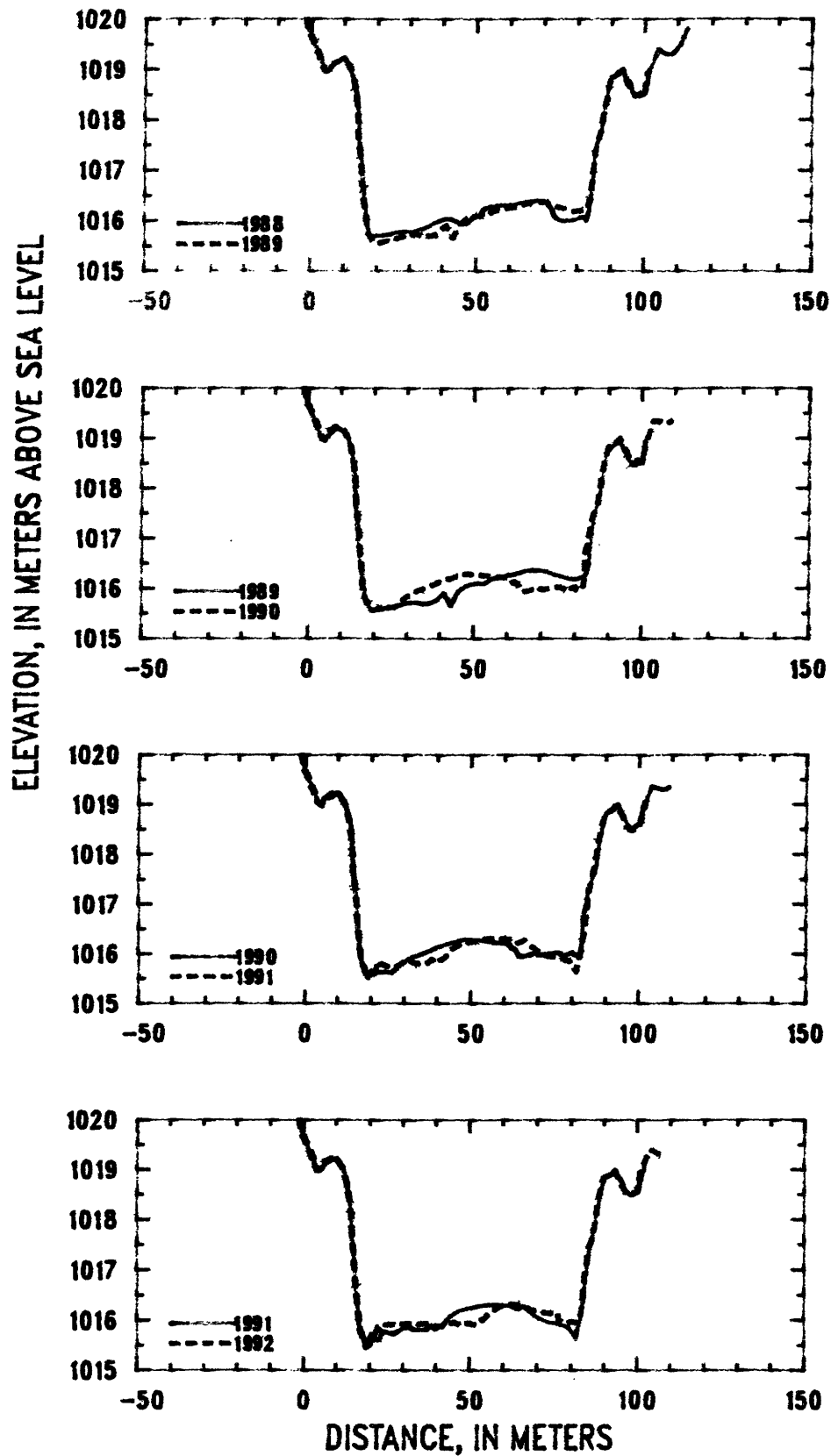


Figure 14. Profiles of cross section PR116 from 1988 to 1992.

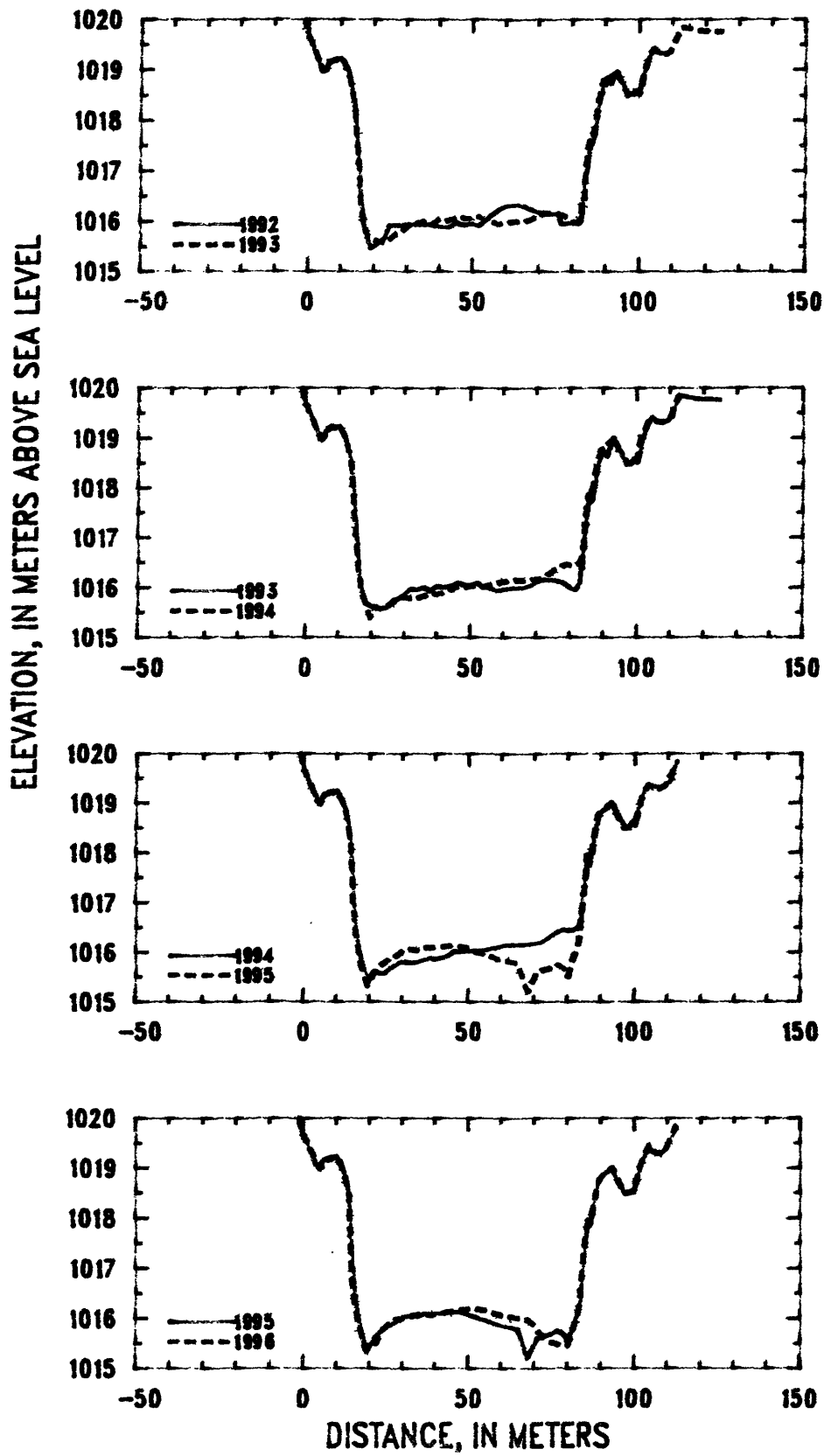


Figure 15. Profiles of cross section PR116 from 1992 to 1996.

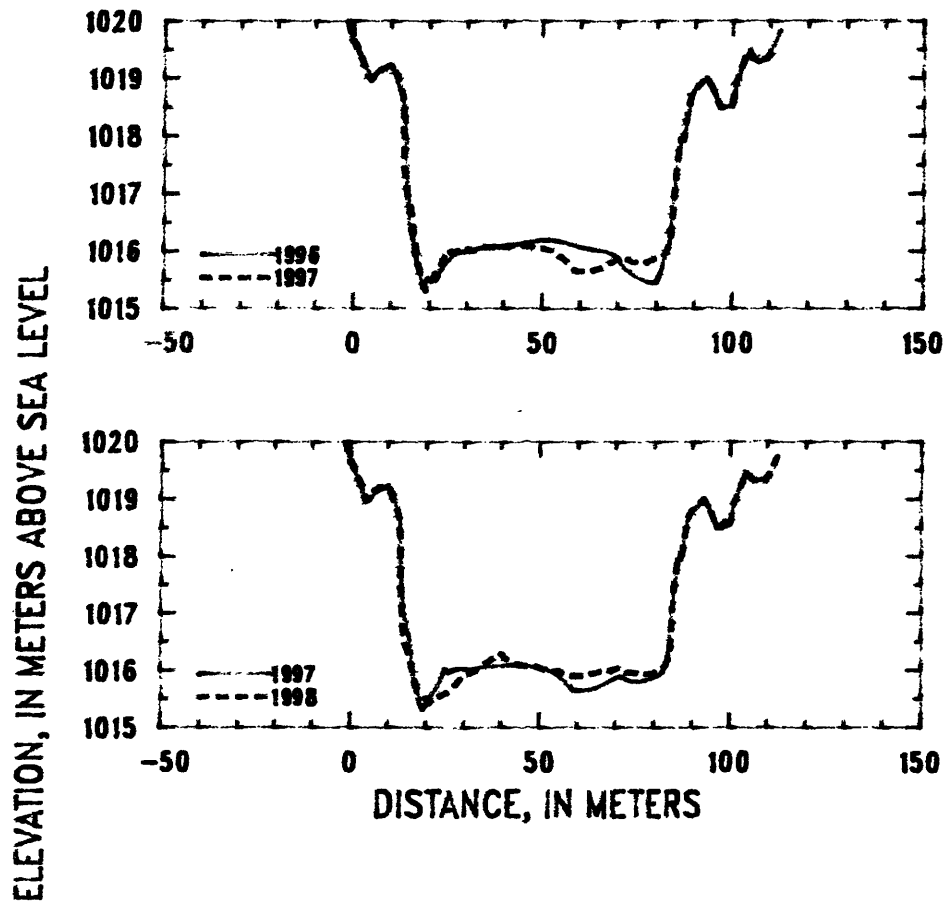


Figure 16. Profiles of cross section PR116 from 1996 to 1998.

Table 8. Listing of horizontal stations and elevations for cross section PR116

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1990		1990		1991	
16 September		16 September		13 September		13 September		28 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.7	1020.18	69.0	1016.37	-1.7	1020.17	70.0	1015.98	-1.7	1020.18
-1.2	1019.89	71.0	1016.35	0.0	1019.65	73.0	1016.00	0.0	1019.65
0.0	1019.65	73.0	1016.29	2.0	1019.39	75.0	1016.04	2.0	1019.35
2.0	1019.38	75.0	1016.26	4.0	1019.03	76.5	1016.01	4.0	1019.02
4.0	1019.00	77.0	1016.23	5.0	1018.96	77.0	1015.95	5.0	1018.96
5.0	1018.96	79.0	1016.18	6.0	1019.15	80.0	1016.04	7.0	1019.13
7.0	1019.13	81.0	1016.19	8.0	1019.23	80.2	1016.00	9.0	1019.19
9.0	1019.20	83.0	1016.26	9.0	1019.20	82.0	1015.96	10.0	1019.22
11.0	1019.13	84.0	1016.48	10.0	1019.22	82.5	1016.05	12.0	1019.00
12.0	1019.01	85.2	1017.33	12.0	1019.01	83.0	1016.39	13.0	1018.74
13.0	1018.75	87.0	1017.80	13.0	1018.76	83.2	1016.74	14.2	1018.17
14.1	1018.22	89.5	1018.75	13.6	1018.56	83.7	1016.85	14.3	1017.72
14.2	1017.75	91.0	1018.86	14.2	1018.21	84.6	1017.25	14.9	1017.49
15.0	1017.20	93.0	1018.99	14.4	1017.67	86.0	1017.57	16.0	1016.51
16.0	1016.40	94.5	1018.76	14.8	1017.51	86.8	1017.71	17.0	1015.87
16.7	1016.09	96.0	1018.57	16.6	1016.05	88.0	1018.30	18.0	1015.69
17.5	1015.73	97.0	1018.47	17.4	1015.76	89.0	1018.62	18.7	1015.48
19.0	1015.58	98.0	1018.47	18.0	1015.74	90.0	1018.84	20.4	1015.71
21.0	1015.56	99.0	1018.56	18.7	1015.57	92.0	1018.90	21.2	1015.61
23.0	1015.60	100.0	1018.51	20.0	1015.57	93.4	1019.01	22.3	1015.87
25.0	1015.63	101.0	1018.95	23.0	1015.64	95.0	1018.75	23.2	1015.78
27.0	1015.66			26.0	1015.62	97.0	1018.47	25.0	1015.75
29.0	1015.71			29.0	1015.80	98.0	1018.52	27.0	1015.73
31.0	1015.73			32.0	1015.92	100.6	1018.66	29.6	1015.83
33.0	1015.72			35.0	1016.00	101.0	1018.93	32.0	1015.87
35.0	1015.68			37.2	1016.06	102.0	1019.06	33.0	1015.82
37.0	1015.70			39.0	1016.11	103.5	1019.36	35.0	1015.80
39.0	1015.77			42.0	1016.19	105.0	1019.35	37.0	1015.81
41.0	1015.91			45.0	1016.25	107.0	1019.28	38.3	1015.90
43.0	1015.66			48.0	1016.30	109.0	1019.35	39.7	1015.82
45.0	1015.92			51.0	1016.27			41.0	1015.88
47.0	1016.04			54.0	1016.25			42.0	1015.92
49.5	1016.09			57.0	1016.22			44.2	1016.11
51.0	1016.10			59.0	1016.22			47.0	1016.20
53.0	1016.10			61.0	1016.21			50.0	1016.25
55.0	1016.19			62.0	1016.11			53.0	1016.28
57.0	1016.22			63.0	1016.11			56.0	1016.31
59.0	1016.25			63.5	1016.04			59.0	1016.31
61.0	1016.27			64.3	1015.94			62.0	1016.28
63.0	1016.31			66.5	1015.95			64.0	1016.22
65.0	1016.35			68.3	1016.02			66.0	1016.28
67.0	1016.37			69.0	1016.04			68.0	1016.15

Table 8. (Continued) Listing of horizontal stations and elevations for cross section PR116
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1992		1992		1993		1993	
28 August		25 August		25 August		25 August		25 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
70.0	1016.04	-1.7	1020.15	70.0	1016.17	-1.7	1020.16	70.0	1016.11
73.0	1015.95	0.0	1019.65	73.0	1016.14	0.0	1019.66	72.0	1016.16
76.0	1015.94	2.0	1019.37	75.0	1016.14	2.0	1019.39	74.0	1016.16
79.0	1015.86	4.3	1018.96	76.1	1016.16	4.3	1018.97	76.0	1016.15
81.4	1015.64	5.4	1019.01	76.8	1015.95	5.4	1018.99	78.0	1016.10
83.0	1016.17	6.0	1019.14	78.0	1015.93	6.1	1019.15	80.0	1015.99
83.4	1016.35	8.0	1019.23	80.0	1015.97	8.0	1019.20	82.0	1015.95
83.6	1016.39	10.0	1019.22	82.0	1015.96	10.0	1019.24	83.1	1016.11
84.0	1016.67	11.0	1019.10	82.4	1015.96	12.0	1018.99	83.3	1016.31
85.0	1017.26	12.2	1018.96	83.0	1016.08	13.0	1018.71	83.5	1016.45
86.0	1017.57	13.0	1018.73	84.3	1016.97	14.3	1018.18	84.0	1016.42
88.0	1018.29	14.0	1018.30	84.7	1017.04	15.0	1017.39	84.4	1016.96
89.0	1018.62	14.3	1018.12	85.3	1017.40	15.7	1016.93	84.9	1017.34
90.0	1018.84	15.0	1017.36	86.6	1017.65	16.1	1016.31	85.7	1017.59
92.0	1018.90	16.0	1016.51	88.0	1018.29	17.0	1015.95	85.8	1017.75
93.0	1018.99	16.7	1016.09	89.4	1018.76	18.2	1015.68	86.7	1017.73
95.0	1018.76	17.3	1015.76	90.0	1018.83	19.3	1015.65	87.4	1017.99
96.2	1018.55	19.0	1015.45	92.0	1018.90	21.0	1015.59	88.1	1018.36
98.0	1018.47	21.0	1015.56	93.0	1018.98	23.0	1015.58	89.0	1018.62
100.0	1018.55	23.0	1015.63	95.0	1018.73	24.5	1015.58	89.6	1018.78
100.6	1018.72	24.6	1015.91	96.3	1018.53	26.0	1015.72	91.0	1018.64
102.0	1019.07	27.0	1015.93	98.0	1018.51	28.0	1015.78	93.0	1018.99
		29.0	1015.92	100.0	1018.54	30.0	1015.86	95.0	1018.73
		31.0	1015.94	101.0	1018.94	32.0	1015.98	96.7	1018.47
		33.0	1015.94	103.0	1019.29	34.0	1015.96	98.2	1018.48
		35.0	1015.93	104.0	1019.41	36.0	1016.01	99.0	1018.58
		37.0	1015.94	106.0	1019.33	38.0	1015.93	100.0	1018.52
		40.0	1015.89	108.0	1019.31	40.0	1016.04	100.8	1018.72
		43.0	1015.87			42.0	1016.00	102.0	1019.07
		45.0	1015.97			44.0	1016.03	103.0	1019.27
		47.0	1015.92			46.0	1016.11	104.3	1019.42
		50.0	1015.95			48.0	1016.05	106.0	1019.33
		52.0	1015.90			50.0	1016.05	108.0	1019.31
		54.0	1016.02			52.0	1016.10	109.4	1019.36
		54.8	1016.05			54.0	1016.00	112.6	1019.84
		55.2	1016.10			56.0	1015.99	114.0	1019.84
		56.0	1016.14			58.0	1015.94	116.0	1019.80
		58.0	1016.23			60.0	1015.96	118.0	1019.77
		60.0	1016.30			62.0	1015.99	120.0	1019.76
		63.0	1016.33			64.0	1016.00	125.0	1019.76
		65.0	1016.32			66.0	1016.00		
		68.0	1016.21			68.0	1016.04		

Table 8. (Continued) Listing of horizontal stations and elevations for cross section PR116
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1994		1994		1995		1995		1996	
24 September		24 September		23 September		23 September		15 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.7	1020.12	86.6	1017.76	-1.7	1020.15	82.0	1015.91	-1.7	1020.15
0.0	1019.67	88.0	1018.37	0.0	1019.67	83.0	1016.08	0.0	1019.66
3.0	1019.22	89.0	1018.65	2.0	1019.39	83.5	1016.22	2.0	1019.40
5.0	1018.98	90.0	1018.83	4.0	1019.03	85.8	1017.61	5.0	1018.97
6.0	1019.15	92.0	1018.91	5.0	1018.97	86.1	1017.93	7.0	1019.14
8.0	1019.23	93.2	1019.01	6.0	1019.15	87.0	1017.85	9.0	1019.19
9.0	1019.19	94.5	1018.79	8.0	1019.21	89.2	1018.77	10.0	1019.24
10.0	1019.25	95.5	1018.67	10.0	1019.23	91.0	1018.88	11.0	1019.12
12.0	1019.00	97.0	1018.50	12.0	1018.99	93.0	1019.01	12.5	1018.85
13.0	1018.74	98.0	1018.49	13.0	1018.73	94.5	1018.78	13.9	1018.41
13.8	1018.44	99.0	1018.61	14.1	1018.27	96.8	1018.49	14.5	1016.96
15.9	1016.36	100.0	1018.54	14.8	1017.23	100.0	1018.55	15.3	1016.36
17.0	1015.95	101.0	1018.95	15.8	1016.42	102.0	1019.08	16.2	1016.14
19.5	1015.40	103.5	1019.35	16.7	1016.03	104.0	1019.37	16.5	1015.99
21.0	1015.61	106.0	1019.33	17.4	1015.75	107.0	1019.28	17.2	1015.77
24.0	1015.55	108.0	1019.31	19.2	1015.32	109.0	1019.33	18.8	1015.38
27.0	1015.73	110.7	1019.45	22.0	1015.65	112.6	1019.79	20.0	1015.53
30.0	1015.82	111.0	1019.57	24.0	1015.77			22.0	1015.50
33.0	1015.77	112.6	1019.84	26.0	1015.86			24.0	1015.77
36.0	1015.83			28.0	1015.93			26.0	1015.90
39.0	1015.89			30.0	1016.03			28.0	1015.99
40.0	1015.86			33.0	1016.06			30.0	1015.99
43.0	1015.90			35.0	1016.04			32.6	1016.04
44.6	1015.97			36.7	1016.09			35.0	1016.08
45.4	1016.02			39.0	1016.09			37.5	1016.09
48.0	1016.02			41.0	1016.10			38.6	1016.07
51.0	1016.03			43.0	1016.12			41.0	1016.09
54.0	1016.02			45.0	1016.13			44.0	1016.12
57.0	1016.08			47.0	1016.12			47.0	1016.16
60.0	1016.12			49.0	1016.09			50.0	1016.19
63.0	1016.15			50.4	1016.07			52.0	1016.19
66.0	1016.15			53.0	1015.99			55.0	1016.16
69.0	1016.16			56.0	1015.94			58.0	1016.11
72.0	1016.19			59.0	1015.87			60.5	1016.05
75.0	1016.34			62.0	1015.83			62.0	1016.04
77.0	1016.42			65.0	1015.78			65.0	1016.00
79.0	1016.47			68.0	1015.21			68.0	1015.97
81.0	1016.43			71.0	1015.61			70.0	1015.86
83.0	1016.48			74.0	1015.66			72.0	1015.66
84.1	1016.65			77.0	1015.76			75.0	1015.53
85.5	1017.66			79.0	1015.68			78.0	1015.45
86.0	1017.84			80.2	1015.50			80.0	1015.46

Table 8. (Continued) Listing of horizontal stations and elevations for cross section PR116
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1997		1997		1998		1998	
15 October		18 September		18 September		22 September		22 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
81.0	1015.61	-1.7	1020.12	85.0	1017.24	-1.7	1020.16	69.0	1016.01
83.0	1016.06	0.0	1019.66	86.2	1017.95	0.0	1019.67	71.0	1016.06
83.6	1016.23	2.0	1019.39	87.0	1017.96	2.0	1019.38	73.0	1015.97
84.4	1016.95	4.0	1019.04	89.0	1018.73	4.6	1018.95	75.0	1015.95
86.2	1017.94	5.0	1018.97	90.0	1018.81	5.6	1019.01	77.0	1015.94
87.1	1017.94	7.0	1019.14	93.0	1019.00	6.2	1019.14	79.0	1015.94
89.0	1018.67	9.0	1019.20	95.0	1018.77	8.0	1019.23	81.0	1015.98
90.0	1018.82	10.0	1019.24	96.7	1018.48	9.2	1019.17	83.0	1016.08
93.2	1019.01	12.0	1019.00	98.0	1018.49	11.0	1019.11	84.0	1016.24
95.0	1018.77	13.5	1018.59	100.0	1018.57	12.9	1018.73	84.3	1016.42
96.8	1018.48	13.7	1017.46	101.0	1018.94	13.3	1018.63	85.2	1017.39
99.9	1018.51	14.2	1017.08	103.0	1019.31	13.5	1017.47	86.2	1017.94
101.0	1018.92	15.5	1016.65	104.0	1019.48	14.0	1016.84	87.2	1018.00
103.0	1019.28	16.6	1016.01	106.0	1019.32	14.8	1016.42	89.0	1018.69
104.5	1019.48	18.5	1015.43	109.0	1019.33	15.8	1016.22	90.0	1018.81
104.9	1019.35	19.3	1015.31	110.6	1019.46	17.5	1015.70	92.0	1018.91
107.0	1019.28	21.0	1015.52			19.0	1015.61	93.1	1019.01
109.0	1019.33	23.5	1015.78			20.6	1015.43	95.0	1018.75
112.6	1019.84	25.0	1016.03			23.0	1015.53	96.7	1018.49
		26.0	1015.97			25.0	1015.60	98.7	1018.62
		28.0	1016.02			27.0	1015.69	99.8	1018.52
		30.0	1016.04			29.0	1015.85	101.2	1018.98
		32.0	1016.00			31.0	1015.93	102.2	1019.11
		35.0	1016.07			33.0	1015.98	104.2	1019.47
		38.0	1016.06			35.0	1016.08	106.0	1019.32
		41.0	1016.08			37.0	1016.16	108.0	1019.30
		44.0	1016.10			38.0	1016.22	109.3	1019.30
		47.0	1016.07			39.9	1016.31	110.7	1019.44
		50.0	1016.05			41.3	1016.20	112.6	1019.81
		53.0	1015.99			43.0	1016.14		
		56.0	1015.85			45.0	1016.09		
		59.0	1015.64			47.0	1016.07		
		62.0	1015.64			49.0	1016.07		
		65.0	1015.69			51.0	1016.02		
		68.0	1015.80			53.0	1015.99		
		71.0	1015.90			55.0	1015.99		
		74.0	1015.80			57.0	1015.90		
		77.0	1015.80			59.0	1015.90		
		80.0	1015.88			61.0	1015.90		
		82.0	1015.93			63.0	1015.93		
		83.1	1016.07			65.0	1015.96		
		83.6	1016.13			67.0	1016.03		

Description of Cross Section PR120

Location: Township 8 South/Range 48 East--section 33

U. S. Geological Survey quadrangle (1:24,000): Moorhead

Landowners--left bank: Larry and Linda Thomas

--right bank: 3 Bar Ranch

Access: Left bank

Permission from: Larry and Linda Thomas

Distance from Moorhead Gaging Station: 4.68 kilometers

Azimuth of Section (degrees magnetic): 114.5

Reference Monuments

[Monuments at stations -82.0 and -30.0 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.06 meter below 1998 ground level	-82.0					
Benchmark--brass circular plate	-30.0	45°05'32.49"	105°51'14.17"	0.619	0.624	1014.70
1/2-inch-rebar; 0.16 meter above 1998 ground level	100.9					1013.93
1/2-inch-rebar; 0.20 meter above 1998 ground level	104.0	45°05'29.73"	105°51'09.40"	0.243	0.481	1014.05

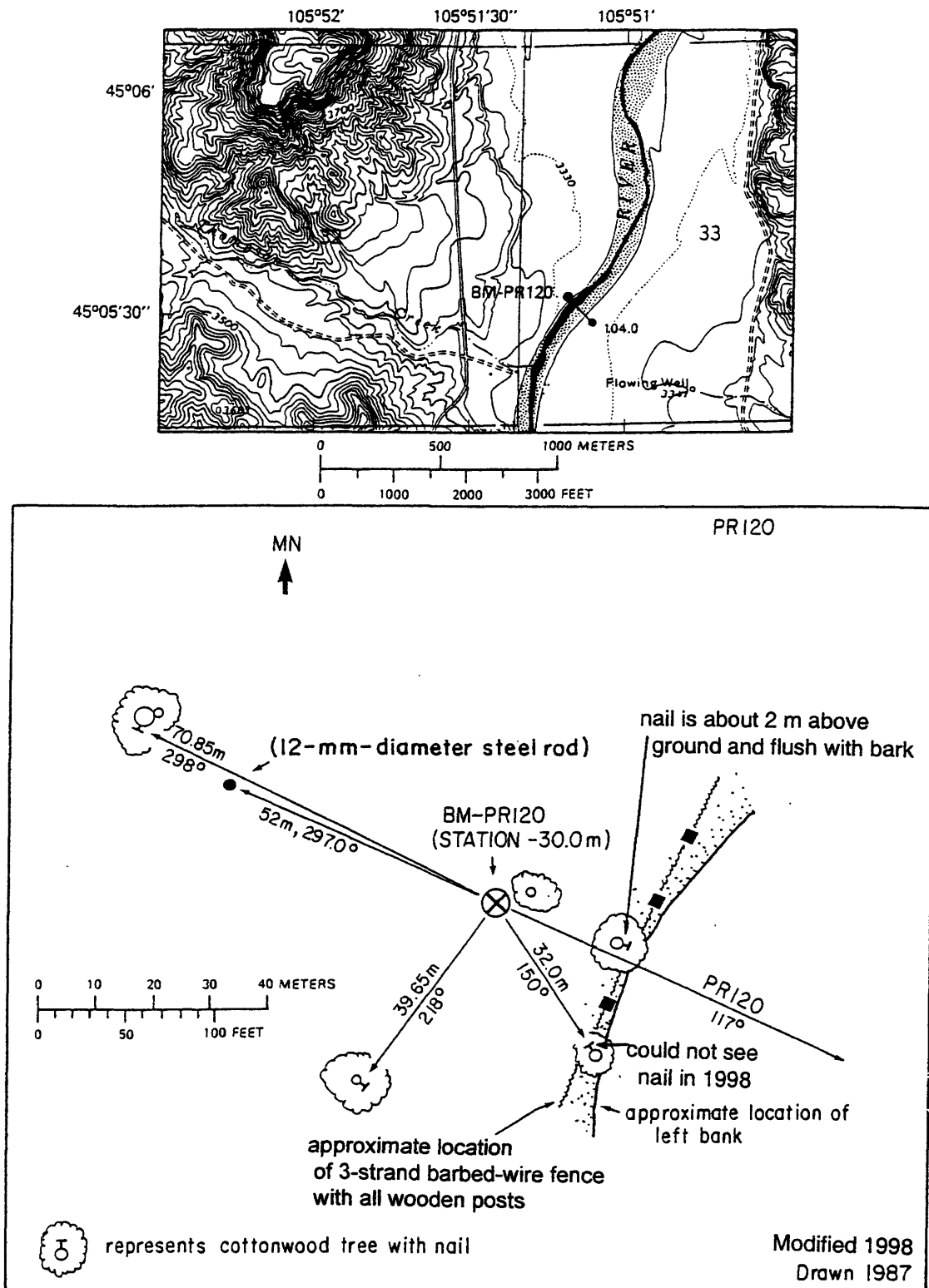


Figure 17. Upper: Location of cross section PR120, bench mark BM-PR120, and the right bank reference monument in the Moorhead quadrangle. Lower: Location of the bench mark on the left bank. MN is magnetic north.

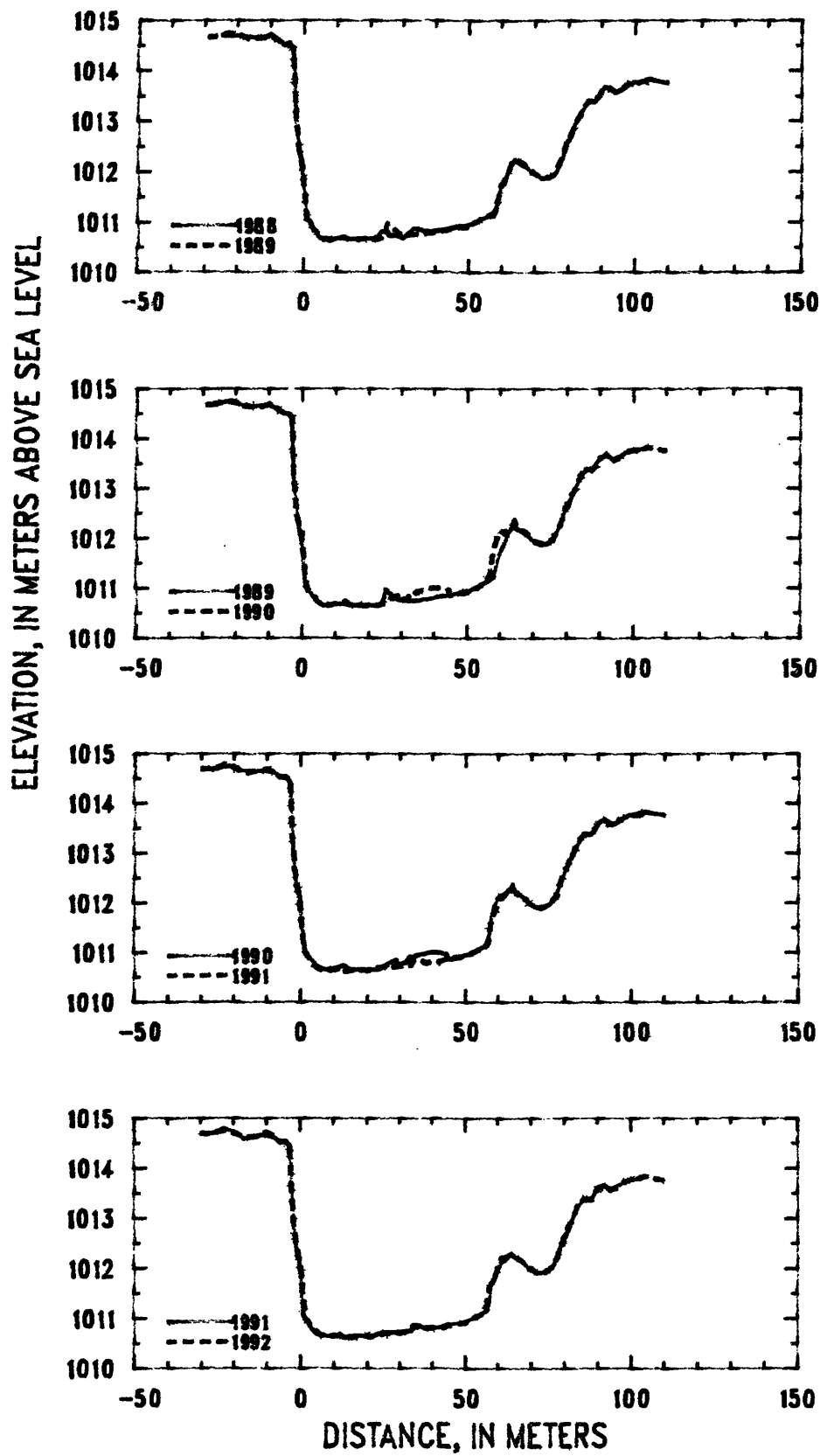


Figure 18. Profiles of cross section PR120 from 1988 to 1992.

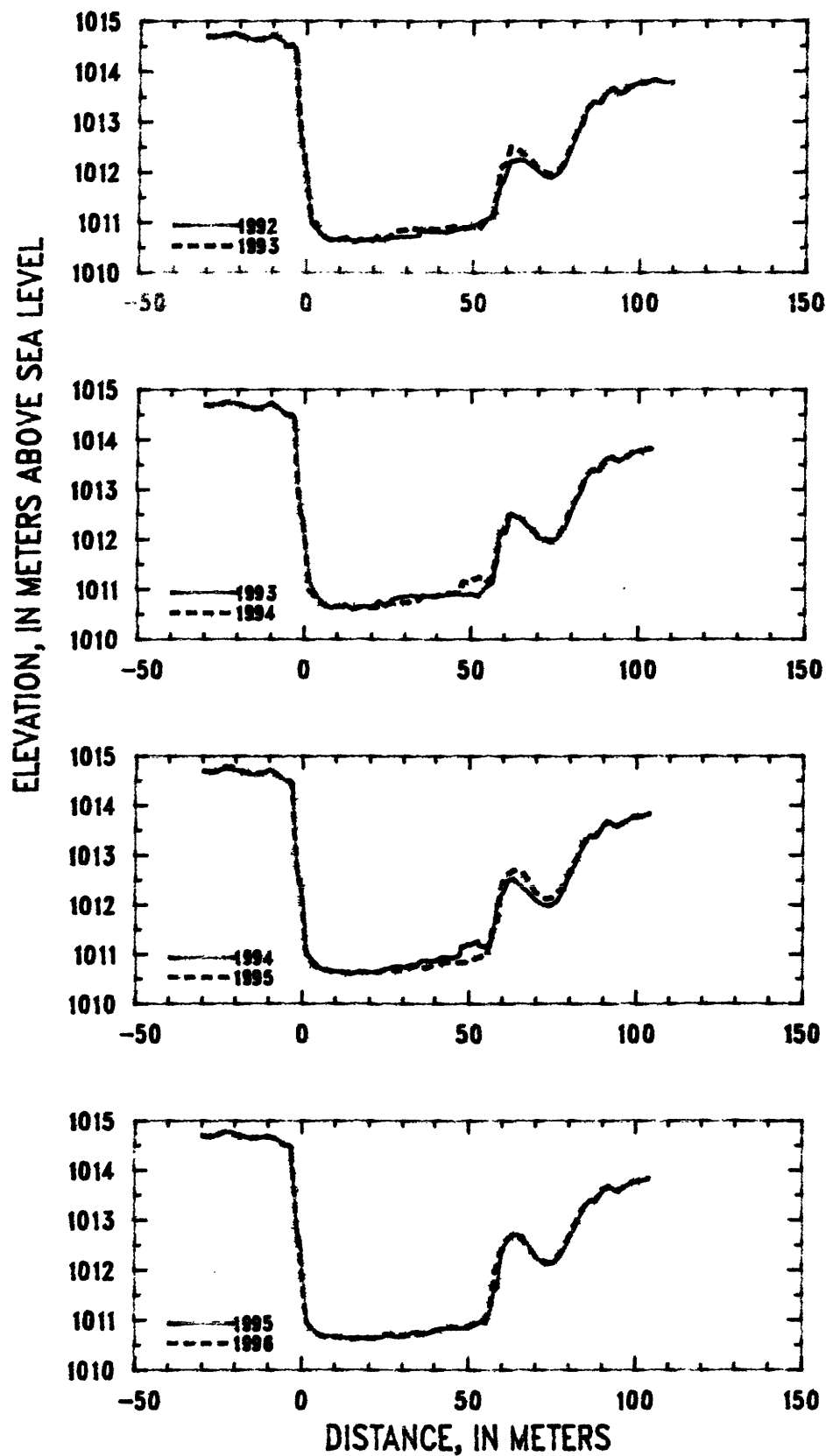


Figure 19. Profiles of cross section PR120 from 1992 to 1996.

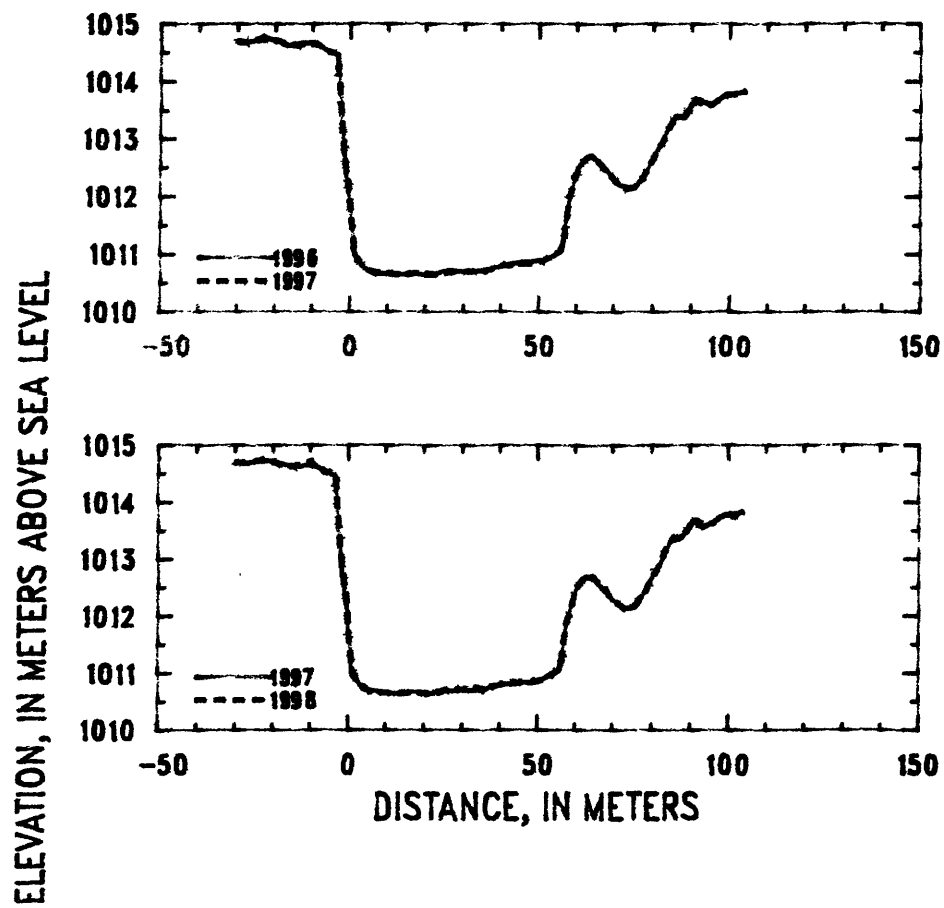


Figure 20. Profiles of cross section PR120 from 1996 to 1998.

Table 9. Listing of horizontal stations and elevations for cross section PR120

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1990		1990		1991	
16 September		16 September		14 September		14 September		28 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-29.0	1014.68	45.0	1010.87	-27.0	1014.68	44.4	1010.97	-30.0	1014.70
-26.0	1014.68	47.0	1010.91	-24.0	1014.74	44.8	1010.86	-29.0	1014.69
-23.0	1014.75	49.0	1010.88	-21.0	1014.76	47.0	1010.90	-26.0	1014.69
-20.0	1014.72	50.6	1010.95	-18.0	1014.66	49.0	1010.94	-23.0	1014.79
-17.0	1014.64	52.0	1011.00	-15.0	1014.65	51.0	1010.96	-20.0	1014.73
-14.0	1014.66	54.0	1011.08	-12.0	1014.64	53.0	1011.02	-17.0	1014.59
-11.0	1014.68	56.0	1011.14	-10.0	1014.71	55.0	1011.11	-14.0	1014.64
-9.0	1014.66	58.2	1011.22	-8.0	1014.62	56.0	1011.12	-11.0	1014.67
-7.0	1014.56	60.0	1011.74	-6.0	1014.52	57.2	1011.34	-8.0	1014.63
-5.0	1014.50	61.6	1011.92	-4.6	1014.52	58.0	1011.76	-6.0	1014.52
-4.0	1014.50	63.0	1012.17	-4.0	1014.51	59.0	1011.96	-4.7	1014.53
-3.2	1014.45	64.0	1012.24	-3.0	1014.41	60.0	1012.11	-3.1	1014.46
-3.0	1014.25	66.0	1012.17	-2.4	1013.17	60.7	1012.15	-2.4	1013.20
-2.6	1013.71	68.0	1012.08	-1.6	1012.56	61.4	1012.10	-1.2	1012.42
-2.5	1013.28	70.0	1011.95	-0.9	1012.28	63.0	1012.25	-0.3	1012.17
-1.2	1012.38	72.0	1011.87	-0.2	1012.20	63.9	1012.28	1.1	1011.04
-0.3	1012.07	74.0	1011.89	1.3	1011.03	64.4	1012.36	3.7	1010.78
0.9	1011.17	76.0	1011.96	2.2	1010.92	65.0	1012.24	5.0	1010.68
1.2	1011.02	77.2	1012.17	3.0	1010.87	66.0	1012.18	7.0	1010.66
2.0	1010.95	78.4	1012.30	5.0	1010.71	68.0	1012.12	8.7	1010.64
4.0	1010.78	79.5	1012.62	7.0	1010.67	70.0	1011.96	10.6	1010.66
6.0	1010.67	80.3	1012.63	9.0	1010.66	72.0	1011.91	11.9	1010.69
8.0	1010.65	82.0	1012.92	11.0	1010.70	74.0	1011.92	13.0	1010.62
10.0	1010.68	84.0	1013.19	13.0	1010.74	76.0	1012.00	15.0	1010.63
12.0	1010.69	86.0	1013.40	15.0	1010.65	78.0	1012.26	17.0	1010.67
14.0	1010.65	88.0	1013.38	17.0	1010.67	80.0	1012.64	19.0	1010.65
16.0	1010.65	90.0	1013.61	19.0	1010.65	81.0	1012.85	21.0	1010.62
18.0	1010.67	92.0	1013.68	21.0	1010.67	82.0	1012.90	23.0	1010.68
20.0	1010.66	94.0	1013.57	23.0	1010.66	84.0	1013.20	25.0	1010.72
22.0	1010.65	96.0	1013.64	25.0	1010.71	85.0	1013.32	27.0	1010.72
23.0	1010.66	98.0	1013.73	27.0	1010.80	86.0	1013.40	30.0	1010.73
24.3	1010.70	100.0	1013.78	29.0	1010.86	88.0	1013.38	31.6	1010.74
25.2	1010.97	101.0	1013.76	29.5	1010.74	90.0	1013.60	33.6	1010.75
27.0	1010.87	104.0	1013.82	32.0	1010.79	92.0	1013.68	34.0	1010.85
29.0	1010.76			33.0	1010.91	93.5	1013.57	36.0	1010.86
31.0	1010.75			33.3	1010.91	95.0	1013.58	38.0	1010.79
33.0	1010.75			34.0	1010.88	96.0	1013.64	40.0	1010.82
35.0	1010.74			35.0	1010.94	99.0	1013.76	42.0	1010.82
37.0	1010.78			37.0	1010.96	101.0	1013.77	45.0	1010.90
39.0	1010.78			39.0	1011.01	102.5	1013.75	48.0	1010.91
41.0	1010.82			41.0	1011.01	104.0	1013.83	51.0	1010.96
43.0	1010.84			43.0	1010.99	107.0	1013.78	54.0	1011.07
						110.0	1013.76		

Table 9. (Continued) Listing of horizontal stations and elevations for cross section PR120
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1992		1992		1993		1993	
28 August		25 August		25 August		25 August		25 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
56.8	1011.17	-30.0	1014.70	50.0	1010.92	-30.0	1014.70	56.2	1011.14
58.1	1011.73	-28.0	1014.69	52.0	1011.00	-28.0	1014.70	57.1	1011.52
58.6	1011.75	-25.0	1014.73	54.0	1011.06	-25.0	1014.73	57.3	1011.53
61.0	1012.14	-22.0	1014.77	56.0	1011.13	-22.0	1014.75	57.6	1011.64
62.0	1012.17	-19.0	1014.68	56.3	1011.18	-19.0	1014.70	58.3	1012.08
64.0	1012.30	-16.0	1014.63	57.4	1011.59	-16.0	1014.63	59.0	1012.14
66.0	1012.18	-13.0	1014.64	58.3	1011.77	-13.0	1014.65	59.5	1012.15
68.0	1012.11	-10.0	1014.72	59.0	1011.83	-10.0	1014.74	60.0	1012.15
70.0	1011.95	-8.0	1014.64	60.0	1012.01	-8.0	1014.65	60.5	1012.22
72.0	1011.90	-6.0	1014.52	61.0	1012.20	-6.0	1014.51	61.2	1012.50
74.0	1011.92	-4.5	1014.54	63.0	1012.25	-4.0	1014.51	62.0	1012.50
76.0	1012.00	-3.2	1014.45	65.0	1012.25	-3.0	1014.41	63.5	1012.45
78.0	1012.25	-2.5	1013.40	68.0	1012.10	-2.4	1013.43	65.0	1012.39
79.5	1012.61	-1.8	1012.75	71.0	1011.93	-1.0	1012.45	66.4	1012.29
80.0	1012.63	-0.6	1012.28	73.0	1011.88	-0.6	1012.41	68.0	1012.21
82.0	1012.90	0.5	1011.80	74.0	1011.93	1.6	1011.13	70.0	1012.03
83.0	1013.09	1.5	1011.00	76.0	1012.02	4.0	1010.84	72.0	1011.99
85.0	1013.32	2.4	1010.92	78.0	1012.26	6.0	1010.69	73.5	1011.95
86.0	1013.39	4.3	1010.77	80.0	1012.63	8.0	1010.63	75.0	1012.01
88.0	1013.37	6.0	1010.67	81.5	1012.88	10.0	1010.66	76.5	1012.11
90.0	1013.60	8.0	1010.65	82.5	1012.96	12.0	1010.69	78.0	1012.27
92.0	1013.67	10.0	1010.66	84.0	1013.26	14.0	1010.61	79.0	1012.46
94.0	1013.57	12.0	1010.66	86.0	1013.39	16.0	1010.66	80.0	1012.62
97.0	1013.70	14.0	1010.63	88.0	1013.38	18.0	1010.66	81.5	1012.88
100.0	1013.78	16.0	1010.63	90.0	1013.60	20.0	1010.64	82.5	1012.95
101.0	1013.77	18.0	1010.66	92.0	1013.67	22.0	1010.76	84.0	1013.26
104.0	1013.84	20.0	1010.66	94.0	1013.57	24.0	1010.67	86.0	1013.40
		22.0	1010.64	96.0	1013.64	26.0	1010.81	88.0	1013.38
		24.0	1010.69	98.0	1013.74	28.0	1010.85	90.0	1013.61
		26.0	1010.70	100.0	1013.79	30.0	1010.85	92.0	1013.67
		28.0	1010.72	101.0	1013.76	32.0	1010.89	94.0	1013.58
		30.0	1010.72	104.0	1013.84	34.0	1010.85	97.0	1013.70
		32.0	1010.72	107.0	1013.79	36.0	1010.88	100.0	1013.79
		33.8	1010.75	110.0	1013.77	38.0	1010.86	101.0	1013.77
		34.3	1010.86			40.0	1010.87	104.0	1013.83
		36.0	1010.83			42.0	1010.88		
		38.0	1010.81			44.0	1010.92		
		40.0	1010.82			46.0	1010.91		
		42.0	1010.80			48.0	1010.88		
		44.0	1010.83			50.0	1010.92		
		46.0	1010.89			52.0	1010.86		
		48.0	1010.90			54.0	1011.04		

Table 9. (Continued) Listing of horizontal stations and elevations for cross section PR120

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1994		1994		1995		1995		1996	
24 September		24 September		23 September		23 September		15 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-30.0	1014.70	50.0	1011.19	-28.0	1014.68	66.0	1012.67	-30.0	1014.70
-28.0	1014.68	52.5	1011.26	-26.0	1014.69	68.0	1012.47	-29.0	1014.68
-26.0	1014.69	53.0	1011.18	-23.0	1014.78	70.0	1012.25	-26.0	1014.69
-24.0	1014.76	54.5	1011.15	-20.0	1014.75	72.0	1012.15	-23.0	1014.78
-21.0	1014.75	56.0	1011.20	-17.0	1014.67	73.0	1012.12	-20.0	1014.72
-18.0	1014.67	56.5	1011.29	-14.0	1014.64	75.0	1012.15	-17.0	1014.63
-16.0	1014.62	57.2	1011.52	-11.0	1014.68	76.0	1012.20	-14.0	1014.66
-13.0	1014.63	58.3	1012.02	-8.0	1014.64	78.0	1012.37	-11.0	1014.68
-10.0	1014.73	58.7	1012.13	-6.0	1014.53	80.0	1012.66	-9.0	1014.67
-8.0	1014.64	60.3	1012.27	-4.0	1014.50	82.0	1012.91	-6.0	1014.52
-6.0	1014.53	61.3	1012.49	-3.3	1014.46	84.0	1013.24	-3.3	1014.47
-3.1	1014.44	61.9	1012.51	-2.7	1013.75	86.0	1013.39	-1.5	1012.74
-2.5	1013.57	63.0	1012.53	-1.5	1012.69	88.0	1013.38	-0.8	1012.42
-1.7	1012.74	65.0	1012.41	-1.0	1012.63	90.0	1013.60	1.3	1010.98
-1.0	1012.45	67.0	1012.28	-0.4	1012.41	92.0	1013.67	1.8	1010.93
-0.3	1012.29	69.0	1012.17	1.2	1010.96	94.0	1013.58	3.0	1010.79
0.5	1011.81	70.0	1012.08	4.0	1010.75	96.0	1013.64	6.0	1010.66
1.2	1011.00	72.0	1012.00	7.0	1010.68	98.5	1013.76	9.0	1010.66
3.0	1010.87	74.0	1011.99	10.0	1010.65	101.0	1013.78	12.0	1010.66
5.5	1010.70	75.0	1012.02	13.0	1010.63	104.0	1013.83	15.0	1010.62
8.0	1010.64	76.0	1012.07	16.0	1010.65			18.0	1010.66
11.0	1010.67	77.5	1012.25	19.0	1010.64			21.0	1010.63
14.0	1010.59	78.6	1012.37	22.0	1010.63			24.0	1010.70
17.0	1010.66	79.0	1012.51	25.0	1010.70			27.0	1010.72
20.0	1010.63	80.0	1012.64	28.0	1010.66			30.0	1010.69
23.0	1010.67	82.0	1012.90	31.0	1010.71			33.0	1010.70
26.0	1010.74	83.4	1013.14	34.0	1010.77			36.0	1010.72
29.0	1010.75	85.0	1013.33	37.0	1010.73			39.0	1010.78
31.0	1010.74	86.0	1013.40	40.0	1010.79			42.0	1010.83
32.0	1010.78	88.0	1013.37	43.0	1010.84			45.0	1010.86
33.0	1010.77	90.0	1013.60	46.0	1010.85			48.0	1010.87
34.5	1010.80	91.0	1013.68	49.0	1010.84			51.0	1010.89
35.2	1010.86	93.0	1013.62	51.0	1010.89			53.0	1010.94
36.2	1010.88	94.0	1013.57	53.5	1010.97			55.0	1011.02
38.0	1010.87	96.0	1013.65	55.0	1010.94			56.2	1011.16
40.0	1010.87	99.0	1013.78	56.3	1011.20			57.1	1011.58
42.0	1010.94	101.0	1013.77	57.4	1011.61			57.9	1011.96
45.0	1010.93	104.0	1013.84	58.4	1011.66			60.0	1012.43
47.0	1010.98			59.2	1012.14			61.0	1012.56
47.5	1011.16			60.1	1012.46			63.0	1012.70
48.5	1011.15			62.0	1012.65			64.0	1012.71
49.5	1011.21			64.0	1012.71			66.0	1012.60

Table 9. (Continued) Listing of horizontal stations and elevations for cross section PR120
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1997		1997		1998		1998	
15 October		18 September		18 September		25 September		25 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
68.0	1012.47	-30.0	1014.70	69.0	1012.37	-30.0	1014.70	54.5	1011.00
70.0	1012.26	-27.0	1014.67	71.0	1012.23	-28.0	1014.70	56.0	1011.09
72.0	1012.18	-24.0	1014.73	73.0	1012.13	-26.0	1014.70	56.5	1011.27
74.0	1012.15	-21.0	1014.74	75.0	1012.16	-24.0	1014.73	57.0	1011.55
75.0	1012.15	-18.0	1014.68	77.0	1012.30	-22.3	1014.77	57.5	1011.79
77.0	1012.31	-15.0	1014.63	79.0	1012.53	-20.0	1014.71	57.8	1011.94
78.0	1012.39	-12.0	1014.64	81.0	1012.79	-18.0	1014.66	58.0	1011.98
80.0	1012.67	-9.0	1014.66	82.5	1012.97	-16.8	1014.62	58.4	1012.06
82.0	1012.93	-6.0	1014.53	85.0	1013.32	-15.0	1014.63	59.0	1012.20
84.0	1013.21	-3.3	1014.47	88.0	1013.38	-13.0	1014.65	60.0	1012.41
86.0	1013.39	-1.6	1012.79	91.0	1013.70	-11.0	1014.68	60.5	1012.49
88.0	1013.38	-1.2	1012.63	93.5	1013.56	-9.8	1014.73	61.0	1012.57
90.0	1013.61	-0.5	1012.25	96.0	1013.64	-9.2	1014.65	62.0	1012.66
92.0	1013.68	1.3	1010.97	99.0	1013.77	-8.0	1014.66	63.0	1012.71
95.0	1013.58	1.6	1010.95	101.0	1013.77	-6.0	1014.52	64.0	1012.71
98.0	1013.74	4.0	1010.73	104.0	1013.84	-5.0	1014.52	65.0	1012.68
100.9	1013.78	7.0	1010.68			-3.2	1014.47	66.0	1012.61
104.0	1013.84	10.0	1010.67			-2.9	1014.11	67.0	1012.53
		13.0	1010.62			-1.7	1012.85	67.5	1012.48
		16.0	1010.66			-0.5	1012.37	68.0	1012.50
		19.0	1010.69			0.0	1011.88	69.0	1012.37
		22.0	1010.64			0.8	1011.33	69.5	1012.34
		25.0	1010.67			1.2	1011.08	70.0	1012.30
		28.0	1010.70			1.5	1010.96	71.0	1012.25
		31.0	1010.70			3.0	1010.83	72.0	1012.19
		34.0	1010.71			6.0	1010.67	73.0	1012.13
		37.0	1010.73			9.0	1010.66	74.0	1012.14
		40.0	1010.80			12.0	1010.66	75.0	1012.15
		43.0	1010.82			15.0	1010.65	75.4	1012.17
		46.0	1010.84			18.0	1010.67	76.0	1012.20
		49.0	1010.84			21.0	1010.63	77.0	1012.33
		51.5	1010.89			24.0	1010.69	78.0	1012.38
		52.6	1010.95			27.0	1010.74	78.5	1012.43
		55.0	1011.04			30.0	1010.72	79.0	1012.53
		55.8	1011.06			33.0	1010.77	80.0	1012.65
		56.5	1011.23			36.0	1010.72	80.8	1012.74
		58.0	1011.98			39.0	1010.79	81.0	1012.78
		59.5	1012.32			42.0	1010.83	82.0	1012.91
		61.0	1012.57			45.0	1010.85	82.7	1013.00
		63.0	1012.70			48.0	1010.85	83.0	1013.07
		65.0	1012.67			51.0	1010.88	83.7	1013.16
		67.0	1012.52			53.0	1010.95	84.0	1013.22

Table 9. (Continued) Listing of horizontal stations and elevations for cross section PR120

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1998	
25 September	
Sta.	Elev.
85.0	1013.33
86.0	1013.39
87.0	1013.38
87.7	1013.35
88.0	1013.38
88.5	1013.43
89.0	1013.49
90.0	1013.58
91.0	1013.71
92.0	1013.68
93.3	1013.57
96.0	1013.63
98.0	1013.74
100.0	1013.80
101.0	1013.78
102.0	1013.73

Description of Cross Section PR122

Location: Township 8 South/Range 48 East--section 28

U. S. Geological Survey quadrangle (1:24,000): Moorhead

Landowners--left bank: Glenn and William Gay

--right bank: U. S. Government

Access: Left bank

Permission from: Gay Ranch

Distance from Moorhead Gaging Station: 7.07 kilometers

Azimuth of Section (degrees magnetic): 135.5

Reference Monuments

[Monuments at stations -1.2 and 0.0 were closest to leveling instrument; benchmark (brass circular plate in concrete) was removed between 1988 and 1998]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; bent, 0.18 meter above 1998 ground level	-1.2	45°06'37.88"	105°51'00.00"	0.280	0.500	1014.76
Benchmark--1/2-inch-rebar	0.0					1014.56
1/2-inch-rebar; bent, about 0.08 meter below 1978 ground level; could not see it in 1998	101.8					1009.29
1/2-inch-rebar; bent, 0.13 meter above 1998 ground level	136.2					1010.36
1/2-inch-rebar; in sand ridge above surrounding floodplain; 0.29 meter above 1998 ground level	141.0	45°06'33.88"	105°51'56.78"	0.475	0.472	1010.93

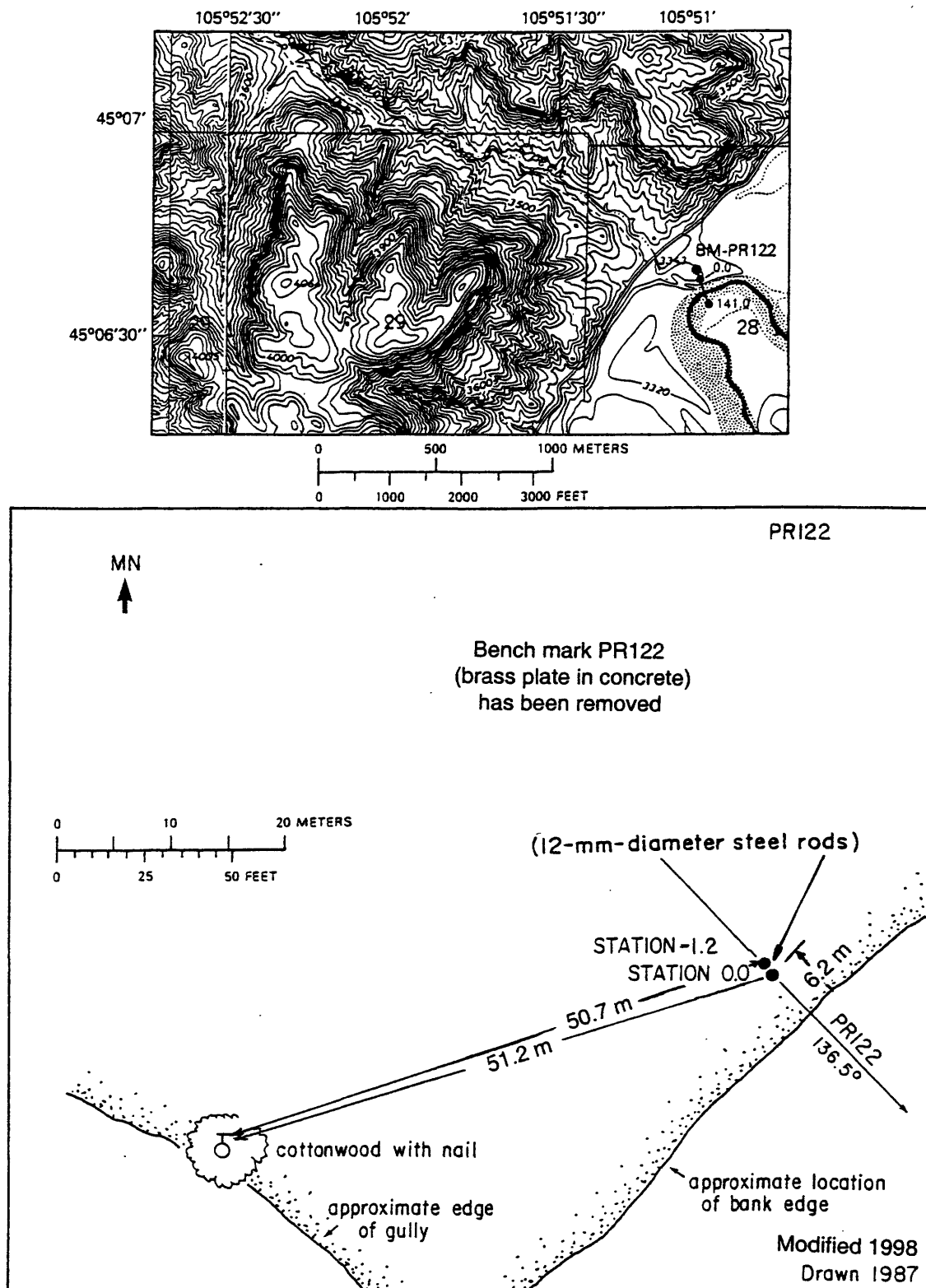


Figure 21. Upper: Location of cross section PR122 and the left and right bank reference monuments in the Moorhead quadrangle. Lower: Location of stations 0.0 and -1.2 on the left bank. MN is magnetic north.

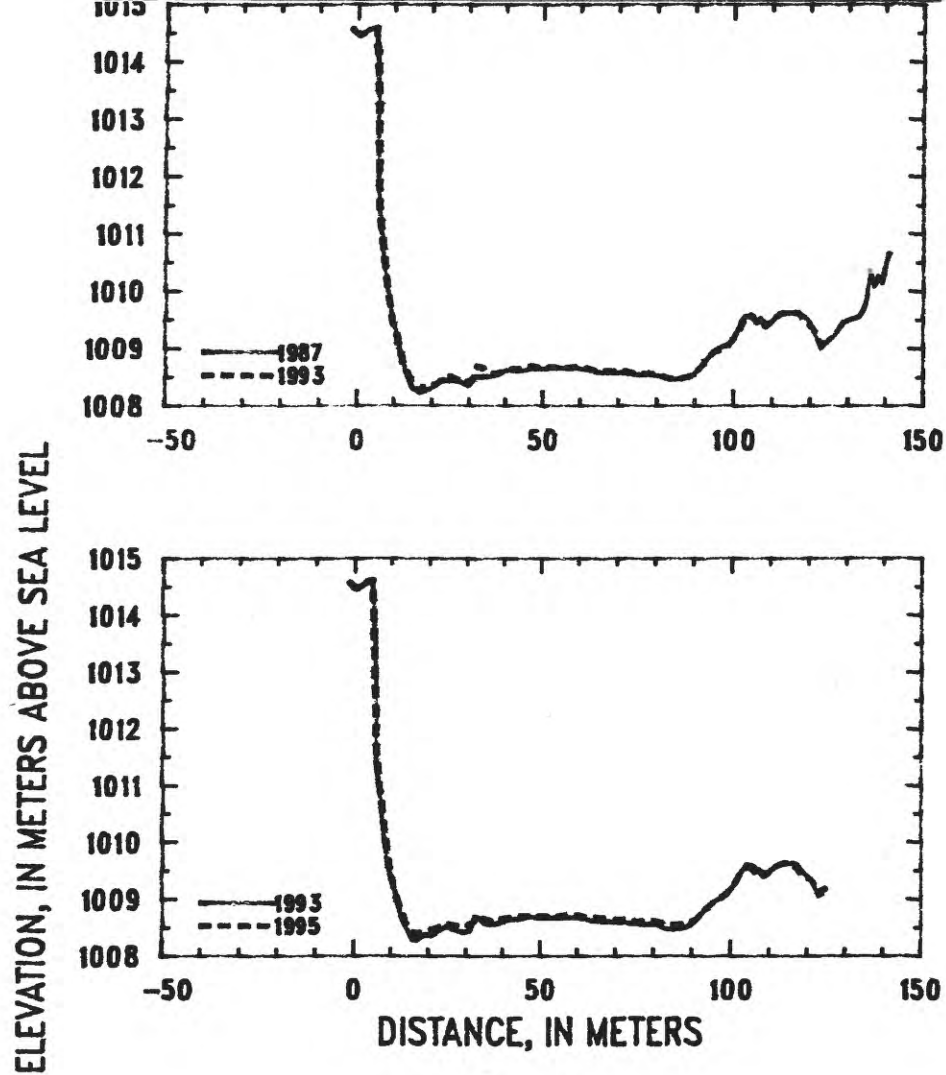


Figure 22. Profiles of cross section PR122 from 1987 to 1995.

Table 10. Listing of horizontal stations and elevations for cross section PR122

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1993		1993		1995		1995	
26 August		26 August		26 September		26 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.0	1014.50	86.0	1008.46	-1.2	1014.57	84.0	1008.55
1.0	1014.46	89.0	1008.52	0.0	1014.48	86.0	1008.55
3.0	1014.55	91.0	1008.64	2.0	1014.53	88.0	1008.57
5.1	1014.59	93.0	1008.80	4.0	1014.61	90.0	1008.61
5.7	1013.84	95.0	1008.94	4.9	1014.62	92.0	1008.71
6.0	1013.26	97.0	1008.99	6.1	1011.54	93.0	1008.79
6.2	1011.47	98.5	1009.05	9.0	1009.82	95.0	1008.92
6.6	1011.24	100.0	1009.16	11.0	1009.12	97.0	1009.00
8.5	1009.98	102.0	1009.42	14.0	1008.58	99.0	1009.12
10.0	1009.42	104.0	1009.60	16.0	1008.39	101.0	1009.29
11.0	1009.22	106.0	1009.46	18.0	1008.41	103.0	1009.52
13.0	1008.66	107.0	1009.52	20.0	1008.45	105.0	1009.59
15.0	1008.39	108.5	1009.39	22.0	1008.50	107.0	1009.52
16.0	1008.29	110.0	1009.47	24.0	1008.56	109.0	1009.40
17.0	1008.28	112.0	1009.59	26.0	1008.56	111.0	1009.54
19.0	1008.38	115.0	1009.63	28.0	1008.53	113.0	1009.61
21.0	1008.36	117.0	1009.62	30.0	1008.52	115.0	1009.63
23.0	1008.46	119.0	1009.46	32.0	1008.61	117.0	1009.57
25.0	1008.52	121.0	1009.32	34.0	1008.69	119.0	1009.37
27.0	1008.46	123.0	1009.05	36.0	1008.63	121.0	1009.33
29.0	1008.41	124.0	1009.10	38.0	1008.62	123.0	1009.12
31.0	1008.44			40.0	1008.66	125.0	1009.19
32.5	1008.70			42.0	1008.69		
34.0	1008.67			44.0	1008.70		
35.0	1008.58			47.0	1008.71		
37.0	1008.55			49.0	1008.71		
39.0	1008.58			51.0	1008.69		
41.0	1008.64			53.0	1008.70		
44.0	1008.65			55.0	1008.69		
47.0	1008.69			57.0	1008.72		
50.0	1008.66			60.0	1008.72		
53.0	1008.68			62.0	1008.69		
56.0	1008.66			64.0	1008.68		
59.0	1008.69			66.0	1008.67		
62.0	1008.65			68.0	1008.65		
65.0	1008.60			70.0	1008.65		
68.0	1008.61			72.0	1008.64		
71.0	1008.61			74.0	1008.61		
74.0	1008.57			76.0	1008.61		
77.0	1008.56			78.0	1008.61		
80.0	1008.56			80.0	1008.61		
83.0	1008.47			82.0	1008.59		

Description of Cross Section PR122A

Location: Township 8 South/Range 48 East--section 28

U. S. Geological Survey quadrangle (1:24,000): Moorhead

Landowners--left bank: U.S. Government

--right bank: U.S. Government

Access: Left bank

Permission from: Gay Ranch

Distance from Moorhead Gaging Station: 6.60 kilometers

Azimuth of Section (degrees magnetic): 133.5

Reference Monuments

[Monuments on left bank were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.17 meter above 1998 ground level	-50.0	45°06'29.84"	105°50'47.05"	0.356	0.551	1010.37
Benchmark--1/2-inch-rebar; 0.06 meter above 1998 ground level	-20.0					1010.33
1/2-inch-rebar; 0.05 meter above 1998 ground level	100.0					1010.00
1/2-inch-rebar; bent, 0.13 meter above 1998 ground level	101.8					1010.12
1/2-inch-rebar; bent flat with 1998 ground level	145.0	45°06'24.50"	105°50'42.28"	0.453	0.781	1009.98

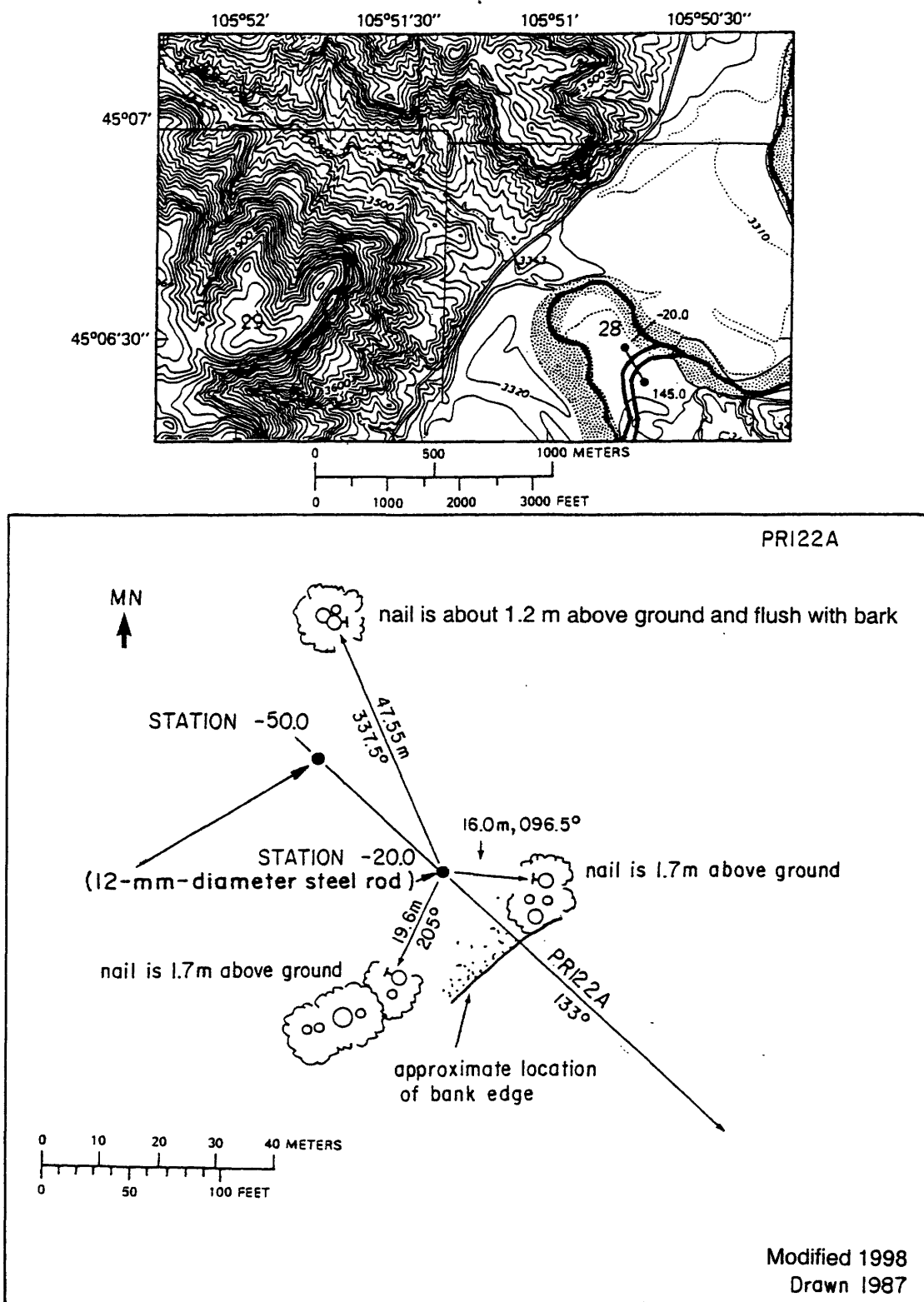


Figure 23. Upper: Location of cross section PR122A and the left and right bank reference monuments in the Moorhead quadrangle. New channel created during the 1978 flood is shown in its approximate location. Lower: Location of the bench marks (12-mm-diameter steel rods) on the left bank. MN is magnetic north.

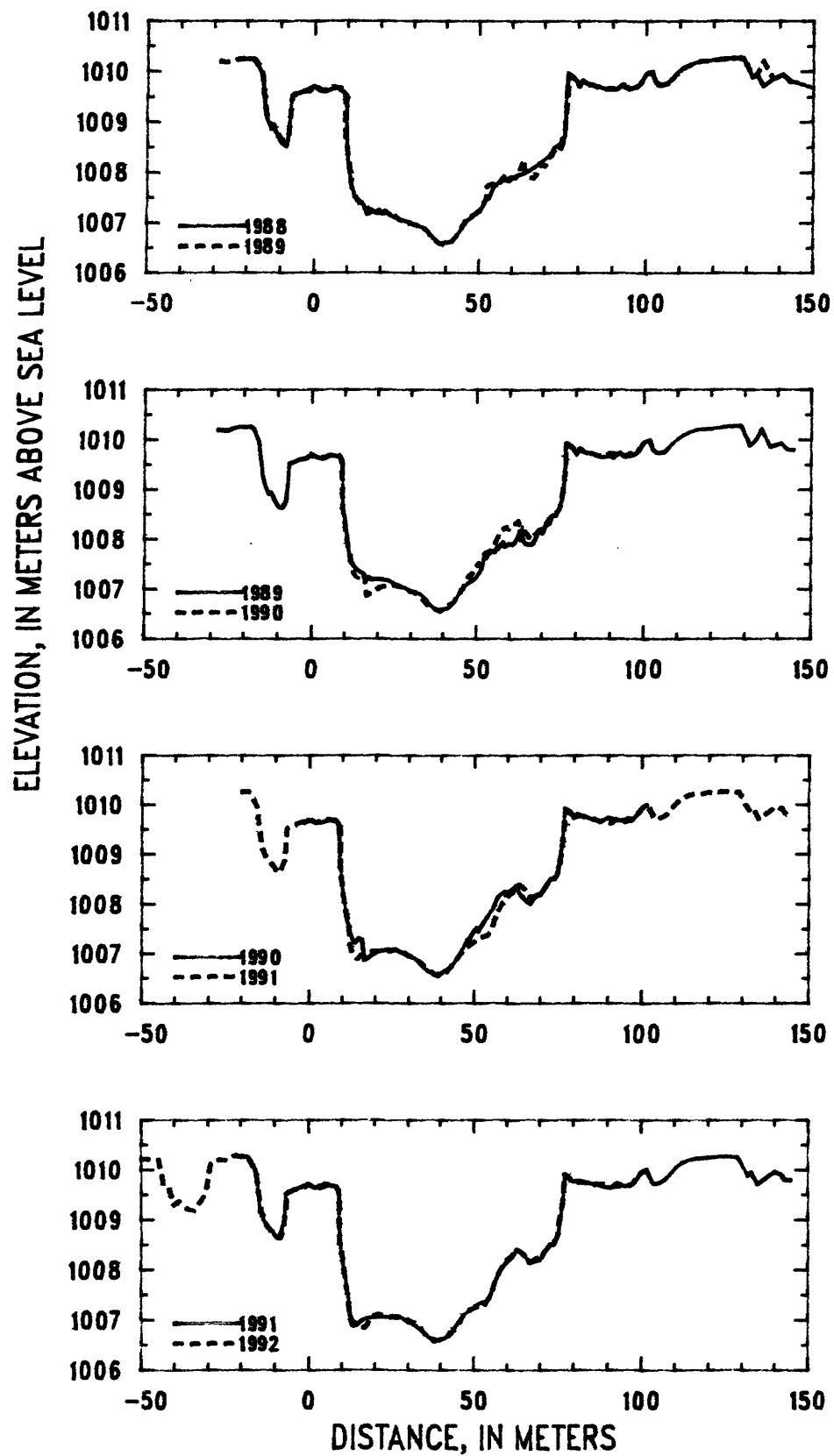


Figure 24. Profiles of cross section PR122A from 1988 to 1992.

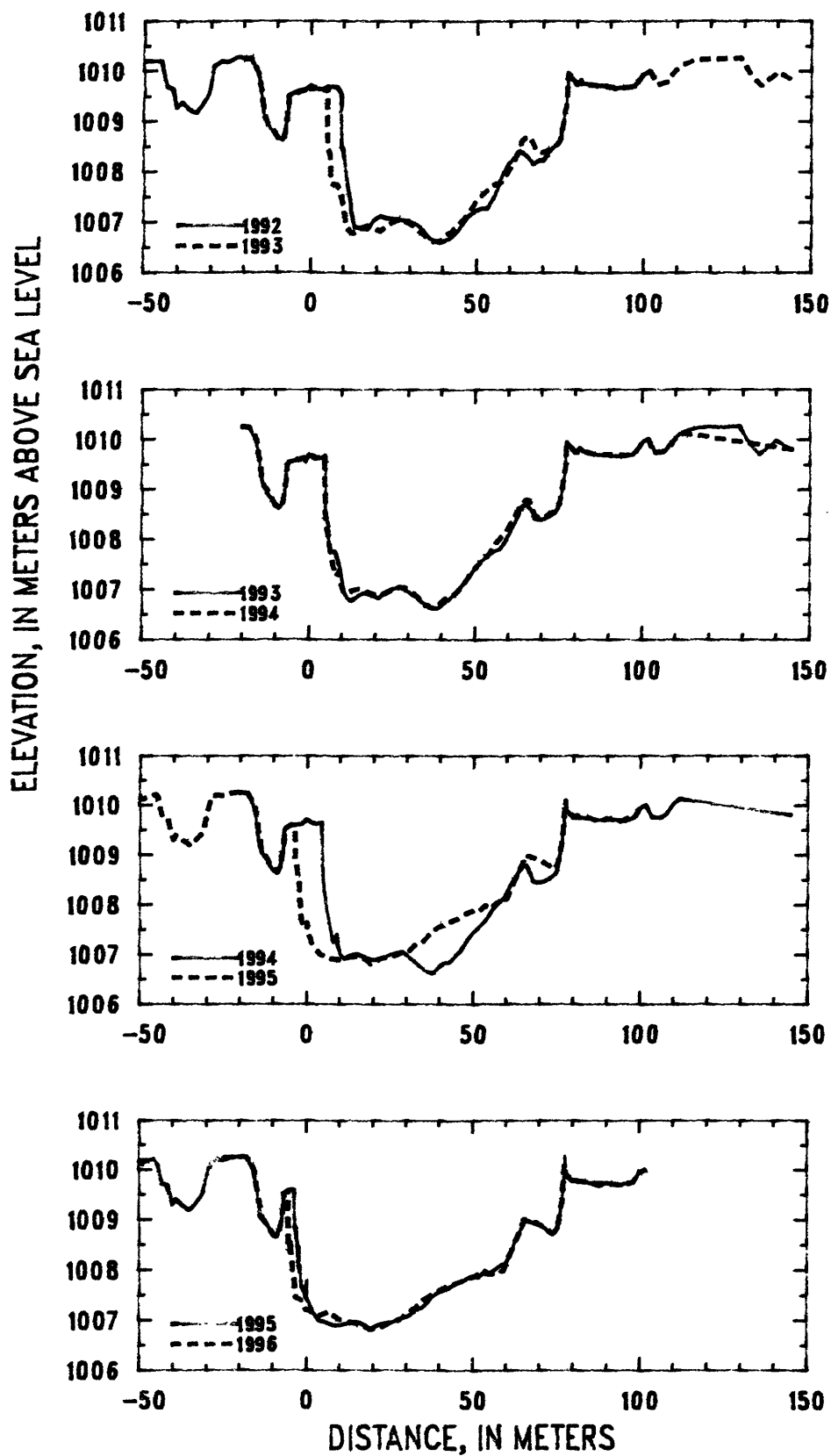


Figure 25. Profiles of cross section PR122A from 1992 to 1996.

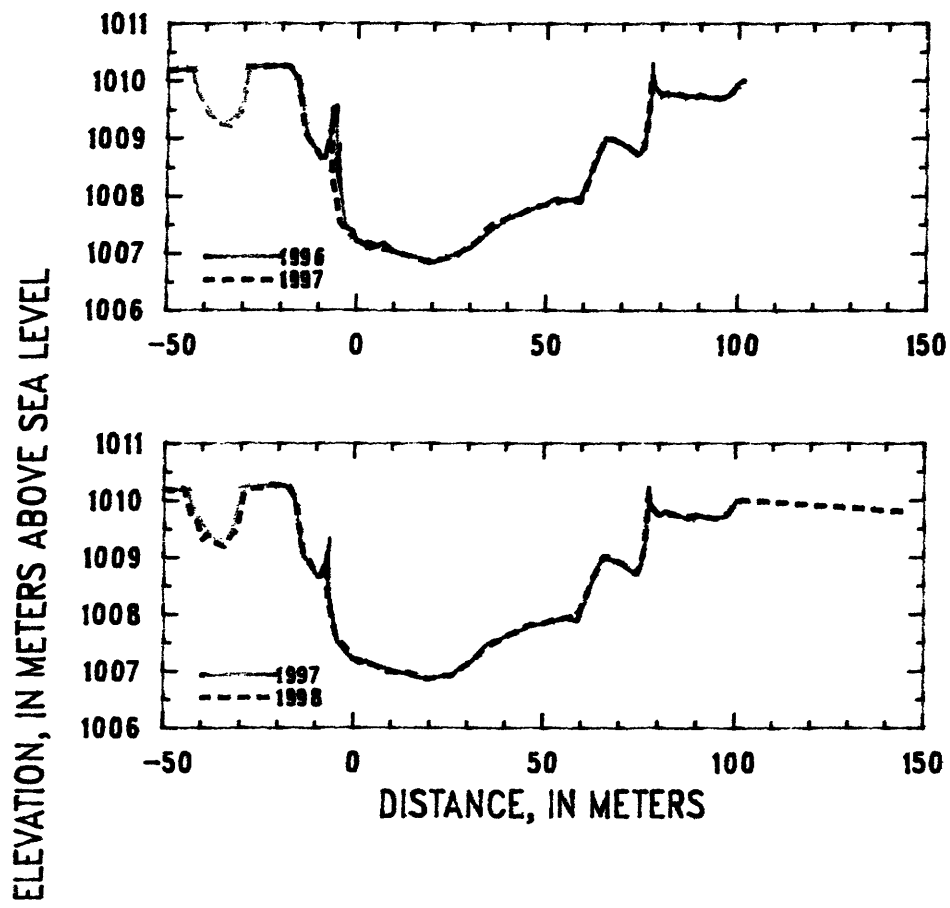


Figure 26. Profiles of cross section PR122A from 1996 to 1998.

Table 11. Listing of horizontal stations and elevations for cross section PR122A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1989		1989		1990	
17 September		17 September		17 September		17 September		15 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-28.0	1010.21	13.0	1007.45	66.8	1007.89	135.0	1010.20	-1.5	1009.63
-25.0	1010.18	15.0	1007.34	68.0	1008.01	138.0	1009.86	0.0	1009.70
-22.5	1010.25	15.8	1007.31	68.4	1008.11	141.0	1009.93	2.0	1009.64
-20.0	1010.26	16.8	1007.19	69.0	1008.18	143.0	1009.80	4.0	1009.64
-18.0	1010.26	17.5	1007.24	70.1	1008.13	145.0	1009.79	6.0	1009.70
-17.0	1010.21	18.1	1007.20	71.0	1008.30			8.0	1009.68
-16.0	1010.03	19.0	1007.19	72.0	1008.32			8.8	1009.63
-15.3	1009.95	20.1	1007.21	73.0	1008.48			9.1	1009.55
-14.9	1009.64	22.0	1007.19	74.0	1008.49			9.3	1008.67
-13.9	1009.10	24.0	1007.16	75.0	1008.61			11.0	1007.80
-12.7	1008.92	26.0	1007.05	76.0	1008.85			12.0	1007.56
-12.0	1008.94	28.0	1007.04	76.7	1009.27			13.0	1007.30
-11.0	1008.81	30.0	1006.96	77.1	1009.65			14.0	1007.23
-9.6	1008.65	32.0	1006.95	77.2	1009.93			15.0	1007.31
-9.5	1008.64	34.0	1006.85	78.0	1009.90			16.1	1007.27
-8.6	1008.64	36.0	1006.70	79.0	1009.86			16.3	1007.13
-8.3	1008.67	38.0	1006.58	80.0	1009.75			16.8	1006.86
-7.6	1008.77	40.0	1006.59	80.3	1009.71			18.0	1006.90
-7.4	1008.87	42.0	1006.63	81.3	1009.83			19.0	1006.97
-6.8	1009.25	44.0	1006.81	83.0	1009.74			21.0	1007.04
-6.6	1009.53	46.0	1007.03	84.5	1009.73			23.0	1007.07
-6.0	1009.55	48.0	1007.15	86.0	1009.67			25.0	1007.09
-5.0	1009.56	49.7	1007.21	88.0	1009.65			26.0	1007.08
-4.0	1009.60	51.0	1007.32	89.5	1009.68			28.0	1007.03
-3.0	1009.62	52.1	1007.51	91.0	1009.64			30.0	1006.96
-1.5	1009.62	52.3	1007.71	93.0	1009.74			32.0	1006.91
0.0	1009.72	53.0	1007.75	94.0	1009.67			33.0	1006.85
1.0	1009.67	54.0	1007.77	95.0	1009.67			35.0	1006.69
2.0	1009.63	55.5	1007.74	97.0	1009.70			37.0	1006.63
3.0	1009.63	56.0	1007.83	98.0	1009.75			39.0	1006.55
4.0	1009.63	56.5	1007.81	100.0	1009.95			41.0	1006.65
5.0	1009.69	57.0	1007.88	101.7	1009.99			43.0	1006.73
6.0	1009.69	58.0	1007.95	103.0	1009.78			45.0	1006.92
7.0	1009.68	58.5	1007.85	104.0	1009.74			47.0	1007.14
8.0	1009.66	60.0	1007.92	106.0	1009.75			47.9	1007.28
9.0	1009.62	61.0	1007.90	110.0	1010.03			48.3	1007.26
9.3	1009.53	62.0	1007.98	115.0	1010.20			49.5	1007.43
9.4	1008.63	63.0	1008.15	120.0	1010.22			50.8	1007.52
10.0	1008.46	63.4	1008.04	125.0	1010.26			51.3	1007.46
11.0	1007.93	63.9	1008.17	129.0	1010.27			52.0	1007.53
11.3	1007.70	64.2	1007.98	131.7	1009.88			53.0	1007.67
12.1	1007.56	65.0	1007.91	133.0	1009.95			55.0	1007.85

Table 11. (Continued) Listing of horizontal stations and elevations for cross section PR122A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1990		1991		1991		1991		1992	
15 September		29 August		29 August		29 August		25 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
57.0	1008.13	-20.0	1010.27	42.0	1006.66	120.0	1010.24	-50.0	1010.22
58.0	1008.21	-18.0	1010.26	44.0	1006.82	123.0	1010.26	-44.7	1010.21
59.2	1008.25	-17.0	1010.20	45.2	1006.93	126.0	1010.26	-43.0	1009.69
59.6	1008.19	-15.3	1009.96	47.0	1007.08	129.0	1010.25	-41.4	1009.64
60.0	1008.25	-14.0	1009.15	50.0	1007.25	132.0	1009.89	-40.2	1009.29
61.0	1008.28	-12.7	1008.94	51.7	1007.33	133.0	1009.95	-38.6	1009.38
62.6	1008.37	-11.2	1008.83	54.0	1007.37	135.0	1009.71	-35.8	1009.21
64.0	1008.19	-9.5	1008.67	55.6	1007.56	138.0	1009.86	-34.2	1009.18
65.0	1008.14	-8.8	1008.63	56.6	1007.79	140.0	1009.96	-31.3	1009.46
66.0	1008.05	-7.4	1008.86	58.0	1007.98	142.0	1009.92	-30.2	1009.68
67.0	1008.01	-6.8	1009.22	60.0	1008.16	143.2	1009.79	-29.2	1010.11
68.0	1008.11	-6.6	1009.52	61.5	1008.24	145.0	1009.79	-27.0	1010.21
69.0	1008.20	-5.0	1009.59	63.0	1008.41			-25.0	1010.19
70.0	1008.19	-3.0	1009.63	65.0	1008.33			-22.0	1010.29
71.0	1008.32	-1.5	1009.66	67.0	1008.13			-20.0	1010.27
72.0	1008.40	0.0	1009.72	69.0	1008.18			-18.0	1010.26
73.0	1008.52	2.0	1009.63	70.0	1008.20			-15.4	1009.96
74.0	1008.52	5.0	1009.72	72.0	1008.40			-14.0	1009.20
75.0	1008.62	7.0	1009.68	73.0	1008.51			-12.8	1008.93
75.7	1008.80	8.5	1009.66	74.0	1008.51			-10.0	1008.68
76.8	1009.34	9.3	1009.55	74.8	1008.57			-8.4	1008.64
77.0	1009.53	9.3	1008.68	75.8	1008.80			-7.4	1008.87
77.3	1009.92	10.0	1008.33	77.1	1009.47			-6.7	1009.23
78.0	1009.90	10.7	1008.00	77.5	1009.90			-6.5	1009.53
79.0	1009.85	12.1	1007.54	80.0	1009.76			-4.0	1009.61
80.0	1009.74	12.6	1007.11	82.0	1009.79			-1.5	1009.64
81.0	1009.82	13.0	1007.04	85.0	1009.73			0.0	1009.71
82.0	1009.78	14.6	1006.90	88.0	1009.66			2.0	1009.64
84.0	1009.75	16.0	1006.99	91.0	1009.63			4.0	1009.64
86.0	1009.69	18.0	1007.04	93.0	1009.73			6.0	1009.70
88.0	1009.66	20.0	1007.05	95.0	1009.67			8.0	1009.68
90.0	1009.74	22.0	1007.06	97.0	1009.70			9.2	1009.58
92.0	1009.71	24.0	1007.06	98.0	1009.74			9.3	1009.48
94.0	1009.67	26.0	1007.09	100.0	1009.95			9.3	1008.50
96.0	1009.74	28.0	1007.05	101.7	1010.00			9.8	1008.46
97.0	1009.70	30.0	1006.96	103.7	1009.72			11.4	1007.69
98.0	1009.75	31.1	1006.95	105.0	1009.72			12.1	1007.45
100.0	1009.95	32.0	1006.92	107.0	1009.78			12.3	1007.30
101.7	1010.00	34.0	1006.80	109.0	1009.94			12.5	1007.15
		36.0	1006.69	111.0	1010.10			13.3	1006.89
		38.0	1006.58	114.0	1010.19			15.0	1006.88
		40.0	1006.61	117.0	1010.23			17.2	1006.85

Table 11. (Continued) Listing of horizontal stations and elevations for cross section PR122A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1992		1992		1993		1993		1993	
25 August		25 August		26 August		26 August		26 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
19.0	1007.04	99.0	1009.87	-20.0	1010.26	35.0	1006.71	100.0	1009.95
21.0	1007.12	100.0	1009.95	-17.7	1010.27	37.0	1006.63	101.7	1010.01
23.0	1007.08	101.7	1010.01	-15.4	1009.96	39.0	1006.62	104.0	1009.74
25.0	1007.07			-13.8	1009.14	41.0	1006.74	107.0	1009.78
27.0	1007.05			-12.6	1008.94	43.0	1006.86	109.0	1009.99
29.0	1007.03			-11.0	1008.83	45.0	1006.99	112.0	1010.15
31.0	1006.98			-9.6	1008.66	46.5	1007.12	115.0	1010.21
33.0	1006.93			-8.8	1008.63	48.0	1007.23	120.0	1010.25
35.0	1006.75			-8.0	1008.69	50.0	1007.44	125.0	1010.25
37.0	1006.64			-7.5	1008.82	52.0	1007.57	129.0	1010.27
39.0	1006.59			-6.7	1009.27	54.0	1007.68	132.0	1009.92
41.0	1006.63			-6.6	1009.52	55.0	1007.74	135.0	1009.71
43.0	1006.73			-6.0	1009.56	57.2	1007.79	140.0	1009.98
45.0	1006.89			-3.0	1009.61	58.4	1007.87	145.0	1009.80
47.0	1007.09			-1.5	1009.64	60.0	1008.06		
48.0	1007.17			-1.0	1009.58	62.0	1008.34		
50.0	1007.24			0.0	1009.71	63.3	1008.53		
52.0	1007.28			2.0	1009.63	63.4	1008.61		
53.0	1007.26			4.0	1009.64	64.0	1008.65		
55.3	1007.51			5.0	1009.69	65.0	1008.71		
56.6	1007.79			5.1	1008.51	66.0	1008.68		
58.0	1007.98			6.0	1008.34	66.7	1008.60		
60.0	1008.20			6.2	1007.90	68.0	1008.41		
62.0	1008.31			6.7	1007.77	69.0	1008.40		
63.0	1008.42			7.2	1007.75	70.0	1008.38		
65.0	1008.33			8.2	1007.75	72.0	1008.45		
67.0	1008.15			8.8	1007.66	74.0	1008.53		
69.0	1008.23			9.5	1007.48	75.0	1008.63		
70.0	1008.23			10.1	1007.26	76.0	1008.97		
72.0	1008.42			10.7	1006.96	77.0	1009.39		
74.0	1008.55			12.0	1006.81	77.3	1009.86		
75.0	1008.64			13.0	1006.78	77.5	1009.95		
77.0	1009.42			15.0	1006.88	79.0	1009.84		
77.5	1009.92			17.0	1006.94	80.0	1009.74		
78.3	1009.88			19.0	1006.90	81.5	1009.83		
80.0	1009.76			21.0	1006.82	83.0	1009.75		
83.0	1009.75			23.0	1006.95	85.0	1009.73		
86.0	1009.70			25.0	1007.01	87.0	1009.70		
89.0	1009.72			27.0	1007.06	89.0	1009.69		
91.0	1009.65			29.0	1007.01	91.0	1009.67		
94.0	1009.68			31.0	1006.92	94.0	1009.67		
97.0	1009.70			33.0	1006.82	97.0	1009.70		

Table 11. (Continued) Listing of horizontal stations and elevations for cross section PR122A
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1994		1994		1995		1995		1995	
24 September		24 September		26 September		26 September		26 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-20.0	1010.26	50.0	1007.44	-50.0	1010.19	1.0	1007.34	75.0	1008.78
-18.0	1010.25	52.0	1007.56	-49.0	1010.12	2.0	1007.17	75.3	1008.81
-17.0	1010.21	54.0	1007.69	-47.0	1010.20	4.0	1007.00	76.0	1009.00
-15.4	1009.97	56.0	1007.91	-45.0	1010.22	6.0	1006.95	77.0	1009.46
-14.2	1009.31	57.7	1008.03	-44.5	1010.17	8.0	1006.91	77.7	1010.10
-13.3	1009.05	59.6	1008.15	-43.0	1009.72	10.0	1006.90	78.0	1009.90
-12.0	1008.94	60.6	1008.32	-41.5	1009.70	12.0	1006.94	80.0	1009.77
-10.0	1008.70	62.0	1008.47	-40.0	1009.31	14.0	1006.97	82.0	1009.79
-8.8	1008.64	64.0	1008.70	-39.0	1009.40	16.0	1006.96	84.0	1009.77
-7.8	1008.74	65.0	1008.79	-37.0	1009.29	18.0	1006.90	86.0	1009.72
-6.6	1009.28	66.0	1008.79	-36.0	1009.24	19.0	1006.81	88.0	1009.68
-6.5	1009.51	67.0	1008.66	-35.0	1009.18	21.0	1006.89	90.0	1009.74
-6.0	1009.57	68.0	1008.48	-33.0	1009.32	23.0	1006.94	92.0	1009.72
-4.0	1009.60	69.0	1008.44	-31.2	1009.49	25.0	1006.95	94.0	1009.68
-1.5	1009.62	71.0	1008.46	-30.0	1009.83	27.0	1007.00	96.0	1009.75
0.0	1009.72	73.0	1008.53	-28.7	1010.17	29.0	1007.05	98.0	1009.75
2.0	1009.63	75.0	1008.64	-27.0	1010.21	31.0	1007.08	100.0	1009.95
4.0	1009.65	76.0	1008.99	-25.0	1010.19	33.0	1007.20	101.7	1010.00
4.6	1009.65	77.2	1009.49	-23.0	1010.25	35.0	1007.26		
4.9	1008.69	77.5	1009.88	-21.0	1010.26	36.6	1007.37		
5.2	1008.36	78.0	1009.91	-20.0	1010.27	38.0	1007.47		
6.7	1007.76	80.0	1009.75	-18.0	1010.26	40.0	1007.57		
8.0	1007.34	83.0	1009.76	-15.4	1009.99	42.0	1007.61		
8.5	1007.27	86.0	1009.70	-13.5	1009.06	44.0	1007.71		
9.2	1007.37	89.0	1009.71	-12.0	1008.94	46.0	1007.74		
10.3	1006.99	92.0	1009.72	-10.0	1008.72	48.0	1007.83		
11.5	1006.92	95.0	1009.68	-8.7	1008.65	50.0	1007.88		
13.0	1006.98	98.0	1009.75	-7.6	1008.88	51.7	1007.87		
15.0	1007.02	100.0	1009.95	-6.7	1009.32	53.7	1008.00		
17.0	1006.97	101.7	1010.00	-6.6	1009.52	55.2	1007.92		
20.0	1006.89	103.5	1009.75	-5.0	1009.60	57.0	1008.03		
23.0	1006.93	106.0	1009.75	-3.5	1009.59	59.0	1008.11		
26.0	1007.04	108.0	1009.84	-3.5	1008.86	59.7	1008.07		
29.0	1007.05	109.5	1009.98	-3.0	1008.82	61.0	1008.27		
32.0	1006.91	110.5	1010.06	-2.5	1008.47	63.0	1008.57		
35.0	1006.71	112.0	1010.12	-2.2	1008.44	65.0	1008.87		
38.0	1006.62	145.0	1009.79	-2.2	1008.08	65.3	1008.99		
41.0	1006.82			-1.9	1008.07	67.0	1008.97		
43.0	1006.84			-1.4	1007.64	69.0	1008.91		
45.5	1007.02			-0.4	1007.54	71.0	1008.86		
46.5	1007.10			0.0	1007.66	73.0	1008.77		
48.0	1007.28			0.0	1007.45	74.0	1008.71		

Table 11. (Continued) Listing of horizontal stations and elevations for cross section PR122A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1996		1997		1997		1998	
17 October		17 October		19 September		19 September		25 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-50.0	1010.19	59.3	1007.99	-50.0	1010.19	60.0	1008.06	-50.0	1010.19
-20.0	1010.27	61.5	1008.36	-20.0	1010.27	62.0	1008.43	-48.0	1010.18
-18.0	1010.26	64.0	1008.72	-18.0	1010.26	63.0	1008.62	-46.0	1010.24
-16.0	1010.07	65.4	1009.00	-16.5	1010.15	65.4	1009.00	-44.5	1010.19
-15.3	1009.99	67.0	1008.98	-15.3	1009.99	67.0	1008.99	-42.8	1009.72
-13.2	1009.03	69.0	1008.94	-14.1	1009.28	69.0	1008.94	-41.5	1009.70
-11.3	1008.85	70.0	1008.91	-13.2	1009.02	71.0	1008.87	-39.8	1009.32
-9.4	1008.67	72.0	1008.81	-11.5	1008.88	73.0	1008.77	-38.9	1009.40
-8.4	1008.67	74.0	1008.72	-9.5	1008.67	74.4	1008.72	-37.8	1009.38
-7.3	1008.98	75.4	1008.80	-8.4	1008.67	75.5	1008.85	-36.0	1009.24
-6.6	1009.30	76.9	1009.37	-6.8	1009.19	76.5	1009.24	-34.3	1009.19
-6.5	1009.52	77.7	1010.12	-6.7	1008.38	77.7	1010.11	-32.5	1009.38
-5.4	1009.56	78.0	1009.92	-6.3	1008.21	78.1	1009.93	-31.1	1009.48
-5.3	1008.50	80.0	1009.77	-5.5	1007.96	80.3	1009.74	-30.0	1009.79
-4.9	1008.36	83.0	1009.77	-4.4	1007.52	82.0	1009.80	-29.0	1010.12
-4.7	1008.60	86.0	1009.72	-2.0	1007.34	85.0	1009.76	-27.0	1010.21
-4.4	1008.23	89.0	1009.73	0.2	1007.21	88.0	1009.67	-24.0	1010.21
-3.0	1007.45	92.0	1009.72	1.5	1007.14	90.0	1009.75	-22.0	1010.28
-1.0	1007.38	95.0	1009.68	3.5	1007.17	92.0	1009.71	-20.0	1010.26
0.0	1007.21	98.0	1009.76	6.0	1007.09	95.0	1009.69	-18.0	1010.25
1.0	1007.19	100.0	1009.95	9.0	1007.04	97.5	1009.72	-17.0	1010.23
3.0	1007.08	101.8	1010.00	12.0	1006.98	100.0	1009.95	-15.4	1010.00
5.0	1007.12			15.0	1006.93	100.8	1010.00	-13.4	1009.07
7.0	1007.17			18.0	1006.86			-12.0	1008.96
10.0	1007.02			21.0	1006.86			-10.0	1008.75
13.0	1006.97			24.0	1006.92			-8.7	1008.70
16.0	1006.93			26.0	1006.92			-7.4	1008.91
19.0	1006.83			28.0	1007.04			-7.1	1008.87
22.0	1006.86			30.0	1007.12			-7.0	1008.35
25.0	1006.96			32.4	1007.25			-6.0	1007.99
28.0	1007.02			33.4	1007.37			-4.5	1007.57
30.0	1007.10			35.7	1007.51			-2.3	1007.43
32.6	1007.24			38.0	1007.55			0.0	1007.21
35.0	1007.39			40.0	1007.62			3.0	1007.17
38.0	1007.53			43.0	1007.68			6.0	1007.09
41.0	1007.63			46.0	1007.79			9.0	1006.99
44.0	1007.72			49.0	1007.84			12.0	1006.98
47.0	1007.79			52.0	1007.87			15.0	1006.97
50.0	1007.87			54.0	1007.91			18.0	1006.89
53.0	1007.95			55.5	1007.93			20.0	1006.86
55.0	1007.91			57.2	1007.93			23.0	1006.91
57.0	1007.94			59.0	1007.89				

Table 11. (Continued) Listing of horizontal stations and elevations for cross section PR122A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1998	
25 September	
Sta.	Elev.
29.0	1007.07
32.0	1007.23
35.1	1007.44
38.0	1007.53
41.0	1007.64
44.0	1007.74
46.5	1007.83
49.0	1007.83
52.0	1007.89
55.0	1007.93
57.0	1007.95
57.8	1008.02
58.7	1007.98
60.0	1008.12
61.5	1008.37
63.0	1008.63
65.0	1008.91
65.9	1009.03
68.0	1009.00
70.0	1008.92
72.0	1008.83
74.3	1008.72
75.6	1008.90
76.7	1009.39
77.6	1010.09
78.3	1009.88
80.0	1009.76
83.0	1009.77
86.0	1009.72
89.0	1009.73
92.0	1009.71
95.0	1009.67
98.0	1009.77
100.0	1009.95
101.7	1010.01
145.0	1009.80

Description of Cross Section PR125

Location: Township 8 South/Range 48 East--section 21

U. S. Geological Survey quadrangle (1:24,000): Moorhead

Landowners--left bank: William and Glenn Gay

--right bank: 3 Bar Ranch

Access: Left bank

Permission from: Gay Ranch

Distance from Moorhead Gaging Station: 8.61 kilometers

Azimuth of Section (degrees magnetic): 84.5

Reference Monuments

[Monuments -14.3, 0.0 and 5.0 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
Benchmark--brass circular plate	-20.0	45°07'06.40"	105°50'17.91"	0.193	0.608	1008.45
1/2-inch-rebar; on fence line, 0.18 meter above 1998 ground level	-14.3					1008.06
1/2-inch-rebar; about 0.05 meter riverward of wooden fence post; 0.16 meter above 1998 ground level	0.0					1008.16
1/2-inch-rebar; 0.12 meter above 1998 ground level	5.0					1008.01
1/2-inch-rebar; 0.07 meter above 1998 ground level	100.8					1007.41
1/2-inch-rebar; probably bent and possibly covered by sand in 1978; elevation was measured in 1977	105.4					1007.57
1/2-inch-rebar; 0.23 meter above 1998 ground level	117.1	45°07'05.73"	105°50'11.70"	0.363	0.521	1007.84

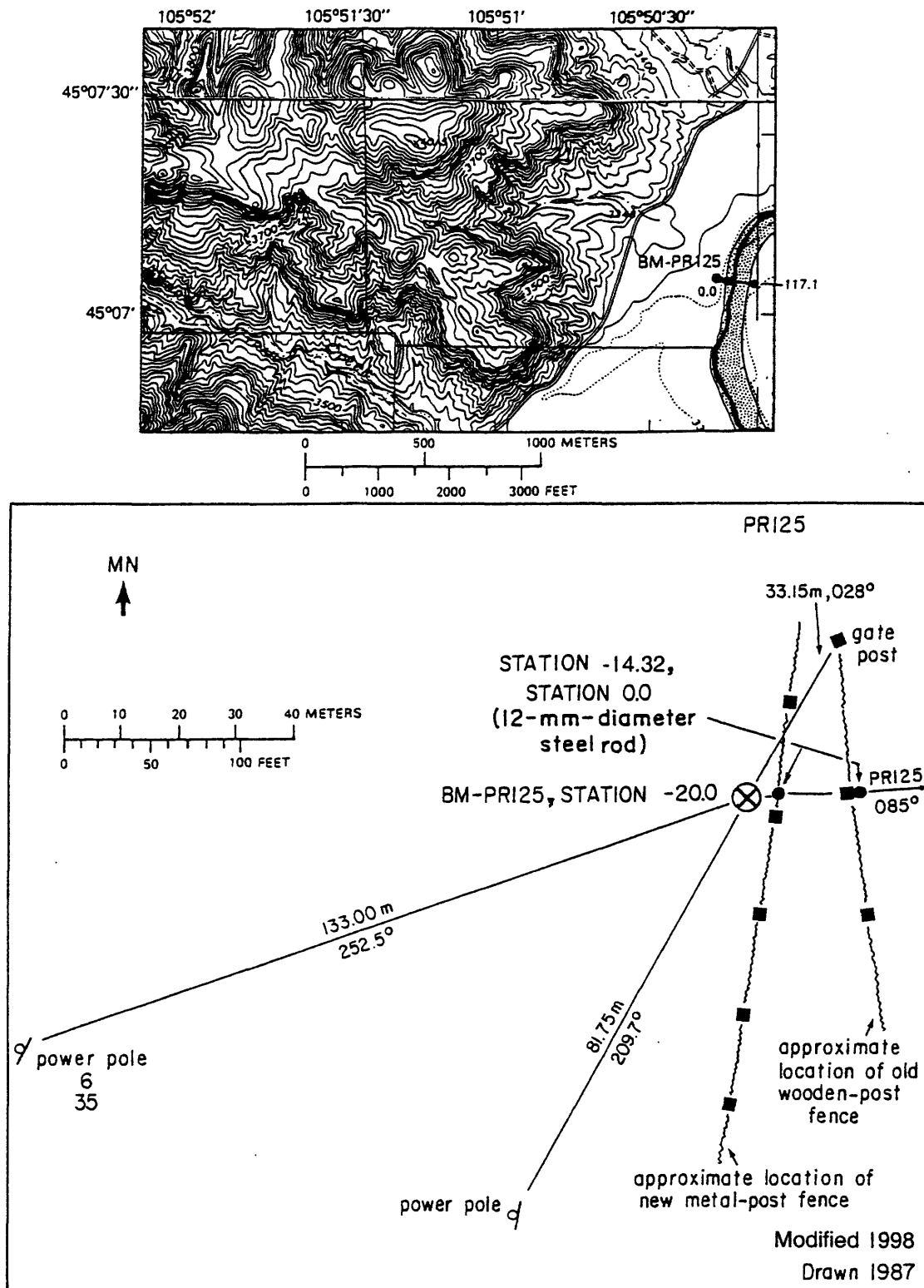


Figure 27. Upper: Location of cross section PR125, bench mark BM-PR125, and the left and right bank reference monuments in the Moorhead quadrangle. Lower: Location of the bench mark on the left bank. MN is magnetic north.

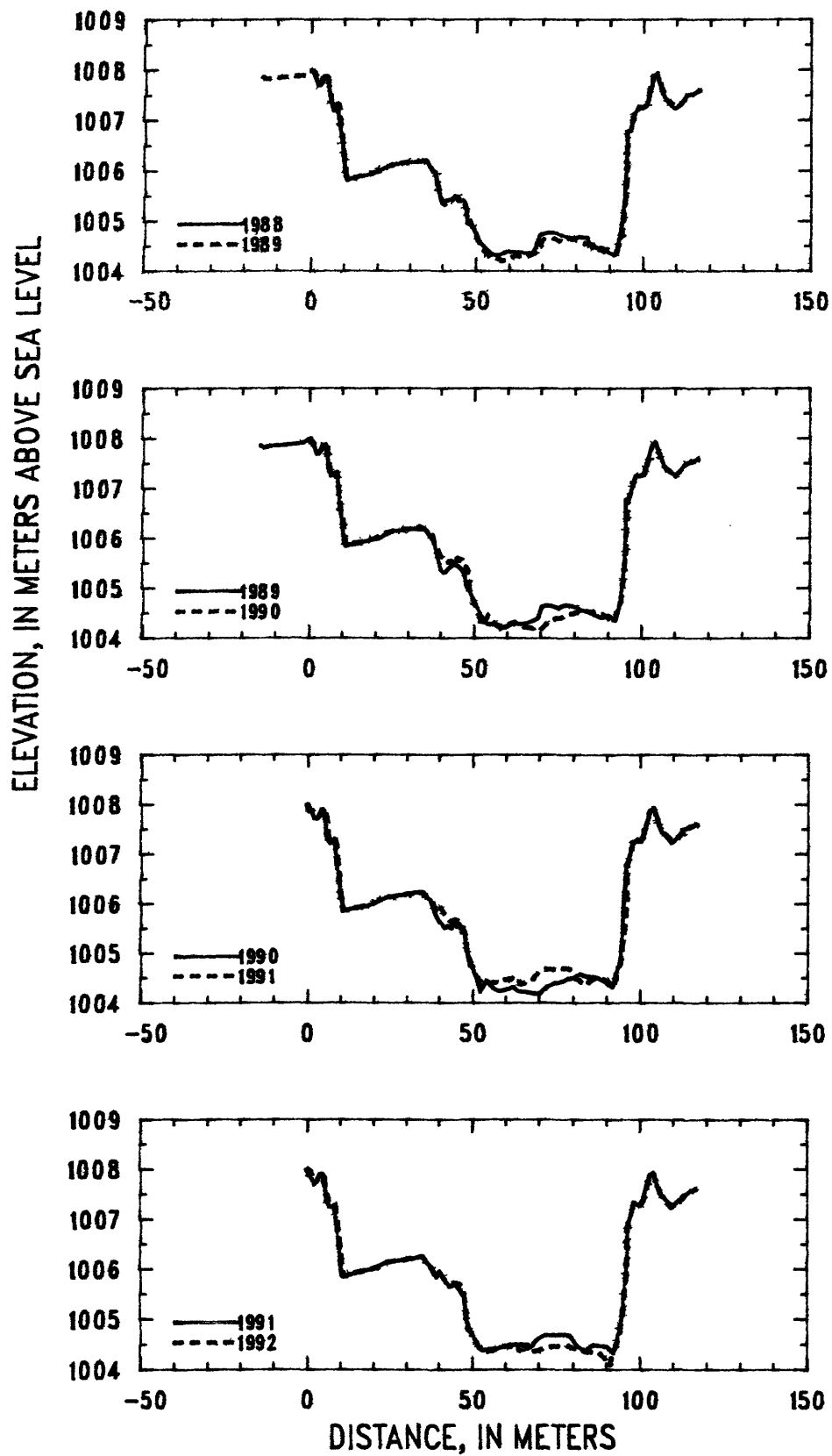


Figure 28. Profiles of cross section PR125 from 1988 to 1992.

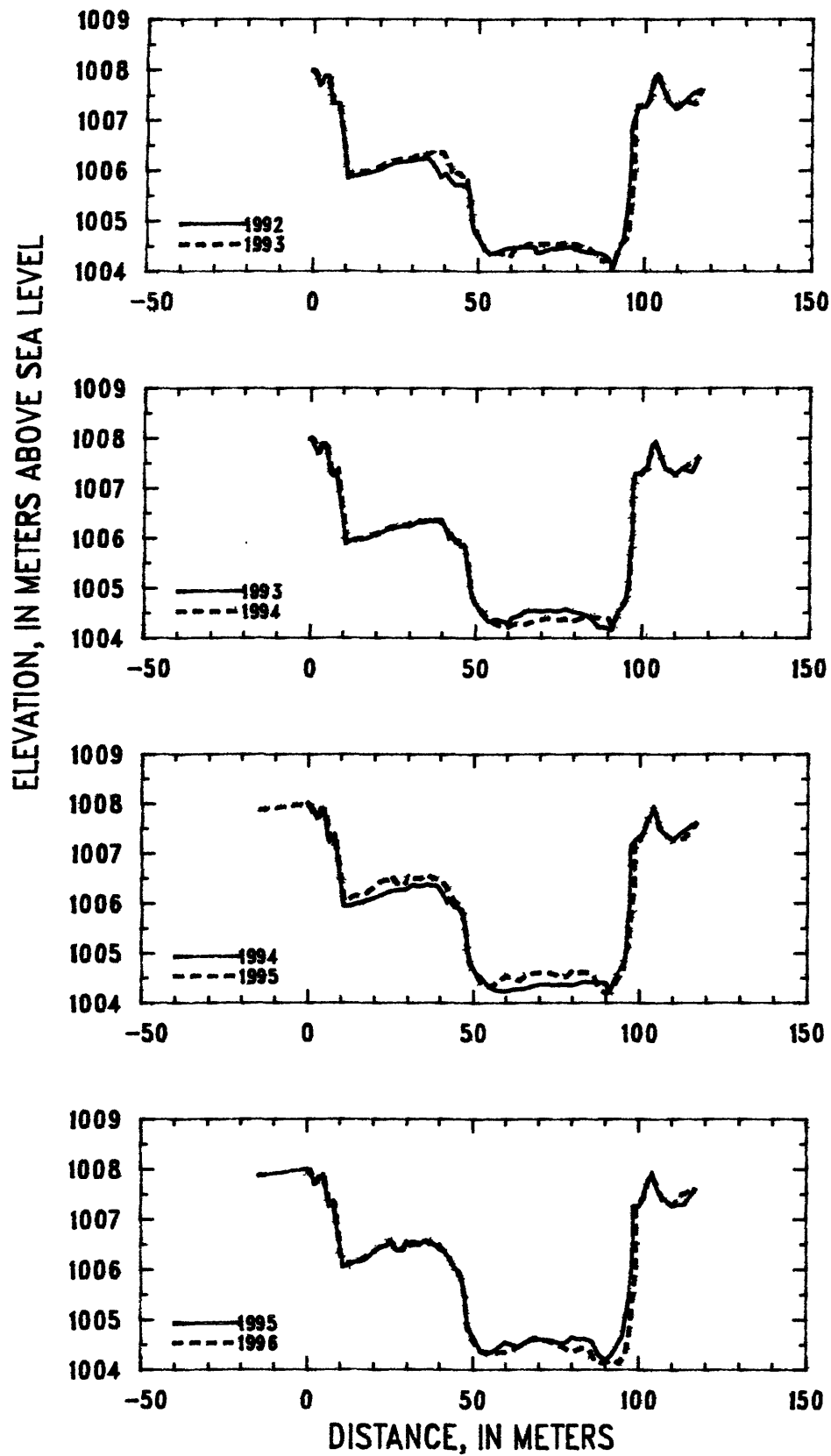


Figure 29. Profiles of cross section PR125 from 1992 to 1996.

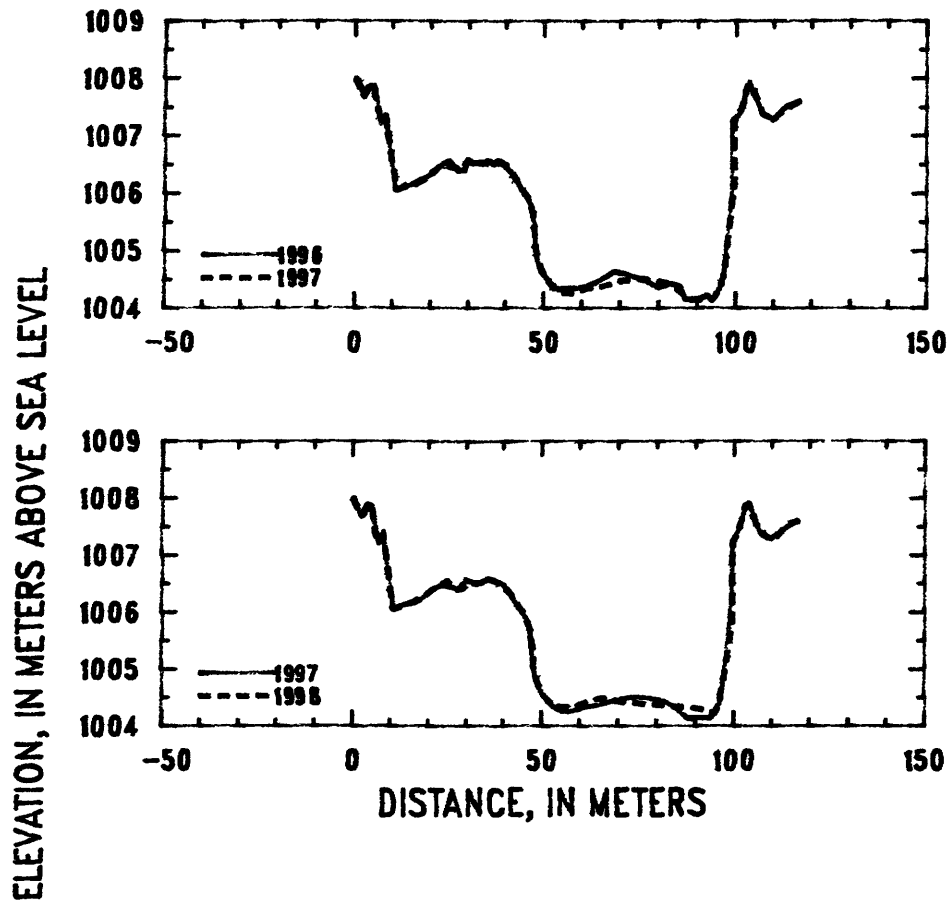


Figure 30. Profiles of cross section PR125 from 1996 to 1998.

Table 12. Listing of horizontal stations and elevations for cross section PR125

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1989		1990		1990	
17 September		17 September		17 September		14 September		14 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-14.5	1007.86	43.0	1005.44	104.0	1007.91	0.0	1008.01	54.0	1004.45
-13.0	1007.82	44.2	1005.48	105.0	1007.73	1.5	1007.87	56.0	1004.30
-12.0	1007.84	45.5	1005.42	107.0	1007.38	2.3	1007.72	58.0	1004.23
-10.0	1007.85	46.8	1005.31	109.0	1007.30	3.0	1007.71	60.0	1004.26
-8.0	1007.86	47.6	1005.04	110.0	1007.26	5.0	1007.89	62.0	1004.33
-6.0	1007.88	48.0	1005.02	111.0	1007.30	5.3	1007.86	64.0	1004.23
-4.0	1007.88	50.2	1004.68	113.0	1007.49	6.0	1007.35	66.0	1004.22
-2.0	1007.90	52.5	1004.39	115.0	1007.53	7.0	1007.21	68.0	1004.19
0.0	1007.99	54.0	1004.28	117.1	1007.61	8.3	1007.30	70.0	1004.18
1.0	1007.97	56.0	1004.28			9.0	1006.77	72.0	1004.32
2.0	1007.78	58.0	1004.20			10.0	1006.45	74.0	1004.39
2.5	1007.69	60.0	1004.24			11.0	1005.86	76.0	1004.42
3.0	1007.71	62.0	1004.31			12.0	1005.88	78.0	1004.48
4.0	1007.87	64.0	1004.27			14.0	1005.91	80.0	1004.50
5.0	1007.88	66.0	1004.30			16.0	1005.93	82.0	1004.59
6.0	1007.38	68.0	1004.37			18.0	1005.96	84.0	1004.54
6.6	1007.25	69.0	1004.40			20.0	1006.01	86.0	1004.52
8.0	1007.32	70.1	1004.62			22.0	1006.09	88.0	1004.49
8.4	1007.32	71.0	1004.65			24.0	1006.13	90.0	1004.41
9.0	1006.92	73.0	1004.66			26.0	1006.15	91.7	1004.32
10.0	1006.35	75.0	1004.59			28.0	1006.18	92.8	1004.59
10.6	1005.95	76.0	1004.65			30.0	1006.19	93.9	1004.81
11.0	1005.84	78.0	1004.66			32.0	1006.22	94.9	1005.54
12.0	1005.87	80.0	1004.63			34.0	1006.24	95.0	1005.97
13.0	1005.86	82.0	1004.56			36.0	1006.15	95.4	1006.27
15.0	1005.90	84.0	1004.53			37.6	1006.06	95.8	1006.78
17.0	1005.94	86.0	1004.46			38.0	1005.94	96.3	1006.87
19.0	1005.97	88.0	1004.41			39.0	1005.76	97.0	1007.04
21.0	1005.99	90.0	1004.46			40.0	1005.64	98.0	1007.26
23.0	1006.09	92.0	1004.36			41.8	1005.51	99.0	1007.26
25.0	1006.15	93.3	1004.67			42.7	1005.55	100.0	1007.26
27.0	1006.15	94.0	1005.01			43.6	1005.50	100.7	1007.34
29.0	1006.17	94.6	1005.46			44.4	1005.65	100.8	1007.41
31.0	1006.19	95.0	1005.73			45.3	1005.54	101.0	1007.36
33.0	1006.18	95.1	1006.77			46.0	1005.59	102.0	1007.66
35.0	1006.19	96.0	1006.81			47.0	1005.42	103.0	1007.86
36.0	1006.11	97.0	1007.07			47.6	1005.43	104.0	1007.93
37.0	1006.00	98.0	1007.25			48.5	1004.96	105.0	1007.73
37.7	1005.98	100.0	1007.26			49.0	1004.85	106.3	1007.45
39.0	1005.62	100.8	1007.30			50.6	1004.59	108.0	1007.36
40.0	1005.35	102.0	1007.65			51.4	1004.47	109.4	1007.22
41.0	1005.31	103.0	1007.87			52.3	1004.24	111.0	1007.31

Table 12. (Continued) Listing of horizontal stations and elevations for cross section PR125
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1990		1991		1991		1992		1992	
14 September		29 August		29 August		26 August		26 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
113.0	1007.50	0.0	1007.99	63.8	1004.49	0.0	1008.00	76.0	1004.47
115.0	1007.53	2.2	1007.74	64.2	1004.37	1.0	1007.96	78.0	1004.49
117.1	1007.60	3.2	1007.74	66.0	1004.41	2.5	1007.70	80.0	1004.42
		4.0	1007.89	68.0	1004.46	4.0	1007.88	82.0	1004.39
		5.0	1007.90	68.6	1004.55	5.0	1007.88	84.0	1004.36
		5.3	1007.86	70.0	1004.63	6.3	1007.33	86.0	1004.36
		6.3	1007.33	72.0	1004.69	8.2	1007.33	88.0	1004.33
		7.0	1007.23	74.0	1004.67	9.5	1006.67	90.0	1004.19
		8.4	1007.27	76.0	1004.69	11.0	1005.85	90.8	1004.07
		9.6	1006.50	78.0	1004.70	13.0	1005.89	92.0	1004.35
		10.6	1005.93	79.2	1004.66	15.0	1005.92	93.7	1004.64
		11.0	1005.86	81.0	1004.47	18.0	1005.96	94.0	1004.75
		13.0	1005.88	83.8	1004.35	21.0	1006.04	94.7	1005.08
		15.0	1005.92	84.5	1004.42	24.0	1006.14	96.0	1006.03
		17.0	1005.96	86.0	1004.49	27.0	1006.18	96.0	1006.84
		20.0	1006.01	88.0	1004.48	30.0	1006.19	97.0	1007.04
		22.0	1006.08	90.0	1004.46	33.0	1006.23	98.0	1007.25
		24.0	1006.13	92.0	1004.33	35.0	1006.24	100.0	1007.27
		26.0	1006.15	92.7	1004.50	37.0	1006.10	100.8	1007.35
		28.0	1006.18	94.4	1004.92	39.0	1005.86	102.0	1007.63
		30.0	1006.20	96.0	1005.99	40.2	1005.94	103.0	1007.87
		32.0	1006.21	96.1	1006.81	41.5	1005.82	104.0	1007.92
		34.0	1006.23	97.0	1007.04	43.0	1005.71	105.0	1007.72
		35.0	1006.23	98.0	1007.34	45.0	1005.72	107.0	1007.39
		36.0	1006.17	100.0	1007.26	47.0	1005.65	109.4	1007.23
		37.0	1006.09	100.8	1007.39	47.6	1005.49	111.4	1007.31
		38.0	1006.03	103.0	1007.88	48.1	1005.17	114.0	1007.52
		39.3	1005.84	104.0	1007.91	48.4	1004.90	117.1	1007.61
		40.3	1005.95	105.0	1007.72	49.0	1004.77		
		41.5	1005.79	106.0	1007.50	50.2	1004.66		
		43.5	1005.64	108.0	1007.37	52.0	1004.44		
		44.8	1005.69	110.0	1007.27	53.8	1004.35		
		46.0	1005.61	112.0	1007.38	56.0	1004.37		
		47.6	1005.45	115.0	1007.56	58.0	1004.44		
		48.3	1004.94	117.1	1007.62	60.0	1004.46		
		50.0	1004.71			62.0	1004.46		
		51.2	1004.52			64.0	1004.49		
		53.0	1004.38			67.2	1004.48		
		55.0	1004.40			68.0	1004.36		
		58.0	1004.42			70.0	1004.38		
		60.0	1004.47			72.0	1004.44		
		62.0	1004.50			74.0	1004.45		

Table 12. (Continued) Listing of horizontal stations and elevations for cross section PR125

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1993		1993		1994		1994		1995	
26 August		26 August		25 September		25 September		24 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.0	1008.00	56.0	1004.37	0.0	1008.02	65.0	1004.27	-14.5	1007.87
1.0	1007.96	58.0	1004.34	1.0	1007.97	68.0	1004.34	0.0	1008.00
2.5	1007.71	60.0	1004.30	3.0	1007.71	71.0	1004.39	3.0	1007.71
4.0	1007.89	61.0	1004.41	4.0	1007.90	74.0	1004.35	5.0	1007.88
5.0	1007.89	63.0	1004.44	5.0	1007.88	77.0	1004.37	7.0	1007.26
6.5	1007.29	65.0	1004.54	6.7	1007.25	80.0	1004.35	8.3	1007.33
7.3	1007.24	67.0	1004.54	7.1	1007.24	83.0	1004.43	11.0	1006.05
8.3	1007.28	69.0	1004.54	8.4	1007.37	86.0	1004.41	12.0	1006.07
10.9	1005.89	71.0	1004.54	11.0	1005.95	89.0	1004.41	14.0	1006.15
12.0	1005.94	73.0	1004.55	12.0	1005.94	90.0	1004.40	16.0	1006.15
14.0	1005.99	75.0	1004.53	13.0	1005.95	91.0	1004.23	18.0	1006.22
16.0	1005.97	77.0	1004.58	15.0	1005.99	93.0	1004.53	20.0	1006.34
18.0	1006.03	79.0	1004.54	18.0	1006.06	95.6	1004.85	22.0	1006.45
20.0	1006.07	81.0	1004.50	21.0	1006.13	96.3	1005.25	24.0	1006.47
22.0	1006.14	83.0	1004.47	24.0	1006.23	96.5	1005.68	25.0	1006.56
24.0	1006.19	85.0	1004.38	27.0	1006.26	97.0	1006.07	26.0	1006.45
26.0	1006.23	87.0	1004.22	29.0	1006.27	97.1	1006.99	27.0	1006.38
28.0	1006.24	89.0	1004.22	30.0	1006.30	97.4	1007.17	29.0	1006.38
30.0	1006.25	91.0	1004.15	31.0	1006.35	99.0	1007.28	30.0	1006.55
32.0	1006.32	92.0	1004.40	32.0	1006.36	100.8	1007.37	31.0	1006.47
34.0	1006.31	93.0	1004.54	34.0	1006.33	102.0	1007.60	32.0	1006.50
36.0	1006.36	94.7	1004.65	36.0	1006.38	104.0	1007.91	34.0	1006.49
37.0	1006.34	95.4	1004.82	37.0	1006.36	105.0	1007.74	35.0	1006.55
38.0	1006.36	96.2	1005.32	39.0	1006.35	106.5	1007.46	36.0	1006.57
39.5	1006.36	96.3	1005.56	41.0	1006.18	108.0	1007.37	37.0	1006.53
40.3	1006.26	97.0	1005.93	42.0	1006.02	110.0	1007.27	38.0	1006.52
41.4	1006.14	97.1	1007.05	42.6	1006.09	112.0	1007.38	39.0	1006.48
42.0	1006.00	98.0	1007.29	43.7	1005.96	115.0	1007.53	40.4	1006.39
42.5	1006.07	100.0	1007.28	44.4	1005.93	117.1	1007.62	41.1	1006.40
43.6	1005.96	100.8	1007.37	44.7	1005.96			43.0	1006.20
44.0	1005.93	101.4	1007.40	46.0	1005.86			44.5	1006.04
44.6	1005.95	103.0	1007.86	46.4	1005.87			46.0	1005.95
45.5	1005.84	104.0	1007.92	47.0	1005.72			47.4	1005.56
46.3	1005.87	105.0	1007.74	47.7	1005.51			48.5	1004.86
46.8	1005.79	107.0	1007.39	48.4	1005.00			49.0	1004.78
47.1	1005.58	110.0	1007.28	49.4	1004.73			52.5	1004.36
47.8	1005.36	112.0	1007.39	50.8	1004.58			54.0	1004.33
48.3	1005.00	115.0	1007.32	52.0	1004.54			56.0	1004.35
49.0	1004.82	117.1	1007.61	54.0	1004.36			58.0	1004.45
50.0	1004.70			57.0	1004.25			60.0	1004.55
52.0	1004.45			60.0	1004.23			62.0	1004.50
54.0	1004.33			62.0	1004.27			64.0	1004.45

Table 12. (Continued) Listing of horizontal stations and elevations for cross section PR125

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1995		1996		1996		1997		1997	
24 September		17 October		17 October		18 September		18 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
66.0	1004.55	0.0	1008.00	66.0	1004.53	0.0	1008.00	94.0	1004.14
68.0	1004.60	1.0	1007.97	68.5	1004.64	2.5	1007.71	96.0	1004.36
70.0	1004.61	2.5	1007.71	71.0	1004.60	4.0	1007.90	97.0	1004.66
72.0	1004.60	4.0	1007.89	74.0	1004.54	5.0	1007.88	99.5	1006.14
74.0	1004.59	5.0	1007.88	77.0	1004.46	7.0	1007.24	99.5	1007.24
76.0	1004.53	7.0	1007.25	80.0	1004.35	8.2	1007.34	100.6	1007.35
78.0	1004.53	8.0	1007.35	83.0	1004.43	11.0	1006.07	101.5	1007.49
80.0	1004.65	8.3	1007.31	85.5	1004.38	12.0	1006.08	103.0	1007.87
82.0	1004.61	10.8	1006.07	87.0	1004.15	14.0	1006.16	104.0	1007.91
84.0	1004.62	12.0	1006.08	90.0	1004.14	16.0	1006.16	107.0	1007.38
86.0	1004.57	15.0	1006.16	92.5	1004.21	18.0	1006.23	110.0	1007.29
88.0	1004.29	17.0	1006.23	94.0	1004.12	20.0	1006.34	112.0	1007.39
90.0	1004.19	19.0	1006.29	96.0	1004.35	22.0	1006.46	115.0	1007.53
92.0	1004.31	21.0	1006.40	97.0	1004.66	24.0	1006.49	117.1	1007.60
94.0	1004.54	23.0	1006.50	99.0	1005.98	26.0	1006.45		
95.0	1004.64	25.0	1006.58	99.2	1007.27	28.0	1006.41		
95.3	1004.77	27.0	1006.41	100.8	1007.36	30.0	1006.58		
96.0	1005.08	29.0	1006.41	102.0	1007.61	32.0	1006.54		
96.5	1005.13	30.0	1006.59	103.5	1007.91	34.0	1006.52		
98.3	1006.32	31.0	1006.54	105.0	1007.71	36.0	1006.59		
98.4	1007.26	32.0	1006.54	107.0	1007.39	38.0	1006.55		
100.0	1007.26	34.0	1006.51	110.0	1007.27	40.0	1006.50		
100.8	1007.37	36.0	1006.56	113.0	1007.50	42.0	1006.31		
102.0	1007.62	37.0	1006.51	117.1	1007.61	44.0	1006.09		
104.0	1007.92	38.0	1006.58			46.0	1005.90		
106.0	1007.51	39.0	1006.55			47.1	1005.66		
108.0	1007.37	40.0	1006.47			48.0	1005.01		
110.0	1007.27	42.0	1006.31			49.4	1004.66		
113.5	1007.30	43.0	1006.23			52.5	1004.36		
117.1	1007.61	44.0	1006.07			55.0	1004.26		
		45.5	1005.95			58.0	1004.25		
		46.8	1005.76			61.0	1004.34		
		47.8	1005.28			64.0	1004.36		
		48.0	1005.03			67.0	1004.41		
		48.3	1004.84			70.0	1004.48		
		49.2	1004.67			73.0	1004.51		
		50.0	1004.57			76.0	1004.52		
		52.0	1004.42			79.0	1004.48		
		54.0	1004.32			82.0	1004.44		
		57.0	1004.34			85.0	1004.32		
		60.0	1004.35			88.0	1004.14		
		63.0	1004.42			91.0	1004.15		

Table 12. (Continued) Listing of horizontal stations and elevations for cross section PR125

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1998		1998	
22 September		22 September	
Sta.	Elev.	Sta.	Elev.
0.0	1008.00	69.0	1004.46
2.7	1007.71	71.0	1004.43
4.0	1007.89	73.0	1004.41
5.0	1007.88	75.0	1004.41
6.2	1007.36	77.0	1004.39
7.3	1007.24	79.0	1004.39
8.1	1007.37	81.0	1004.38
10.8	1006.07	83.0	1004.36
11.6	1006.07	85.0	1004.34
13.0	1006.12	87.0	1004.34
15.0	1006.16	89.0	1004.33
17.0	1006.22	91.0	1004.30
19.0	1006.29	93.0	1004.25
21.0	1006.41	95.0	1004.22
23.0	1006.47	96.0	1004.39
25.0	1006.56	97.3	1004.81
27.0	1006.40	99.4	1005.77
29.0	1006.42	99.6	1006.04
31.0	1006.53	99.6	1007.23
33.0	1006.51	100.7	1007.34
35.0	1006.53	103.0	1007.87
37.0	1006.58	104.0	1007.90
38.0	1006.55	106.3	1007.46
40.0	1006.50	108.0	1007.35
41.0	1006.38	110.0	1007.27
43.0	1006.25	112.0	1007.36
44.0	1006.10	114.0	1007.52
45.0	1006.04	116.0	1007.58
47.0	1005.70	117.1	1007.61
47.4	1005.48		
47.8	1005.38		
48.0	1004.96		
48.8	1004.81		
50.5	1004.55		
53.0	1004.37		
55.0	1004.33		
57.0	1004.34		
59.0	1004.35		
61.0	1004.41		
63.0	1004.45		
65.0	1004.49		
67.0	1004.50		

Description of Cross Section PR130

Location: Township 8 South/Range 48 East--section 14

U. S. Geological Survey quadrangle (1:24,000): Bloom Creek

Landowners--left bank: Gay Ranch

--right bank: Bowers Ranch

Access: Left bank

Permission from: Gay Ranch

Distance from Moorhead Gaging Station: 13.92 kilometers

Azimuth of Section (degrees magnetic): 075

Reference Monuments

[Monuments at stations -1.1 and 0.0 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
Benchmark--brass circular plate	-53.0	45°08'23.46"	105°48'39.01"	0.554	0.922	1002.67
1/2-inch-rebar; bent flat at 1998 ground level	-1.1	45°08'23.52"	105°48'36.61"	0.384	0.690	1002.69
1/2-inch-rebar; bent flat at 1998 ground level	0.0					1002.67
1/2-inch-rebar; 0.02 meter above 1998 ground level	101.9					1000.64
1/2-inch-rebar; 0.01 meter above 1987 ground level; could not find in 1998	108.4					1000.92
1/2-inch-rebar; 0.20 meter above 1998 ground level	110.6	45°08'23.65"	105°48'31.52"	0.364	1.064	1001.92

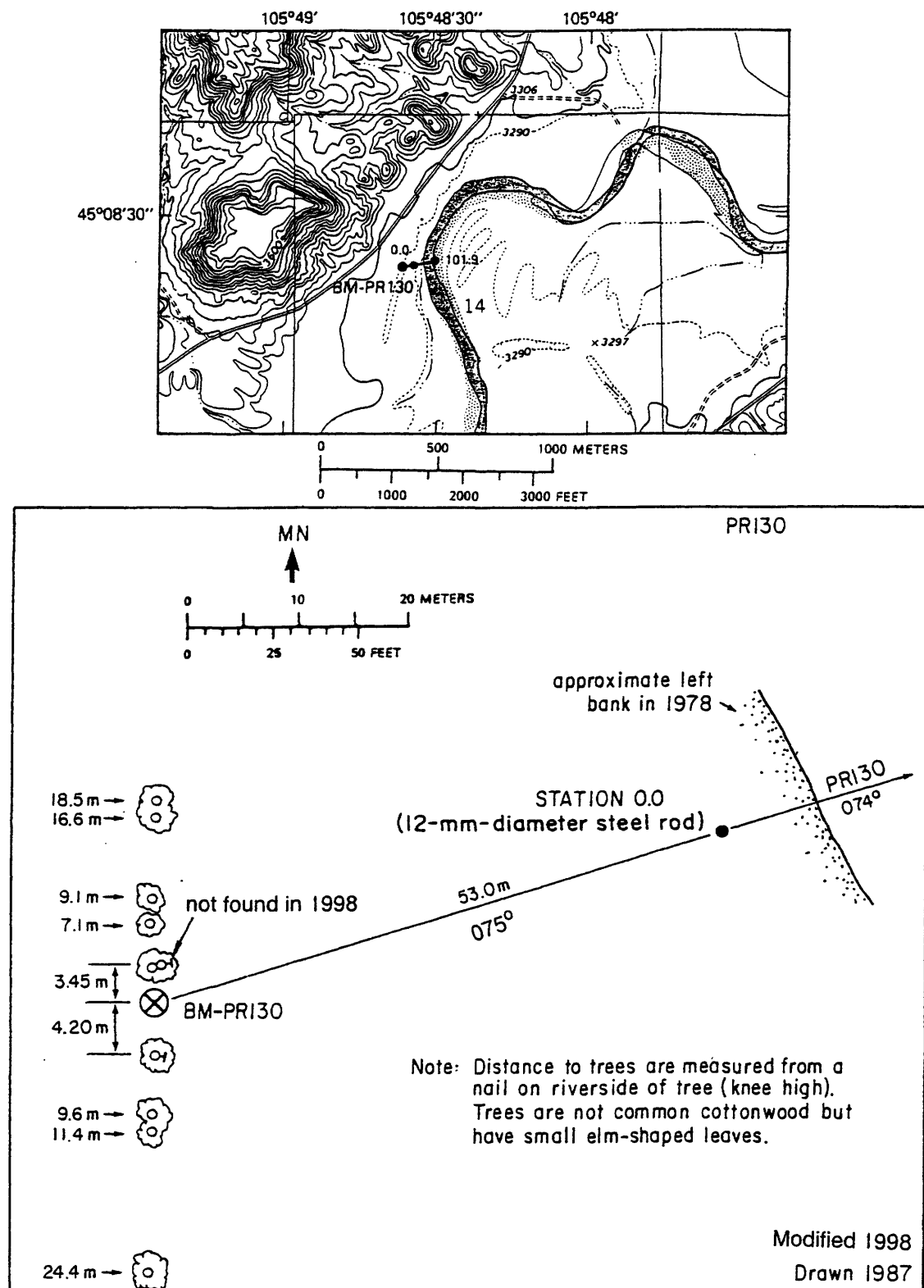


Figure 31. Upper: Location of cross section PR130, bench mark BM-PR130, and the left and right bank reference monuments in the Bloom Creek quadrangle. Lower: Location of the bench mark on the left bank. MN is magnetic north.

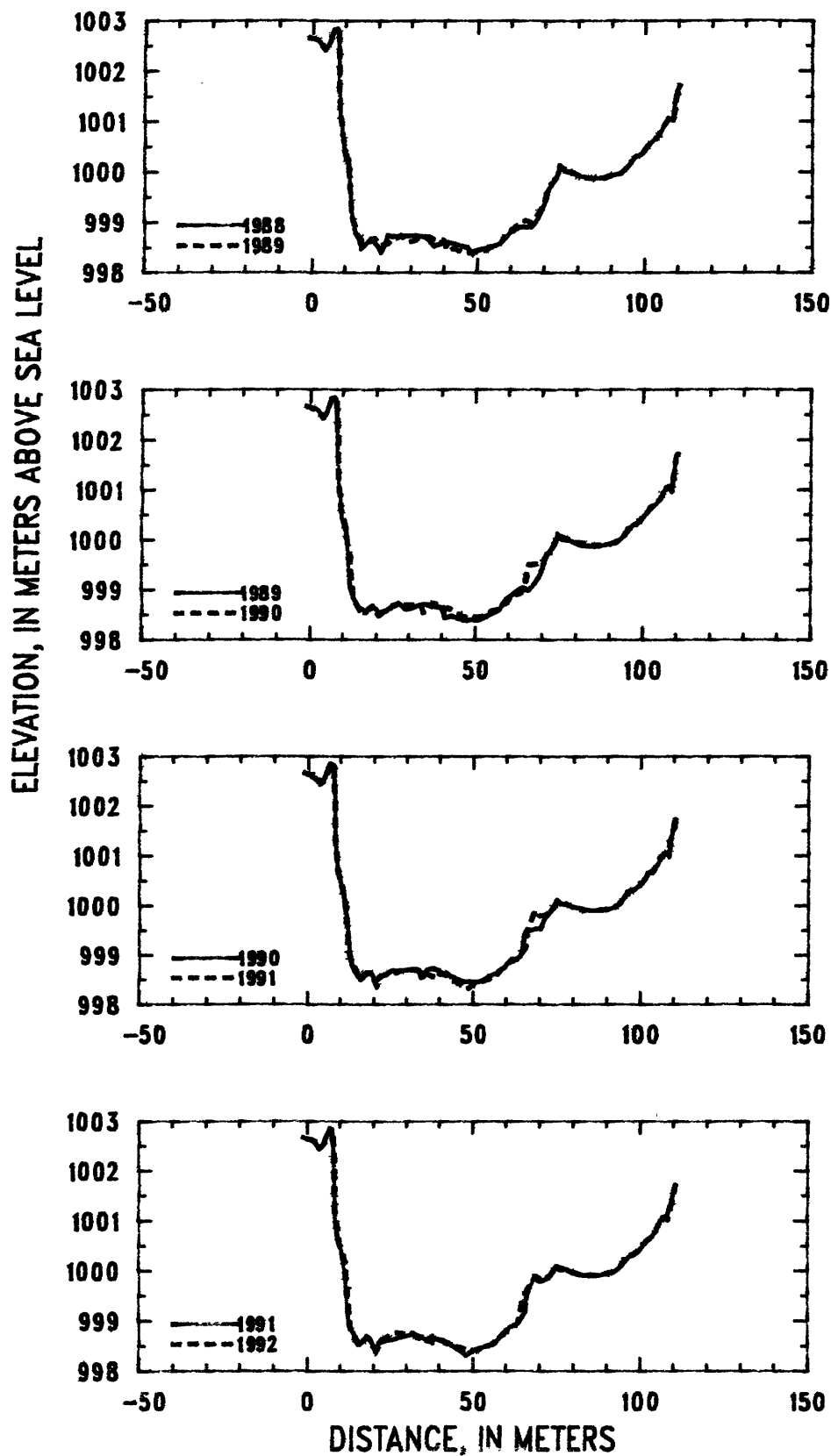


Figure 32. Profiles of cross section PR130 from 1988 to 1992.

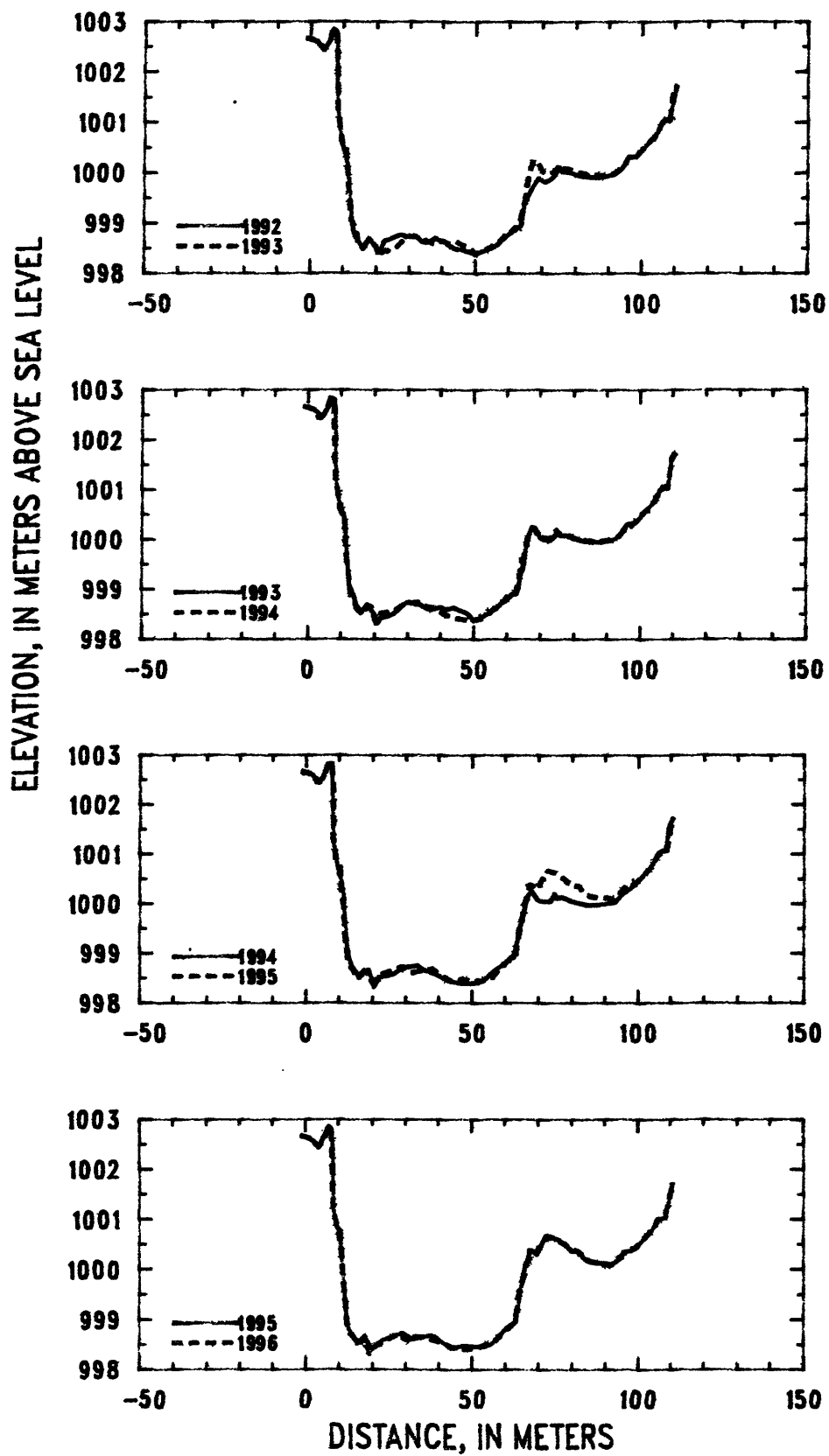


Figure 33. Profiles of cross section PR130 from 1992 to 1996.

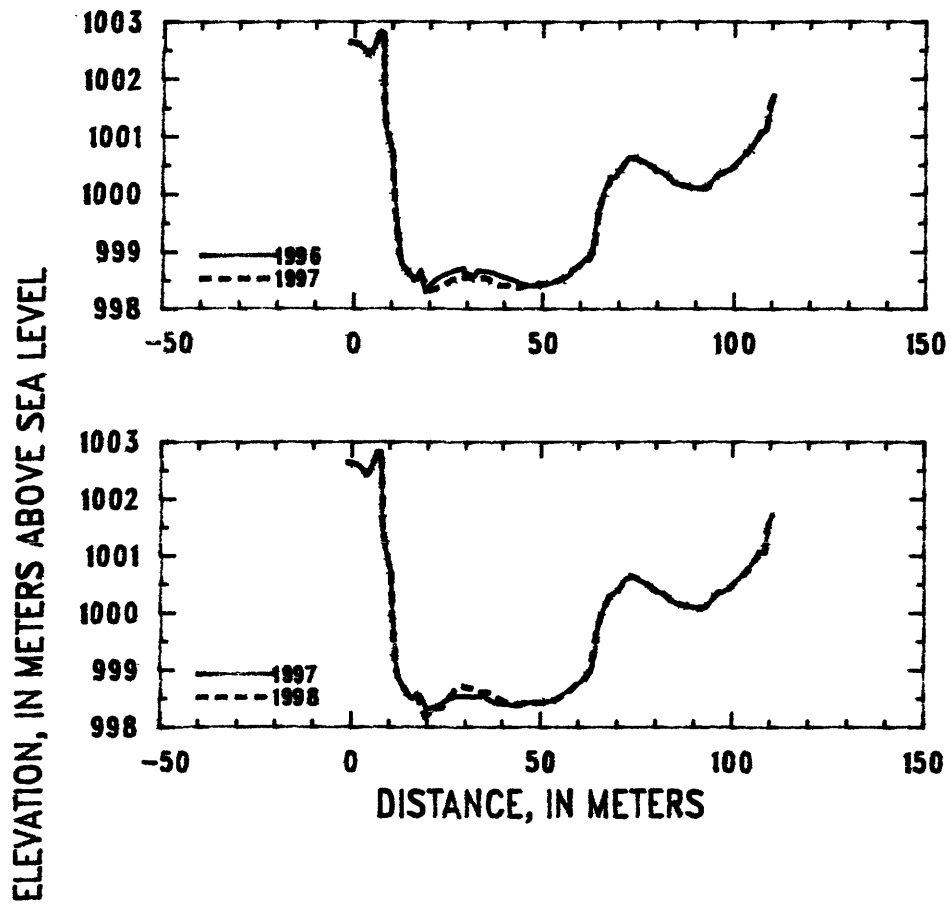


Figure 34. Profiles of cross section PR130 from 1996 to 1998.

Table 13. Listing of horizontal stations and elevations for cross section PR130

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1990		1990		1991	
17 September		17 September		15 September		15 September		28 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.1	1002.67	63.2	999.02	-1.1	1002.67	51.0	998.45	-1.1	1002.67
0.0	1002.65	64.4	999.04	0.0	1002.65	53.0	998.48	0.0	1002.65
2.0	1002.61	66.0	998.99	1.0	1002.61	55.0	998.57	2.0	1002.61
4.0	1002.43	68.0	999.14	3.0	1002.51	57.0	998.62	4.0	1002.44
5.0	1002.53	69.0	999.26	4.0	1002.44	57.7	998.68	5.0	1002.51
6.4	1002.82	70.0	999.41	5.0	1002.53	59.5	998.74	6.0	1002.69
7.6	1002.84	71.0	999.66	6.4	1002.80	60.3	998.83	7.0	1002.85
8.1	1002.76	72.0	999.76	7.0	1002.85	61.7	998.92	7.8	1002.83
8.3	1002.21	73.0	999.83	8.0	1002.81	62.5	998.90	8.3	1002.19
8.4	1001.30	74.4	1000.02	8.5	1002.16	64.2	998.98	8.4	1001.22
10.0	1000.38	74.5	1000.11	8.6	1001.18	65.0	999.16	9.4	1000.63
11.0	1000.20	76.0	1000.01	9.5	1000.64	65.3	999.42	10.2	1000.46
12.0	999.24	78.0	1000.01	10.6	1000.30	66.1	999.51	11.5	999.97
12.4	999.03	80.0	999.93	11.0	1000.24	67.0	999.50	12.5	999.06
13.3	998.89	82.0	999.88	11.4	999.94	69.0	999.53	13.4	998.83
13.5	998.78	84.0	999.87	12.2	999.68	70.0	999.53	15.2	998.62
15.0	998.64	86.0	999.87	12.3	999.51	71.4	999.75	16.0	998.53
17.0	998.58	88.0	999.89	13.1	998.87	73.0	999.86	17.5	998.65
19.0	998.68	90.0	999.92	13.8	998.75	75.0	1000.11	19.0	998.66
21.0	998.54	92.0	999.94	16.0	998.49	76.0	1000.03	20.9	998.37
23.0	998.57	94.0	1000.06	17.8	998.61	78.0	1000.02	21.8	998.57
25.0	998.68	95.0	1000.13	19.2	998.64	80.0	999.96	23.0	998.59
27.0	998.74	97.0	1000.30	20.8	998.48	82.0	999.95	26.0	998.64
29.0	998.61	99.0	1000.35	22.0	998.55	84.0	999.90	29.0	998.69
31.0	998.62	100.0	1000.46	24.3	998.62	86.0	999.89	32.0	998.72
33.0	998.70	101.9	1000.59	24.6	998.66	88.0	999.91	33.0	998.73
35.0	998.71	104.0	1000.72	26.0	998.70	90.0	999.91	34.8	998.67
37.0	998.67	105.0	1000.83	28.0	998.69	92.0	999.96	38.0	998.55
39.0	998.65	106.0	1000.96	30.0	998.71	94.0	1000.06	38.2	998.65
40.0	998.64	107.0	1001.05	32.0	998.71	96.0	1000.28	40.8	998.62
41.0	998.44	108.5	1001.00	34.0	998.67	98.0	1000.31	42.4	998.58
43.0	998.48	109.9	1001.66	34.5	998.54	100.0	1000.44	44.0	998.49
45.0	998.42	110.6	1001.74	35.4	998.57	101.8	1000.60	46.0	998.42
47.0	998.39			36.2	998.70	101.9	1000.64	48.0	998.31
49.0	998.40			38.0	998.73	104.0	1000.73	50.0	998.41
51.0	998.39			40.0	998.68	105.0	1000.82	52.0	998.45
53.0	998.46			41.0	998.61	107.0	1001.05	54.0	998.49
55.0	998.53			42.0	998.64	108.0	1001.07	56.0	998.53
57.0	998.58			43.0	998.59	108.5	1001.00	57.0	998.58
58.9	998.78			45.0	998.51	110.0	1001.68	59.0	998.74
60.0	998.83			47.0	998.46	110.6	1001.75	61.0	998.87
62.0	998.95			49.0	998.46			63.0	998.91

Table 13. (Continued) Listing of horizontal stations and elevations for cross section PR130
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1992		1992		1993		1993	
28 August		26 August		26 August		27 August		27 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
65.6	999.15	0.0	1002.65	65.5	999.50	-1.2	1002.68	60.6	998.84
66.1	999.52	2.0	1002.61	65.7	999.56	0.0	1002.65	61.4	998.88
68.6	999.89	3.0	1002.51	68.0	999.81	2.0	1002.61	61.8	998.91
69.8	999.79	4.0	1002.44	69.0	999.89	3.0	1002.52	62.8	998.91
71.0	999.79	5.5	1002.57	71.0	999.82	4.0	1002.44	63.3	998.99
73.0	999.88	7.0	1002.85	73.0	999.90	5.4	1002.55	64.3	999.34
74.0	999.98	7.9	1002.80	74.0	999.99	6.6	1002.83	64.8	999.40
75.0	1000.10	8.3	1002.28	75.0	1000.12	7.9	1002.81	65.0	999.49
77.0	1000.05	8.4	1001.29	76.0	1000.02	8.4	1002.23	66.0	999.99
78.0	1000.02	9.7	1000.59	78.0	1000.02	8.5	1001.24	66.5	1000.12
80.0	999.96	10.4	1000.42	80.0	999.96	9.7	1000.60	67.4	1000.25
82.0	999.92	11.5	1000.15	82.0	999.93	10.3	1000.51	69.0	1000.17
84.0	999.91	13.0	998.90	84.0	999.92	10.8	1000.52	70.0	1000.03
86.0	999.90	13.5	998.79	86.0	999.90	11.3	1000.20	71.0	1000.01
88.0	999.92	14.5	998.64	88.0	999.91	12.0	999.60	73.0	1000.00
90.0	999.94	16.0	998.48	90.0	999.95	12.5	999.06	74.0	1000.06
92.0	999.97	18.0	998.69	92.0	999.97	14.0	998.87	75.0	1000.16
93.5	1000.03	20.0	998.50	94.0	1000.08	14.6	998.62	76.0	1000.08
95.0	1000.16	21.0	998.41	96.0	1000.32	16.0	998.52	78.0	1000.08
97.0	1000.31	22.4	998.63	98.0	1000.32	18.0	998.69	80.0	1000.02
99.0	1000.35	25.0	998.71	100.0	1000.48	20.0	998.50	82.0	1000.00
101.0	1000.52	27.0	998.77	101.9	1000.60	21.0	998.32	84.0	999.96
102.0	1000.60	28.8	998.75	104.0	1000.72	22.0	998.43	86.0	999.96
104.0	1000.71	29.0	998.72	106.0	1001.01	24.0	998.46	88.0	999.94
106.0	1000.99	32.0	998.75	107.0	1001.07	26.0	998.52	90.0	999.98
108.0	1001.07	34.0	998.62	108.4	1001.02	28.0	998.64	92.0	1000.00
110.6	1001.72	36.0	998.61	110.6	1001.73	30.0	998.74	94.0	1000.10
		38.0	998.69			32.0	998.72	95.0	1000.18
		40.0	998.63			34.0	998.69	95.4	1000.24
		42.0	998.56			36.0	998.61	96.0	1000.31
		44.0	998.47			38.0	998.60	98.0	1000.32
		46.0	998.47			40.0	998.64	100.0	1000.46
		48.0	998.42			42.0	998.60	101.9	1000.60
		50.0	998.40			44.0	998.64	103.0	1000.68
		52.0	998.43			46.0	998.56	104.6	1000.78
		54.0	998.48			48.0	998.52	106.0	1001.00
		56.0	998.54			50.0	998.38	108.0	1001.05
		58.0	998.66			52.0	998.42	108.5	1001.04
		60.0	998.78			54.0	998.51	109.6	1001.64
		62.0	998.88			56.0	998.57	110.6	1001.73
		63.7	998.96			58.0	998.68		
		64.8	999.41			60.0	998.85		

Table 13. (Continued) Listing of horizontal stations and elevations for cross section PR130

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1994		1994		1995		1995		1996	
25 September		25 September		24 September		24 September		17 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.1	1002.67	66.0	999.99	-1.2	1002.65	80.0	1000.36	-1.2	1002.66
0.0	1002.64	67.0	1000.19	0.0	1002.65	82.0	1000.36	0.0	1002.65
2.0	1002.59	68.0	1000.25	2.0	1002.59	84.0	1000.20	2.0	1002.58
3.2	1002.44	70.0	1000.06	4.0	1002.44	86.0	1000.14	4.0	1002.44
5.0	1002.51	72.0	1000.03	6.0	1002.70	88.0	1000.12	5.5	1002.58
6.5	1002.81	73.5	1000.05	7.0	1002.85	90.0	1000.12	7.0	1002.85
7.8	1002.81	74.7	1000.20	7.8	1002.80	92.0	1000.09	7.8	1002.81
8.1	1001.82	75.4	1000.11	8.3	1002.28	94.0	1000.18	8.0	1002.46
8.4	1001.16	77.0	1000.14	8.3	1001.27	96.0	1000.34	8.3	1001.23
10.0	1000.64	78.0	1000.10	9.3	1000.85	98.0	1000.37	9.5	1000.88
11.2	1000.31	80.0	1000.04	10.3	1000.76	100.0	1000.48	10.3	1000.77
11.7	999.67	82.5	1000.00	12.1	999.25	101.9	1000.61	11.8	999.38
12.9	998.94	85.0	999.97	12.7	998.85	104.0	1000.74	12.1	999.29
13.7	998.76	88.0	999.97	15.5	998.52	106.0	1000.99	12.7	998.85
14.8	998.65	91.0	1000.01	17.7	998.66	108.5	1001.03	13.0	998.76
16.0	998.51	93.0	1000.03	20.0	998.41	110.6	1001.72	15.0	998.60
18.0	998.65	95.0	1000.19	23.0	998.59			16.0	998.49
19.0	998.66	98.0	1000.32	26.0	998.67			17.7	998.65
20.5	998.33	100.0	1000.47	29.0	998.74			19.0	998.30
22.0	998.52	101.9	1000.60	32.0	998.61			21.0	998.47
24.0	998.54	104.0	1000.73	35.0	998.66			24.0	998.59
26.0	998.57	106.0	1001.00	38.0	998.68			27.0	998.68
28.0	998.66	107.0	1001.06	41.0	998.55			29.0	998.71
30.0	998.72	108.5	1001.07	44.0	998.43			29.5	998.62
32.0	998.73	109.5	1001.58	47.0	998.48			32.0	998.56
33.7	998.75	110.6	1001.73	50.0	998.46			33.0	998.66
35.2	998.66			53.0	998.44			36.0	998.65
38.0	998.62			56.0	998.50			39.0	998.57
41.0	998.51			59.0	998.72			42.0	998.50
44.0	998.43			60.7	998.85			45.0	998.42
47.0	998.39			63.2	998.95			48.0	998.40
50.0	998.39			64.5	999.51			51.0	998.41
53.0	998.44			66.0	1000.05			54.0	998.50
55.0	998.54			67.0	1000.22			57.0	998.57
57.0	998.67			67.3	1000.38			59.5	998.76
60.0	998.80			68.2	1000.37			61.0	998.84
62.0	998.93			69.5	1000.30			63.0	998.94
62.5	998.91			71.0	1000.48			63.5	999.14
64.0	999.32			72.2	1000.67			64.5	999.68
64.1	999.46			74.0	1000.65			65.2	999.78
64.3	999.48			76.0	1000.58			66.2	1000.07
65.2	999.70			78.0	1000.48			68.0	1000.29

Table 13. (Continued) Listing of horizontal stations and elevations for cross section PR130
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1997		1997		1998		1998	
17 October		19 September		19 September		22 September		22 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
69.0	1000.29	-1.2	1002.66	80.0	1000.38	-1.1	1002.65	70.0	1000.38
70.0	1000.41	0.0	1002.65	82.0	1000.35	0.0	1002.64	72.0	1000.59
71.0	1000.49	2.0	1002.59	84.0	1000.20	2.0	1002.59	73.0	1000.65
72.5	1000.63	4.0	1002.44	86.0	1000.16	4.0	1002.43	74.0	1000.64
74.0	1000.63	5.5	1002.60	88.0	1000.12	6.0	1002.70	76.0	1000.58
76.0	1000.57	6.7	1002.83	90.0	1000.09	7.7	1002.83	78.0	1000.49
79.0	1000.44	7.7	1002.83	93.0	1000.11	8.0	1002.13	80.0	1000.37
82.0	1000.34	7.9	1002.41	96.0	1000.35	8.1	1001.46	82.0	1000.34
83.0	1000.31	8.1	1001.59	98.0	1000.38	9.9	1000.82	84.0	1000.21
84.0	1000.20	8.4	1001.28	100.0	1000.49	10.4	1000.74	86.0	1000.16
86.0	1000.15	9.7	1000.87	101.9	1000.62	10.9	999.76	88.0	1000.13
88.0	1000.12	10.4	1000.76	105.0	1000.85	11.8	999.08	90.0	1000.09
90.0	1000.10	11.1	999.77	107.0	1001.08	12.5	998.87	92.0	1000.08
92.0	1000.09	12.3	998.94	108.5	1001.06	15.5	998.52	94.0	1000.18
94.0	1000.19	13.3	998.75	109.5	1001.57	17.3	998.57	96.0	1000.36
96.0	1000.35	16.0	998.51	110.6	1001.73	19.5	998.17	98.0	1000.37
97.0	1000.38	18.0	998.56	80.0	1000.38	22.0	998.34	100.0	1000.50
99.0	1000.42	20.0	998.32	82.0	1000.35	24.0	998.34	101.9	1000.61
101.9	1000.61	23.0	998.38	84.0	1000.20	26.0	998.54	103.3	1000.69
104.0	1000.78	26.0	998.52	86.0	1000.16	28.0	998.72	105.0	1000.85
105.0	1000.84	29.0	998.56	88.0	1000.12	30.0	998.71	107.0	1001.07
107.0	1001.08	32.0	998.53	90.0	1000.09	32.0	998.68	108.4	1001.01
108.6	1001.12	35.0	998.55	93.0	1000.11	34.0	998.61	109.4	1001.56
110.6	1001.73	38.0	998.42	96.0	1000.35	36.0	998.62	110.6	1001.73
		41.0	998.41	98.0	1000.38	38.0	998.55		
		44.0	998.37	100.0	1000.49	40.0	998.47		
		47.0	998.44	101.9	1000.62	42.0	998.41		
		50.0	998.44	105.0	1000.85	44.0	998.40		
		53.0	998.47	107.0	1001.08	46.0	998.44		
		56.0	998.56	108.5	1001.06	48.0	998.42		
		59.2	998.74	109.5	1001.57	50.0	998.43		
		62.2	998.87	110.6	1001.73	52.0	998.43		
		63.2	998.98			54.0	998.48		
		63.8	999.15			56.0	998.56		
		65.0	999.83			58.0	998.65		
		66.0	999.99			60.0	998.79		
		68.0	1000.30			61.6	998.85		
		70.0	1000.39			62.8	998.95		
		72.0	1000.59			63.8	999.26		
		74.0	1000.64			64.4	999.63		
		76.0	1000.57			65.5	999.92		
		78.0	1000.50			68.0	1000.32		

Description of Cross Section PR136

Location: Township 8 South/Range 49 East--section 6

U. S. Geological Survey quadrangle (1:24,000): Bloom Creek

Landowners--left bank: Gay Ranch

--right bank: Bowers Ranch

Access: Left bank

Permission from: Gay Ranch

Distance from Moorhead Gaging Station: 20.19 kilometers

Azimuth of Section (degrees magnetic): 129

Reference Monuments

[Monuments at stations -20.0, -1.5, and 0.0 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; bent nearly flat with 1998 ground level, 0.13 meter long	-82.5					994.18
Benchmark--brass circular plate	-32.6	45°10'05.91"	105°46'26.89"	0.283	0.433	994.30
1/2-inch-rebar; 0.19 meter above 1998 ground level	-20.0					994.50
1/2-inch-rebar; 0.18 meter above 1998 ground level	-1.5					994.72
1/2-inch-rebar; 0.01 meter below 1998 ground level; about 0.02 meter upstream and landward from the other monument at -1.5	-1.5					994.53
1/2-inch-rebar; at 1998 ground level	0.0					994.59
1/2-inch-rebar; 0.03 meter above 1998 ground level; about 35 meters upstream from a large solitary cottonwood tree at the edge of the right bank	112.0					994.45
1/2-inch-rebar; 0.16 meter above 1998 ground level; about 35 meters upstream from a large solitary cottonwood tree at the edge of the right bank	115.0	45°10'02.15"	105°46'22.71"	0.255	0.645	994.80

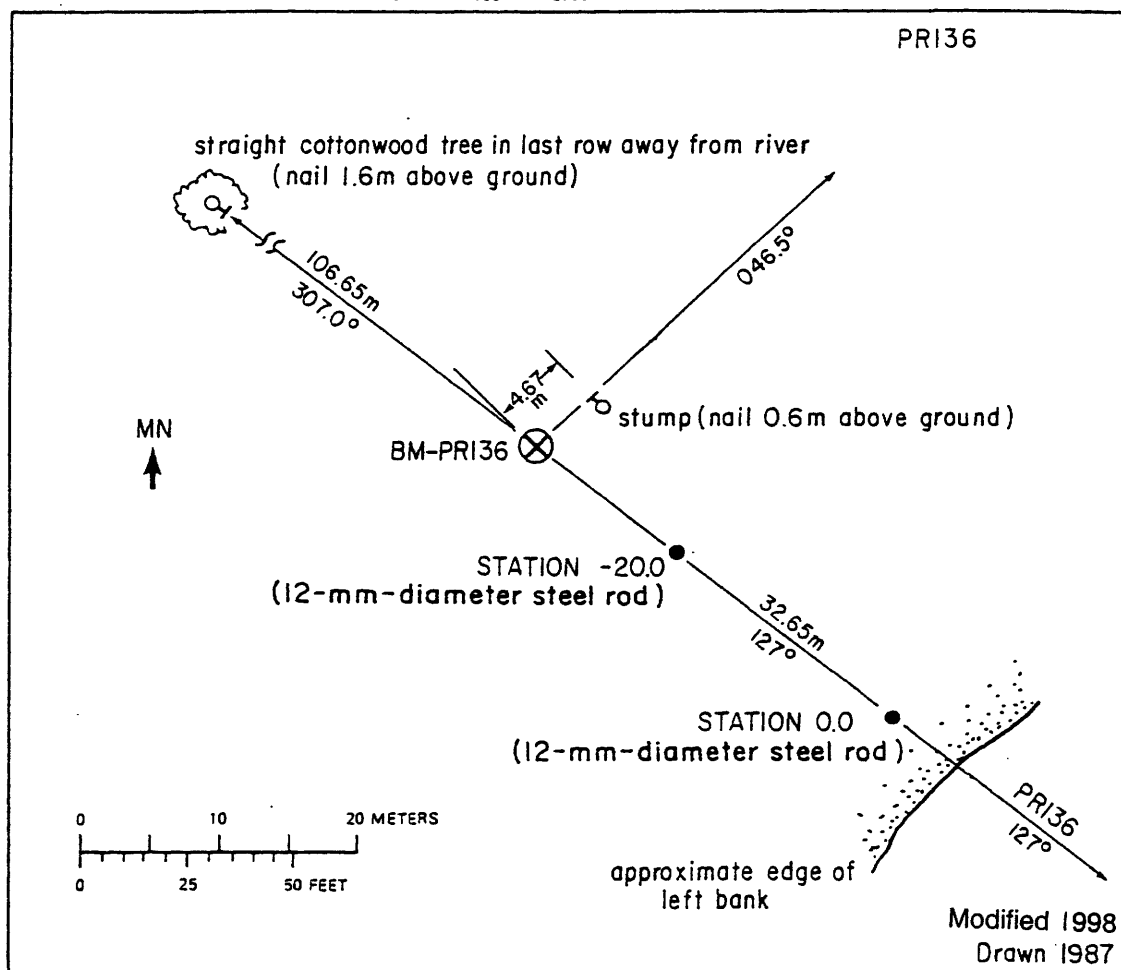
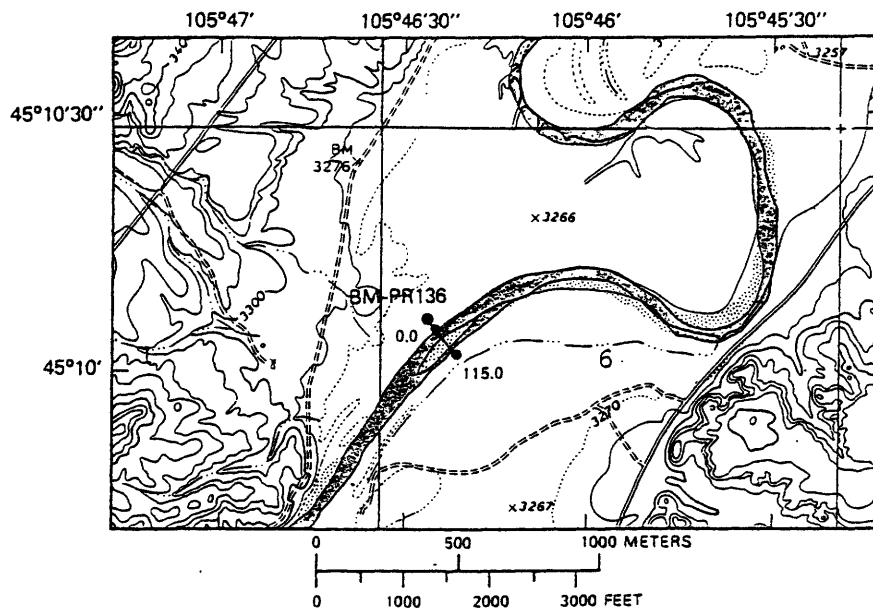


Figure 35. Upper: Location of cross section PR136, bench mark BM-PR136, and the left and right bank reference monuments in the Bloom Creek quadrangle. Lower: Location of the bench mark on the left bank. MN is magnetic north.

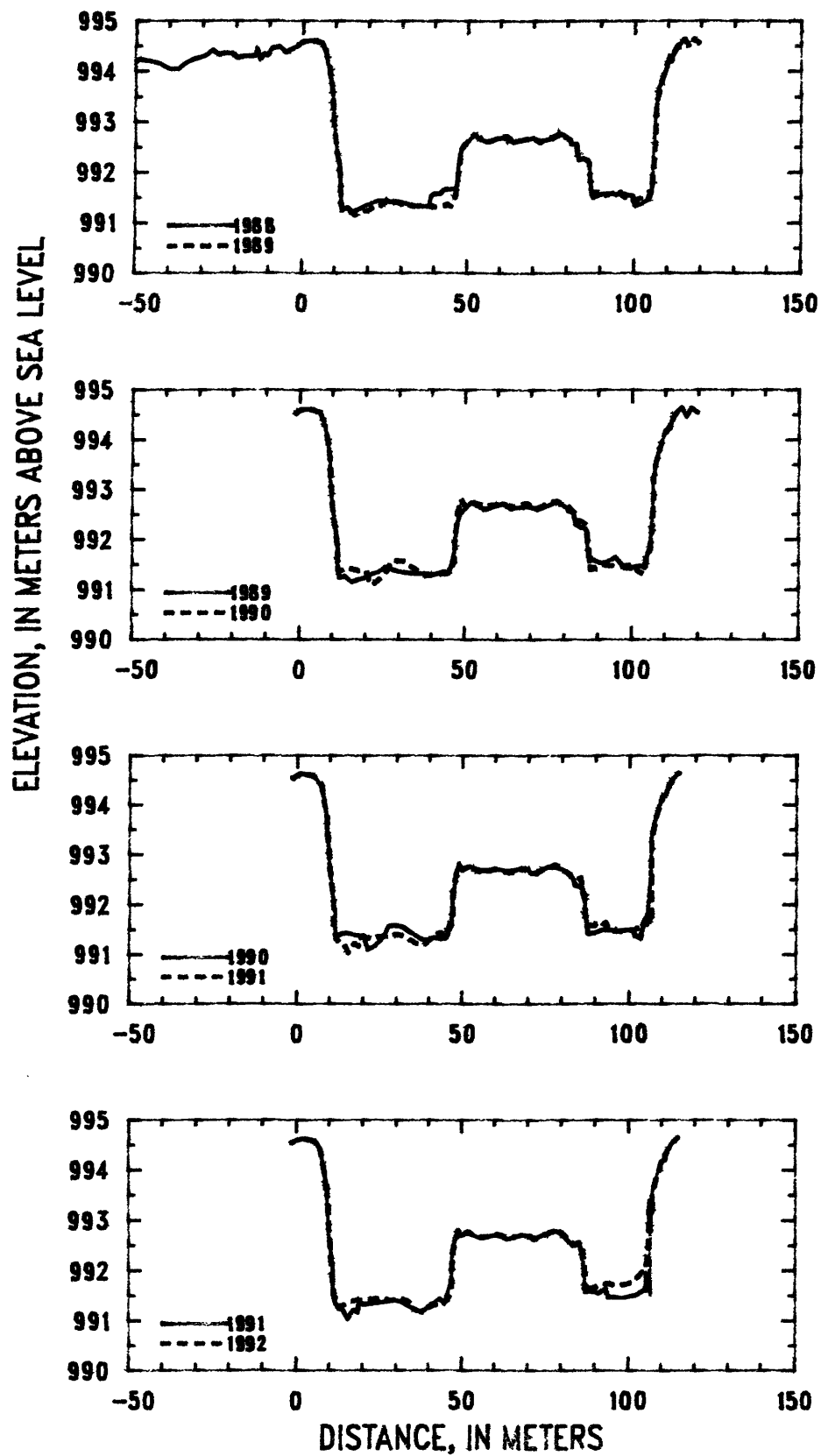


Figure 36. Profiles of cross section PR136 from 1988 to 1992.

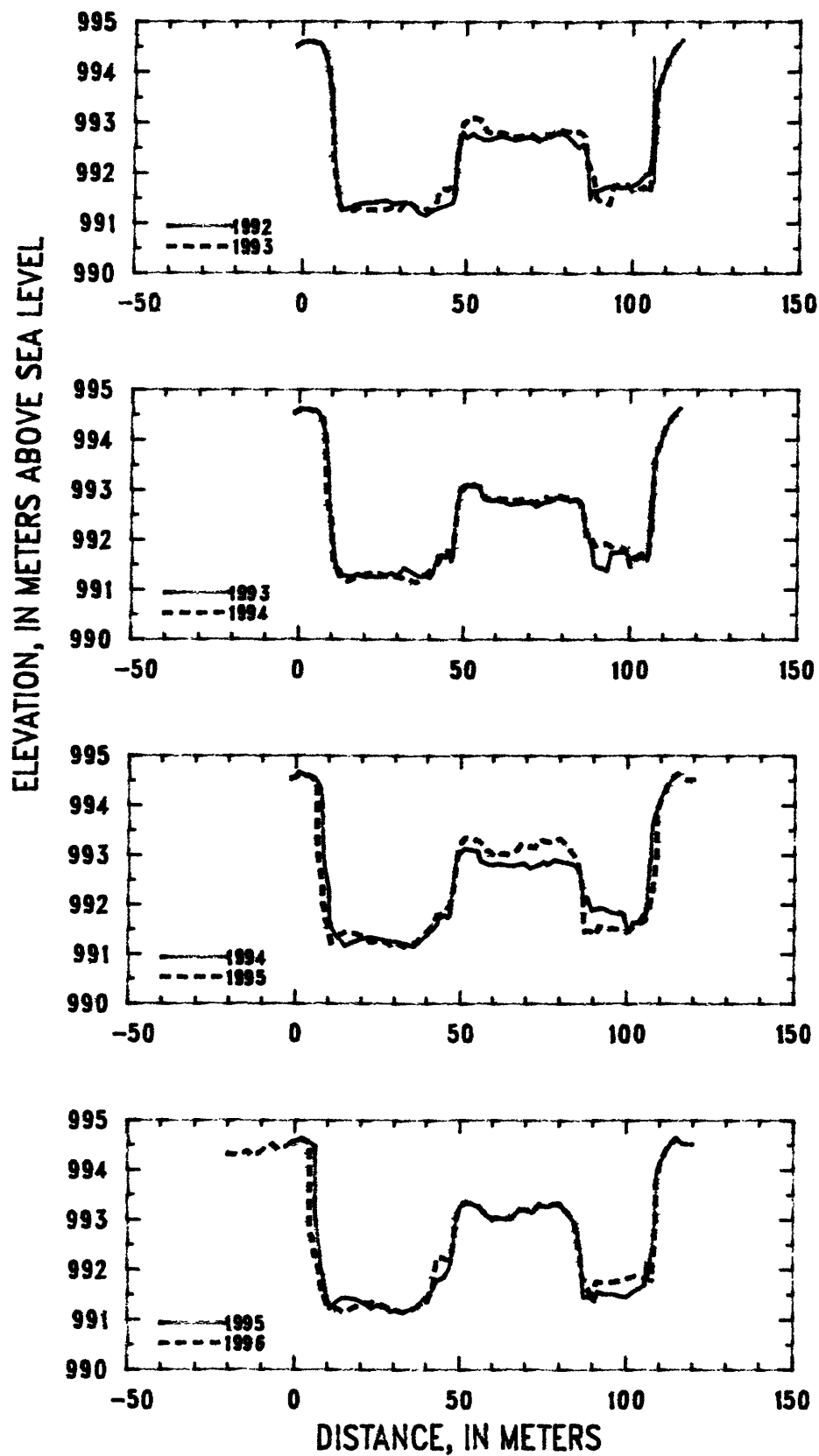


Figure 37. Profiles of cross section PR136 from 1992 to 1996.

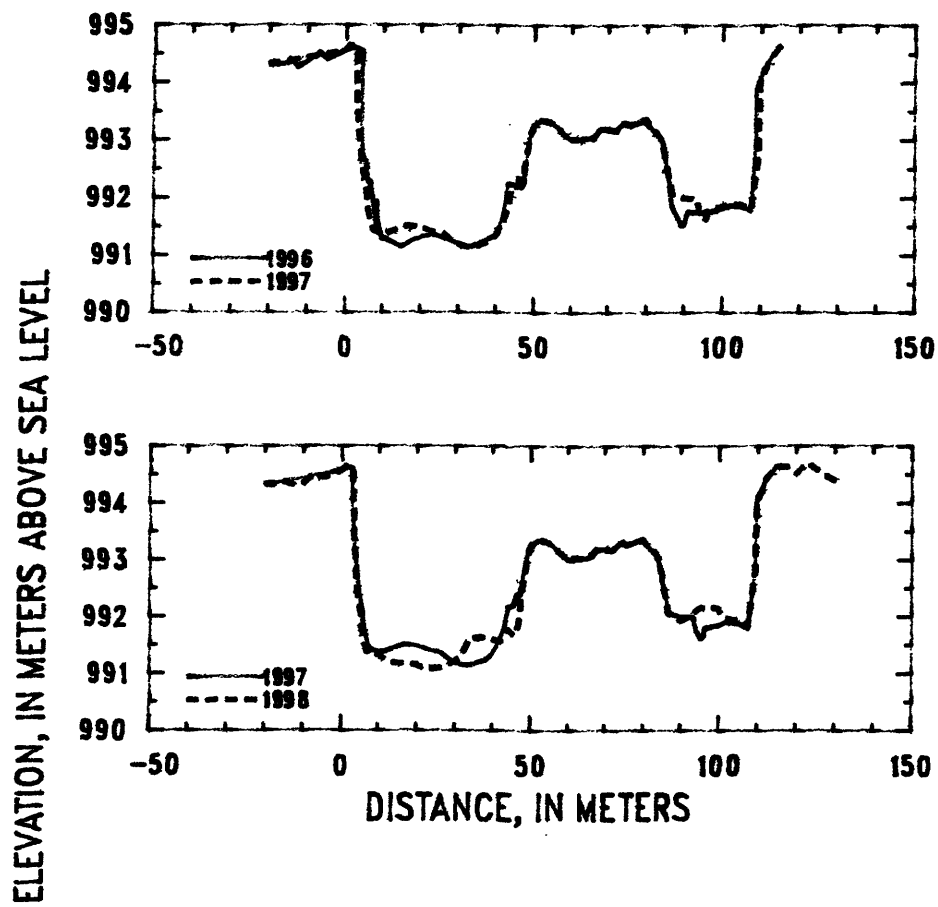


Figure 38. Profiles of cross section PR136 from 1996 to 1998.

Table 14. Listing of horizontal stations and elevations for cross section PR136

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1989		1990		1990	
18 September		18 September		18 September		15 September		15 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.5	994.52	58.0	992.64	111.0	994.21	-1.5	994.52	49.6	992.71
0.0	994.59	60.0	992.69	112.0	994.39	0.0	994.60	50.0	992.68
2.0	994.62	62.0	992.72	113.0	994.50	1.0	994.63	51.0	992.73
4.0	994.60	64.0	992.61	115.0	994.64	3.0	994.60	52.0	992.76
6.0	994.55	66.0	992.64	116.6	994.48	5.0	994.56	53.0	992.73
7.0	994.40	68.0	992.67	118.0	994.64	7.0	994.41	55.0	992.69
8.0	994.14	70.0	992.67	120.0	994.53	8.0	994.16	57.0	992.67
8.4	994.01	72.0	992.59			8.5	993.94	59.0	992.70
9.0	993.76	74.0	992.66			9.0	993.79	61.0	992.70
10.0	992.77	76.0	992.70			9.4	993.30	63.0	992.67
11.0	992.22	78.0	992.78			10.2	992.55	65.0	992.67
11.5	992.03	79.5	992.70			11.6	991.86	67.0	992.71
11.7	991.87	81.0	992.64			11.7	991.51	69.0	992.73
11.8	991.39	81.3	992.57			11.8	991.33	71.0	992.62
12.3	991.24	82.5	992.56			12.0	991.35	73.0	992.64
14.0	991.27	83.0	992.48			14.0	991.42	75.0	992.73
16.0	991.15	83.5	992.31			16.0	991.42	77.0	992.77
18.0	991.20	85.0	992.24			18.0	991.38	79.0	992.73
20.0	991.24	86.0	992.24			20.3	991.36	81.0	992.68
22.0	991.32	86.6	992.19			21.5	991.09	83.0	992.55
24.0	991.35	87.2	991.71			23.0	991.13	84.0	992.38
26.0	991.46	87.5	991.69			25.0	991.25	86.0	992.33
28.0	991.41	87.7	991.57			26.8	991.41	87.0	992.05
30.0	991.37	88.5	991.61			27.4	991.54	87.4	991.74
32.0	991.35	90.0	991.56			28.0	991.58	87.7	991.55
34.0	991.32	91.5	991.53			30.0	991.59	88.0	991.41
36.0	991.32	94.0	991.59			32.0	991.56	90.0	991.43
38.0	991.33	95.2	991.66			32.4	991.53	92.0	991.49
40.0	991.30	96.7	991.54			33.0	991.51	94.0	991.48
42.0	991.33	98.0	991.43			34.0	991.44	96.0	991.48
44.0	991.37	100.0	991.43			36.0	991.37	98.0	991.47
45.0	991.32	102.0	991.48			38.0	991.29	100.0	991.50
45.5	991.36	103.3	991.46			40.0	991.29	101.3	991.48
46.5	991.55	104.0	991.44			41.0	991.33	101.7	991.37
47.0	991.76	104.5	991.53			42.0	991.34	103.4	991.32
47.2	992.00	104.7	991.73			44.0	991.31	104.1	991.54
48.0	992.40	105.4	991.76			45.2	991.33	104.2	991.61
49.0	992.55	106.4	992.60			46.8	991.56	105.4	991.80
50.0	992.60	106.6	993.28			47.0	991.61	106.1	992.21
52.0	992.75	107.0	993.46			47.1	992.02	106.5	992.78
54.0	992.67	108.0	993.76			48.0	992.56	106.6	993.28
56.0	992.60	110.0	994.18			48.9	992.81	107.0	993.50

Table 14. (Continued) Listing of horizontal stations and elevations for cross section PR136
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1990		1991		1991		1992		1992	
15 September		29 August		29 August		26 August		26 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
108.0	993.77	-1.5	994.53	62.0	992.68	-1.5	994.53	60.0	992.72
110.0	994.15	0.0	994.58	64.0	992.62	0.0	994.59	62.0	992.72
111.0	994.21	2.0	994.63	66.0	992.65	2.0	994.63	64.0	992.66
112.0	994.39	4.0	994.60	68.0	992.71	4.0	994.60	66.0	992.67
113.0	994.50	6.0	994.54	70.0	992.70	6.0	994.56	68.0	992.71
115.0	994.65	7.4	994.37	72.0	992.61	7.4	994.37	70.0	992.71
		8.5	993.94	74.0	992.70	8.4	993.99	72.0	992.62
		9.0	993.80	76.0	992.71	8.7	993.90	74.0	992.70
		9.5	993.30	78.0	992.79	9.2	993.47	76.0	992.73
		10.1	992.55	80.0	992.74	9.5	993.56	78.0	992.81
		11.1	992.11	81.0	992.66	10.0	992.86	80.0	992.77
		11.2	991.56	82.0	992.61	10.5	992.32	82.0	992.63
		11.5	991.41	83.3	992.50	11.0	991.69	84.0	992.51
		12.1	991.31	84.0	992.49	11.4	991.61	85.3	992.56
		13.0	991.23	85.6	992.53	12.2	991.27	86.1	992.49
		14.0	991.23	86.8	992.07	14.0	991.29	86.6	992.35
		15.7	991.03	87.0	991.63	16.0	991.36	87.0	992.06
		17.4	991.21	88.0	991.58	18.0	991.40	87.2	991.67
		18.7	991.16	90.0	991.58	20.0	991.41	87.5	991.52
		19.1	991.34	91.2	991.54	22.0	991.42	88.0	991.64
		21.0	991.32	93.2	991.64	24.0	991.44	90.0	991.65
		24.0	991.34	94.2	991.46	26.0	991.46	92.0	991.72
		27.0	991.38	96.0	991.47	28.0	991.39	94.0	991.74
		30.0	991.40	98.0	991.45	30.0	991.41	96.0	991.70
		32.0	991.36	100.0	991.49	32.0	991.43	98.0	991.71
		33.8	991.29	102.0	991.50	34.0	991.37	100.0	991.74
		36.0	991.22	103.0	991.53	36.0	991.20	102.0	991.80
		37.8	991.17	105.0	991.62	38.0	991.16	104.0	991.96
		39.0	991.21	105.3	991.60	40.0	991.26	105.0	991.98
		41.0	991.34	105.4	991.86	42.0	991.31	106.0	992.34
		43.6	991.44	106.5	991.61	44.0	991.35	106.3	993.42
		45.0	991.34	106.6	993.26	46.0	991.41	106.5	992.75
		47.0	991.73	108.0	993.76	47.0	991.60	106.6	993.17
		47.2	992.26	110.0	994.17	47.2	992.17	107.0	993.39
		48.0	992.60	111.0	994.20	47.5	992.40	107.0	993.15
		48.9	992.78	112.0	994.41	48.0	992.50	107.2	993.52
		50.0	992.70	114.0	994.60	49.0	992.79	108.0	993.74
		52.0	992.76	115.0	994.64	50.0	992.70	110.0	994.14
		54.0	992.68			52.0	992.77	112.0	994.40
		56.0	992.64			54.0	992.69	115.0	994.65
		58.0	992.67			56.0	992.66		
		60.0	992.71			58.0	992.67		

Table 14. (Continued) Listing of horizontal stations and elevations for cross section PR136
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1993		1993		1993		1994		1994	
27 August		27 August		27 August		23 September		23 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.5	994.53	53.5	993.08	106.6	992.86	-1.5	994.55	63.0	992.81
0.0	994.59	54.8	993.05	106.8	992.57	0.0	994.58	65.0	992.78
2.0	994.62	56.3	992.83	107.0	992.91	1.0	994.67	67.0	992.81
4.0	994.59	58.0	992.78	107.3	993.55	3.0	994.61	69.0	992.84
6.0	994.56	60.0	992.80	108.0	993.75	5.0	994.58	71.0	992.74
7.5	994.32	62.0	992.78	110.0	994.13	6.5	994.49	73.0	992.79
8.5	993.99	64.0	992.71	112.0	994.41	7.3	994.38	75.0	992.87
9.2	993.49	66.0	992.72	113.5	994.54	8.1	994.08	76.0	992.81
9.9	992.37	68.0	992.75	115.0	994.65	8.3	993.51	78.0	992.91
10.1	992.14	70.0	992.76			8.5	992.97	80.0	992.87
10.5	991.97	72.0	992.67			9.3	992.53	82.0	992.85
11.0	991.70	74.0	992.74			10.1	992.34	84.0	992.82
11.5	991.40	76.0	992.77			10.5	991.62	85.0	992.75
12.3	991.28	78.0	992.86			11.2	991.47	86.0	992.61
14.0	991.28	80.0	992.83			13.0	991.31	86.8	992.14
16.0	991.25	81.0	992.82			15.0	991.17	87.1	992.09
18.0	991.32	82.0	992.79			18.0	991.26	88.0	992.15
20.0	991.27	83.0	992.81			21.0	991.33	89.6	991.88
22.0	991.27	84.0	992.82			24.0	991.33	91.0	991.91
24.0	991.26	85.0	992.78			27.0	991.28	93.0	991.93
26.0	991.29	85.9	992.70			30.0	991.26	95.0	991.85
28.0	991.34	86.1	992.53			33.0	991.21	97.6	991.80
30.0	991.27	86.7	992.20			36.0	991.15	98.0	991.84
32.0	991.45	88.0	991.98			38.0	991.29	99.0	991.80
35.0	991.33	88.5	991.93			40.0	991.39	100.0	991.47
37.0	991.27	89.0	991.71			41.2	991.48	100.8	991.49
39.0	991.28	89.3	991.52			42.6	991.55	101.6	991.63
40.0	991.25	90.0	991.46			43.6	991.73	103.5	991.65
40.9	991.35	92.0	991.43			45.3	991.78	105.0	991.79
42.4	991.68	93.2	991.38			46.3	991.74	105.5	991.77
44.0	991.69	94.5	991.75			46.8	991.80	106.0	992.13
44.6	991.66	96.4	991.76			47.1	991.96	106.5	992.78
45.5	991.73	98.6	991.77			48.0	992.63	107.0	992.98
46.4	991.58	100.0	991.62			49.0	993.02	107.4	993.56
46.8	991.70	102.0	991.67			51.0	993.13	108.0	993.74
47.1	991.91	103.5	991.73			53.0	993.11	110.5	994.25
48.0	992.62	105.0	991.60			54.0	993.09	112.0	994.42
49.0	992.99	105.5	991.72			55.0	993.07	115.0	994.64
50.0	993.01	105.8	991.87			56.0	992.88		
50.3	993.08	105.9	992.05			57.0	992.84		
51.0	993.10	106.1	992.20			59.0	992.80		
52.0	993.09	106.2	992.62			61.0	992.82		

Table 14. (Continued) Listing of horizontal stations and elevations for cross section PR136
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1995		1995		1996		1996		1997	
27 September		27 September		18 October		18 October		19 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.5	994.54	61.0	993.05	-20.0	994.33	54.0	993.33	-20.0	994.33
0.0	994.58	63.0	993.02	-18.0	994.32	56.0	993.26	-1.4	994.55
2.0	994.62	65.0	993.01	-16.0	994.33	58.0	993.11	0.0	994.59
4.0	994.60	67.0	993.10	-14.0	994.39	60.0	993.02	1.0	994.66
6.4	994.48	68.0	993.22	-12.5	994.28	62.0	993.04	2.9	994.61
6.5	993.33	70.0	993.20	-10.0	994.39	64.0	993.03	3.2	993.52
6.6	993.06	72.0	993.15	-7.0	994.53	66.0	993.05	4.3	992.68
8.0	992.29	74.0	993.31	-5.0	994.42	68.0	993.20	5.7	992.11
8.2	991.99	76.0	993.26	-3.0	994.47	70.0	993.21	5.8	991.86
8.8	991.91	78.0	993.32	-1.4	994.54	72.0	993.17	6.6	991.64
8.9	991.75	80.0	993.33	0.0	994.58	74.0	993.30	7.6	991.42
9.1	991.70	82.0	993.17	2.0	994.62	76.0	993.26	9.0	991.38
10.8	991.22	83.0	993.08	4.5	994.55	78.0	993.32	11.0	991.37
13.0	991.39	84.5	992.96	4.5	992.77	80.0	993.31	14.0	991.45
15.0	991.44	85.2	992.84	5.0	992.67	82.0	993.17	17.0	991.51
17.0	991.42	86.5	992.29	5.6	992.62	83.0	993.11	20.0	991.49
19.0	991.39	86.9	992.00	6.1	992.28	84.0	992.99	23.0	991.41
21.0	991.33	87.0	991.67	6.7	992.28	84.6	992.92	26.0	991.38
23.0	991.23	87.3	991.46	7.5	991.93	85.1	992.67	29.0	991.21
25.0	991.29	89.0	991.46	8.2	991.58	86.1	992.32	32.0	991.14
27.0	991.26	90.5	991.38	8.5	991.77	86.7	991.85	35.0	991.16
29.0	991.16	91.5	991.56	8.7	991.60	88.1	991.70	38.0	991.23
31.0	991.20	94.0	991.51	9.7	991.30	89.2	991.52	40.0	991.35
33.0	991.15	96.0	991.52	12.0	991.25	90.0	991.52	42.2	991.65
35.0	991.20	98.0	991.47	15.0	991.14	91.0	991.75	43.2	991.79
37.0	991.25	100.0	991.45	18.0	991.25	93.0	991.76	44.0	992.17
39.0	991.40	102.0	991.57	21.0	991.33	96.0	991.75	45.6	992.21
42.0	991.60	104.0	991.63	24.0	991.35	99.0	991.79	46.3	992.39
42.5	991.71	105.5	991.69	27.0	991.27	102.0	991.87	47.3	992.39
42.9	991.78	106.0	992.04	30.0	991.20	105.0	991.84	48.8	993.04
45.0	991.83	106.4	991.90	33.0	991.14	107.4	991.78	50.0	993.27
46.5	991.98	107.3	992.19	35.0	991.18	108.2	992.37	52.0	993.35
47.3	992.14	108.7	992.96	38.0	991.29	108.8	993.01	54.0	993.33
49.0	993.09	108.8	993.90	40.0	991.33	108.9	993.87	56.0	993.26
50.0	993.25	110.0	994.12	41.8	991.60	110.0	994.12	58.0	993.10
51.0	993.35	112.0	994.41	43.2	992.25	112.0	994.42	60.0	993.00
53.0	993.33	114.0	994.59	45.0	992.24	115.0	994.65	62.0	993.02
55.0	993.29	115.0	994.64	46.7	992.19			64.0	993.02
57.0	993.20	117.0	994.52	47.5	992.26			66.0	993.04
58.0	993.09	120.0	994.52	48.8	993.02			68.0	993.19
59.0	993.06			50.0	993.26			70.0	993.19
60.0	992.99			52.0	993.35			72.0	993.17

Table 14. (Continued) Listing of horizontal stations and elevations for cross section PR136

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1997		1998		1998	
19 September		28 September		28 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
74.0	993.30	-20.0	994.32	62.0	993.04
76.0	993.27	-18.0	994.32	64.0	993.02
78.0	993.32	-15.0	994.37	66.0	993.06
80.0	993.37	-13.0	994.32	68.0	993.22
81.0	993.26	-10.0	994.36	70.0	993.19
83.0	993.11	-7.0	994.51	72.0	993.18
84.0	993.00	-6.0	994.47	74.0	993.32
85.0	992.69	-4.0	994.46	76.0	993.27
86.8	992.07	-1.5	994.52	78.0	993.33
89.0	992.01	0.0	994.59	80.0	993.35
91.0	991.99	1.5	994.62	82.0	993.19
93.2	991.99	3.0	994.58	83.0	993.14
94.2	991.71	3.3	993.40	84.0	993.02
95.3	991.61	4.1	992.47	85.0	992.73
95.8	991.64	5.1	992.01	85.5	992.48
96.3	991.81	5.3	991.80	86.0	992.34
99.0	991.83	6.4	991.43	86.5	992.06
102.0	991.91	7.3	991.33	88.0	992.00
105.0	991.88	10.0	991.34	90.0	991.93
107.4	991.80	13.0	991.19	93.0	992.06
108.0	992.05	16.0	991.17	95.0	992.16
109.3	992.67	19.0	991.16	97.0	992.17
109.7	994.07	22.0	991.10	99.5	992.15
111.0	994.23	25.0	991.09	101.0	991.99
112.0	994.42	28.0	991.15	104.0	991.94
115.0	994.65	31.0	991.27	106.5	991.92
		34.0	991.62	107.3	991.82
		37.0	991.65	109.3	992.78
		40.0	991.60	109.7	994.04
		42.0	991.56	111.0	994.21
		44.0	991.78	112.0	994.42
		45.7	991.67	115.0	994.65
		46.4	991.79	118.0	994.64
		46.8	991.89	120.0	994.53
		47.7	992.49	123.0	994.71
		49.0	993.06	125.0	994.59
		50.0	993.27	130.0	994.39
		52.0	993.35		
		54.0	993.33		
		56.0	993.25		
		58.0	993.10		
		60.0	993.04		

Description of Cross Section PR141

Location: Township 7 South/Range 49 East--section 29

U. S. Geological Survey quadrangle (1:24,000): Bloom Creek

Landowners--left bank: U. S. Government

--right bank:U. S. Government

Access: Left bank

Permission from: Gay Ranch

Distance from Moorhead Gaging Station: 26.10 kilometers

Azimuth of Section (degrees magnetic): 021

Reference Monuments

[Monuments at stations 100.0 and 100.9 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.14 meter above 1998 ground level	-26.5	45°11'31.75"	105°45'13.37"	0.365	0.682	988.47
1/2-inch-rebar; 0.04 meter above 1998 ground level	-0.8	45°11'32.43"	105°45'12.71"	0.319	0.543	988.31
1/2-inch-rebar; 0.09 meter above 1998 ground level	100.0					989.06
1/2-inch-rebar; 0.21 meter above 1998 ground level	100.9					989.19
Benchmark--brass circular plate	123.0	45°11'35.80"	105°45'09.56"	0.336	0.486	988.93

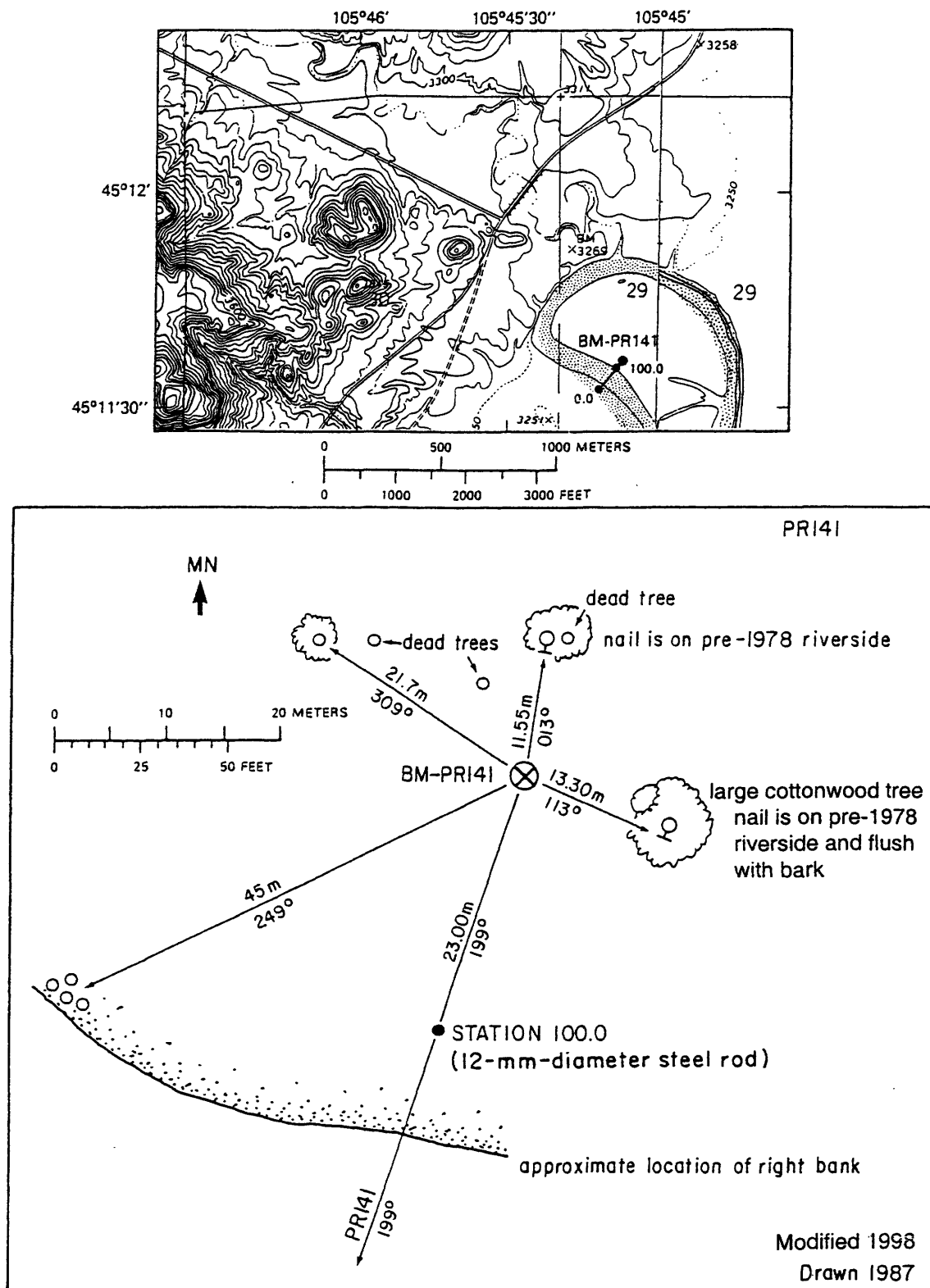


Figure 39. Upper: Location of cross section PR141, bench mark BM-PR141, and the left and right bank reference monuments in the Bloom Creek quadrangle. Lower: Location of the bench mark on the right bank of an abandoned channel. MN is magnetic north.

No plots were made because this cross section, PR141, was only resurveyed once in 1998 and virtually no change was measured in the profile when compared to the last survey in 1984.

Table 15. Listing of horizontal stations and elevations for cross section PR141

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1998		1998	
26 September		26 September	
Sta.	Elev.	Sta.	Elev.
-26.5	988.33	75.0	987.49
-0.8	988.26	77.0	987.43
0.0	988.27	79.0	987.49
3.0	988.44	81.0	987.47
4.5	988.55	83.0	987.47
6.0	988.59	85.0	987.62
7.0	988.49	87.0	987.73
9.0	988.52	88.3	987.77
10.0	988.59	89.0	988.04
12.0	988.39	90.9	989.02
14.0	987.93	92.0	989.08
15.9	987.74	94.0	989.06
18.0	988.07	96.0	989.03
20.0	988.11	98.0	988.98
22.0	988.13	100.0	988.97
24.0	988.13	100.9	988.99
26.0	988.25		
27.0	988.11		
29.0	988.15		
30.0	988.13		
32.0	987.81		
34.0	987.59		
36.0	987.50		
38.0	987.34		
40.0	987.18		
42.0	987.13		
44.0	987.08		
46.0	987.12		
48.0	987.10		
50.0	987.16		
52.0	987.29		
54.0	987.24		
56.0	987.27		
58.0	987.30		
60.0	987.35		
62.0	987.43		
64.0	987.40		
66.0	987.38		
68.0	987.38		
70.0	987.46		
71.0	987.46		
73.0	987.48		

Description of Cross Section PR141A

Location: Township 7 South/Range 49 East--section 29

U. S. Geological Survey quadrangle (1:24,000): Huckins School

Landowners--left bank: U. S. Government

--right bank: U. S. Government

Access: Left Bank

Permission from: Gay Ranch

Distance from Moorhead Gaging Station: 26.22 kilometers

Azimuth of Section (degrees magnetic): 181.5

Reference Monuments

[Monuments at stations -60.0, -40.6, and -40.0 were closest to the leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.21 meter above above 1998 ground level	-60.0	45°11'38.08"	105°44'47.90"	0.443	0.425	986.99
1/2-inch-rebar; 0.16 meter above 1998 ground level	-40.6					987.48
Benchmark--1/2-inch-rebar; 0.09 meter above 1998 ground level	-40.0					987.38
1/2-inch-rebar; 0.14 meter above above 1998 ground level	110.0					987.05
1/2-inch-rebar; 0.09 meter above above 1998 ground level	130.0					987.06
1/2-inch-rebar; 0.06 meter above 1998 ground level	150.8	45°11'31.51"	105°44'50.49"	0.177	0.443	987.37
1/2-inch-rebar; 0.17 meter above 1998 ground level; 1.1 meter downstream from side of cottonwood tree	190.0					988.02
1/2-inch-rebar; offsection near cottonwood tree with nail shown in accompanying figure	---					988.12

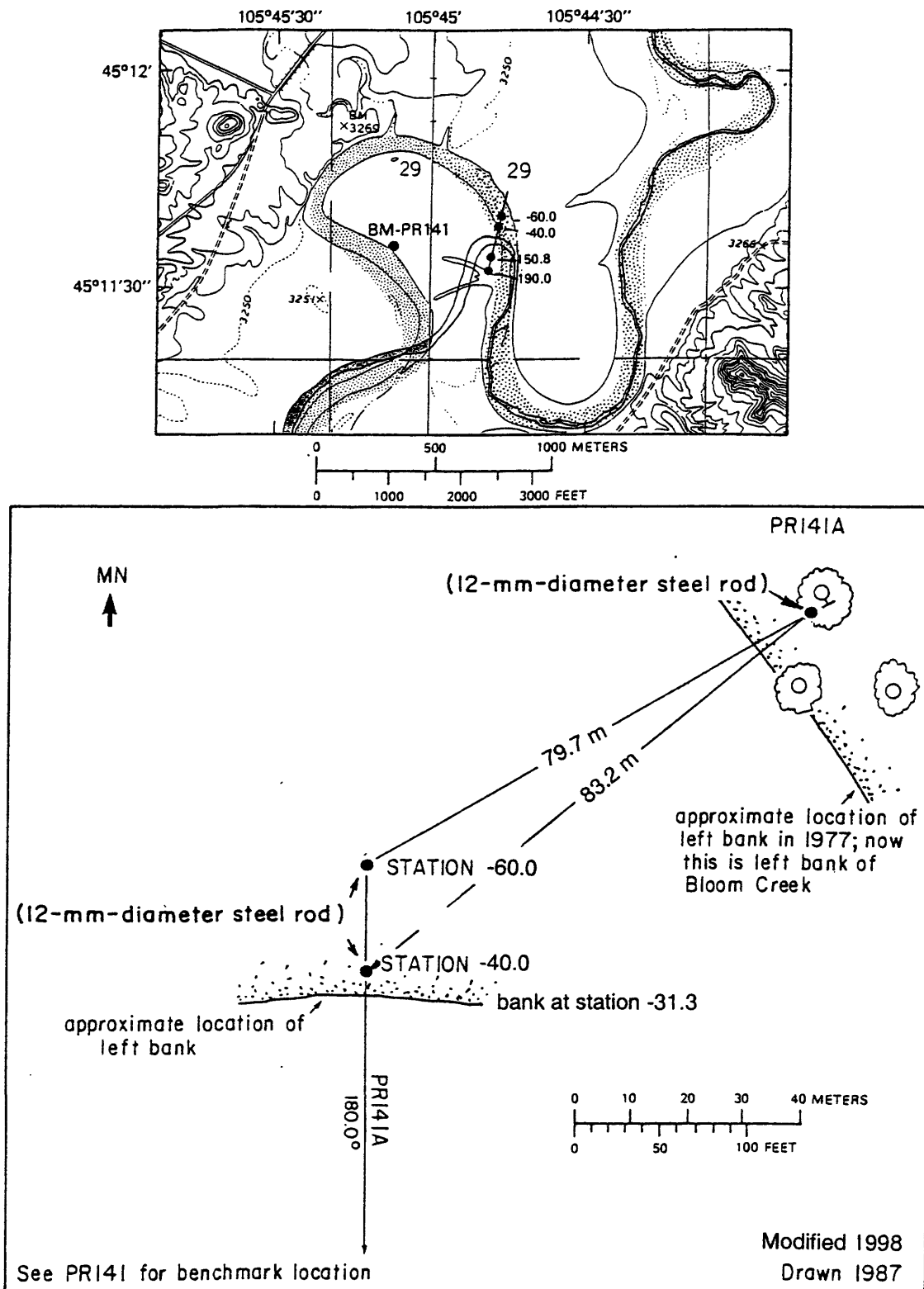


Figure 40. Upper: Location of cross section PR141A, bench mark BM-PR141, and the left and right bank reference monuments of PR-141A in the Huckins School quadrangle. New channel is shown in its approximate location. Lower: Location of the bench marks (12-mm-diameter steel rods) at stations -40.0 and -60.0 on the left bank. MN is magnetic north.

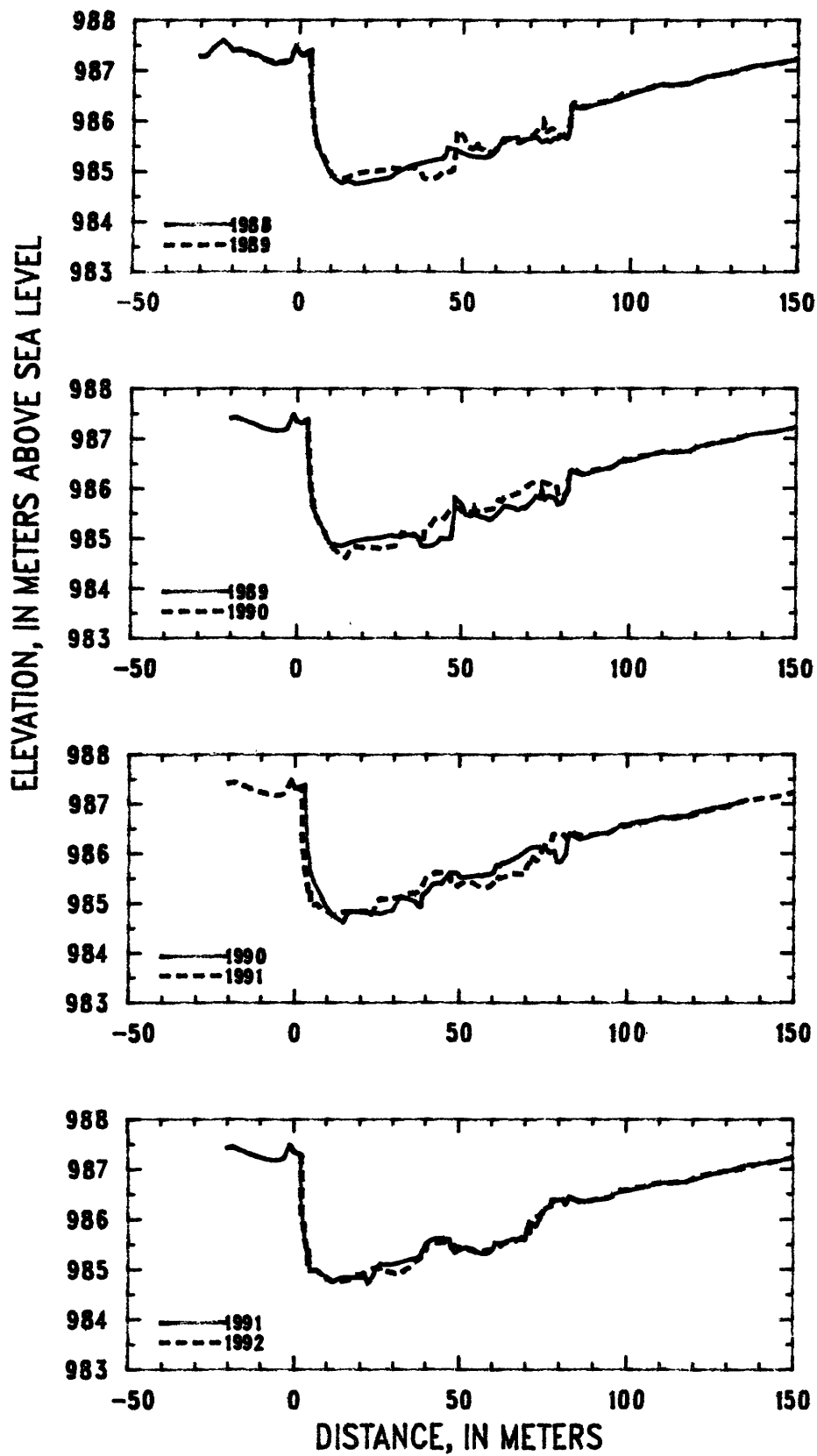


Figure 41. Profiles of cross section PR141A from 1988 to 1992.

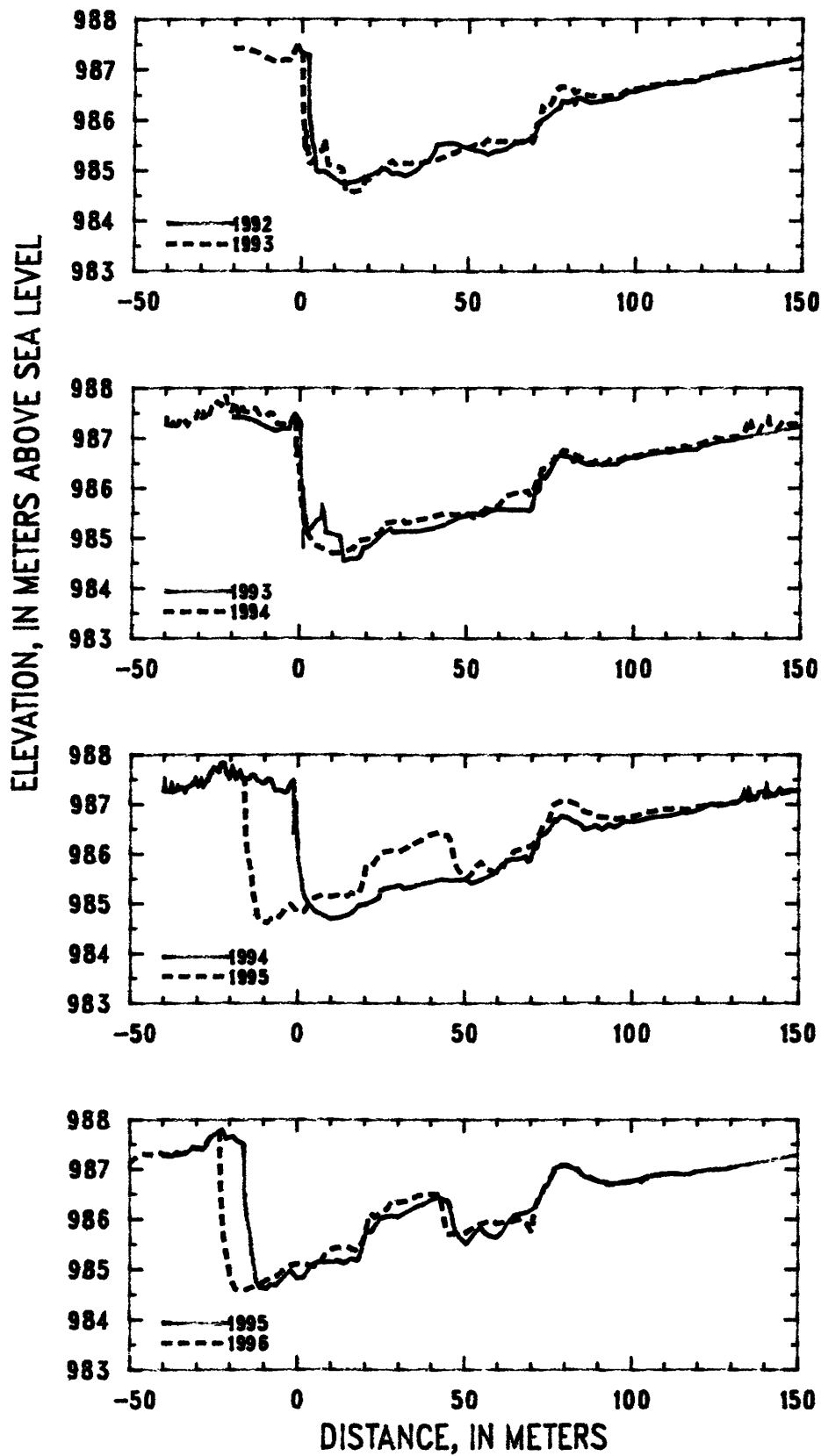


Figure 42. Profiles of cross section PR141A from 1992 to 1996.

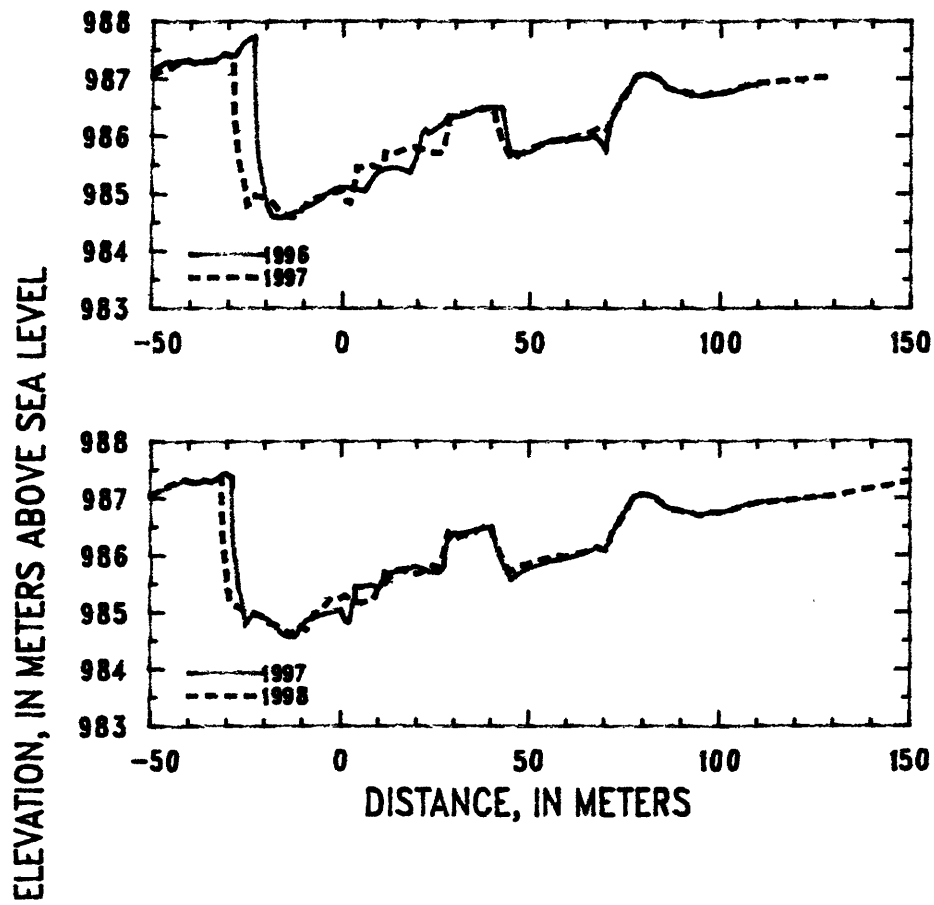


Figure 43. Profiles of cross section PR141A from 1996 to 1998.

Table 16. Listing of horizontal stations and elevations for cross section PR141A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1989		1990		1990	
18 September		18 September		18 September		16 September		16 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-20.0	987.41	43.0	984.93	93.0	986.39	-1.2	987.47	59.0	985.59
-18.0	987.43	44.0	985.01	96.0	986.47	0.3	987.31	60.5	985.63
-16.0	987.37	46.0	984.99	97.0	986.54	2.0	987.34	61.3	985.78
-14.0	987.33	47.0	985.01	100.0	986.56	3.3	987.38	62.3	985.75
-12.0	987.28	47.2	985.16	103.0	986.61	4.3	986.02	62.8	985.80
-10.0	987.22	48.0	985.49	106.0	986.67	5.4	985.54	64.0	985.82
-8.0	987.18	48.1	985.81	109.0	986.72	7.0	985.34	65.0	985.86
-6.0	987.16	49.0	985.77	112.0	986.71	8.6	985.11	67.0	985.92
-4.0	987.17	50.3	985.68	115.0	986.74	9.7	984.93	69.0	986.01
-2.8	987.20	51.3	985.48	118.0	986.75	11.0	984.83	71.0	986.12
-1.2	987.48	53.0	985.45	121.0	986.85	13.0	984.69	73.0	986.15
0.0	987.35	53.9	985.50	124.0	986.90	15.0	984.61	75.0	986.12
1.0	987.31	54.1	985.62	127.0	986.93	16.6	984.82	76.3	986.09
2.7	987.32	54.7	985.47	130.0	986.96	18.0	984.85	76.9	986.02
3.4	987.38	56.0	985.43	133.0	987.01	20.0	984.82	78.5	986.04
3.5	986.82	57.0	985.43	136.0	987.08	22.0	984.82	79.0	985.84
3.8	986.54	58.0	985.38	139.0	987.11	24.0	984.81	80.3	985.83
4.4	986.08	59.0	985.37	142.0	987.13	26.0	984.78	81.9	985.99
4.9	985.73	61.0	985.49	145.0	987.16	28.0	984.83	82.1	986.20
5.3	985.75	63.0	985.65	148.0	987.20	29.8	984.85	82.6	986.35
5.5	985.53	65.0	985.64	150.0	987.23	31.9	985.12	83.0	986.41
7.0	985.34	67.0	985.58	150.8	987.24	33.4	985.11	85.0	986.33
8.3	985.18	68.4	985.63			35.0	985.09	86.0	986.29
10.0	984.91	69.0	985.61			37.0	985.02	88.0	986.32
12.0	984.87	71.0	985.73			37.7	984.94	90.0	986.37
14.0	984.85	72.4	985.85			38.6	984.92	92.0	986.40
16.0	984.92	73.8	985.82			39.0	985.12	94.0	986.41
18.0	984.96	74.0	985.99			39.1	985.17	96.0	986.48
20.0	984.99	74.9	985.79			40.5	985.24	98.0	986.58
22.0	985.00	76.0	985.85			42.0	985.38	100.0	986.57
24.0	985.01	77.0	985.84			43.8	985.41	102.0	986.62
26.0	985.02	78.3	985.80			44.8	985.39	104.0	986.65
28.0	985.07	78.8	985.69			46.0	985.51	106.0	986.66
30.0	985.04	80.0	985.71			47.4	985.62	108.0	986.69
32.0	985.05	80.6	985.79			49.5	985.60	110.0	986.73
34.0	985.08	81.8	985.93			50.2	985.54	112.0	986.71
36.0	985.05	82.0	986.16			51.0	985.52	114.0	986.75
37.0	985.03	82.6	986.35			52.0	985.52	116.0	986.76
38.0	984.86	83.0	986.37			54.0	985.54	118.0	986.75
39.0	984.83	85.0	986.29			56.0	985.58	120.0	986.84
41.0	984.85	87.0	986.29			57.0	985.55	122.0	986.85
42.0	984.87	90.0	986.35			58.0	985.59	124.0	986.89

Table 16. (Continued) Listing of horizontal stations and elevations for cross section PR141A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1990		1991		1991		1991		1992	
16 September		31 August		31 August		31 August		27 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
126.0	986.93	-20.0	987.42	47.3	985.61	140.0	987.12	-1.2	987.48
128.0	986.95	-18.0	987.44	47.5	985.45	145.0	987.14	0.0	987.36
130.0	986.96	-16.0	987.38	48.8	985.32	150.8	987.26	1.0	987.31
133.0	987.02	-14.0	987.34	51.0	985.41			2.4	987.29
136.0	987.08	-12.0	987.29	52.0	985.43			2.4	986.12
		-10.0	987.23	54.0	985.41			3.0	985.91
		-8.0	987.19	56.0	985.34			3.4	985.60
		-6.0	987.17	58.0	985.31			3.9	985.44
		-4.0	987.18	59.3	985.33			4.3	985.19
		-2.7	987.22	60.4	985.42			4.5	985.00
		-1.2	987.48	61.0	985.54			5.0	984.97
		0.0	987.35	63.0	985.51			7.0	984.98
		1.0	987.31	66.0	985.61			9.0	984.88
		2.3	987.30	68.0	985.60			11.0	984.77
		2.3	986.34	69.8	985.59			13.0	984.72
		3.3	985.71	70.3	985.78			15.0	984.77
		4.2	985.30	70.9	985.82			17.0	984.79
		4.5	985.20	71.4	985.76			19.0	984.88
		4.8	985.29	72.0	985.93			21.0	984.92
		5.0	984.95	73.1	985.86			23.0	985.00
		7.0	984.98	74.0	985.98			25.0	985.04
		8.0	984.91	76.0	986.22			27.0	984.94
		10.0	984.85	77.6	986.26			29.0	984.95
		12.0	984.76	77.9	986.39			31.0	984.90
		14.0	984.82	81.0	986.39			33.0	984.95
		16.0	984.83	82.0	986.30			35.0	985.03
		18.0	984.83	83.0	986.45			36.9	985.19
		20.0	984.84	85.0	986.38			37.3	985.17
		21.7	984.85	88.0	986.35			38.2	985.19
		22.4	984.71	91.0	986.39			39.0	985.29
		24.2	984.91	94.0	986.40			40.4	985.41
		24.4	985.00	97.0	986.52			40.4	985.51
		26.0	985.10	100.0	986.56			42.0	985.53
		29.0	985.09	103.0	986.61			44.0	985.54
		32.0	985.13	106.0	986.64			46.0	985.55
		35.0	985.20	110.0	986.73			48.0	985.47
		37.0	985.21	114.0	986.72			50.0	985.45
		38.4	985.26	118.0	986.76			52.0	985.39
		40.0	985.49	122.0	986.83			54.0	985.38
		41.0	985.55	126.0	986.90			56.0	985.31
		43.0	985.62	130.0	986.96			58.0	985.38
		45.0	985.62	135.0	987.06			60.0	985.40

Table 16. (Continued) Listing of horizontal stations and elevations for cross section PR141A
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1992		1993		1993		1993		1994	
27 August		28 August		28 August		28 August		23 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
62.0	985.44	-20.0	987.43	42.0	985.26	101.0	986.61	-40.0	987.26
64.0	985.54	-19.0	987.42	43.0	985.26	103.0	986.65	-39.7	987.43
65.6	985.55	-17.0	987.44	45.0	985.33	105.0	986.68	-39.3	987.27
67.0	985.56	-15.0	987.39	46.0	985.35	107.0	986.70	-38.0	987.26
69.0	985.64	-13.0	987.34	48.0	985.43	109.0	986.73	-37.6	987.39
70.4	985.76	-11.0	987.26	50.0	985.44	111.0	986.73	-37.1	987.25
71.1	985.95	-9.0	987.20	52.0	985.51	113.0	986.74	-36.4	987.27
72.0	985.99	-7.0	987.15	53.7	985.47	115.0	986.77	-35.8	987.38
74.0	986.08	-5.0	987.20	55.7	985.60	117.0	986.78	-35.3	987.31
76.0	986.20	-3.0	987.19	58.0	985.56	119.0	986.78	-34.3	987.35
77.4	986.24	-2.0	987.38	60.0	985.58	120.0	986.84	-33.5	987.26
78.0	986.37	-1.2	987.48	62.0	985.58	122.0	986.85	-33.0	987.34
80.0	986.35	0.0	987.36	64.0	985.56	124.0	986.90	-32.0	987.38
81.3	986.40	0.4	987.30	66.0	985.57	126.0	986.94	-31.0	987.42
82.0	986.32	0.5	986.52	68.0	985.57	128.0	986.95	-30.4	987.52
82.6	986.44	1.2	985.36	69.0	985.55	130.0	986.96	-29.6	987.37
84.0	986.42	1.3	985.79	69.6	985.60	150.8	987.25	-29.0	987.40
86.0	986.35	2.0	985.38	70.5	985.93			-28.7	987.49
88.0	986.35	2.5	985.13	71.4	985.94			-28.1	987.37
90.0	986.38	3.5	985.19	71.8	986.01			-27.7	987.43
92.0	986.41	5.0	985.35	72.2	986.26			-26.7	987.53
95.0	986.43	6.6	985.40	72.8	986.22			-26.3	987.63
97.0	986.53	6.8	985.62	73.4	986.20			-25.6	987.67
98.0	986.57	7.3	985.54	74.0	986.25			-25.1	987.74
100.0	986.57	8.0	985.11	75.0	986.36			-24.3	987.70
103.0	986.62	12.3	985.04	76.0	986.50			-23.4	987.65
106.0	986.65	13.3	984.55	77.0	986.63			-23.0	987.82
109.0	986.72	15.0	984.57	78.0	986.66			-22.0	987.83
112.0	986.71	17.0	984.59	79.0	986.66			-21.3	987.64
115.0	986.75	18.0	984.63	80.0	986.64			-21.0	987.61
118.0	986.75	19.0	984.81	81.0	986.62			-20.3	987.53
121.0	986.85	21.0	984.85	82.0	986.53			-20.0	987.60
124.0	986.89	23.0	984.98	83.0	986.57			-19.5	987.74
127.0	986.93	25.0	985.10	84.0	986.54			-19.0	987.63
130.0	986.96	27.0	985.20	85.0	986.50			-18.3	987.51
135.0	987.01	28.0	985.13	87.0	986.47			-17.2	987.66
140.0	987.11	30.0	985.13	89.0	986.47			-17.0	987.60
145.0	987.16	32.0	985.15	91.0	986.48			-16.6	987.54
150.0	987.23	34.0	985.14	93.0	986.48			-15.0	987.51
150.8	987.26	36.0	985.14	95.0	986.48			-14.4	987.52
		38.0	985.19	97.0	986.59			-13.8	987.59
		40.0	985.20	99.0	986.62			-13.0	987.59

Table 16. (Continued) Listing of horizontal stations and elevations for cross section PR141A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1994		1994		1994		1995		1995	
23 September		23 September		23 September		2 October		2 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-12.0	987.47	50.0	985.51	128.0	986.98	-40.0	987.27	19.0	985.36
-11.0	987.44	52.0	985.41	130.0	987.04	-39.0	987.28	20.3	985.76
-10.0	987.43	55.0	985.48	131.5	987.03	-38.0	987.28	22.0	985.75
-9.0	987.50	58.0	985.57	133.2	987.11	-37.0	987.26	24.5	986.01
-8.0	987.50	59.5	985.63	133.7	987.24	-36.0	987.35	26.0	986.04
-7.0	987.34	61.6	985.82	134.2	987.12	-34.0	987.30	28.0	986.07
-6.6	987.28	64.0	985.90	134.7	987.14	-33.0	987.31	30.0	986.04
-5.0	987.28	66.0	985.89	135.2	987.29	-31.0	987.44	32.0	986.11
-3.5	987.23	68.5	985.95	135.7	987.16	-30.0	987.42	34.0	986.20
-3.0	987.25	69.0	985.85	137.4	987.11	-29.0	987.42	36.0	986.25
-2.0	987.42	69.6	985.87	138.3	987.25	-28.0	987.39	38.0	986.30
-1.2	987.47	70.7	986.11	140.3	987.27	-27.0	987.46	40.0	986.40
-1.0	987.35	71.6	986.14	140.5	987.37	-26.0	987.63	42.0	986.43
-1.0	986.64	72.4	986.38	141.0	987.23	-24.0	987.72	44.0	986.38
-0.5	986.88	74.0	986.39	143.0	987.17	-22.3	987.79	45.0	986.37
-0.1	986.35	75.5	986.50	144.4	987.31	-21.0	987.62	45.5	986.30
0.1	986.28	77.0	986.69	145.3	987.24	-20.0	987.64	47.0	985.84
0.3	985.83	77.4	986.66	147.5	987.29	-19.0	987.66	48.0	985.67
1.3	985.45	79.0	986.77	149.0	987.27	-18.0	987.57	50.5	985.51
1.6	985.23	81.0	986.73	150.8	987.30	-15.8	987.51	52.0	985.60
2.6	985.08	82.0	986.68	153.0	987.38	-15.4	986.36	53.0	985.73
5.0	984.84	84.0	986.62	154.5	987.35	-15.0	986.05	55.0	985.83
8.0	984.75	85.0	986.57	155.8	987.37	-13.8	985.64	56.0	985.73
10.0	984.69	86.0	986.49	157.0	987.33	-13.6	985.38	57.0	985.69
13.0	984.72	88.0	986.52	158.3	987.37	-12.0	984.74	59.0	985.63
16.0	984.79	89.0	986.57	158.7	987.46	-11.0	984.63	60.0	985.63
18.0	984.96	91.0	986.50	159.5	987.42	-10.0	984.63	62.0	985.78
20.0	984.98	93.0	986.59	162.0	987.44	-9.0	984.61	63.0	985.91
22.0	985.04	95.0	986.54	162.5	987.49	-8.0	984.69	64.0	985.96
23.0	985.07	98.0	986.66	163.3	987.39	-6.0	984.68	65.0	986.06
24.3	985.13	100.5	986.64	166.0	987.39	-4.0	984.85	67.0	986.10
24.6	985.26	103.0	986.68	169.0	987.38	-2.0	984.97	69.0	986.14
26.0	985.31	106.0	986.74	171.0	987.36	0.0	984.82	71.0	986.23
29.0	985.35	109.0	986.77	173.0	987.30	2.0	984.83	72.0	986.34
30.8	985.37	112.0	986.78	176.0	987.28	4.0	985.06	73.5	986.58
31.4	985.31	114.0	986.80	179.0	987.17	6.0	985.14	75.0	986.67
34.0	985.33	115.4	986.85	181.0	987.15	8.0	985.15	76.7	986.99
37.0	985.39	116.5	986.82	182.8	987.15	10.0	985.13	78.0	987.04
40.0	985.44	119.0	986.85	185.0	987.42	12.0	985.17	80.0	987.08
43.0	985.50	122.0	986.94	188.5	987.58	14.0	985.12	82.0	987.05
46.0	985.47	124.0	987.01	190.3	987.84	16.0	985.21	84.0	986.98
49.0	985.48	126.0	986.98			18.0	985.18	86.0	986.84

Table 16. (Continued) Listing of horizontal stations and elevations for cross section PR141A
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1995		1996		1996		1996		1997	
2 October		18 October		18 October		18 October		20 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
88.0	986.81	-60.0	986.77	25.0	986.13	108.0	986.88	-60.0	986.79
90.0	986.74	-57.0	986.90	27.0	986.22	110.0	986.91	-40.6	987.33
92.0	986.75	-55.0	987.02	28.0	986.35			-40.0	987.30
94.0	986.70	-52.0	987.00	30.0	986.33			-39.0	987.27
96.0	986.71	-49.0	987.19	33.0	986.37			-37.0	987.28
98.0	986.75	-46.0	987.30	36.0	986.47			-35.5	987.31
100.0	986.76	-43.0	987.29	39.0	986.50			-33.0	987.32
102.0	986.79	-40.6	987.32	41.0	986.50			-31.0	987.44
104.0	986.83	-40.0	987.30	42.7	986.49			-30.0	987.43
106.0	986.85	-37.0	987.28	44.4	985.80			-29.4	987.39
108.0	986.88	-34.0	987.31	45.2	985.70			-28.5	987.37
110.0	986.89	-31.0	987.43	47.0	985.71			-28.4	986.36
112.0	986.91	-28.0	987.40	50.0	985.72			-27.7	985.92
114.0	986.90	-26.0	987.63	53.0	985.85			-26.7	985.44
116.0	986.89	-24.0	987.70	56.0	985.92			-25.8	985.20
118.0	986.89	-23.1	987.74	58.7	985.96			-24.9	984.79
119.0	986.94	-22.7	986.43	60.0	985.91			-23.0	984.98
122.0	986.97	-21.9	985.62	63.0	985.95			-21.0	984.95
124.0	986.99	-20.8	985.19	65.0	985.96			-19.0	984.89
126.0	987.00	-19.6	984.79	67.0	986.00			-16.0	984.67
128.0	987.00	-18.3	984.61	69.0	985.89			-15.0	984.61
130.0	987.03	-16.0	984.57	70.0	985.74			-12.0	984.58
150.8	987.30	-13.0	984.65	70.5	985.93			-9.0	984.86
190.3	988.02	-11.0	984.69	71.0	986.20			-6.0	984.94
		-9.0	984.79	72.0	986.38			-3.0	984.99
		-6.0	984.87	73.0	986.47			0.0	985.05
		-4.0	984.99	74.0	986.65			1.0	984.86
		-2.0	985.06	75.0	986.68			2.0	984.82
		0.0	985.11	76.0	986.84			3.4	985.20
		3.0	985.08	77.0	986.96			3.7	985.27
		6.0	985.04	78.0	987.05			3.8	985.45
		7.3	985.18	80.0	987.08			6.0	985.44
		9.0	985.34	82.0	987.05			8.0	985.47
		11.0	985.41	84.0	986.99			10.4	985.43
		14.0	985.45	86.0	986.84			11.2	985.56
		16.0	985.42	88.0	986.81			11.3	985.71
		18.0	985.36	91.0	986.73			12.5	985.67
		19.5	985.58	94.0	986.69			14.0	985.70
		20.5	985.79	97.0	986.72			17.0	985.77
		21.2	986.06	100.0	986.75			20.0	985.80
		22.0	986.10	103.0	986.76			23.0	985.71
		23.0	986.04	106.0	986.87			26.0	985.70

Table 16. (Continued) Listing of horizontal stations and elevations for cross section PR141A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1997		1998		1998	
20 September		26 September		26 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
27.0	985.77	-60.0	986.80	30.0	986.30
27.3	985.82	-55.0	987.00	33.0	986.35
28.3	986.27	-50.0	987.02	36.0	986.41
30.0	986.38	-45.0	987.24	38.0	986.50
33.0	986.38	-40.6	987.32	40.0	986.47
36.0	986.44	-40.0	987.29	42.0	986.10
39.0	986.48	-38.0	987.30	44.0	985.78
40.4	986.51	-36.0	987.32	45.4	985.72
41.4	986.15	-33.2	987.29	48.0	985.82
44.0	985.71	-31.4	987.40	51.0	985.88
45.5	985.57	-31.2	986.70	54.0	985.93
47.0	985.68	-30.9	986.19	57.0	985.98
50.0	985.77	-29.8	985.46	60.0	985.98
53.0	985.85	-29.0	985.18	63.0	986.03
56.0	985.91	-27.0	985.10	66.0	986.08
59.0	985.92	-25.0	985.00	68.0	986.14
62.0	985.99	-23.0	985.00	70.0	986.09
65.0	986.04	-21.0	984.95	71.0	986.23
68.0	986.14	-19.0	984.82	72.0	986.43
70.0	986.08	-17.0	984.77	73.0	986.50
72.0	986.40	-15.0	984.71	75.0	986.70
74.0	986.66	-13.0	984.62	77.0	986.99
76.0	986.83	-11.0	984.77	80.0	987.08
77.6	987.03	-9.0	984.68	83.0	987.02
80.0	987.08	-7.0	984.98	86.0	986.83
82.0	987.07	-5.0	985.03	89.0	986.79
84.0	986.99	-3.0	985.22	92.0	986.75
86.0	986.84	-1.0	985.22	95.0	986.69
89.0	986.79	1.0	985.29	98.0	986.75
92.0	986.74	3.0	985.20	101.0	986.75
95.0	986.69	5.0	985.16	104.0	986.81
98.0	986.75	7.0	985.19	107.0	986.87
101.0	986.75	9.0	985.26	110.0	986.91
104.0	986.82	10.2	985.48	130.0	987.04
107.0	986.89	12.0	985.51	150.0	987.30
110.0	986.92	14.0	985.72	190.0	987.84
130.0	987.04	16.5	985.75		
		18.0	985.66		
		21.0	985.68		
		24.0	985.82		
		26.3	985.79		
		28.5	986.41		

Description of Cross Section PR141.7

Location: Township 7 South/Range 49 East--section 32

U. S. Geological Survey quadrangle (1:24,000): Huckins School

Landowners--left bank: Bowers Ranch

--right bank: U. S. Government

Access: Left bank

Permission from: Gay Ranch

Distance from Moorhead Gaging Station: 26.9 kilometers

Azimuth of Section (degrees magnetic): 240.5

Reference Monuments

[Monuments at stations -29.0, -28.95, 0.25, and 1.0 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.14 meter above 1998 ground level; upstream from a group of buffaloberry trees and 0.05 meter riverward of wooden stake	-29.0	45°11'20.20"	105°44'44.86"	0.527	0.759	987.34
Benchmark--1/2-inch-rebar; 0.18 meter above 1998 ground level	0.25					986.82
1/2-inch-rebar; 0.10 meter above 1998 ground level	1.0					986.65
1/2-inch-rebar; 0.16 meter above 1998 ground level; 2 meters upstream from large solitary cottonwood tree near the right bank	149.1	45°11'18.74"	105°44'52.74"	0.590	0.534	988.62

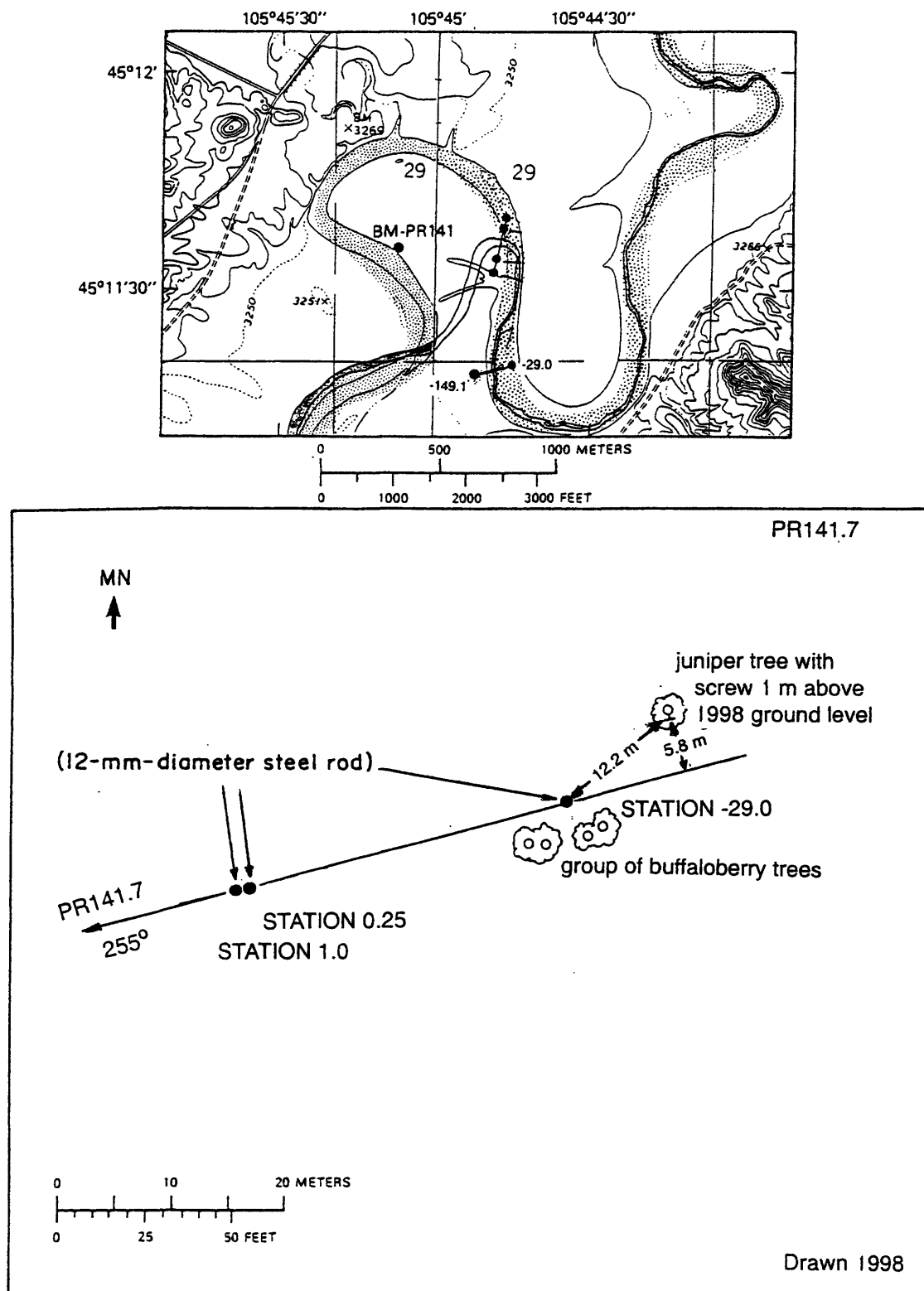


Figure 44. Upper: Location of cross section PR141.7, bench mark BM-PR141, and the left and right bank reference monuments of PR141.7 in the Huckins School quadrangle. Lower: Location of the reference monuments on the left bank. MN is magnetic north.

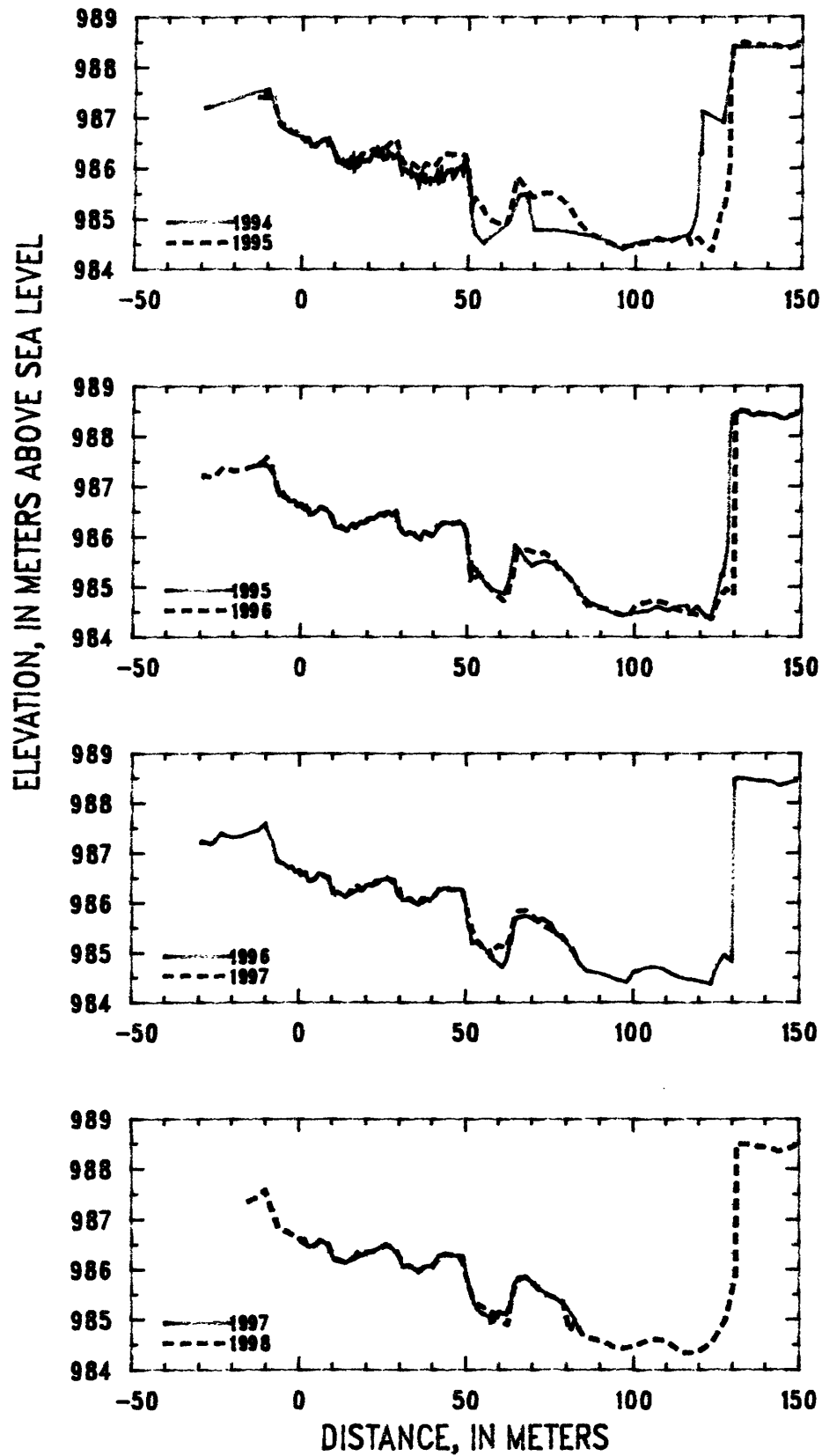


Figure 45. Profiles of cross section PR141.7 from 1994 to 1998.

Table 17. Listing of horizontal stations and elevations for cross section PR141.7

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1993		1994		1994		1994		1994	
see note below		3 September		3 September		3 September		3 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.0	985.79	-29.0	987.20	17.1	986.07	32.2	985.90	42.5	985.74
2.6	985.71	-10.0	987.57	17.3	986.14	32.4	985.89	42.7	985.80
6.8	985.66	-6.0	986.81	17.5	986.25	32.6	985.94	42.9	985.85
12.2	985.54	-3.3	986.69	18.1	986.19	32.8	985.85	43.2	985.88
19.2	985.75	0.3	986.63	18.6	986.13	33.0	985.89	43.5	985.91
25.0	986.01	1.0	986.54	19.5	986.16	33.2	985.92	43.7	985.97
30.3	986.00	1.1	986.59	20.0	986.14	33.3	985.86	43.8	985.94
33.3	985.99	2.0	986.60	20.6	986.23	33.6	985.84	44.2	985.93
35.4	985.86	2.9	986.45	20.8	986.28	33.8	985.89	44.5	985.96
37.4	985.96	3.9	986.41	21.1	986.28	33.9	985.86	44.6	985.96
39.7	986.03	4.6	986.45	21.3	986.27	34.1	985.88	44.8	985.90
40.7	986.28	5.1	986.50	21.4	986.34	34.4	985.84	45.0	985.93
42.6	986.49	5.9	986.53	21.9	986.34	34.9	985.79	45.1	985.98
44.5	986.42	6.2	986.56	22.1	986.25	35.1	985.68	45.3	985.97
46.0	986.31	6.8	986.56	22.5	986.25	35.3	985.74	45.5	985.80
48.5	986.43	7.6	986.58	22.9	986.24	35.6	985.82	45.7	985.82
depths to surface		7.9	986.49	23.3	986.31	35.7	985.78	46.3	985.92
measured on		8.2	986.56	23.9	986.38	36.0	985.77	46.7	985.99
3 September 1994		8.4	986.50	24.2	986.17	36.2	985.88	46.9	985.98
		8.8	986.49	24.7	986.18	36.5	985.78	47.4	985.99
		9.4	986.41	25.0	986.21	36.7	985.74	47.6	986.02
		10.0	986.31	25.4	986.20	37.2	985.72	47.6	986.05
		10.3	986.18	25.6	986.33	37.3	985.80	47.7	986.03
		10.9	986.11	26.3	986.27	37.5	985.75	47.8	986.06
		11.8	986.11	26.6	986.28	37.8	985.74	47.9	986.01
		12.1	986.15	26.8	986.26	38.2	985.77	48.0	986.06
		12.2	986.09	27.2	986.20	38.5	985.79	48.1	986.03
		12.6	986.11	27.6	986.24	38.7	985.73	48.3	985.96
		12.7	986.15	28.1	986.22	39.0	985.79	48.4	986.03
		12.8	986.05	28.3	986.27	39.1	985.79	48.5	986.02
		13.2	986.08	28.6	986.30	39.3	985.76	48.7	986.15
		13.6	986.06	28.9	986.22	39.8	985.77	49.1	986.16
		13.9	986.02	29.1	986.20	40.0	985.76	49.6	986.02
		14.2	986.06	29.5	986.00	40.4	985.81	49.9	985.87
		14.6	986.02	29.8	985.92	40.8	985.91	50.5	985.60
		15.0	986.10	30.0	985.99	41.0	985.75	51.5	984.84
		15.3	986.11	30.2	986.00	41.2	985.72	52.3	984.67
		15.4	986.16	30.8	985.97	41.4	985.80	54.8	984.51
		15.7	986.00	31.0	985.96	41.7	985.83	54.8	984.53
		16.0	986.12	31.1	985.99	42.0	985.93	62.4	984.93
		16.3	986.03	31.2	985.95	42.2	985.79	65.3	985.47
		16.7	986.05	31.8	985.91	42.4	985.74	67.7	985.50

Table 17. (Continued) Listing of horizontal stations and elevations for cross section PR141.7
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1994		1995		1995		1995		1996	
3 September		2 October		2 October		2 October		18 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
70.0	984.78	-15.0	987.37	39.5	986.01	121.0	984.45	-29.0	987.20
75.8	984.78	-13.0	987.42	41.0	986.13	123.0	984.35	-29.0	987.23
80.0	984.74	-11.0	987.51	42.5	986.29	125.0	984.89	-26.0	987.18
86.4	984.66	-9.0	987.38	44.0	986.28	126.2	985.25	-23.0	987.40
90.0	984.60	-8.0	987.26	46.0	986.26	126.7	985.23	-20.0	987.31
96.0	984.39	-6.3	986.83	47.5	986.30	127.6	985.59	-17.0	987.34
100.1	984.52	-5.0	986.89	49.0	986.25	128.3	986.07	-14.0	987.41
104.9	984.57	-3.0	986.71	50.0	986.00	128.5	987.87	-12.0	987.45
110.1	984.58	-1.5	986.71	50.7	985.39	129.5	988.43	-10.0	987.59
116.3	984.67	0.0	986.61	51.0	985.31	131.0	988.49	-8.0	987.27
118.5	985.04	1.5	986.54	51.0	985.14	133.0	988.50	-6.3	986.84
119.4	986.29	2.0	986.62	51.3	985.15	135.5	988.41	-4.0	986.77
119.9	986.29	3.0	986.44	51.4	985.38	137.0	988.45	-3.0	986.70
120.2	987.12	4.5	986.48	52.0	985.40	138.5	988.43	-2.0	986.72
126.5	986.90	6.0	986.58	54.0	985.24	140.0	988.45	-0.8	986.61
129.4	988.41	7.0	986.57	56.0	985.03	143.0	988.42	0.3	986.65
138.5	988.40	9.0	986.48	58.0	984.93	145.0	988.34	1.0	986.59
149.1	988.42	10.5	986.20	60.0	984.89	147.0	988.41	2.0	986.61
		12.0	986.19	61.5	984.86	149.1	988.47	3.0	986.45
		14.0	986.12	62.7	985.11			4.5	986.47
		15.0	986.23	64.5	985.82			6.0	986.59
		15.5	986.26	66.0	985.74			7.0	986.58
		16.5	986.19	68.0	985.52			9.0	986.49
		18.0	986.30	69.5	985.42			10.5	986.19
		19.0	986.27	71.0	985.49			12.0	986.22
		20.0	986.31	74.0	985.52			14.0	986.13
		21.0	986.38	77.0	985.43			15.0	986.21
		22.0	986.37	80.0	985.25			15.5	986.26
		23.0	986.43	83.5	984.89			16.5	986.22
		23.7	986.47	86.0	984.71			18.0	986.29
		25.0	986.41	89.0	984.62			19.0	986.25
		26.4	986.50	92.0	984.52			20.0	986.36
		27.4	986.43	95.0	984.43			21.0	986.38
		28.6	986.52	98.0	984.44			22.0	986.36
		29.5	986.20	101.0	984.50			23.0	986.46
		30.7	986.09	104.0	984.51			23.7	986.45
		31.5	986.05	107.0	984.61			25.0	986.47
		32.5	986.10	110.0	984.53			26.4	986.50
		35.0	986.00	113.0	984.61			27.4	986.47
		36.0	985.94	116.0	984.62			28.6	986.46
		36.8	986.07	117.0	984.47			29.5	986.20
		37.3	986.10	119.0	984.61			30.7	986.08

Table 17. (Continued) Listing of horizontal stations and elevations for cross section PR141.7

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1996		1997		1997		1998	
18 October		18 October		20 September		20 September		26 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
31.5	986.05	95.0	984.46	0.3	986.62	60.0	985.15	-15.0	987.37
33.5	986.10	98.0	984.40	1.0	986.57	62.4	985.10	-12.5	987.43
35.0	985.99	100.0	984.61	2.0	986.61	63.3	985.28	-10.0	987.59
36.0	985.97	103.0	984.69	3.0	986.45	64.9	985.72	-7.5	987.12
36.8	986.08	106.0	984.73	4.5	986.47	66.0	985.84	-6.0	986.82
37.3	986.10	109.0	984.70	6.5	986.59	68.0	985.86	-4.0	986.78
39.5	986.04	112.0	984.57	8.0	986.53	70.0	985.75	-2.0	986.70
41.0	986.19	115.0	984.49	9.0	986.51	72.0	985.61	0.3	986.64
42.5	986.26	118.0	984.46	10.5	986.21	74.0	985.52	1.0	986.55
44.0	986.31	121.0	984.42	12.0	986.20	76.0	985.43	4.0	986.45
46.0	986.26	123.5	984.37	14.0	986.13	78.0	985.37	7.0	986.58
47.5	986.29	124.5	984.61	16.0	986.22	80.0	985.24	9.0	986.49
49.0	986.26	126.0	984.81	16.5	986.21	82.0	985.06	11.0	986.19
50.0	986.04	127.6	984.96	17.5	986.35	83.7	984.80	14.0	986.13
50.7	985.57	129.9	984.83	18.5	986.28			17.0	986.25
51.2	985.48	130.4	988.48	20.0	986.32			20.0	986.33
52.0	985.19	132.0	988.51	22.0	986.37			22.0	986.36
54.0	985.23	135.0	988.47	24.0	986.43			24.0	986.43
56.0	985.06	138.0	988.44	26.0	986.52			26.0	986.48
58.0	984.90	141.0	988.45	28.0	986.43			27.5	986.46
60.0	984.79	144.0	988.36	30.0	986.28			29.0	986.41
61.2	984.71	146.0	988.40	31.0	986.05			31.3	986.07
62.4	984.82	149.1	988.46	33.0	986.09			33.0	986.08
62.8	985.00			35.0	986.00			36.0	985.95
63.5	985.19			36.0	985.97			38.0	986.07
63.8	985.21			38.0	986.06			40.0	986.04
65.0	985.68			40.0	986.07			42.0	986.22
66.0	985.71			42.0	986.27			44.0	986.31
68.0	985.75			44.0	986.31			46.0	986.28
70.0	985.70			46.0	986.27			48.0	986.28
71.0	985.65			48.0	986.28			49.2	986.10
73.0	985.69			49.1	986.26			51.0	985.68
74.3	985.62			50.0	985.99			52.3	985.40
75.5	985.59			51.0	985.68			54.0	985.28
77.2	985.36			51.4	985.63			57.0	985.19
78.5	985.32			52.0	985.45			60.0	985.04
81.0	985.14			53.0	985.25			62.0	984.92
82.5	985.00			55.0	985.11			62.7	984.89
83.8	984.80			57.3	985.05			64.0	985.45
86.0	984.63			57.7	984.93			65.8	985.81
89.0	984.60			58.5	984.97			68.0	985.85
92.0	984.55			58.7	985.07			70.0	985.74

Table 17. (Continued) Listing of horizontal stations and elevations for cross section PR141.7

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1998	
26 September	
Sta.	Elev.
73.0	985.53
76.0	985.45
79.0	985.35
81.0	984.76
82.5	984.97
85.0	984.68
88.0	984.61
91.0	984.57
94.0	984.45
97.0	984.42
100.0	984.47
103.0	984.56
106.0	984.61
109.0	984.60
112.0	984.49
115.0	984.33
118.0	984.35
121.0	984.41
124.0	984.56
128.0	985.01
131.0	985.86
131.4	988.51
135.0	988.48
138.0	988.44
141.0	988.43
144.0	988.35
147.0	988.41
149.1	988.47

Description of Cross Section PR147

Location: Township 7 South/Range 49 East--section 21

U. S. Geological Survey quadrangle (1:24,000): Huckins School

Landowners--left bank: Gay Ranch

--right bank: Huckins Ranch

Access: Left or right bank

Permission from: Left bank, Gay Ranch; right bank, Huckins Ranch

Distance from Moorhead Gaging Station: 30.24 kilometers

Azimuth of Section (degrees magnetic): 130

Reference Monuments

[Monuments at stations -68.9 and 0.0 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.19 meter above 1998 ground level under a fenceline	-68.9					984.01
1/2-inch-rebar; 0.05 meter above 1998 ground level	0.0					983.91
Benchmark--brass circular plate	-2.0	45°12'19.56"	105°44'06.61"	0.557	0.460	983.92
1/2-inch-rebar; 0.04 meter below 1998 ground level	100.0					983.10
1/2-inch-rebar; 0.09 meter above 1998 ground level	100.7					983.27
1/2-inch-rebar; 0.15 meter above 1998 ground level	110.0	45°12'16.63"	105°44'03.58"	0.153	0.348	983.56

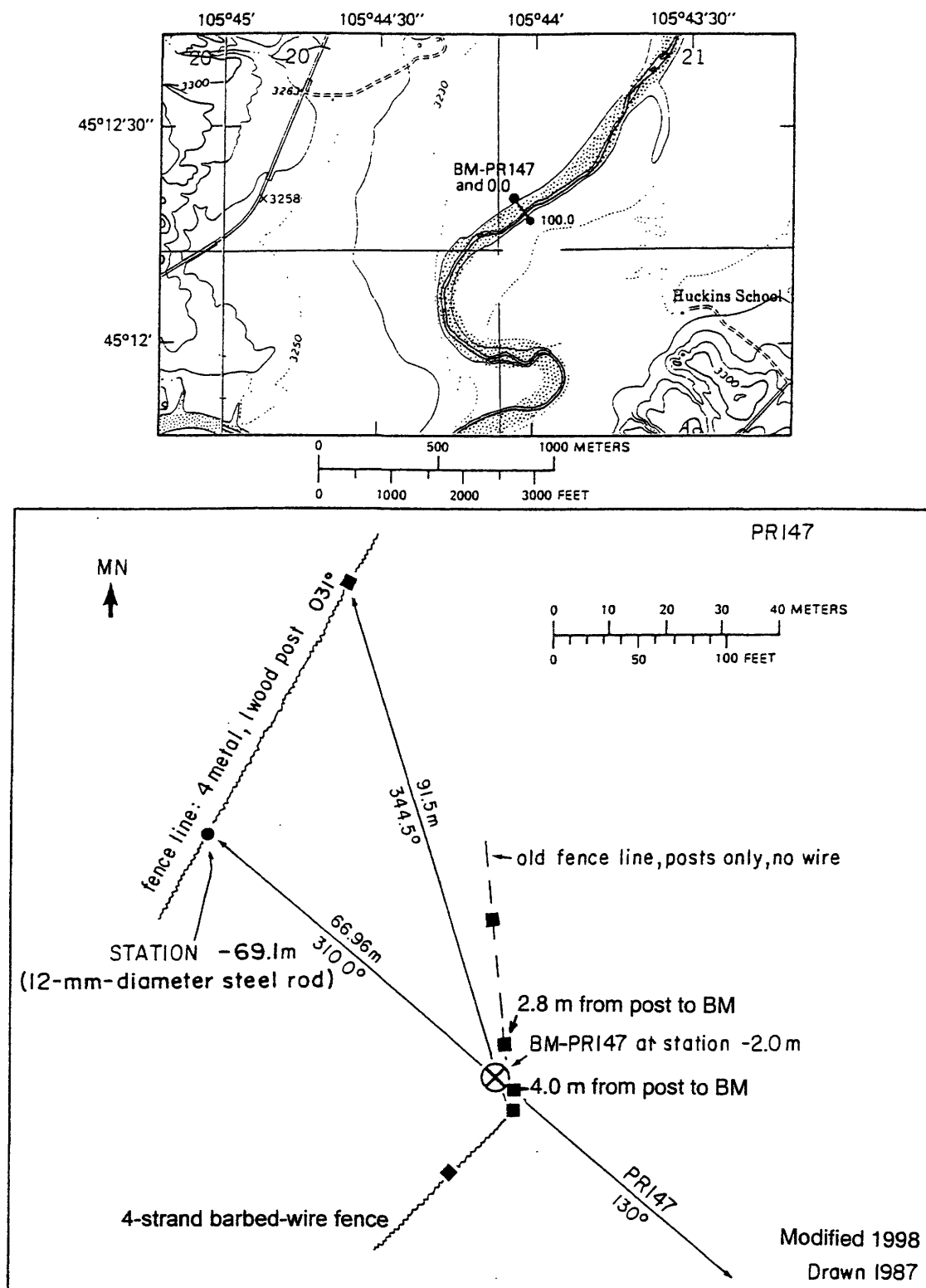


Figure 46. Upper: Location of cross section PR147, bench mark BM-PR147, and the right bank reference monument in the Huckins School quadrangle. Lower: Location of the bench mark on the left bank. MN is magnetic north.

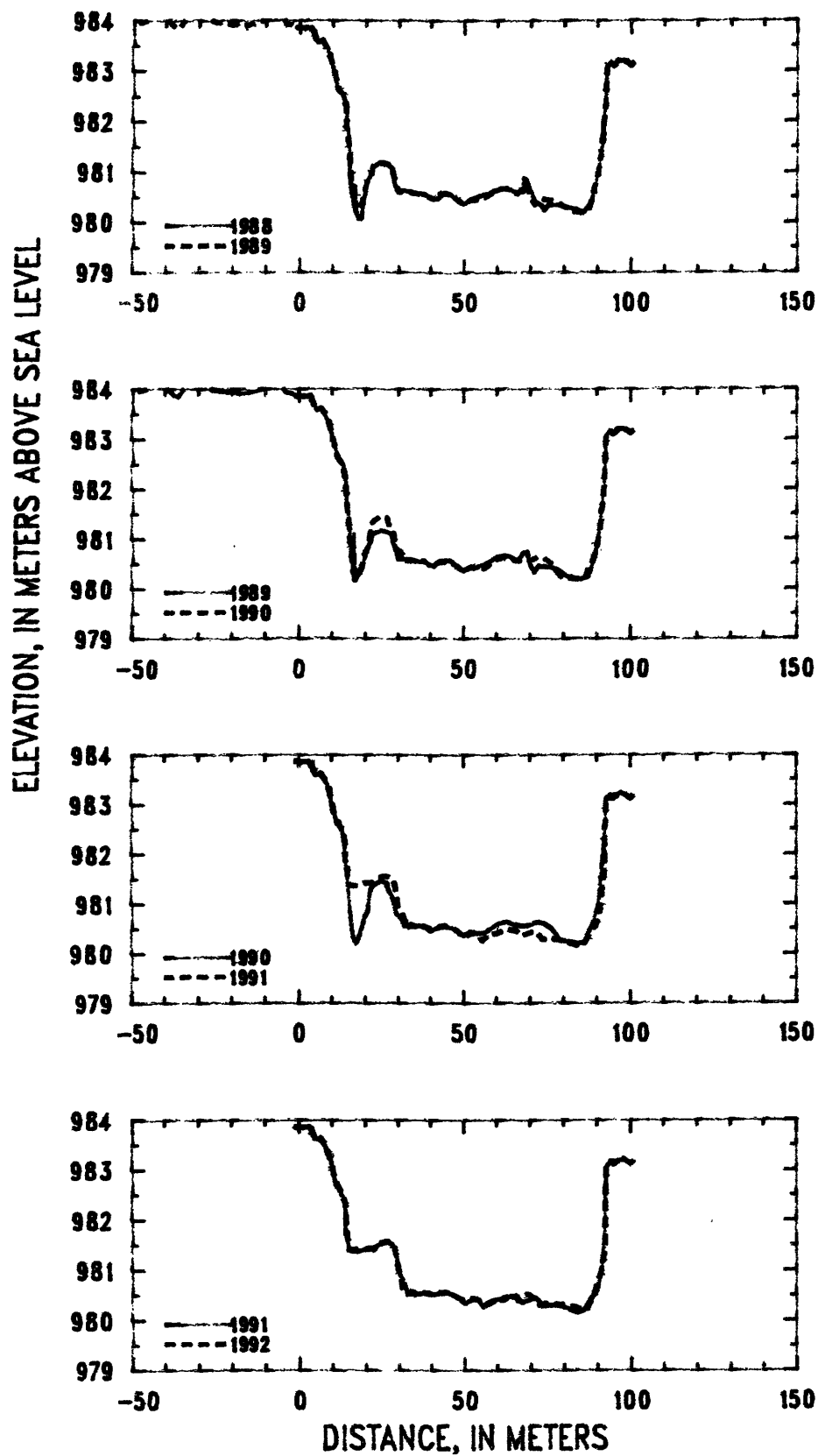


Figure 47. Profiles of cross section PR147 from 1988 to 1992.

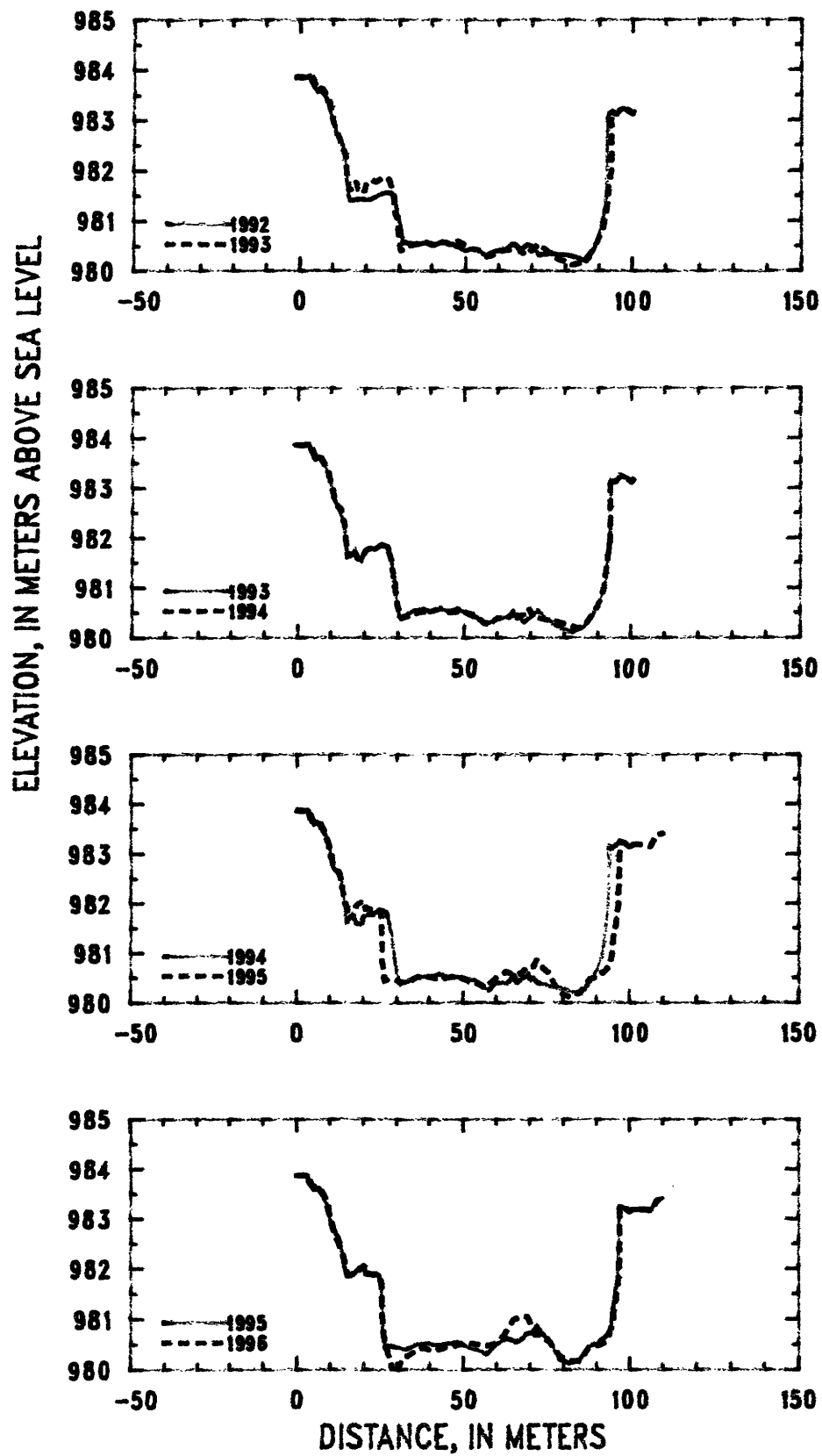


Figure 48. Profiles of cross section PR147 from 1992 to 1996.

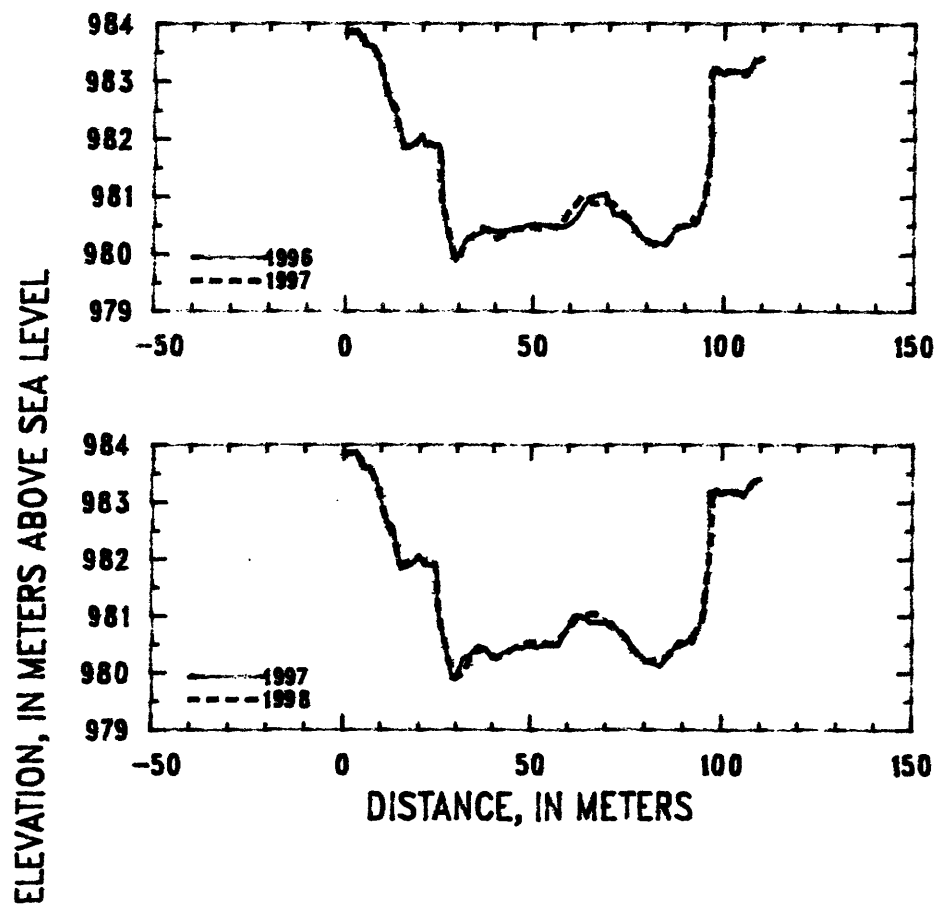


Figure 49. Profiles of cross section PR147 from 1996 to 1998.

Table 18. Listing of horizontal stations and elevations for cross section PR147

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1989		1990		1990	
19 September		19 September		19 September		23 September		23 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-69.1	983.83	15.0	981.46	69.9	980.49	-0.9	983.86	58.0	980.50
-66.0	983.85	15.7	980.77	70.3	980.46	0.0	983.86	60.0	980.60
-63.0	984.17	16.4	980.37	71.3	980.34	2.0	983.85	62.0	980.65
-61.0	984.22	16.6	980.73	72.5	980.46	3.4	983.87	64.0	980.62
-59.0	984.19	17.0	980.19	74.0	980.45	5.0	983.61	65.8	980.56
-56.0	984.25	18.0	980.29	76.0	980.44	5.4	983.58	66.0	980.58
-53.0	984.22	19.0	980.43	78.0	980.39	6.8	983.62	68.0	980.55
-50.0	984.13	20.0	980.73	80.0	980.31	8.0	983.51	70.0	980.57
-47.6	983.96	20.2	980.78	82.0	980.20	9.0	983.34	72.0	980.63
-45.0	984.01	21.0	980.90	84.0	980.20	10.0	983.08	74.0	980.62
-43.0	984.06	21.7	980.97	85.0	980.19	11.6	982.64	76.0	980.53
-41.0	984.15	22.0	981.10	87.5	980.25	13.0	982.53	77.0	980.47
-39.0	983.99	24.0	981.16	88.5	980.47	13.4	982.40	79.0	980.26
-37.0	983.86	26.0	981.16	89.0	980.65	13.8	982.31	81.0	980.25
-36.0	983.85	28.0	981.10	90.2	980.91	14.4	981.78	83.0	980.21
-34.0	984.03	28.3	980.93	91.0	981.34	15.7	980.77	85.0	980.20
-32.0	984.09	29.0	980.84	92.1	982.09	16.5	980.30	86.5	980.21
-30.0	984.07	29.2	980.76	92.6	982.68	17.3	980.21	87.6	980.45
-28.0	984.06	30.0	980.60	92.7	983.08	18.8	980.46	88.0	980.48
-25.0	983.97	32.0	980.60	94.0	983.17	20.0	980.78	88.8	980.56
-22.0	983.94	34.0	980.57	95.0	983.10	20.8	980.84	90.3	980.96
-19.0	983.92	36.0	980.55	96.0	983.21	21.7	981.32	91.0	981.28
-16.0	983.90	38.0	980.56	98.0	983.21	23.0	981.41	91.2	981.58
-13.0	983.96	40.0	980.48	100.0	983.12	25.0	981.46	91.5	981.63
-10.0	984.01	41.0	980.46	100.7	983.17	26.5	981.43	91.6	981.78
-7.0	984.14	42.0	980.55			26.9	981.30	92.0	982.04
-6.0	984.16	44.0	980.57			28.5	981.10	92.7	983.07
-5.0	984.06	46.0	980.57			29.4	980.80	93.0	983.13
-4.0	983.94	48.0	980.44			31.3	980.69	95.0	983.11
-2.0	983.90	50.0	980.37			32.0	980.56	97.0	983.24
-0.9	983.86	52.0	980.44			34.0	980.58	99.0	983.17
0.0	983.86	54.0	980.44			36.0	980.55	100.0	983.12
2.0	983.85	56.0	980.50			38.0	980.56	100.7	983.18
3.6	983.87	58.0	980.56			40.0	980.47		
5.1	983.59	60.0	980.66			42.0	980.53		
7.0	983.61	61.0	980.66			44.0	980.55		
9.0	983.34	63.0	980.68			46.0	980.52		
10.0	983.08	65.0	980.61			48.0	980.46		
12.0	982.60	66.0	980.57			50.0	980.36		
13.2	982.52	67.2	980.63			52.0	980.44		
14.0	982.31	67.7	980.74			54.0	980.41		
14.2	981.88	69.0	980.75			56.0	980.40		

Table 18. (Continued) Listing of horizontal stations and elevations for cross section PR147
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1991		1992		1992		1993	
31 AUGust		31 August		27 August		27 August		28 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-0.9	983.87	64.0	980.49	-0.9	983.86	64.0	980.52	-0.9	983.87
0.0	983.86	66.0	980.46	0.0	983.86	65.0	980.52	0.0	983.87
2.0	983.86	67.4	980.35	2.0	983.86	66.0	980.46	2.0	983.86
3.6	983.87	69.0	980.39	3.5	983.88	66.4	980.38	3.6	983.88
5.0	983.63	71.0	980.45	4.6	983.67	67.9	980.49	4.2	983.79
7.0	983.61	72.0	980.43	5.7	983.57	69.0	980.52	5.0	983.62
8.5	983.44	73.6	980.28	6.6	983.64	70.0	980.50	5.5	983.58
9.3	983.30	75.0	980.31	8.0	983.49	72.0	980.31	6.8	983.62
11.0	982.75	78.0	980.29	9.6	983.19	74.0	980.33	9.0	983.37
13.0	982.52	80.0	980.26	11.0	982.78	76.0	980.35	11.0	982.78
14.0	982.28	82.0	980.21	13.0	982.53	78.0	980.31	12.5	982.58
14.2	981.74	84.0	980.15	14.0	982.30	80.0	980.31	14.0	982.28
14.6	981.75	86.0	980.20	14.3	981.81	82.0	980.28	14.4	981.91
15.0	981.40	87.0	980.29	15.0	981.42	84.0	980.24	14.6	981.87
16.0	981.37	88.4	980.46	16.0	981.40	86.0	980.20	15.0	981.62
18.0	981.37	89.8	980.57	18.0	981.43	86.5	980.19	16.0	981.63
20.0	981.43	91.0	980.90	20.0	981.42	88.0	980.37	17.2	981.76
22.0	981.43	92.3	981.77	22.0	981.43	89.0	980.50	17.8	981.60
24.0	981.52	92.3	982.50	24.0	981.52	91.0	980.97	18.1	981.57
26.0	981.56	92.6	982.72	26.0	981.57	92.2	981.46	19.0	981.58
28.0	981.52	92.7	983.07	27.5	981.57	92.4	982.48	19.3	981.55
29.0	981.39	94.0	983.18	28.5	981.49	92.6	983.05	20.0	981.72
30.0	980.95	96.0	983.18	30.0	980.99	93.0	983.14	21.0	981.79
31.0	980.85	98.0	983.21	30.5	980.87	94.0	983.17	22.0	981.81
32.3	980.64	100.0	983.12	31.0	980.75	95.0	983.11	23.0	981.77
32.7	980.51	100.7	983.17	31.3	980.57	97.0	983.25	23.7	981.79
34.0	980.59			33.0	980.55	100.0	983.12	25.0	981.86
36.0	980.52			35.0	980.51	100.7	983.17	26.0	981.85
38.0	980.56			37.0	980.54			27.0	981.82
40.0	980.51			39.0	980.56			28.2	981.61
42.0	980.53			41.0	980.51			28.9	981.11
44.0	980.57			43.0	980.56			29.4	981.09
46.0	980.52			45.0	980.55			29.7	980.80
48.0	980.47			46.0	980.54			30.5	980.41
50.0	980.32			48.0	980.45			32.0	980.42
52.0	980.40			50.0	980.40			34.0	980.51
54.0	980.42			52.0	980.44			36.0	980.54
55.7	980.26			54.0	980.42			38.0	980.58
57.0	980.35			56.0	980.29			40.0	980.51
59.0	980.40			58.0	980.35			42.0	980.56
60.5	980.42			60.0	980.41			44.0	980.56
62.0	980.46			62.0	980.40			46.0	980.51

Table 18. (Continued) Listing of horizontal stations and elevations for cross section PR147
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1993		1994		1994		1995		1995	
28 August		22 September		22 September		2 October		2 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
48.0	980.59	0.0	983.87	75.0	980.35	0.0	983.88	82.0	980.12
50.0	980.50	2.0	983.86	78.0	980.32	2.0	983.86	85.0	980.20
52.0	980.43	3.6	983.87	81.0	980.26	3.5	983.88	88.0	980.48
54.0	980.41	5.5	983.58	84.0	980.19	4.5	983.69	91.0	980.53
56.0	980.27	6.6	983.63	86.5	980.27	5.5	983.58	91.5	980.60
58.0	980.30	8.0	983.49	87.8	980.42	7.0	983.60	93.0	980.66
60.0	980.38	9.3	983.30	90.0	980.64	9.0	983.36	94.4	980.85
62.0	980.40	11.4	982.69	91.7	980.97	11.0	982.78	94.8	981.24
64.0	980.43	13.0	982.58	93.6	981.98	13.0	982.60	95.7	981.53
66.0	980.46	13.9	982.33	93.7	983.16	14.6	981.99	96.5	981.98
68.0	980.30	15.0	981.62	95.0	983.12	15.5	981.85	96.9	983.25
70.0	980.42	17.0	981.77	97.0	983.25	17.0	981.87	98.0	983.23
72.0	980.53	18.0	981.59	100.0	983.12	19.0	982.02	100.0	983.14
74.0	980.43	19.5	981.58	100.7	983.18	20.5	982.05	100.7	983.18
76.0	980.31	20.1	981.74			20.7	981.89	102.0	983.19
78.0	980.21	21.0	981.78			22.0	981.89	104.0	983.17
80.0	980.18	23.0	981.78			23.0	981.86	106.0	983.14
82.0	980.11	25.0	981.87			24.6	981.88	108.0	983.37
84.0	980.14	27.0	981.82			25.4	981.75	110.0	983.41
86.0	980.22	28.0	981.56			25.7	980.81		
88.0	980.40	29.8	980.70			26.5	980.43		
89.4	980.58	31.0	980.38			28.0	980.47		
91.0	980.80	34.0	980.45			30.0	980.44		
92.0	981.06	37.0	980.51			33.0	980.40		
92.6	981.34	40.0	980.53			36.0	980.51		
92.9	981.68	43.0	980.59			39.0	980.54		
93.3	981.79	46.0	980.50			42.0	980.49		
93.4	981.91	49.0	980.53			45.0	980.50		
93.6	981.95	52.0	980.47			48.0	980.55		
93.7	983.15	54.0	980.43			51.0	980.45		
95.0	983.11	56.0	980.29			54.0	980.40		
97.0	983.25	58.0	980.25			57.0	980.30		
99.0	983.19	60.0	980.40			60.0	980.50		
100.0	983.12	63.5	980.40			63.0	980.63		
100.7	983.17	64.8	980.53			66.0	980.54		
		65.6	980.54			68.0	980.61		
		66.0	980.40			69.0	980.72		
		68.0	980.47			71.0	980.73		
		69.5	980.59			72.0	980.86		
		70.2	980.46			74.0	980.69		
		71.3	980.49			75.5	980.61		
		72.5	980.39			79.0	980.19		

Table 18. (Continued) Listing of horizontal stations and elevations for cross section PR147
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1996		1997		1997		1998	
25 October		25 October		20 September		20 September		28 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.0	983.87	94.8	980.89	0.0	983.86	66.0	980.88	0.0	983.86
3.0	983.87	96.5	981.73	2.0	983.85	68.0	980.88	2.0	983.86
5.0	983.63	96.8	981.98	3.6	983.87	70.0	980.89	3.5	983.87
7.0	983.60	97.0	983.22	5.5	983.59	71.4	980.87	5.5	983.59
9.0	983.36	98.0	983.23	7.0	983.60	73.0	980.72	7.0	983.57
11.0	982.80	100.0	983.12	8.5	983.44	75.0	980.65	9.0	983.33
14.0	982.26	100.7	983.18	10.0	983.07	75.9	980.54	11.0	982.77
15.3	981.86	104.0	983.17	11.5	982.66	78.0	980.33	13.0	982.45
17.0	981.86	106.5	983.17	13.0	982.57	81.0	980.18	15.0	981.93
20.0	982.06	108.0	983.35	14.5	982.04	84.0	980.11	17.0	981.95
21.0	981.90	110.0	983.41	15.5	981.85	86.0	980.26	19.0	982.05
23.0	981.88			18.0	981.91	88.0	980.46	21.0	981.99
24.5	981.89			20.0	982.06	89.5	980.47	23.0	981.97
25.4	981.72			21.5	981.92	91.2	980.54	24.0	981.94
25.6	981.06			23.0	981.89	92.0	980.62	24.7	981.71
26.0	980.69			24.5	981.87	92.5	980.54	25.0	981.12
28.7	979.99			25.0	981.67	95.0	980.92	25.9	980.80
29.5	979.89			25.0	981.20	96.6	981.83	28.0	980.20
32.0	980.23			25.5	980.86	96.7	983.17	30.0	979.90
35.0	980.33			26.3	980.69	98.5	983.19	32.0	980.00
38.0	980.43			27.3	980.39	100.0	983.14	35.0	980.37
41.0	980.37			29.0	979.91	100.7	983.18	38.0	980.42
44.0	980.42			30.0	979.89	103.0	983.18	41.0	980.25
47.0	980.46			32.0	980.25	105.5	983.10	44.0	980.37
50.0	980.52			34.0	980.30	108.0	983.36	47.0	980.50
53.0	980.51			36.0	980.46	110.0	983.40	50.0	980.54
56.0	980.47			38.0	980.42			53.0	980.54
58.0	980.47			40.0	980.26			56.0	980.51
60.0	980.52			42.0	980.31			58.0	980.62
62.0	980.65			44.0	980.39			59.7	980.75
65.0	980.98			46.0	980.45			61.7	981.00
67.0	981.02			48.0	980.43			64.0	981.02
69.3	981.04			50.0	980.48			67.0	981.04
71.5	980.68			52.0	980.44			68.0	981.02
73.0	980.68			54.0	980.50			70.0	980.88
75.7	980.56			56.0	980.47			72.0	980.78
79.0	980.26			57.3	980.48			74.4	980.68
82.0	980.17			58.8	980.64			77.0	980.40
85.0	980.16			60.3	980.84			80.0	980.20
88.0	980.46			61.4	980.86			83.0	980.23
91.0	980.49			63.0	981.01			86.0	980.28
93.0	980.55			64.9	980.97			89.0	980.55

Table 18. (Continued) Listing of horizontal stations and elevations for cross section PR147

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1998	
28 September	
Sta.	Elev.
91.0	980.52
92.8	980.69
95.0	980.95
97.0	982.23
97.5	983.24
100.0	983.15
100.7	983.19
104.0	983.17
106.0	983.15
107.5	983.32
110.0	983.41

Description of Cross Section PR151

Location: Township 7 South/Range 49 East--section 15

U. S. Geological Survey quadrangle (1:24,000): Huckins School

Landowners--left bank: Gay Ranch

--right bank: Huckins Ranch

Access: Right bank

Permission from: Floyd and Dora Huckins

Distance from Moorhead Gaging Station: 36.27 kilometers

Azimuth of Section (degrees magnetic): 176.5

Reference Monuments

[Monuments at stations 100.0, 101.1, and 101.2 were closest to the leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
Benchmark--brass circular plate	-1.95	45°13'32.83"	105°41'47.36"	0.251	0.531	977.46
1/2-inch-rebar; bent flat on 1998 ground level	-0.9					977.63
1/2-inch-rebar; 0.02 meter above 1998 ground level	0.0					977.54
1/2-inch-rebar; 0.07 meter above 1998 ground level	100.0					977.12
1/2-inch-rebar; 0.02 meter above 1998 ground level	101.1					976.98
1/2-inch-rebar; 0.10 meter above 1998 ground level	101.2	45°13'36.11"	105°41'46.45"	0.353	0.596	977.06

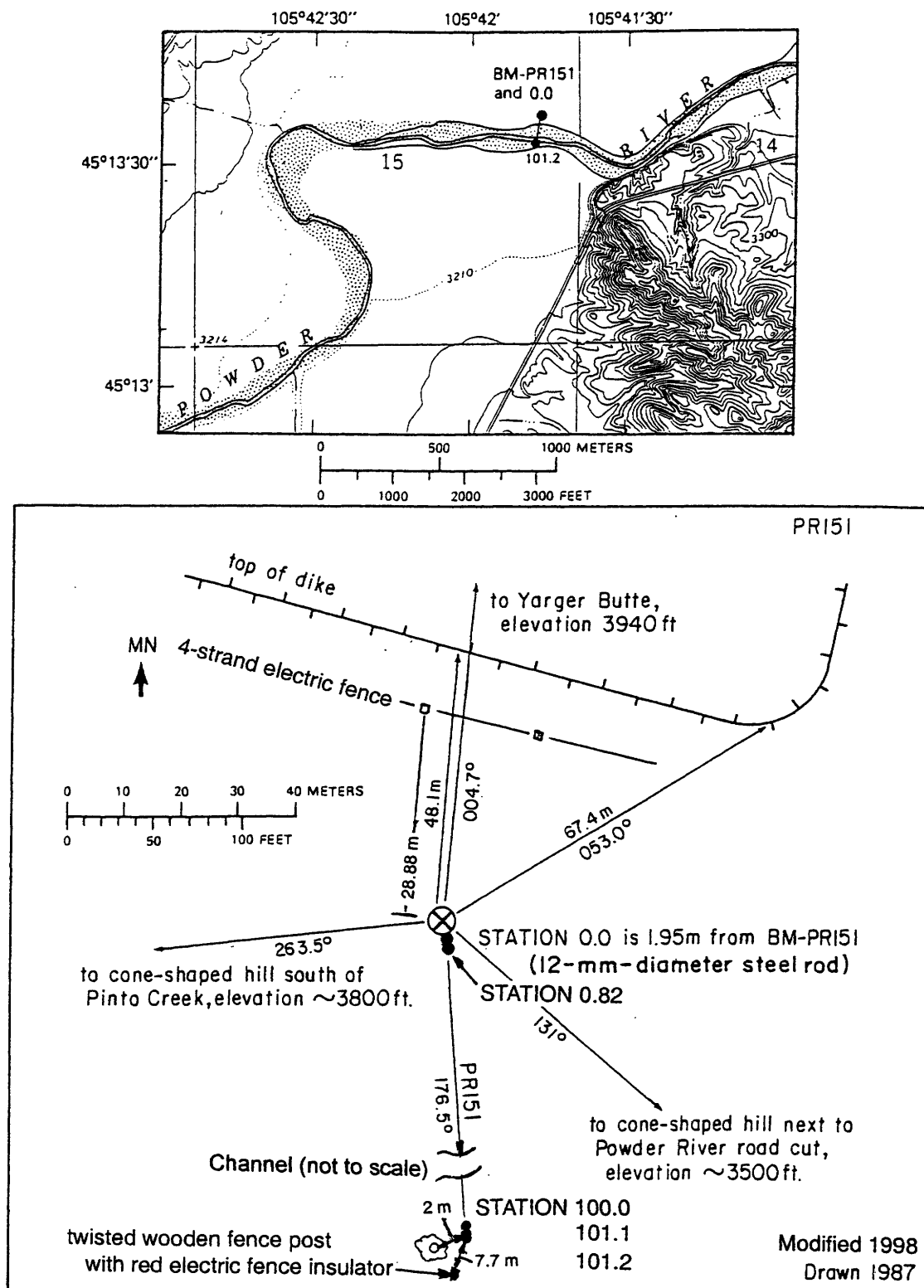


Figure 50. Upper: Location of cross section PR151, bench mark BM-PR151, and the right bank reference monument in the Huckins School quadrangle. Lower: Location of the bench mark on the left bank and reference monuments on the right bank. MN is magnetic north.

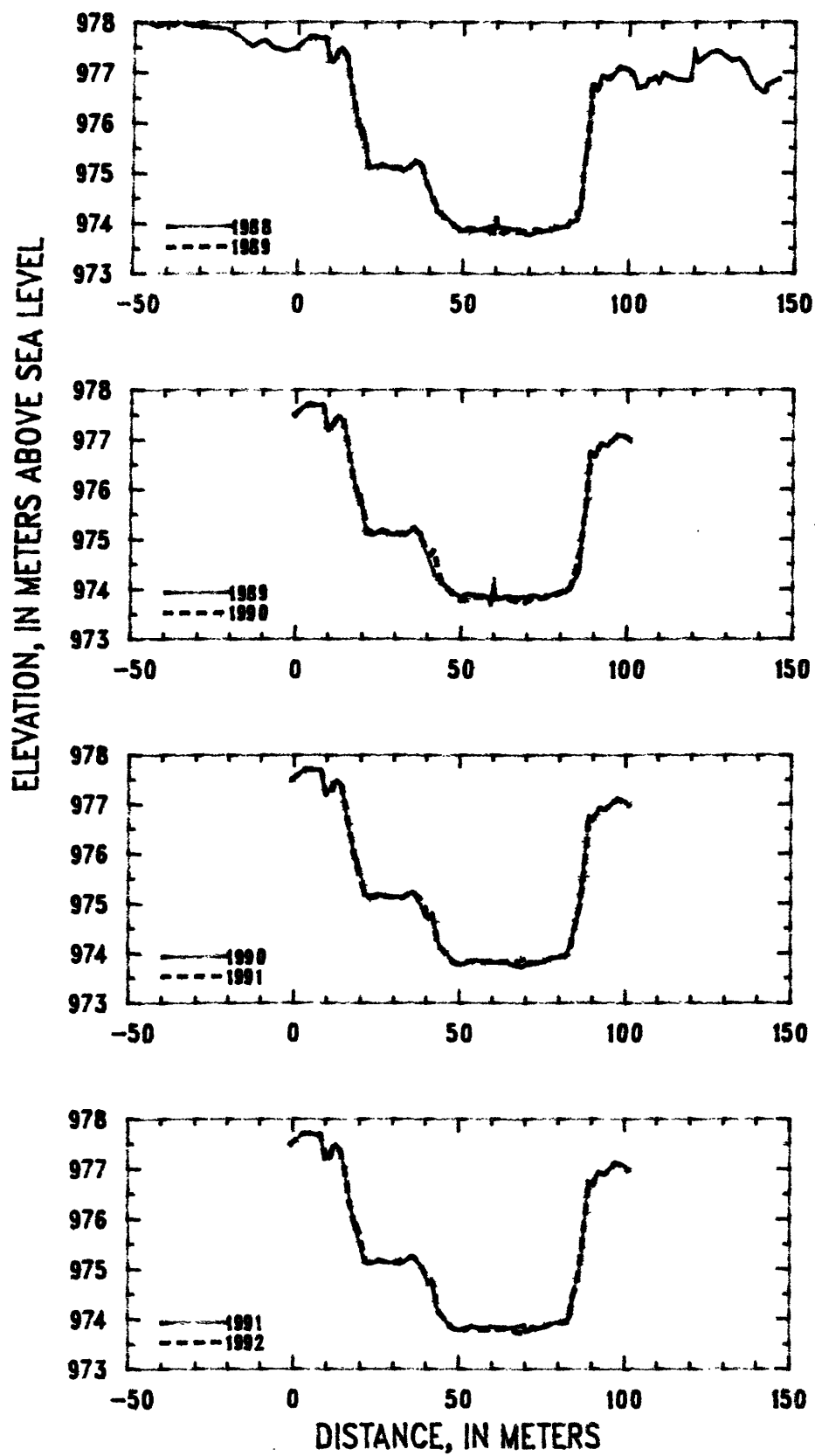


Figure 51. Profiles of cross section PR151 from 1988 to 1992.

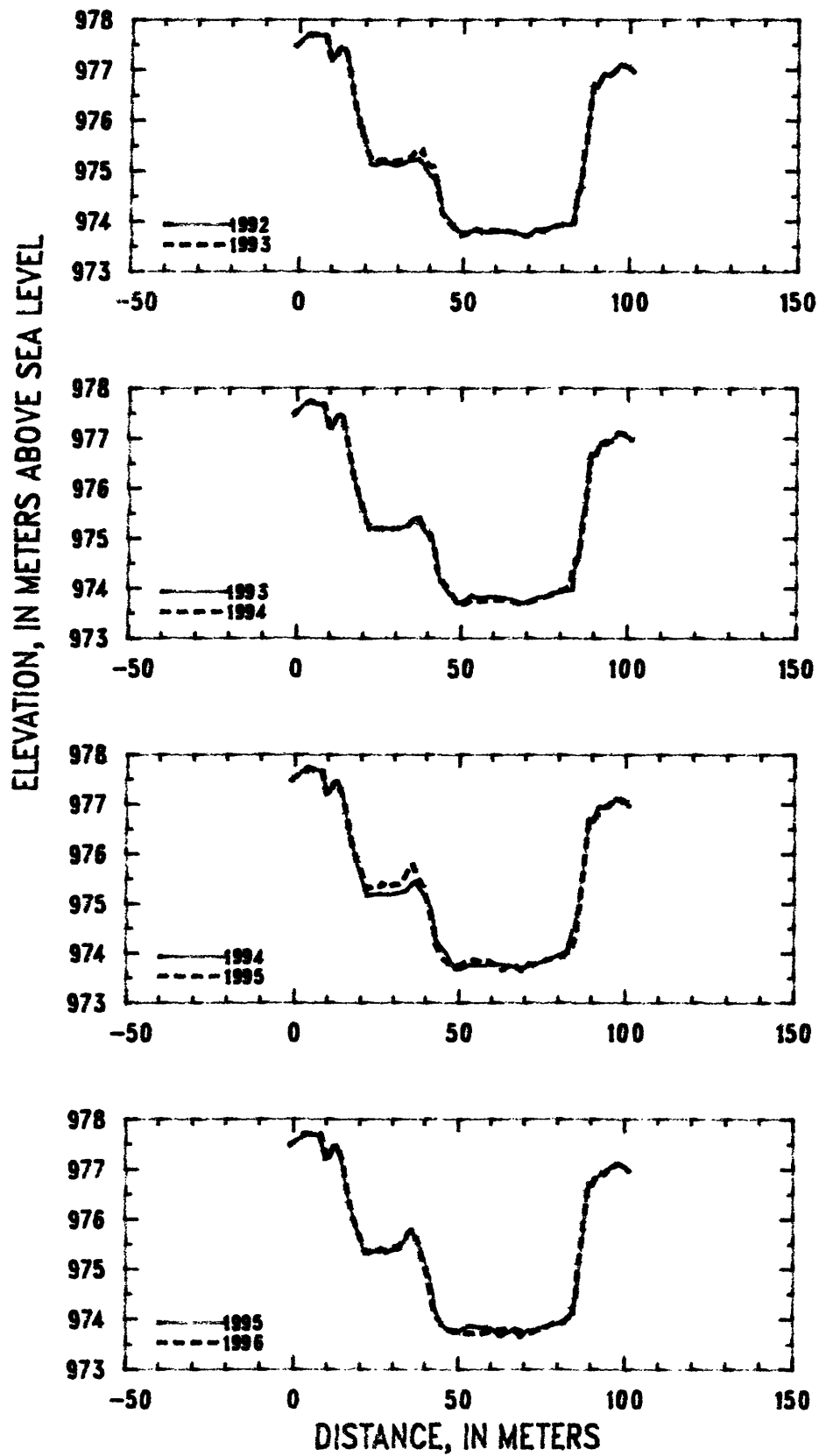


Figure 52. Profiles of cross section PR151 from 1992 to 1996.

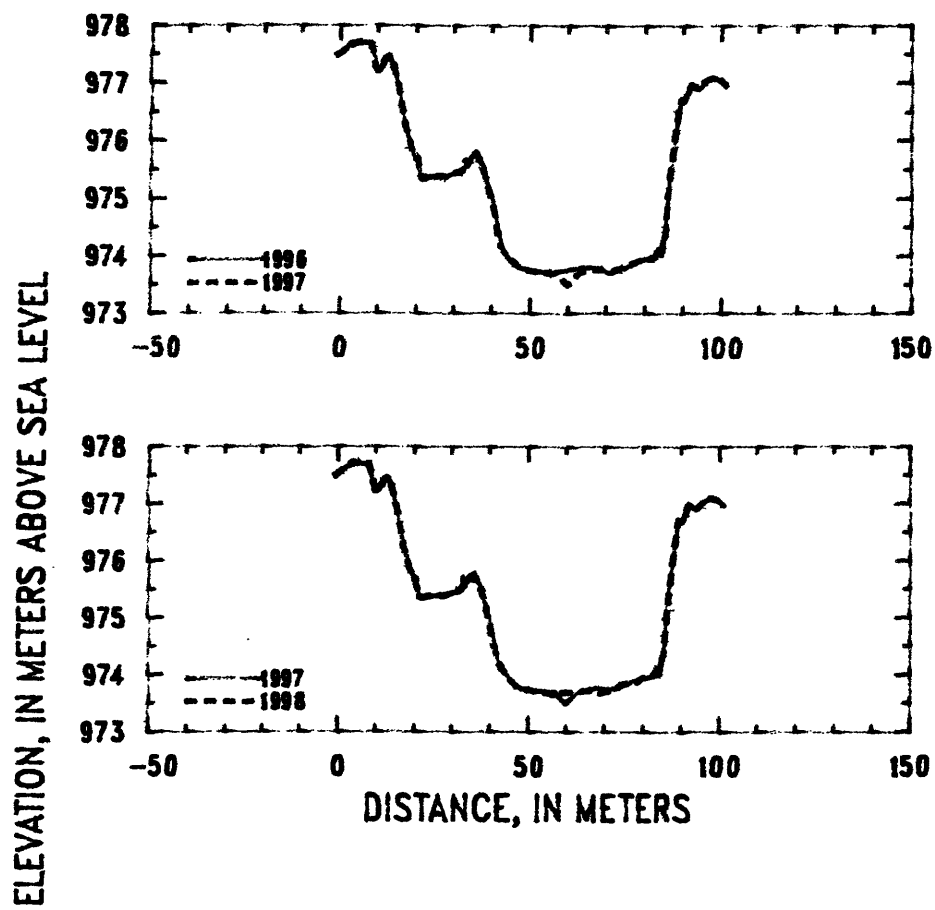


Figure 53. Profiles of cross section PR151 from 1996 to 1998.

Table 19. Listing of horizontal stations and elevations for cross section PR151

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1990		1990		1991	
19 September		19 September		19 September		19 September		30 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-0.8	977.48	62.0	973.81	-0.8	977.49	65.0	973.80	-0.9	977.50
0.0	977.53	64.0	973.86	0.0	977.53	67.0	973.75	0.0	977.53
2.0	977.65	66.0	973.84	3.0	977.70	69.0	973.73	3.0	977.71
4.0	977.73	68.0	973.83	6.0	977.70	71.0	973.82	5.0	977.72
6.0	977.69	70.0	973.87	8.3	977.69	73.0	973.82	7.0	977.67
8.4	977.70	72.0	973.88	8.6	977.62	75.0	973.82	8.4	977.66
9.7	977.19	74.0	973.83	9.4	977.25	77.0	973.90	9.7	977.20
11.0	977.27	76.0	973.87	10.0	977.19	79.0	973.91	11.2	977.21
12.0	977.43	78.0	973.92	12.0	977.43	81.0	973.96	12.0	977.42
13.0	977.48	80.0	973.96	13.0	977.49	82.0	973.93	13.0	977.48
14.5	977.35	81.5	973.94	14.1	977.42	83.0	974.06	14.3	977.38
16.0	976.74	82.5	974.07	15.0	977.13	84.0	974.28	15.0	977.14
18.0	976.03	83.5	974.12	17.0	976.31	85.0	974.58	18.0	976.02
19.0	975.77	85.4	974.31	19.0	975.76	85.9	974.76	19.0	975.75
19.2	975.85	85.7	974.43	19.2	975.84	86.9	975.38	21.3	975.17
20.0	975.68	86.3	975.04	20.7	975.44	87.3	975.51	23.0	975.11
21.0	975.12	87.0	975.41	21.1	975.19	89.0	976.75	26.0	975.17
23.0	975.09	87.3	975.49	23.0	975.14	90.1	976.68	29.0	975.13
25.0	975.16	88.5	976.32	25.0	975.18	92.0	976.91	32.0	975.10
27.0	975.14	88.8	976.74	27.0	975.16	94.0	976.90	34.0	975.16
29.0	975.10	89.8	976.74	29.0	975.13	96.0	977.03	35.0	975.23
31.0	975.10	90.3	976.67	31.0	975.13	97.5	977.12	36.0	975.24
33.0	975.08	92.0	976.92	33.0	975.12	99.0	977.07	38.0	975.13
35.0	975.19	94.0	976.88	34.0	975.18	100.0	977.05	39.7	974.90
36.3	975.22	96.0	977.04	36.0	975.23	101.2	976.96	40.8	974.70
37.3	975.11	97.0	977.11	37.0	975.17			41.9	974.76
37.7	975.13	98.5	977.07	38.0	975.04			42.6	974.59
39.0	974.79	100.0	977.05	40.0	974.73			43.4	974.23
41.7	974.40	101.2	976.96	40.9	974.69			44.4	974.12
42.0	974.29			42.0	974.80			46.4	973.96
43.8	974.14			43.0	974.43			48.0	973.82
44.7	974.11			44.2	974.12			50.0	973.77
46.0	974.03			45.3	974.08			52.0	973.82
48.0	973.91			47.0	973.93			54.0	973.85
50.0	973.85			49.0	973.78			56.0	973.81
52.0	973.90			51.0	973.77			58.0	973.83
54.0	973.87			53.0	973.84			60.0	973.85
56.0	973.88			55.0	973.85			62.0	973.83
58.0	973.83			57.0	973.85			64.0	973.83
59.0	973.72			59.0	973.81			66.0	973.82
60.0	974.12			61.0	973.82			68.0	973.86
60.5	973.85			63.0	973.82			69.6	973.89

Table 19. (Continued) Listing of horizontal stations and elevations for cross section PR151

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1992		1992		1993		1993	
30 August		31 August		31 August		29 August		29 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
70.1	973.76	-0.9	977.48	72.0	973.84	-0.9	977.48	59.0	973.83
72.0	973.81	0.0	977.53	74.0	973.80	0.0	977.53	61.0	973.83
74.0	973.81	3.0	977.71	76.0	973.86	2.0	977.64	63.0	973.82
76.0	973.86	6.0	977.70	78.0	973.91	4.0	977.73	65.0	973.78
78.0	973.92	8.5	977.69	80.0	973.94	6.0	977.70	67.0	973.73
80.0	973.94	9.8	977.20	82.0	973.92	7.0	977.68	69.0	973.70
81.5	973.96	11.0	977.28	83.0	973.95	8.3	977.68	71.0	973.76
83.4	974.02	12.0	977.43	83.6	974.13	9.5	977.27	73.0	973.83
84.2	974.36	14.0	977.42	84.5	974.52	10.4	977.20	75.0	973.83
86.0	974.88	15.0	977.15	84.9	974.55	11.3	977.30	77.0	973.89
87.3	975.52	17.0	976.32	85.5	974.74	13.0	977.48	79.0	973.92
88.0	975.98	19.0	975.75	87.2	975.49	14.0	977.44	81.0	973.95
88.9	976.75	19.3	975.83	89.2	976.73	15.0	977.11	83.0	973.97
90.0	976.68	21.6	975.14	90.2	976.67	17.0	976.30	83.6	973.98
92.0	976.92	23.0	975.11	92.0	976.92	19.0	975.74	83.8	974.15
94.0	976.90	25.0	975.18	94.0	976.89	19.8	975.66	84.5	974.59
96.0	977.05	27.0	975.15	96.0	977.04	20.9	975.38	85.6	974.64
98.0	977.10	29.0	975.12	97.0	977.11	22.0	975.19	86.4	975.30
100.0	977.05	31.0	975.13	99.0	977.07	24.0	975.22	87.0	975.51
101.2	976.96	33.0	975.19	100.0	977.04	26.0	975.22	87.3	975.56
		35.0	975.23	101.2	976.96	28.0	975.19	88.6	976.47
		36.6	975.23			30.0	975.20	89.0	976.56
		38.0	975.13			32.0	975.21	89.1	976.71
		39.6	974.92			34.0	975.27	90.2	976.67
		41.0	974.88			35.0	975.34	92.0	976.93
		42.0	974.74			36.0	975.41	93.4	976.88
		42.5	974.68			37.0	975.42	95.0	976.95
		43.7	974.20			37.4	975.36	97.5	977.11
		44.1	974.13			37.7	975.40	100.0	977.04
		46.0	974.00			38.6	975.19	101.2	976.96
		48.0	973.82			40.0	975.09		
		50.0	973.77			40.9	975.10		
		52.0	973.79			42.2	974.68		
		54.0	973.85			43.0	974.41		
		56.0	973.79			43.6	974.17		
		58.0	973.77			45.0	974.02		
		60.0	973.81			47.0	973.87		
		62.0	973.80			49.0	973.70		
		64.0	973.80			51.0	973.74		
		66.0	973.78			53.0	973.85		
		68.0	973.73			55.0	973.80		
		70.0	973.73			57.0	973.82		

Table 19. (Continued) Listing of horizontal stations and elevations for cross section PR151
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1994		1994		1995		1995		1996	
20 September		20 September		27 September		27 September		19 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-0.8	977.48	85.5	974.63	-0.8	977.49	71.0	973.78	-0.9	977.49
0.0	977.52	87.3	975.57	0.0	977.52	73.0	973.78	0.0	977.52
2.0	977.65	89.1	976.71	2.0	977.63	75.0	973.83	3.0	977.71
4.0	977.74	90.3	976.66	5.0	977.71	77.0	973.87	6.0	977.70
6.0	977.70	92.0	976.95	8.3	977.68	79.0	973.90	8.4	977.70
8.5	977.68	95.0	976.94	9.7	977.21	81.0	973.93	10.0	977.20
10.0	977.20	97.0	977.12	11.0	977.25	83.0	974.02	11.0	977.26
11.0	977.25	99.0	977.09	12.0	977.44	83.5	974.02	12.0	977.43
12.0	977.43	100.0	977.05	13.2	977.48	84.5	974.18	13.0	977.48
13.0	977.47	101.1	976.97	15.0	977.04	85.5	974.50	14.6	977.24
14.0	977.34	101.2	976.97	17.0	976.30	87.9	975.91	16.5	976.49
15.0	977.07			19.0	975.79	89.2	976.73	18.0	976.02
17.0	976.28			20.0	975.67	90.4	976.68	20.0	975.66
19.0	975.76			21.5	975.31	93.0	976.93	21.7	975.33
22.0	975.17			23.0	975.33	96.0	977.05	24.0	975.39
25.0	975.21			25.0	975.38	97.5	977.11	26.0	975.39
28.0	975.19			26.0	975.35	100.0	977.05	28.0	975.38
31.0	975.21			26.5	975.42	101.1	976.97	30.0	975.43
34.0	975.26			28.0	975.32	101.2	976.97	32.0	975.47
36.0	975.40			30.0	975.39			34.0	975.60
36.8	975.45			32.0	975.40			35.0	975.74
38.0	975.33			34.0	975.59			36.0	975.79
40.0	975.12			35.0	975.75			37.0	975.65
42.0	974.82			36.0	975.80			38.0	975.55
43.0	974.27			37.0	975.60			38.5	975.38
43.5	974.21			39.0	975.39			40.0	975.03
46.0	974.01			41.0	974.94			41.0	974.75
49.0	973.68			42.6	974.40			42.0	974.40
51.0	973.69			43.0	974.19			43.0	974.10
53.0	973.77			45.0	973.90			43.4	974.07
56.0	973.75			47.0	973.79			45.0	973.90
59.0	973.77			49.0	973.73			47.0	973.79
62.0	973.78			51.0	973.79			50.0	973.76
65.0	973.76			53.0	973.88			53.0	973.72
68.0	973.68			55.0	973.86			56.0	973.71
71.0	973.74			57.0	973.81			59.0	973.74
74.0	973.80			59.0	973.85			62.0	973.79
77.0	973.86			61.0	973.78			65.0	973.81
80.0	973.96			63.0	973.65			68.0	973.79
82.0	974.01			65.0	973.74			71.0	973.70
83.0	974.07			67.0	973.79			74.0	973.78
83.4	974.33			69.0	973.65			77.0	973.86

Table 19. (Continued) Listing of horizontal stations and elevations for cross section PR151

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1997		1997		1998		1998	
19 October		23 September		23 September		23 September		23 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
80.0	973.96	-0.9	977.49	69.0	973.77	-0.9	977.49	73.0	973.77
82.0	973.93	0.0	977.52	72.0	973.75	0.0	977.52	75.0	973.85
83.2	974.06	2.0	977.64	75.0	973.82	2.0	977.64	77.0	973.84
83.8	974.13	5.0	977.72	78.0	973.91	4.0	977.74	79.0	973.90
84.5	974.11	8.0	977.69	81.0	973.95	6.0	977.69	80.0	973.96
85.6	974.51	8.5	977.64	82.8	973.99	8.3	977.69	82.0	973.96
86.0	974.95	9.5	977.26	83.5	974.11	10.0	977.21	83.0	974.02
88.8	976.41	10.0	977.21	84.2	974.01	11.3	977.28	84.2	974.03
89.3	976.73	10.5	977.22	85.6	974.42	12.4	977.45	84.7	974.19
90.3	976.69	12.0	977.43	86.0	975.04	13.5	977.43	85.4	974.35
92.0	976.95	13.0	977.47	87.5	975.78	15.0	977.11	87.0	975.50
94.0	976.90	14.0	977.35	89.1	976.70	17.0	976.31	89.2	976.72
96.0	977.05	15.0	977.05	90.2	976.69	19.0	975.82	90.3	976.67
98.0	977.11	17.0	976.32	92.0	976.98	21.0	975.50	92.0	977.00
100.0	977.05	19.0	975.82	94.0	976.91	22.0	975.35	94.0	976.90
101.1	976.97	20.0	975.67	96.0	977.05	24.0	975.40	97.0	977.11
101.2	976.97	20.5	975.70	98.0	977.10	26.0	975.40	100.0	977.05
		21.4	975.36	100.0	977.05	28.0	975.38	101.1	976.96
		23.0	975.37	101.1	976.97	30.0	975.45	101.2	976.95
		26.0	975.39	101.2	976.96	32.0	975.48		
		28.0	975.38			33.7	975.58		
		30.0	975.44			34.1	975.72		
		32.0	975.46			34.5	975.69		
		32.9	975.50			36.0	975.69		
		33.2	975.67			37.5	975.59		
		33.7	975.58			39.1	975.21		
		35.0	975.74			40.7	974.63		
		36.0	975.79			42.6	974.20		
		37.0	975.66			45.0	973.94		
		38.3	975.41			47.0	973.77		
		40.0	974.94			49.0	973.74		
		41.0	974.71			51.0	973.72		
		41.5	974.41			53.0	973.68		
		42.7	974.11			55.0	973.69		
		45.0	973.95			57.0	973.62		
		48.0	973.75			59.0	973.69		
		51.0	973.73			61.0	973.70		
		54.0	973.70			63.0	973.70		
		57.0	973.69			65.0	973.72		
		60.0	973.49			67.0	973.74		
		63.0	973.71			69.0	973.68		
		66.0	973.76			71.0	973.72		

Description of Cross Section PR156A

Location: Township 7 South/Range 49 East--section 12

U. S. Geological Survey quadrangle (1:24,000): Huckins School

Landowners--left bank: Gay Ranch

--right bank: Twin Butte Ranch

Access: Right bank

Permission from: Butch Samuelson

Distance from Moorhead Gaging Station: 40.24 kilometers

Azimuth of Section (degrees magnetic): 124.5

Reference Monuments

[Monuments at stations 130.0, 131.0, and 159.2 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.27 meter above 1998 ground level; on old fence line with no wire but just post made from tree and riverward of a dike	-141.6	45°14'52.42"	105°40'05.27"	0.416	0.660	975.93
1/2-inch-rebar; bent, 0.07 meter above 1998 ground level; 36.9 meters upstream from monument at station -4.2 on PR156	-1.6	45°14'48.99"	105°40'01.06"	0.126	0.534	971.21
1/2-inch-rebar; at 1998 ground level	0.0					971.12
1/2-inch-rebar; at 1998 ground level	130.0					971.66
1/2-inch-rebar; bent, 0.18 meter above 1998 ground level	131.0	45°14'45.74"	105°39'57.08"	0.463	0.786	971.84
1/2-inch-rebar; 0.11 meter above 1998 ground level; under a 3-strand barbed-wire fence	159.2					971.95
Benchmark--brass circular plate; offsection	---	45°14'44.90"	105°39'56.56"	1.241	0.637	972.17

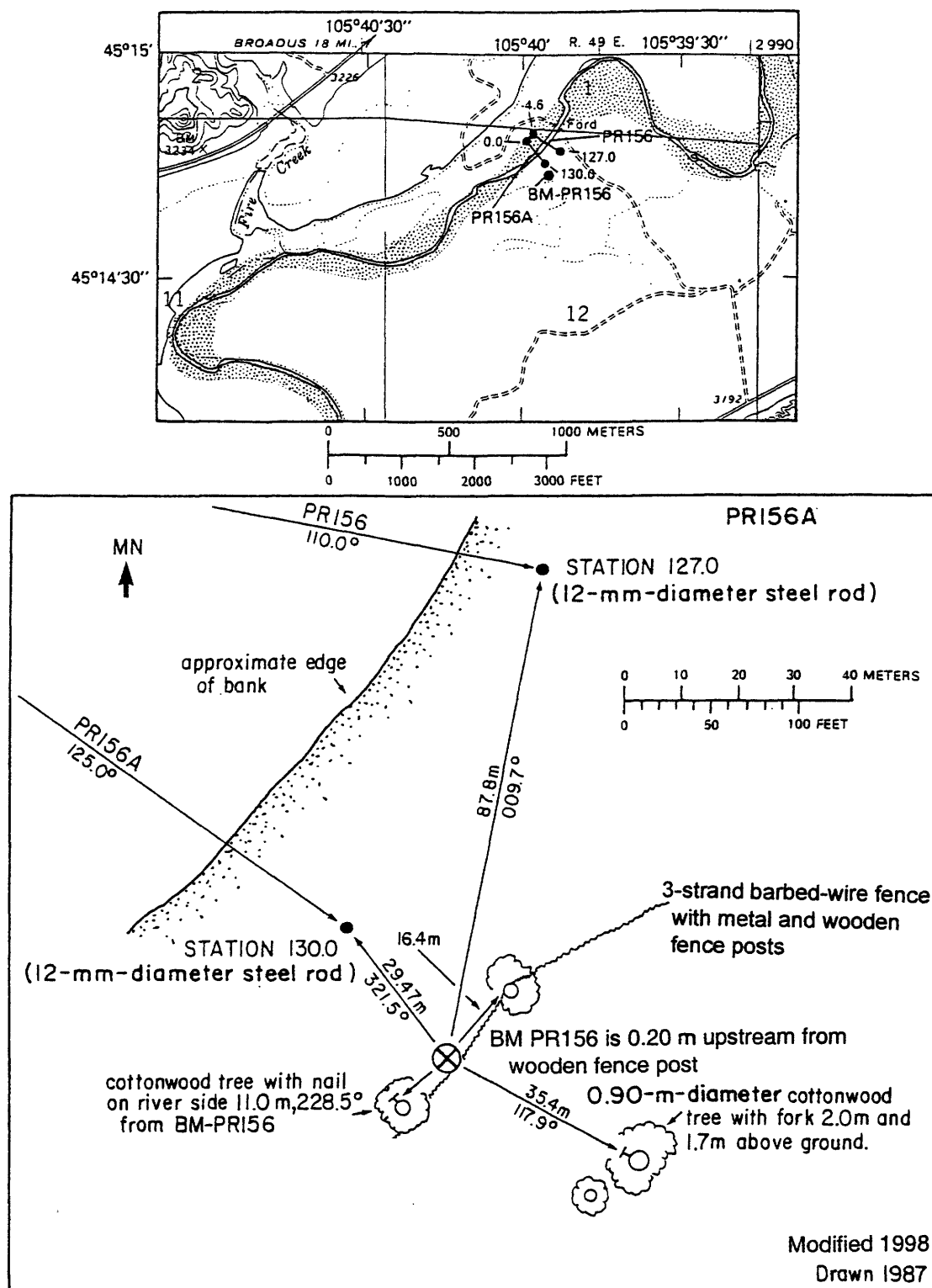


Figure 54. Upper: Location of cross section PR156A, bench mark BM-PR156, and the left and right bank reference monuments in the Huckins School quadrangle. Lower: Location of the bench mark on the left bank. MN is magnetic north.

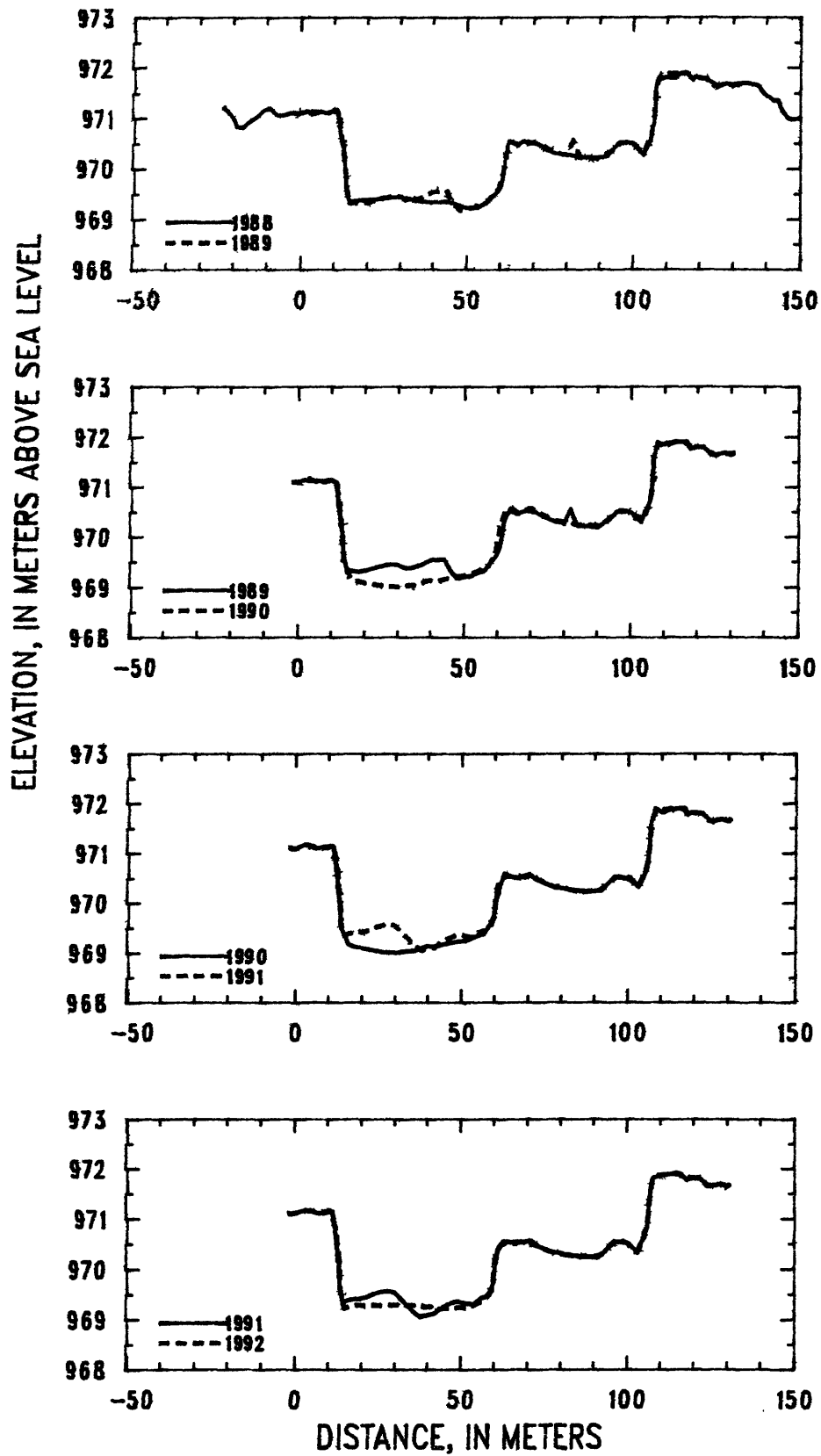


Figure 55. Profiles of cross section PR156A from 1988 to 1992.

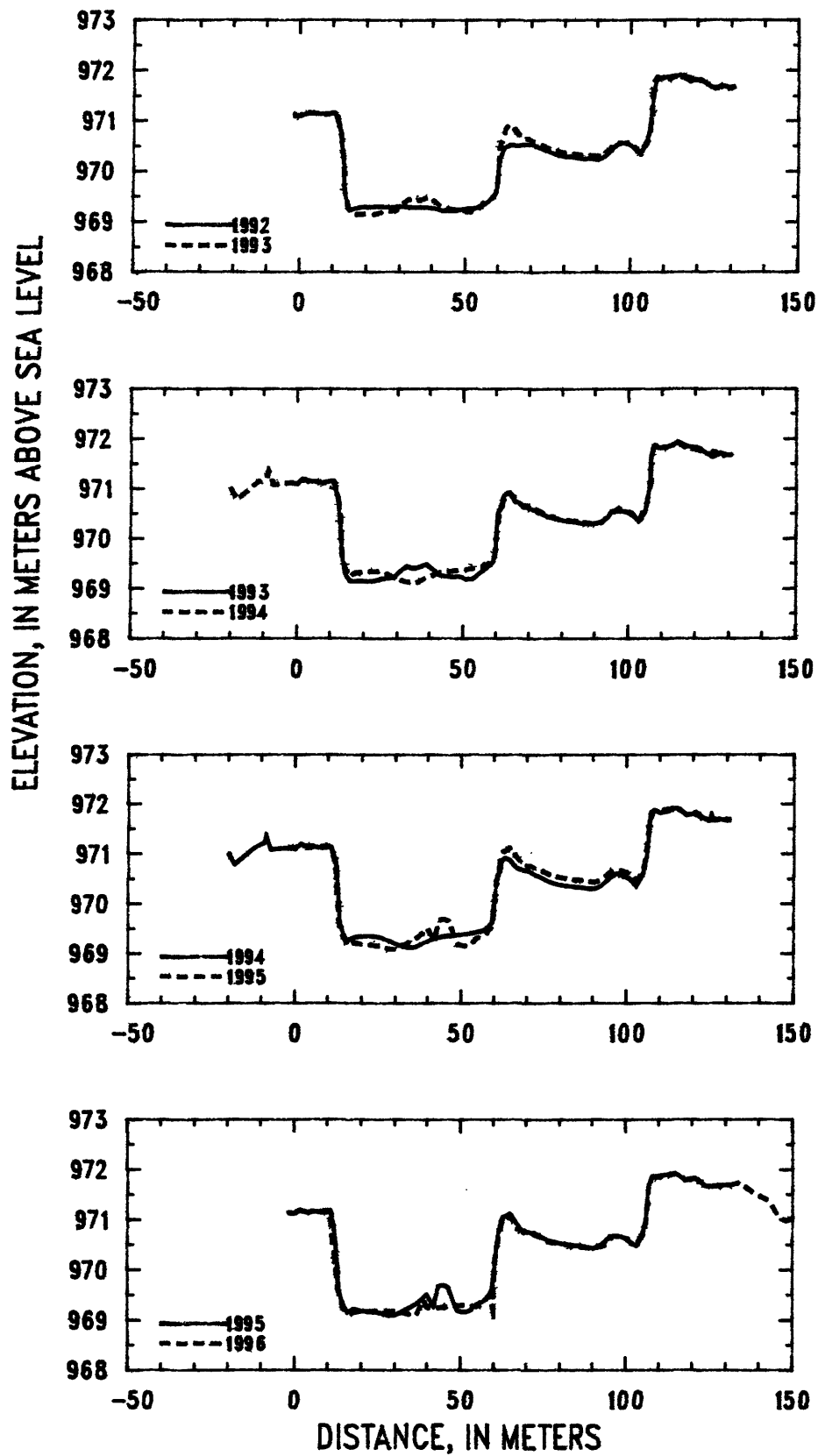


Figure 56. Profiles of cross section PR156A from 1992 to 1996.

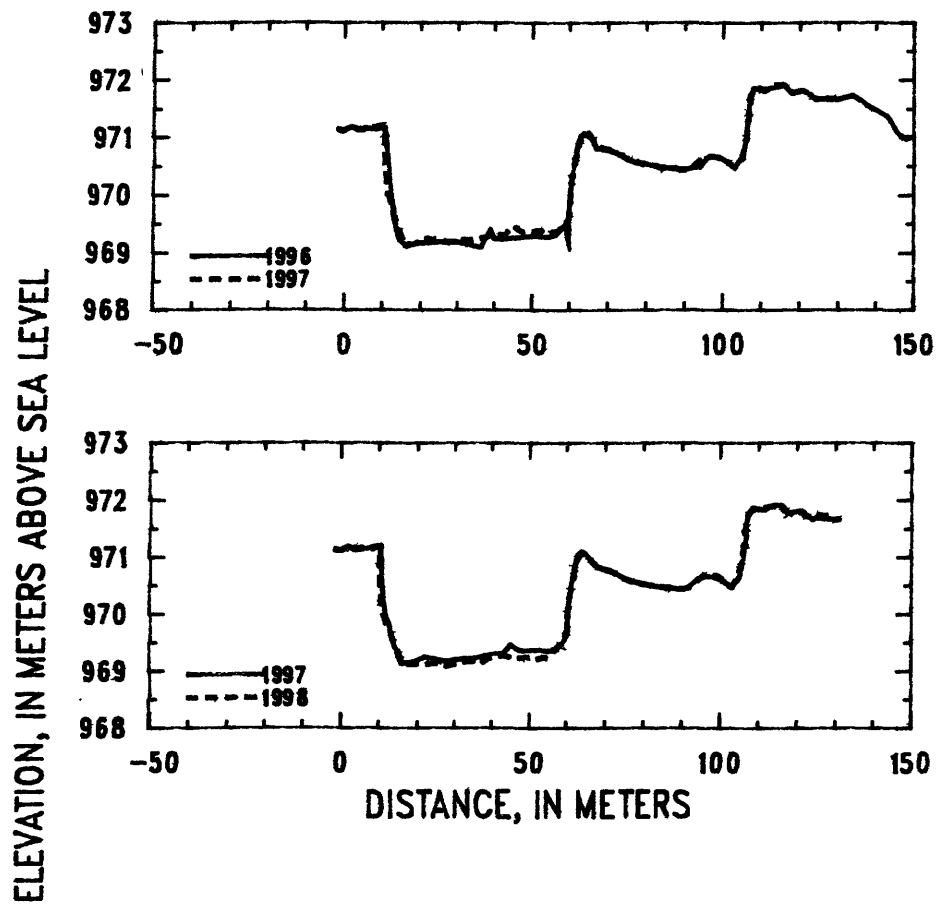


Figure 57. Profiles of cross section PR156A from 1996 to 1998.

Table 20. Listing of horizontal stations and elevations for cross section PR156A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1990		1990		1991	
20 September		20 September		19 September		19 September		30 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.6	971.10	66.0	970.47	-1.6	971.10	76.0	970.36	-1.6	971.11
0.0	971.10	68.0	970.52	0.0	971.09	78.0	970.32	0.0	971.10
2.0	971.14	70.0	970.52	1.0	971.13	80.0	970.30	3.0	971.17
4.0	971.12	72.0	970.47	3.0	971.18	82.0	970.27	5.0	971.15
6.0	971.14	74.0	970.41	5.0	971.12	84.0	970.26	7.0	971.10
8.0	971.10	76.0	970.34	7.0	971.10	86.0	970.25	9.0	971.11
10.0	971.15	78.0	970.30	9.0	971.13	88.0	970.24	10.0	971.13
11.6	971.09	80.0	970.27	11.0	971.15	90.0	970.23	11.4	971.14
12.3	970.63	82.0	970.55	11.5	971.13	92.0	970.27	12.4	970.77
12.6	970.52	84.0	970.23	12.1	970.81	94.0	970.39	13.0	970.31
12.9	970.28	86.0	970.22	12.4	970.72	95.0	970.47	13.4	970.10
13.4	970.04	88.0	970.20	13.2	970.09	97.0	970.54	13.7	969.62
13.8	969.61	90.0	970.18	13.3	970.03	99.0	970.52	13.9	969.53
14.9	969.30	92.0	970.28	13.7	969.60	101.0	970.44	14.5	969.34
16.0	969.34	94.0	970.37	14.0	969.47	103.1	970.33	16.0	969.38
18.0	969.30	96.0	970.51	16.0	969.17	104.8	970.52	19.0	969.41
20.0	969.32	98.0	970.52	18.0	969.11	105.8	970.81	22.0	969.46
22.0	969.37	100.0	970.50	21.0	969.09	106.5	971.29	23.4	969.51
24.0	969.41	102.0	970.35	24.0	969.05	106.7	971.59	26.0	969.56
26.0	969.44	103.0	970.30	27.0	969.01	108.0	971.90	28.0	969.57
28.0	969.45	104.0	970.46	30.0	969.00	110.0	971.82	30.0	969.55
30.0	969.44	105.4	970.65	33.0	969.04	113.0	971.89	32.0	969.41
32.0	969.38	106.0	970.94	36.0	969.05	117.0	971.91	34.0	969.28
34.0	969.38	106.6	971.26	39.0	969.13	118.0	971.77	36.0	969.15
36.0	969.42	106.7	971.51	42.0	969.13	119.0	971.81	38.0	969.06
38.0	969.47	107.0	971.67	45.0	969.18	122.0	971.79	40.0	969.09
40.0	969.54	108.0	971.84	48.0	969.22	125.0	971.63	42.0	969.11
42.0	969.55	110.0	971.87	51.0	969.24	128.0	971.68	44.0	969.21
44.0	969.56	112.0	971.88	54.0	969.32	130.0	971.64	46.0	969.29
46.0	969.31	114.0	971.91	57.0	969.40	130.9	971.68	48.0	969.35
48.0	969.17	116.0	971.91	59.0	969.60			50.0	969.35
50.0	969.20	118.0	971.77	59.8	969.77			52.0	969.32
52.0	969.23	120.0	971.80	60.6	970.17			54.0	969.30
54.0	969.29	122.0	971.79	60.9	970.14			56.0	969.42
56.0	969.33	124.0	971.65	62.0	970.43			58.0	969.46
58.0	969.48	126.0	971.65	63.0	970.59			58.5	969.51
59.7	969.60	128.0	971.69	64.0	970.56			59.7	969.65
60.0	969.69	130.0	971.64	66.0	970.51			60.5	970.16
60.8	969.80	130.9	971.67	68.0	970.53			61.3	970.42
62.0	970.29			70.0	970.58			62.0	970.47
62.7	970.44			72.0	970.49			63.0	970.55
64.0	970.53			74.0	970.44			65.0	970.53

Table 20. (Continued) Listing of horizontal stations and elevations for cross section PR156A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1992		1992		1993		1993	
30 August		31 August		31 August		29 August		29 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
67.0	970.54	-1.6	971.10	72.0	970.48	-1.6	971.12	61.4	970.58
69.0	970.52	0.0	971.10	74.0	970.43	0.0	971.10	62.4	970.86
71.0	970.57	3.0	971.16	76.0	970.37	2.0	971.20	63.5	970.92
73.0	970.46	6.0	971.14	78.0	970.32	3.0	971.16	64.3	970.91
75.0	970.40	9.0	971.14	80.0	970.29	5.0	971.15	65.7	970.75
77.0	970.34	10.5	971.16	82.0	970.28	7.0	971.11	67.0	970.73
79.0	970.32	11.0	971.14	84.0	970.27	9.0	971.13	68.0	970.64
81.0	970.29	12.2	970.83	86.0	970.24	10.0	971.15	69.0	970.66
83.0	970.26	12.5	970.79	88.0	970.26	11.2	971.17	70.0	970.62
85.0	970.26	13.5	970.07	90.0	970.23	12.0	970.90	72.0	970.57
87.0	970.23	13.7	969.62	92.0	970.27	12.4	970.82	74.0	970.49
89.0	970.24	15.0	969.22	94.0	970.40	13.3	970.17	76.0	970.43
91.0	970.22	17.0	969.26	96.0	970.53	13.6	969.69	78.0	970.40
92.0	970.26	19.0	969.29	98.0	970.56	14.7	969.27	80.0	970.37
94.0	970.39	21.0	969.29	100.0	970.52	16.0	969.16	82.0	970.35
96.0	970.53	23.0	969.30	102.0	970.37	17.0	969.14	84.0	970.33
98.0	970.54	25.0	969.29	103.0	970.32	19.0	969.16	85.0	970.33
100.0	970.52	27.0	969.27	104.0	970.46	21.0	969.15	86.0	970.31
101.0	970.46	29.0	969.30	105.0	970.61	23.0	969.15	88.0	970.31
103.0	970.32	31.0	969.30	105.8	970.82	25.0	969.19	90.0	970.30
104.0	970.48	33.0	969.29	107.5	971.76	27.0	969.21	92.0	970.34
105.0	970.59	35.0	969.28	108.3	971.86	29.0	969.22	94.0	970.44
105.9	970.84	37.0	969.29	110.0	971.87	31.0	969.35	95.0	970.55
107.0	971.64	39.0	969.26	112.0	971.88	33.0	969.45	96.0	970.56
107.8	971.82	41.0	969.26	115.0	971.91	35.0	969.40	98.0	970.56
110.0	971.86	43.0	969.20	118.0	971.78	37.0	969.44	99.0	970.55
112.0	971.89	45.0	969.22	119.0	971.82	39.0	969.49	100.0	970.54
114.0	971.90	47.0	969.22	122.0	971.79	41.0	969.38	101.0	970.48
116.0	971.90	49.0	969.24	124.0	971.67	43.0	969.28	102.3	970.40
118.0	971.77	51.0	969.26	126.0	971.65	45.0	969.26	103.0	970.34
120.0	971.81	53.0	969.26	128.0	971.69	47.0	969.23	104.0	970.49
122.0	971.80	55.0	969.32	130.0	971.64	49.0	969.25	104.9	970.54
124.0	971.65	57.0	969.39	130.9	971.68	51.0	969.18	105.7	970.77
126.0	971.65	59.0	969.52			53.0	969.19	106.1	970.96
128.0	971.70	59.8	969.62			55.0	969.31	106.5	971.12
130.0	971.64	60.2	970.10			57.0	969.40	106.8	971.63
130.9	971.68	60.6	970.26			59.1	969.51	107.4	971.80
		62.0	970.47			59.8	969.69	108.0	971.87
		64.0	970.53			60.0	969.74	109.0	971.82
		66.0	970.50			60.3	970.16	111.0	971.81
		68.0	970.54			60.6	970.47	113.0	971.87
		70.0	970.55			61.0	970.58	115.0	971.93

Table 20. (Continued) Listing of horizontal stations and elevations for cross section PR156A
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1993		1994		1994		1995		1995	
29 August		22 September		22 September		25 September		25 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
117.0	971.87	-20.0	971.00	65.0	970.87	-1.6	971.13	64.0	971.07
119.0	971.84	-18.0	970.79	66.0	970.76	0.0	971.12	65.0	971.12
121.0	971.82	-15.0	970.95	68.0	970.68	2.0	971.19	67.0	970.92
123.0	971.73	-12.0	971.12	70.0	970.67	4.0	971.14	69.0	970.76
125.0	971.63	-9.0	971.23	72.0	970.59	6.0	971.17	71.0	970.76
127.5	971.71	-8.5	971.37	75.0	970.50	8.0	971.14	73.0	970.68
130.0	971.67	-7.0	971.08	78.0	970.40	10.0	971.14	75.0	970.64
130.9	971.68	-4.0	971.11	81.0	970.37	11.0	971.17	77.0	970.57
		-1.6	971.12	84.0	970.34	12.0	970.85	79.0	970.54
		0.0	971.10	87.0	970.32	12.6	970.56	81.0	970.51
		2.0	971.20	90.0	970.29	12.8	970.22	83.0	970.49
		4.0	971.11	92.0	970.34	13.2	970.05	85.0	970.48
		6.0	971.14	94.0	970.44	13.3	969.67	87.0	970.47
		8.0	971.11	96.5	970.60	14.0	969.42	89.0	970.45
		10.0	971.14	97.0	970.61	16.0	969.15	91.0	970.43
		11.0	971.14	99.0	970.57	18.0	969.22	93.0	970.51
		12.0	970.89	101.0	970.51	20.0	969.18	95.0	970.63
		12.5	970.76	103.0	970.34	22.0	969.17	96.0	970.66
		13.3	970.16	104.6	970.51	24.0	969.16	98.0	970.68
		13.7	969.57	105.5	970.75	26.0	969.14	100.0	970.63
		15.5	969.25	106.6	971.14	28.0	969.09	101.0	970.57
		18.0	969.33	106.8	971.57	30.0	969.08	102.0	970.51
		21.0	969.35	107.4	971.82	32.0	969.15	103.5	970.48
		24.0	969.35	108.5	971.88	34.0	969.22	105.0	970.66
		27.0	969.29	110.0	971.83	36.0	969.29	106.0	970.99
		30.0	969.19	112.5	971.86	38.0	969.38	107.0	971.67
		33.0	969.13	115.0	971.92	40.0	969.51	108.0	971.85
		36.0	969.11	118.0	971.77	42.0	969.26	110.0	971.87
		39.0	969.22	120.0	971.80	43.6	969.67	112.0	971.89
		42.0	969.30	123.0	971.72	45.0	969.69	115.0	971.92
		45.0	969.35	125.0	971.67	46.5	969.65	118.0	971.78
		48.0	969.37	125.5	971.78	49.0	969.19	121.0	971.83
		51.0	969.39	126.0	971.68	51.0	969.15	124.0	971.67
		54.0	969.42	128.0	971.69	53.0	969.18	127.0	971.67
		57.0	969.46	130.0	971.66	55.0	969.32	130.9	971.69
		59.0	969.57	130.9	971.68	57.0	969.36		
		59.7	969.63			59.4	969.53		
		60.1	969.98			59.8	969.67		
		61.0	970.55			60.9	970.44		
		61.8	970.63			62.0	970.80		
		62.4	970.87			62.2	970.93		
		63.5	970.92			63.0	971.05		

Table 20. (Continued) Listing of horizontal stations and elevations for cross section PR156A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1996		1996		1997		1997	
21 October		21 October		21 October		23 September		23 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.6	971.14	74.0	970.66	165.0	972.02	-1.6	971.14	79.0	970.55
0.0	971.12	76.0	970.59	170.0	971.98	0.0	971.12	81.0	970.53
2.0	971.19	78.0	970.54	175.0	971.96	2.0	971.20	83.0	970.49
4.0	971.14	80.0	970.54	180.0	972.00	4.0	971.13	85.0	970.47
6.0	971.17	82.0	970.50	184.0	971.95	7.0	971.15	87.0	970.48
8.0	971.15	84.0	970.46	188.0	971.70	9.0	971.20	89.0	970.43
10.0	971.17	86.0	970.46	189.0	971.82	10.5	971.21	91.0	970.45
10.7	971.18	88.0	970.44	193.0	971.87	10.7	971.05	93.0	970.54
10.9	971.14	90.0	970.44	195.0	971.74	10.8	970.51	95.0	970.66
11.1	970.94	92.0	970.47	200.0	971.75	11.7	970.00	97.0	970.67
12.8	969.90	94.0	970.49			12.9	969.81	99.0	970.66
13.2	969.80	96.0	970.66			13.2	969.64	101.0	970.58
13.3	969.59	98.0	970.68			16.0	969.13	103.0	970.48
14.7	969.23	100.0	970.63			19.0	969.15	104.0	970.55
16.5	969.11	102.0	970.52			22.0	969.25	105.0	970.64
19.0	969.17	103.0	970.47			25.0	969.21	106.1	970.98
22.0	969.17	104.0	970.57			28.0	969.17	106.5	971.24
25.0	969.19	105.0	970.65			31.0	969.21	107.2	971.74
28.0	969.18	106.0	970.94			34.0	969.22	108.5	971.87
31.0	969.18	106.6	971.33			37.0	969.25	111.1	971.82
34.0	969.12	107.0	971.68			40.0	969.31	114.0	971.93
36.5	969.09	108.0	971.86			43.0	969.31	116.0	971.92
39.0	969.39	109.0	971.85			45.0	969.46	118.0	971.77
40.0	969.25	111.0	971.83			47.0	969.37	121.0	971.83
42.0	969.23	113.0	971.89			49.0	969.36	124.0	971.66
45.0	969.25	116.0	971.91			52.0	969.38	125.0	971.70
48.0	969.28	118.0	971.78			55.0	969.35	127.0	971.68
51.0	969.30	121.0	971.83			57.0	969.38	130.0	971.66
54.0	969.27	124.0	971.67			59.0	969.48	130.9	971.67
56.0	969.29	127.0	971.67			60.1	969.63		
59.0	969.49	130.0	971.66			60.6	970.15		
59.9	969.19	130.9	971.68			61.0	970.42		
60.0	969.67	134.0	971.73			62.0	970.77		
60.6	970.24	139.0	971.50			63.0	971.04		
62.0	970.80	143.0	971.37			64.0	971.11		
62.5	970.94	146.0	971.05			65.0	971.08		
63.0	971.04	148.0	970.97			67.0	970.88		
64.0	971.07	151.0	971.04			69.0	970.80		
66.0	970.99	155.0	971.28			71.0	970.78		
67.0	970.82	159.0	971.80			73.0	970.70		
70.0	970.77	159.2	971.83			75.0	970.63		
72.0	970.74	160.0	971.87			77.0	970.58		

Table 20. (Continued) Listing of horizontal stations and elevations for cross section PR156A
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1998		1998	
29 September		29 September	
Sta.	Elev.	Sta.	Elev.
-1.6	971.14	86.0	970.46
0.0	971.12	88.0	970.44
2.0	971.18	90.0	970.44
4.0	971.16	92.0	970.47
6.0	971.18	94.0	970.60
8.0	971.14	96.0	970.69
10.2	971.20	98.0	970.69
10.3	970.68	100.0	970.65
10.6	970.39	102.0	970.50
10.7	970.12	103.0	970.48
11.8	969.85	104.0	970.58
13.0	969.69	105.8	970.94
16.0	969.15	106.8	971.64
19.0	969.12	107.3	971.76
22.0	969.13	109.0	971.86
25.0	969.14	112.3	971.88
28.0	969.09	115.0	971.93
31.0	969.15	117.6	971.77
34.0	969.18	120.0	971.82
37.0	969.13	123.0	971.71
40.0	969.25	125.0	971.75
43.0	969.28	128.0	971.72
46.0	969.22	130.0	971.66
49.0	969.26	130.9	971.68
52.0	969.21		
55.0	969.26		
58.0	969.44		
60.2	969.68		
60.4	970.18		
61.5	970.53		
62.4	970.94		
64.0	971.07		
66.0	970.98		
68.0	970.83		
70.0	970.77		
72.0	970.74		
74.0	970.66		
76.0	970.60		
78.0	970.54		
80.0	970.53		
82.0	970.50		
84.0	970.48		

Description of Cross Section PR156

Location: Township 7 South/Range 49 East--section 12

U. S. Geological Survey quadrangle (1:24,000): Huckins School

Landowners--left bank: Gay Ranch

--right bank: Twin Butte Ranch

Access: Right bank

Permission from: Butch Samuelson

Distance from Moorhead Gaging Station: 40.28 kilometers

Azimuth of Section (degrees magnetic): 109.5

Reference Monuments

[Monuments at stations 127.0, 140.0, and 187.9 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.20 meter above 1998 ground level; 36.9 meters downstream from monument at station -1.6 on PR156A	-4.2	45°14'49.86"	105°39'59.90"	0.397	0.566	971.31
1/2-inch-rebar; 0.01 meter above 1998 ground level	-1.6					971.05
1/2-inch-rebar; 0.16 meter above 1998 ground level	127.0					971.78
1/2-inch-rebar; 0.19 meter above 1998 ground level	140.0					971.74
1/2-inch-rebar; 0.18 meter above 1998 ground level; 0.20 meter riverward of 3-strand barbed-wire fence and 0.36 meter downstream from metal fence post near gate	187.9					971.86
Benchmark--brass circular plate; offsection	---	45°14'44.90"	105°39'56.56"	1.241	0.637	972.17

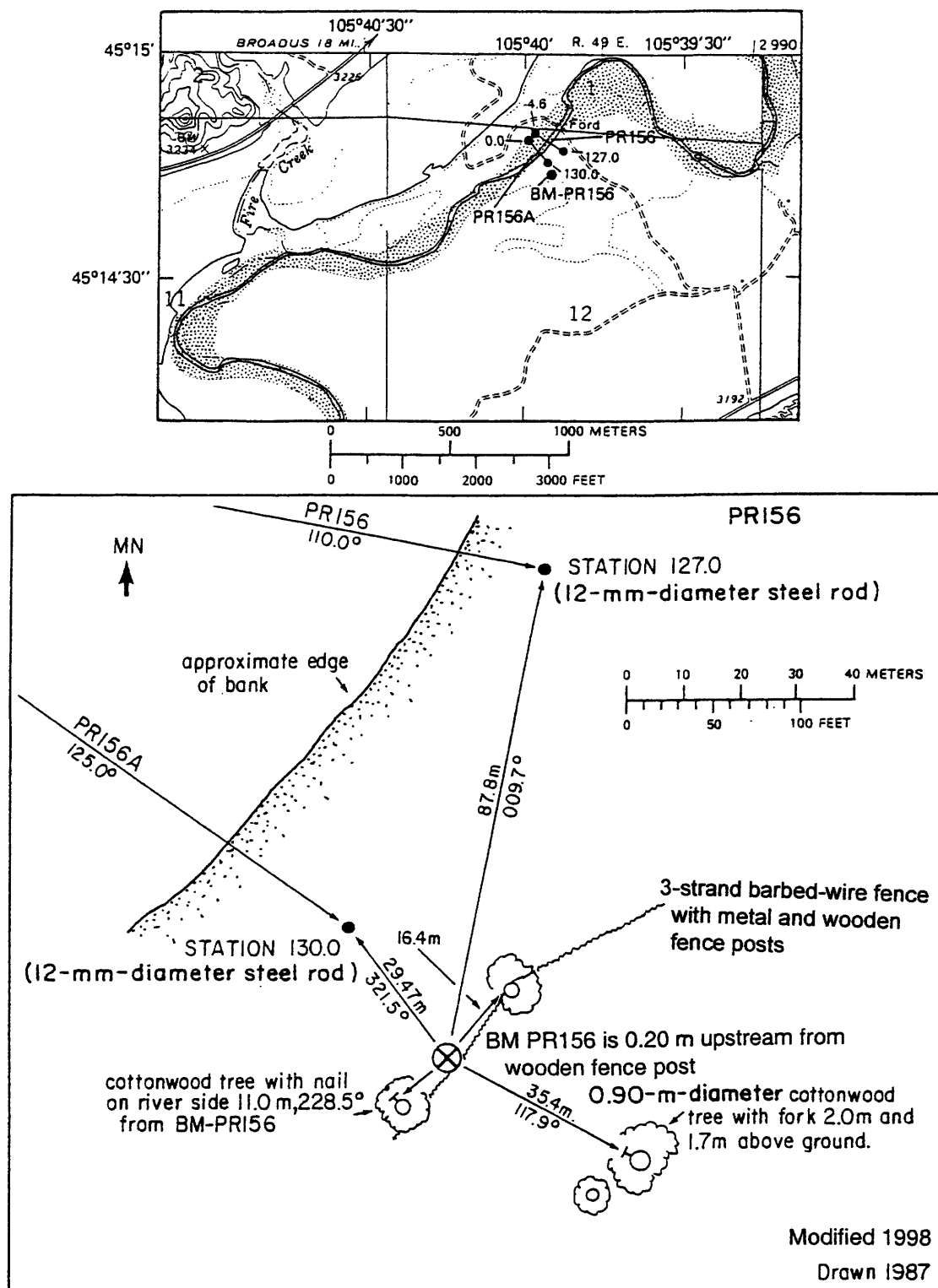


Figure 58. Upper: Location of cross section PR156, bench mark BM-PR156, and the left and right bank reference monuments in the Huckins School quadrangle. Lower: Location of the bench mark on the left bank. MN is magnetic north.

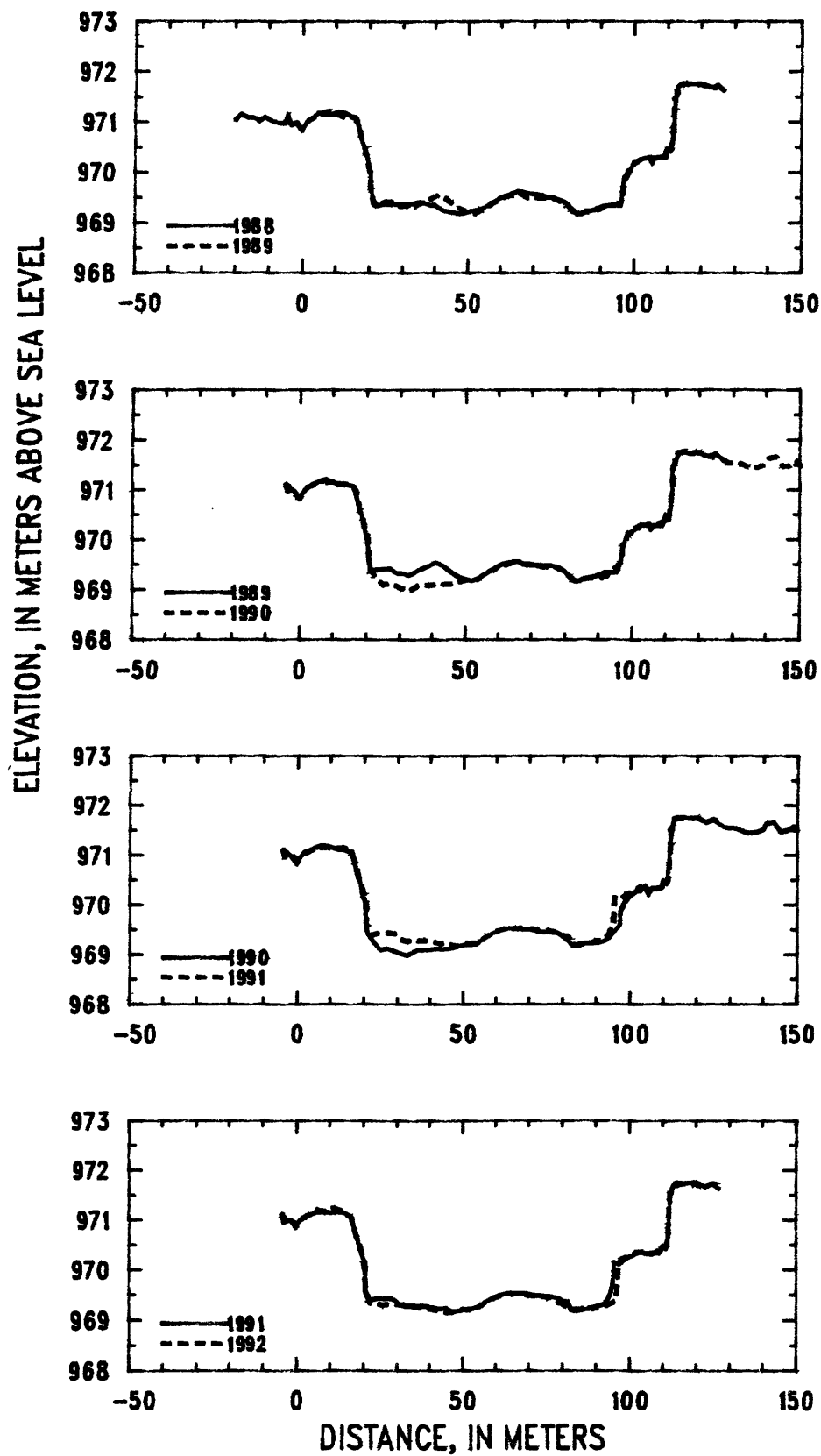


Figure 59. Profiles of cross section PR156 from 1988 to 1992.

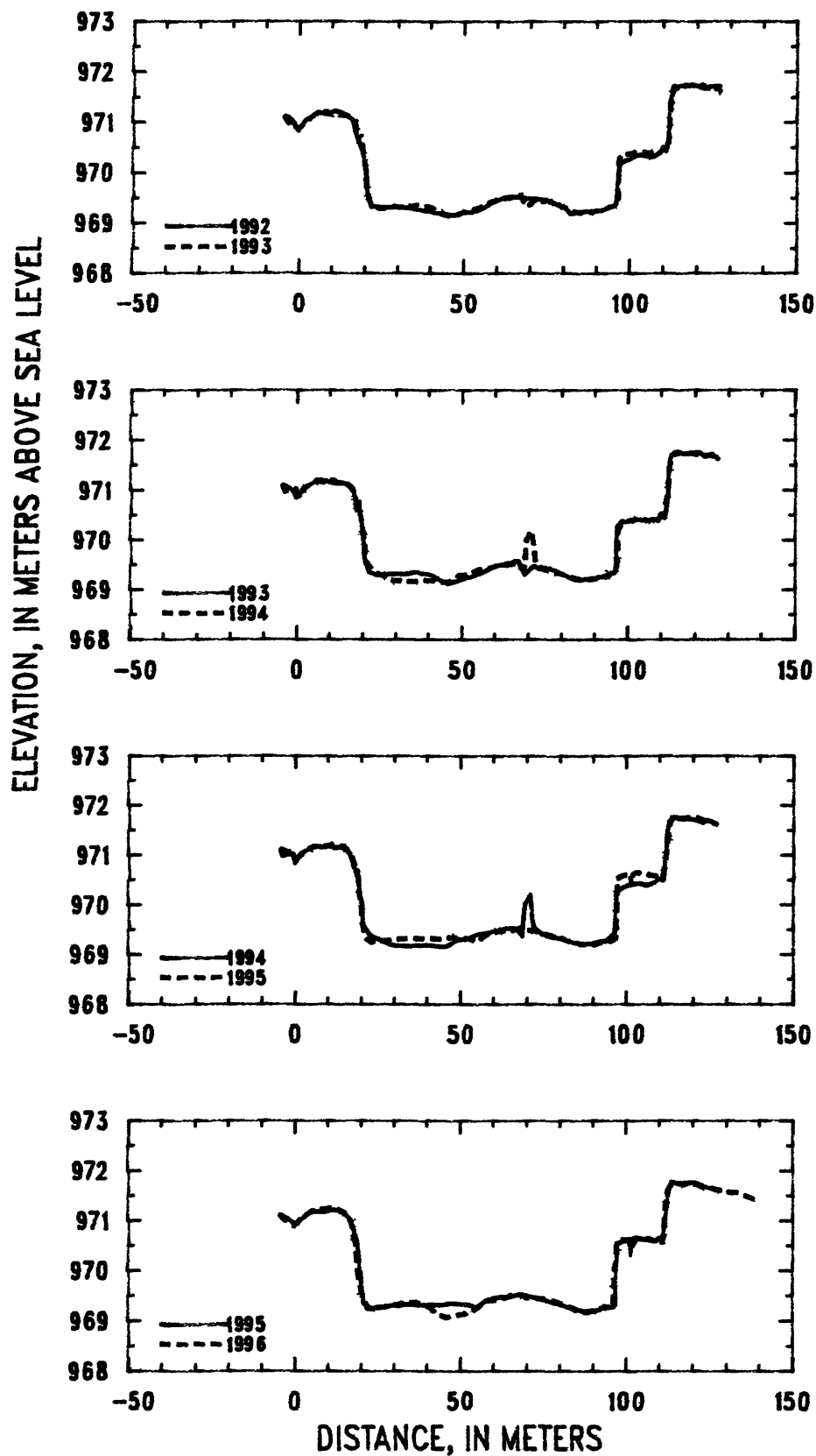


Figure 60. Profiles of cross section PR156 from 1992 to 1996.

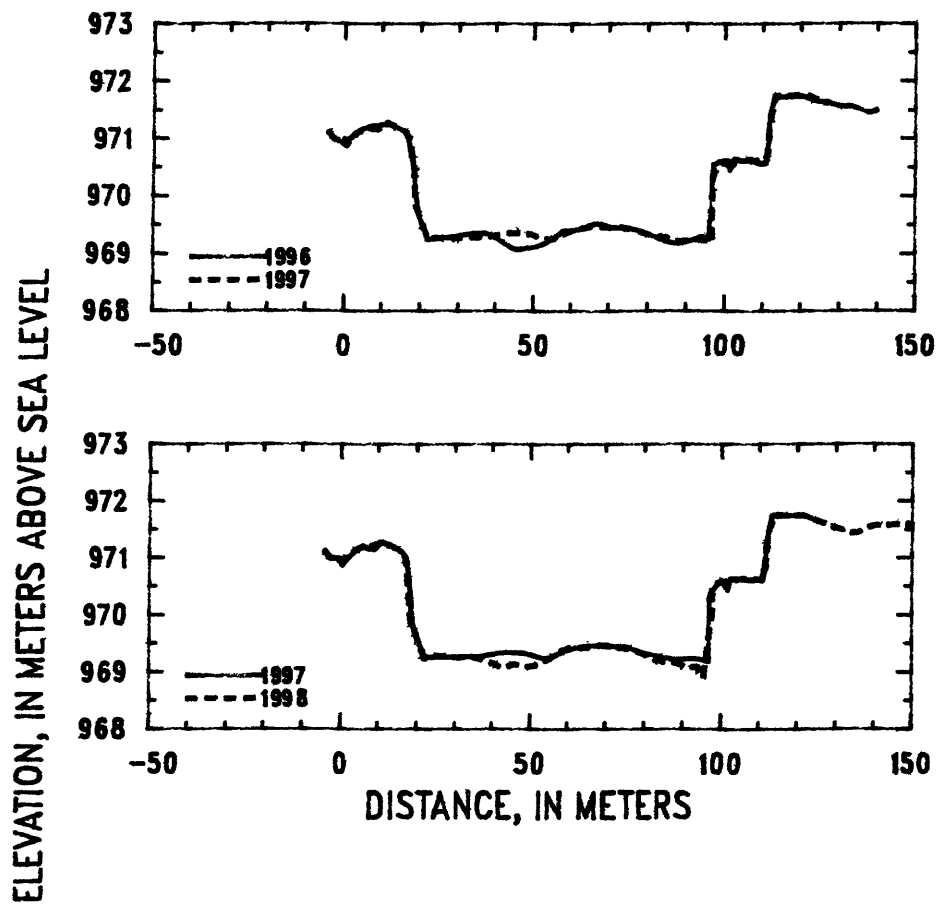


Figure 61. Profiles of cross section PR156 from 1996 to 1998.

Table 21. Listing of horizontal stations and elevations for cross section PR156

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1990		1990		1990	
20 September		20 September		19 September		19 September		19 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-4.2	971.12	64.0	969.55	-4.2	971.11	81.0	969.30	147.0	971.48
-3.5	970.97	66.0	969.57	-1.6	970.98	83.0	969.17	149.0	971.57
-2.0	971.00	68.0	969.49	0.0	970.82	85.0	969.21	149.9	971.52
-1.6	970.98	70.0	969.50	2.0	971.05	88.0	969.23	151.0	971.14
0.0	970.83	72.0	969.49	4.0	971.10	91.0	969.24	152.1	971.09
2.0	971.03	74.0	969.47	6.0	971.17	93.6	969.31	153.3	971.18
4.0	971.11	76.0	969.49	8.0	971.19	97.0	969.59	154.6	971.16
6.0	971.17	78.0	969.41	10.0	971.17	97.1	969.89	157.0	971.46
8.0	971.21	80.0	969.37	12.0	971.11	98.0	969.96	159.0	971.38
8.4	971.15	82.0	969.19	14.0	971.12	98.7	970.12	161.0	971.29
10.0	971.17	84.0	969.16	15.0	971.07	99.0	970.08	163.0	971.23
12.0	971.10	86.0	969.22	16.3	971.07	100.0	970.18	165.0	971.03
14.0	971.11	88.0	969.25	17.3	970.82	101.0	970.24	167.0	970.99
16.0	971.07	90.0	969.29	18.1	970.55	102.0	970.29	170.0	970.95
17.0	970.88	92.0	969.36	18.9	970.47	103.0	970.29	172.0	970.93
18.0	970.60	94.0	969.34	19.7	970.16	104.5	970.38	174.0	970.96
19.0	970.43	95.4	969.35	20.2	970.13	105.6	970.21	175.0	971.00
19.5	970.22	96.9	969.61	20.5	969.98	106.4	970.32	176.4	971.28
20.5	969.96	97.0	969.85	20.7	969.59	108.0	970.33	177.6	971.54
20.7	969.59	99.0	970.12	21.2	969.40	109.6	970.36	179.0	971.62
21.5	969.37	101.0	970.21	23.0	969.23	110.0	970.49	182.0	971.68
23.0	969.40	103.0	970.30	25.0	969.09	111.0	970.43	185.0	971.66
25.0	969.41	105.0	970.28	27.0	969.12	112.0	970.95	188.0	971.68
27.0	969.42	107.0	970.29	30.0	969.05	112.4	971.50		
29.0	969.33	109.0	970.28	33.0	968.98	112.7	971.51		
31.0	969.33	110.0	970.49	36.0	969.09	113.2	971.74		
33.0	969.29	110.6	970.40	39.0	969.08	114.0	971.74		
35.0	969.36	111.0	970.40	42.0	969.12	116.0	971.78		
37.0	969.42	111.6	970.63	45.0	969.11	118.0	971.74		
39.0	969.47	112.0	970.94	48.0	969.15	120.0	971.76		
41.0	969.54	112.2	971.48	51.0	969.20	123.0	971.66		
43.0	969.49	112.6	971.50	54.0	969.21	125.0	971.72		
44.0	969.44	114.0	971.75	57.0	969.36	127.0	971.60		
46.0	969.33	116.0	971.77	60.0	969.45	129.0	971.54		
48.0	969.27	118.0	971.72	63.0	969.51	131.0	971.55		
50.0	969.21	120.0	971.76	65.0	969.54	133.0	971.51		
52.0	969.17	122.0	971.68	68.0	969.50	135.0	971.44		
54.0	969.23	124.0	971.67	70.0	969.51	138.0	971.46		
56.0	969.31	125.0	971.73	73.0	969.46	140.0	971.52		
58.0	969.39	127.0	971.62	76.0	969.44	141.0	971.64		
60.0	969.47			78.0	969.44	143.0	971.66		
62.0	969.52			80.0	969.36	145.0	971.47		

Table 21. (Continued) Listing of horizontal stations and elevations for cross section PR156
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1991		1992		1992		1993	
30 August		30 August		31 August		31 August		29 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-4.2	971.11	69.0	969.53	-4.2	971.11	72.0	969.48	-4.2	971.11
-3.5	970.95	71.0	969.50	-3.0	970.97	74.0	969.46	-1.6	971.02
-1.6	970.99	73.0	969.48	-1.6	971.01	76.0	969.45	0.0	970.86
0.0	970.89	75.0	969.48	0.0	970.84	78.0	969.36	2.0	971.01
2.0	971.02	77.0	969.46	2.0	971.04	80.0	969.33	4.0	971.11
4.0	971.08	79.0	969.42	4.0	971.11	82.0	969.20	6.0	971.21
6.0	971.16	80.3	969.36	6.0	971.20	84.0	969.21	8.0	971.21
9.0	971.15	81.6	969.36	9.0	971.16	86.0	969.23	10.0	971.17
12.0	971.13	82.6	969.20	11.0	971.23	88.0	969.24	12.0	971.14
14.0	971.15	84.0	969.18	13.0	971.20	90.0	969.24	14.0	971.14
16.0	971.08	86.0	969.20	15.0	971.10	92.0	969.26	15.0	971.12
16.7	970.96	88.0	969.23	16.3	971.05	94.0	969.31	16.0	971.06
18.0	970.69	90.0	969.27	18.0	970.64	95.8	969.37	17.0	971.03
18.5	970.54	92.0	969.30	19.5	970.38	96.0	969.48	18.0	970.64
20.0	970.23	93.2	969.34	20.0	970.16	96.6	970.04	18.8	970.74
20.6	970.13	94.9	969.61	20.5	969.97	97.0	970.16	19.0	970.59
20.7	969.57	95.4	970.15	20.7	969.57	98.0	970.23	19.6	970.37
20.9	969.53	97.0	970.11	21.9	969.33	100.0	970.26	20.3	969.96
22.0	969.39	99.0	970.23	24.0	969.32	102.0	970.34	20.4	969.62
24.0	969.43	101.0	970.27	26.0	969.31	104.0	970.35	22.0	969.36
26.0	969.44	103.0	970.37	28.0	969.32	106.0	970.30	24.0	969.30
28.0	969.44	105.0	970.32	30.0	969.32	108.0	970.34	26.0	969.30
29.0	969.41	106.0	970.32	32.0	969.30	110.0	970.46	28.0	969.32
31.0	969.30	108.0	970.34	34.0	969.29	111.0	970.43	30.0	969.33
33.0	969.28	109.0	970.32	36.0	969.26	111.7	970.70	32.0	969.32
35.0	969.29	110.0	970.48	38.0	969.24	112.0	971.44	34.0	969.33
37.0	969.28	111.3	970.46	40.0	969.22	113.0	971.62	36.0	969.36
39.0	969.27	111.9	970.81	42.0	969.20	115.0	971.72	38.0	969.33
41.0	969.25	112.3	971.48	44.0	969.17	117.0	971.72	40.0	969.32
43.0	969.22	113.0	971.64	46.0	969.15	120.0	971.73	42.0	969.26
45.0	969.24	114.0	971.75	48.0	969.15	122.0	971.66	44.0	969.18
47.0	969.16	117.0	971.73	50.0	969.22	125.0	971.73	46.0	969.12
49.0	969.18	120.0	971.76	52.0	969.21	127.0	971.71	48.0	969.16
51.0	969.22	123.0	971.66	54.0	969.24			50.0	969.22
53.0	969.23	125.0	971.72	56.0	969.30			52.0	969.26
55.0	969.26	127.0	971.62	58.0	969.39			54.0	969.29
57.0	969.35			60.0	969.45			56.0	969.35
59.0	969.42			62.0	969.50			58.0	969.41
61.0	969.48			64.0	969.53			60.0	969.47
62.8	969.53			66.0	969.52			62.0	969.50
65.0	969.52			68.0	969.51			64.0	969.49
67.0	969.53			70.0	969.48			66.0	969.58

Table 21. (Continued) Listing of horizontal stations and elevations for cross section PR156
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1993		1994		1994		1995		1995	
29 August		22 September		22 September		25 September		25 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
67.0	969.58	-4.2	971.10	80.0	969.32	-4.2	971.11	72.0	969.48
68.8	969.32	-3.5	970.98	83.0	969.24	-1.6	971.04	74.0	969.42
71.7	969.48	-1.6	971.03	86.0	969.21	0.0	970.94	76.0	969.40
73.0	969.43	-0.5	971.03	89.0	969.20	1.0	970.94	78.0	969.36
75.0	969.45	-0.1	970.93	92.0	969.27	3.0	971.07	80.0	969.34
77.0	969.43	0.3	970.86	94.0	969.27	5.0	971.17	82.0	969.27
79.0	969.35	2.0	971.04	96.5	969.43	7.0	971.18	84.0	969.26
81.0	969.30	4.0	971.11	97.0	970.23	9.0	971.17	86.0	969.21
83.0	969.22	6.0	971.18	98.0	970.31	11.0	971.21	88.0	969.19
85.0	969.20	9.0	971.16	100.0	970.38	13.0	971.21	90.0	969.18
87.0	969.21	11.0	971.20	102.0	970.41	15.0	971.14	92.0	969.23
89.0	969.22	12.0	971.15	104.0	970.44	16.5	971.06	94.0	969.26
91.0	969.26	14.0	971.16	106.0	970.39	18.0	970.79	96.0	969.27
93.0	969.29	16.4	971.06	108.0	970.42	19.0	970.54	96.8	969.32
95.0	969.33	18.4	970.66	110.0	970.53	19.8	969.96	97.3	970.53
96.0	969.35	18.8	970.68	111.0	970.49	20.0	969.96	99.0	970.59
96.4	969.40	20.4	969.97	112.0	971.07	20.3	969.66	101.0	970.63
96.5	969.96	20.5	969.59	112.3	971.46	21.0	969.34	101.4	970.41
96.7	970.27	23.0	969.36	113.0	971.68	23.0	969.24	101.9	970.62
98.0	970.38	26.0	969.29	114.5	971.77	25.0	969.26	103.0	970.66
100.0	970.37	29.0	969.19	117.0	971.72	27.0	969.27	105.0	970.62
102.0	970.41	32.0	969.17	119.0	971.74	29.0	969.31	107.0	970.60
104.0	970.41	35.0	969.16	122.0	971.67	31.0	969.31	109.0	970.58
106.0	970.38	38.0	969.19	124.5	971.70	33.0	969.31	110.0	970.64
108.0	970.42	41.0	969.19	127.0	971.62	35.0	969.32	111.0	970.59
109.0	970.38	44.0	969.16			37.0	969.32	112.0	971.04
110.0	970.50	46.0	969.16			39.0	969.32	113.0	971.63
111.0	970.44	49.0	969.29			41.0	969.31	114.0	971.76
111.5	970.59	52.0	969.32			43.0	969.31	117.0	971.74
111.8	970.77	55.0	969.41			45.0	969.32	120.0	971.78
112.0	970.99	58.0	969.43			47.0	969.34	123.0	971.70
112.3	971.46	61.0	969.49			49.0	969.34	127.0	971.62
113.0	971.69	64.0	969.53			51.0	969.33		
115.0	971.74	66.0	969.53			53.0	969.31		
117.0	971.73	67.0	969.51			55.0	969.26		
119.0	971.73	68.5	969.39			57.0	969.36		
121.0	971.76	69.0	969.73			59.0	969.42		
123.0	971.67	69.4	970.04			61.0	969.46		
125.0	971.72	71.0	970.19			63.0	969.47		
127.0	971.61	72.0	969.55			65.0	969.47		
		74.0	969.42			68.0	969.53		
		77.0	969.36			70.0	969.49		

Table 21. (Continued) Listing of horizontal stations and elevations for cross section PR156
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1996		1997		1997		1998	
21 October		21 October		23 September		23 September		29 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-4.2	971.10	97.1	970.54	-4.2	971.12	96.9	970.32	-4.2	971.12
-3.0	971.01	99.0	970.61	-3.0	970.99	98.0	970.44	-3.0	971.01
0.0	970.89	101.0	970.61	0.0	970.98	100.0	970.60	-1.6	971.04
2.0	971.04	101.5	970.46	0.5	970.88	101.7	970.45	0.0	970.93
5.0	971.18	103.0	970.63	3.0	971.08	102.5	970.64	2.0	971.05
8.0	971.22	105.0	970.61	6.0	971.21	105.0	970.63	5.0	971.18
11.0	971.26	107.0	970.64	7.0	971.16	107.5	970.62	8.0	971.21
14.0	971.19	109.0	970.56	9.0	971.16	110.5	970.62	11.0	971.29
16.0	971.12	110.9	970.56	11.0	971.28	111.2	970.69	13.0	971.22
17.0	970.96	111.4	970.70	14.0	971.19	112.4	971.44	15.0	971.16
17.7	970.68	112.0	971.41	16.0	971.12	113.3	971.74	17.1	971.00
18.3	970.52	113.0	971.66	17.3	970.98	115.0	971.75	17.4	970.75
19.0	970.00	114.0	971.73	18.5	970.40	118.0	971.75	18.0	970.34
20.0	969.60	117.0	971.74	18.7	969.98	121.0	971.77	18.3	969.95
22.0	969.24	120.0	971.75	19.1	969.79	124.0	971.68	19.8	969.67
25.0	969.26	123.0	971.67	20.0	969.62	127.0	971.62	22.0	969.24
28.0	969.28	127.0	971.63	22.0	969.26			25.0	969.29
31.0	969.32	130.0	971.57	25.0	969.26			28.0	969.29
34.0	969.35	133.0	971.57	28.0	969.27			31.0	969.25
37.0	969.36	138.0	971.44	31.0	969.26			34.0	969.28
40.0	969.30	140.0	971.50	34.0	969.28			37.0	969.22
43.0	969.13			37.0	969.27			40.0	969.15
46.0	969.06			40.0	969.31			43.0	969.07
49.0	969.10			43.0	969.35			46.0	969.14
52.0	969.14			46.0	969.35			49.0	969.09
55.0	969.24			49.0	969.34			52.0	969.14
58.0	969.39			52.0	969.26			55.0	969.23
61.0	969.40			55.0	969.24			58.0	969.37
64.0	969.46			58.0	969.34			61.0	969.44
66.0	969.51			61.0	969.41			64.0	969.42
68.0	969.52			64.0	969.44			67.0	969.47
70.0	969.45			67.0	969.47			70.0	969.48
73.0	969.44			70.0	969.45			73.0	969.44
76.0	969.43			73.0	969.45			76.0	969.39
79.0	969.37			76.0	969.42			79.0	969.34
82.0	969.29			79.0	969.35			82.0	969.24
85.0	969.20			82.0	969.30			85.0	969.17
88.0	969.16			85.0	969.27			88.0	969.16
91.0	969.21			88.0	969.20			91.0	969.09
94.0	969.29			91.0	969.23			94.0	969.09
96.0	969.25			94.0	969.24			95.4	968.89
97.0	970.33			96.7	969.18			97.6	970.03

Table 21. (Continued) Listing of horizontal stations and elevations for cross section PR156

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1998	
29 September	
Sta.	Elev.
97.6	970.51
99.0	970.56
102.0	970.60
105.0	970.63
108.0	970.64
111.0	970.61
111.7	970.82
112.2	971.41
114.0	971.76
117.0	971.75
119.0	971.75
121.5	971.75
124.0	971.67
127.0	971.60
130.0	971.52
135.0	971.42
140.0	971.57
187.9	971.69

Description of Cross Section PR163

Location: Township 6 South/Range 50 East--section 32

U. S. Geological Survey quadrangle (1:24,000): Yarger Butte

Landowners--left bank: Gay Ranch

--right bank: Gay Ranch

Access: Left bank

Permission from: Gay Ranch

Distance from Moorhead Gaging Station: 48.30 kilometers

Azimuth of Section (degrees magnetic):151

Reference Monuments

[Monument at station -88.0 was closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
Benchmark--brass circular plate	-122.0	45°16'12.70"	105°37'52.08"	0.191	0.532	965.53
1/2-inch-rebar; 0.23 meter above 1998 ground level	-88.0					965.61
1/2-inch-rebar; 0.04 meter below 1998 ground level	30.0					964.21
1/2-inch-rebar; 0.11 meter above 1998 ground level	50.0	45°16'07.31"	105°37'50.04"	0.426	0.632	964.09
1/2-inch-rebar; 0.10 meter above 1998 ground level	75.0					964.42
1/2-inch-rebar; 0.08 meter above 1998 ground level	110.9					964.55

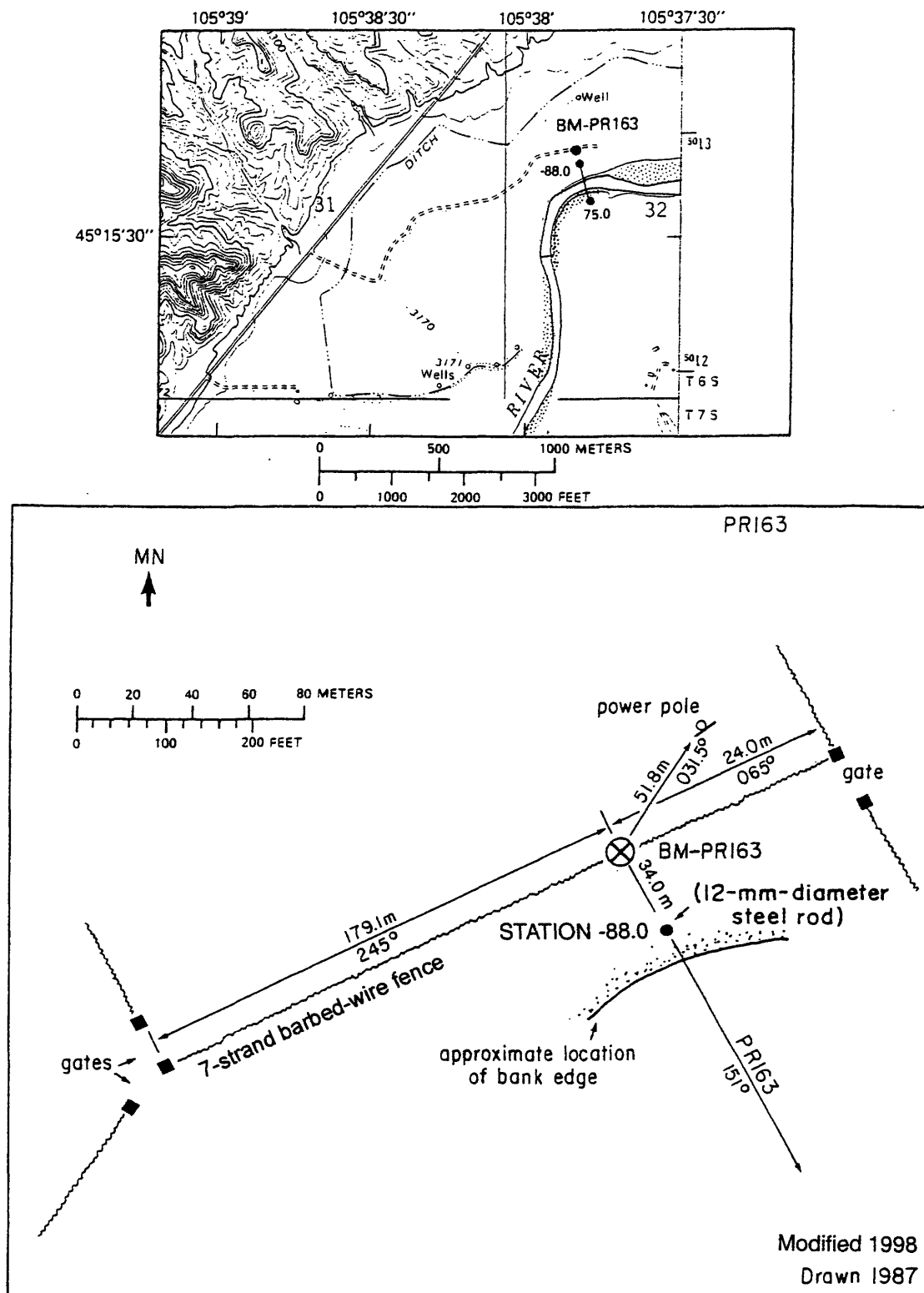


Figure 62. Upper: Location of cross section PR163, bench mark BM-PR163, and the left and right bank reference monuments in the Yarger Butte quadrangle. Lower: Location of the bench mark on the left bank. MN is magnetic north.

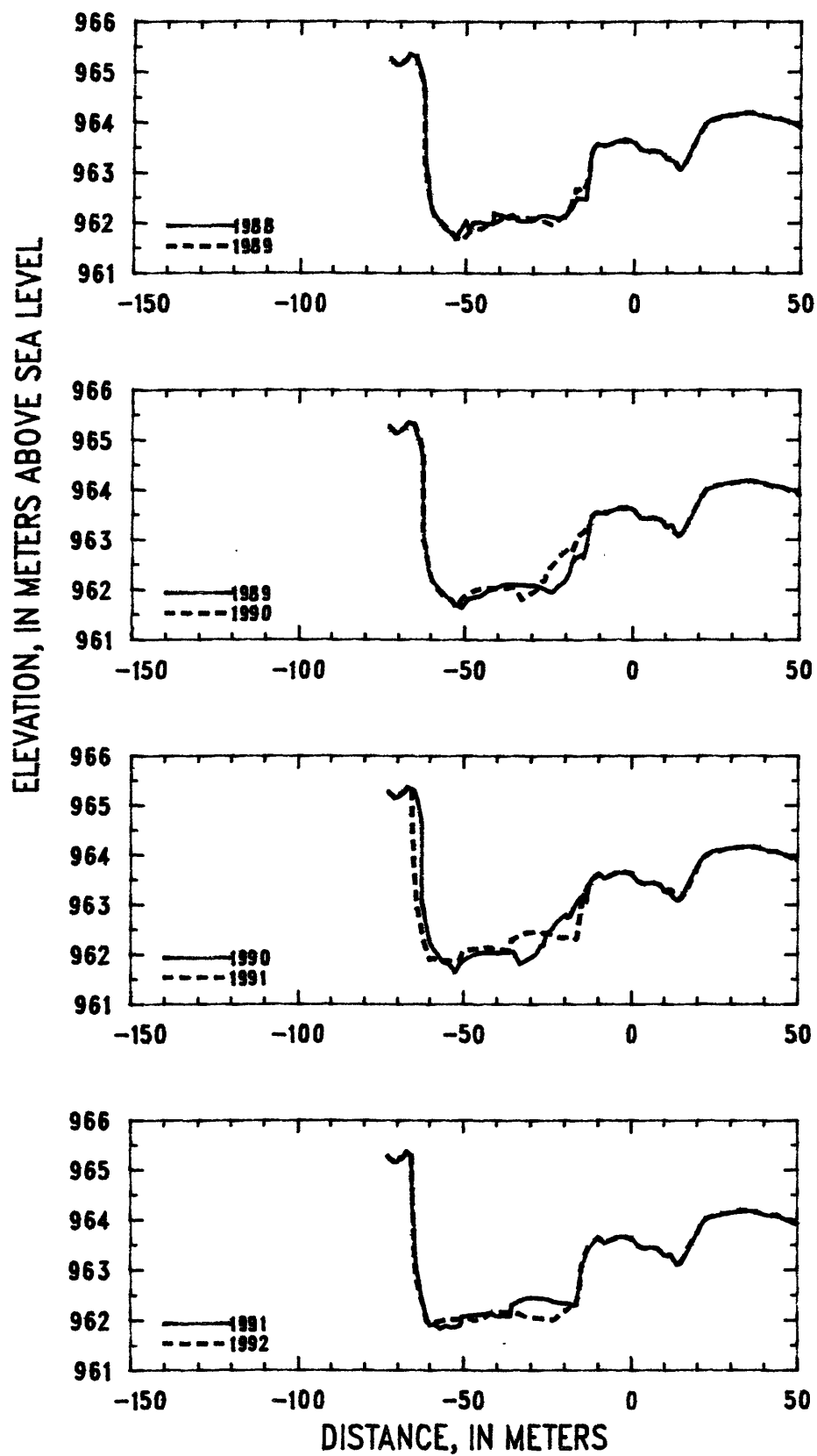


Figure 63. Profiles of cross section PR163 from 1988 to 1992.

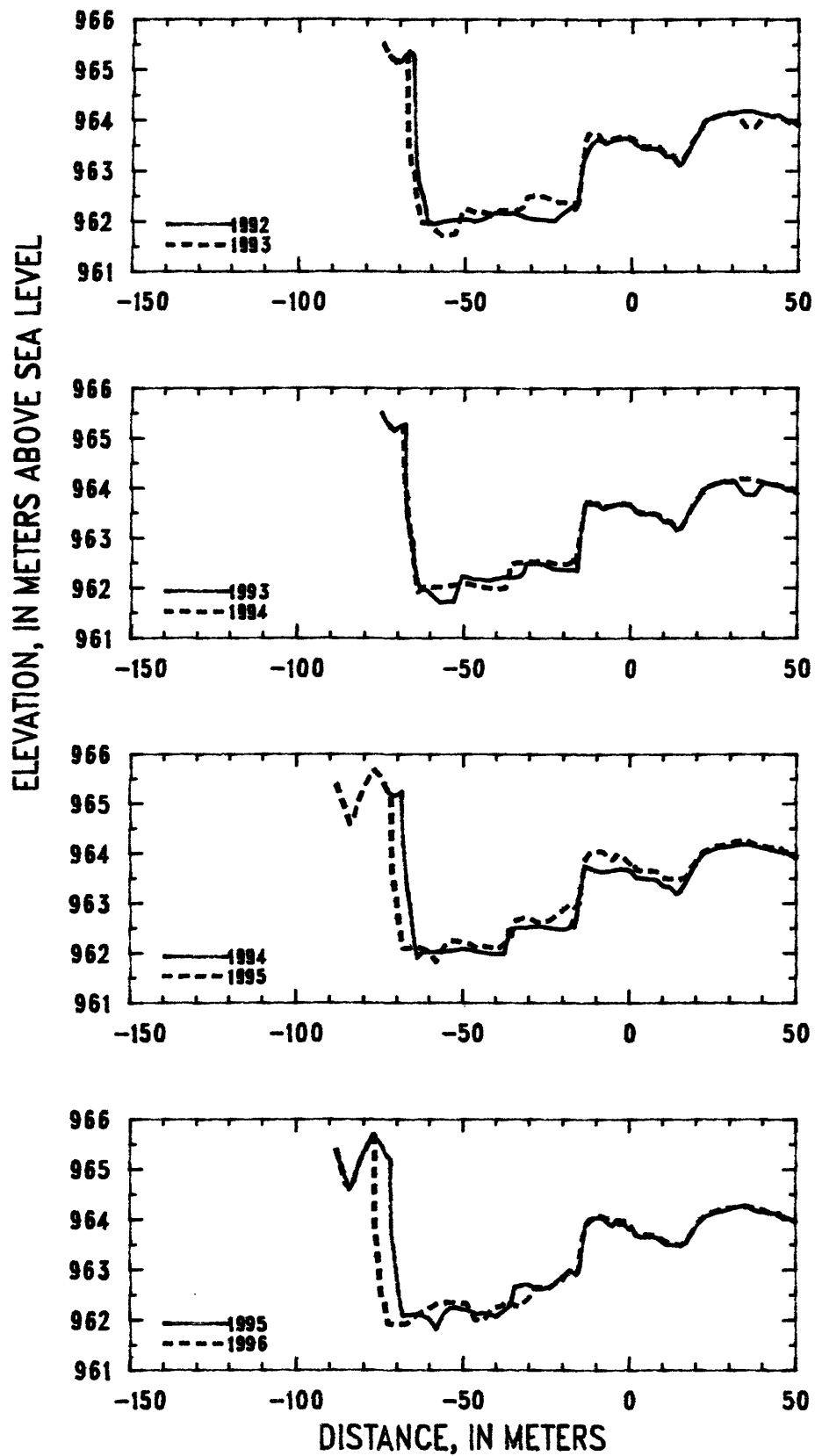


Figure 64. Profiles of cross section PR163 from 1992 to 1996.

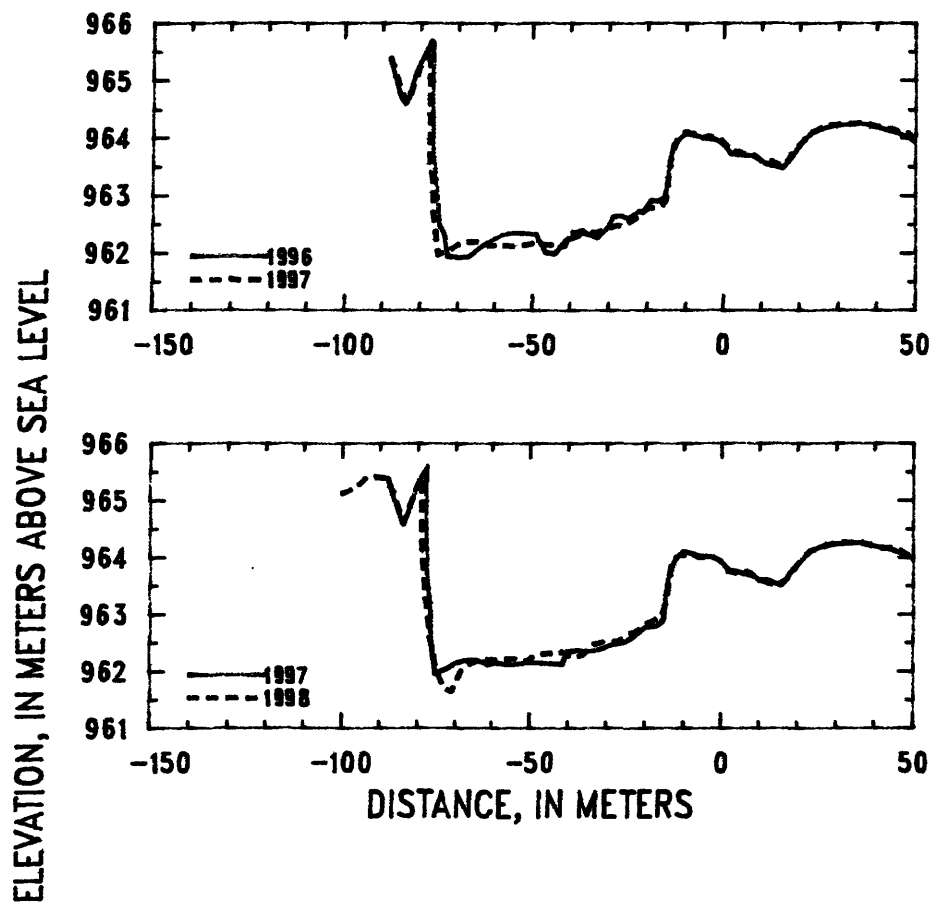


Figure 65. Profiles of cross section PR163 from 1996 to 1998.

Table 22. Listing of horizontal stations and elevations for cross section PR163

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1990		1990		1990	
22 September		22 September		21 September		21 September		21 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-73.0	965.28	-9.0	963.53	-73.0	965.29	-12.8	963.39	66.8	963.66
-71.0	965.15	-7.0	963.57	-71.0	965.15	-12.0	963.52	67.7	963.78
-70.0	965.16	-5.0	963.62	-70.0	965.16	-10.6	963.56	69.0	964.05
-68.0	965.26	-3.0	963.61	-68.0	965.26	-9.7	963.63	71.0	964.19
-67.0	965.36	-1.0	963.64	-67.0	965.38	-8.2	963.53	73.0	964.18
-65.0	965.32	0.0	963.62	-65.0	965.31	-6.0	963.60	75.0	964.27
-62.4	964.69	2.0	963.45	-64.0	965.15	-4.0	963.64	66.8	963.66
-62.3	963.17	4.0	963.41	-62.4	964.73	-2.0	963.66	67.7	963.78
-61.0	962.55	6.0	963.43	-62.5	963.02	0.0	963.61	69.0	964.05
-60.0	962.26	8.0	963.41	-62.0	962.93	2.0	963.46	71.0	964.19
-59.3	962.16	9.0	963.37	-60.6	962.41	4.0	963.42	73.0	964.18
-57.0	961.98	10.0	963.27	-59.6	962.19	6.0	963.44	75.0	964.27
-55.0	961.85	12.0	963.28	-58.0	962.03	8.0	963.42		
-53.0	961.71	14.0	963.07	-56.0	961.85	9.0	963.39		
-51.0	961.64	15.0	963.12	-54.0	961.80	10.0	963.26		
-49.0	961.81	17.0	963.36	-52.5	961.65	12.0	963.24		
-47.0	961.85	19.0	963.64	-51.0	961.82	13.0	963.13		
-45.0	961.88	21.0	963.88	-49.0	961.92	14.0	963.09		
-43.0	961.99	22.0	963.99	-47.0	961.99	15.0	963.13		
-41.0	962.02	25.0	964.07	-45.0	962.03	16.0	963.25		
-39.0	962.09	28.0	964.13	-43.0	962.04	18.0	963.52		
-37.0	962.11	31.0	964.15	-41.0	962.03	20.4	963.81		
-35.0	962.11	34.0	964.19	-39.0	962.03	22.0	963.98		
-33.0	962.10	37.0	964.17	-37.0	962.04	24.0	964.05		
-31.0	962.09	40.0	964.11	-35.0	962.05	26.0	964.10		
-29.0	962.09	43.0	964.08	-33.0	961.80	29.0	964.13		
-27.0	962.03	45.0	964.04	-31.0	961.90	32.0	964.16		
-25.0	961.97	48.0	963.99	-29.0	961.98	35.0	964.18		
-24.0	961.95	50.0	963.91	-27.8	962.08	38.0	964.15		
-22.0	962.10	52.0	963.75	-27.0	962.17	41.0	964.09		
-20.3	962.16	54.0	963.76	-26.3	962.18	44.0	964.07		
-18.7	962.37	57.0	963.79	-25.6	962.39	47.0	963.97		
-18.3	962.55	60.0	963.76	-24.0	962.49	49.0	963.95		
-17.7	962.58	62.0	963.71	-22.0	962.68	51.0	963.81		
-17.4	962.66	64.0	963.74	-19.6	962.79	53.0	963.75		
-17.0	962.65	66.8	963.65	-19.0	962.73	55.0	963.78		
-15.5	962.71	69.0	964.03	-18.3	962.76	57.0	963.79		
-14.9	962.66	71.0	964.18	-17.3	962.92	58.0	963.82		
-13.7	962.90	73.0	964.17	-16.0	963.10	59.0	963.80		
-12.7	963.41	75.0	964.27	-15.0	963.15	61.0	963.74		
-12.0	963.50			-14.4	963.20	63.0	963.66		
-11.0	963.55			-13.5	963.08	65.0	963.63		

Table 22. (Continued) Listing of horizontal stations and elevations for cross section PR163
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1991		1992		1992		1992	
31 August		31 August		27 August		27 August		27 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-73.0	965.29	-10.0	963.62	-73.0	965.29	-13.3	963.40	71.0	964.18
-71.0	965.16	-8.0	963.52	-72.0	965.21	-12.0	963.54	73.0	964.18
-70.0	965.16	-6.0	963.60	-70.0	965.17	-10.0	963.64	75.0	964.28
-69.0	965.25	-4.0	963.66	-68.0	965.26	-8.0	963.54		
-68.0	965.27	-2.0	963.65	-67.0	965.38	-6.0	963.60		
-67.0	965.37	0.0	963.64	-66.0	965.34	-4.0	963.63		
-65.5	965.28	2.0	963.47	-65.5	965.26	-2.0	963.66		
-65.4	964.59	4.0	963.42	-65.4	964.48	0.0	963.61		
-64.9	963.90	6.0	963.45	-65.4	964.58	2.0	963.47		
-64.4	963.35	8.0	963.42	-64.6	963.22	4.0	963.43		
-63.9	962.96	10.0	963.28	-64.0	962.78	6.0	963.44		
-63.6	962.88	12.0	963.30	-63.5	962.64	8.0	963.42		
-62.0	962.28	14.0	963.10	-63.0	962.56	10.0	963.28		
-60.9	962.07	15.0	963.12	-62.0	962.30	12.0	963.29		
-60.0	961.91	17.0	963.34	-61.0	961.98	14.0	963.11		
-58.6	961.92	19.0	963.60	-59.2	961.94	15.0	963.15		
-57.0	961.83	21.0	963.87	-57.0	961.98	16.0	963.27		
-55.0	961.89	22.0	963.96	-55.0	962.02	18.0	963.52		
-53.0	961.85	24.0	964.04	-53.0	962.02	20.0	963.74		
-51.0	961.89	26.0	964.08	-51.0	962.03	21.0	963.89		
-50.4	962.06	29.0	964.14	-49.0	962.05	22.0	963.99		
-48.0	962.09	32.0	964.15	-47.0	961.99	24.0	964.05		
-46.0	962.11	35.0	964.18	-45.0	962.02	27.0	964.11		
-44.0	962.12	38.0	964.15	-43.0	962.09	30.0	964.14		
-42.0	962.14	41.0	964.08	-41.0	962.17	33.0	964.18		
-40.0	962.07	44.0	964.07	-39.0	962.16	36.0	964.18		
-38.0	962.09	47.0	963.97	-37.0	962.16	39.0	964.11		
-36.0	962.08	50.0	963.90	-35.0	962.17	42.0	964.08		
-35.5	962.30	52.0	963.75	-33.0	962.12	44.0	964.10		
-33.0	962.39	54.0	963.75	-31.0	962.06	46.0	964.00		
-31.0	962.44	56.0	963.78	-29.0	962.05	48.0	963.99		
-29.0	962.45	58.0	963.80	-27.0	962.03	50.0	963.88		
-27.0	962.43	60.0	963.76	-25.0	962.01	52.0	963.75		
-25.0	962.42	62.0	963.71	-23.0	962.01	53.0	963.74		
-23.0	962.37	64.0	963.63	-21.0	962.14	55.0	963.78		
-21.0	962.33	66.0	963.63	-19.0	962.23	57.0	963.79		
-19.0	962.34	66.5	963.59	-18.0	962.29	59.0	963.79		
-17.0	962.29	67.0	963.67	-17.0	962.23	61.0	963.73		
-16.4	962.33	69.0	964.01	-16.6	962.29	63.0	963.67		
-15.0	963.01	71.0	964.15	-15.7	962.64	66.0	963.64		
-13.2	963.38	73.0	964.16	-15.0	963.08	67.0	963.70		
-11.0	963.57	75.0	964.27	-14.3	963.24	69.0	964.05		

Table 22. (Continued) Listing of horizontal stations and elevations for cross section PR163
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1993		1993		1993		1994		1994	
30 August		30 August		30 August		21 September		21 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-75.0	965.52	-13.8	963.62	64.0	963.65	-73.0	965.29	8.0	963.48
-73.0	965.29	-13.1	963.73	66.0	963.65	-72.0	965.21	10.0	963.35
-71.0	965.16	-12.0	963.69	67.0	963.69	-71.0	965.16	12.0	963.33
-69.0	965.26	-10.0	963.71	67.7	963.86	-70.0	965.17	14.0	963.19
-67.5	965.28	-9.0	963.61	69.0	964.03	-68.3	965.24	15.0	963.21
-67.5	964.08	-8.0	963.59	71.0	964.16	-68.0	964.36	16.0	963.32
-67.2	963.49	-6.0	963.64	73.0	964.18	-66.5	963.25	17.0	963.43
-66.5	963.23	-4.0	963.68			-65.9	963.01	18.0	963.58
-66.3	963.04	-2.0	963.68			-64.5	962.24	20.0	963.78
-65.4	962.97	0.0	963.65			-63.6	961.92	22.0	964.00
-65.1	962.81	1.0	963.59			-62.0	962.03	25.0	964.07
-65.0	962.63	2.0	963.50			-59.0	962.02	27.5	964.13
-64.7	962.42	4.0	963.47			-56.0	962.03	30.0	964.13
-63.0	961.98	6.0	963.49			-53.0	962.06	33.0	964.18
-61.0	961.97	8.0	963.46			-49.0	962.09	36.0	964.18
-59.0	961.82	10.0	963.32			-46.0	962.04	39.0	964.12
-57.0	961.72	12.0	963.31			-43.0	962.00	42.0	964.07
-55.0	961.73	13.8	963.16			-40.0	961.98	45.0	964.03
-53.0	961.74	15.0	963.19			-37.4	962.00	48.0	963.99
-50.6	962.23	16.5	963.36			-36.5	962.24	51.0	963.83
-49.0	962.23	18.0	963.56			-36.2	962.31	54.0	963.76
-47.0	962.17	20.0	963.76			-36.1	962.46	57.0	963.78
-45.0	962.18	21.5	963.96			-34.0	962.52	60.0	963.78
-43.0	962.14	23.0	964.02			-31.0	962.52	63.0	963.70
-41.0	962.17	25.0	964.06			-28.0	962.54	65.5	963.66
-39.0	962.21	28.0	964.14			-25.0	962.53	67.0	963.70
-37.0	962.22	30.0	964.13			-22.0	962.48	68.0	963.92
-35.0	962.21	31.0	964.14			-19.0	962.48	70.0	964.13
-33.0	962.25	34.0	963.87			-17.6	962.53	72.5	964.17
-31.6	962.37	37.0	963.86			-17.1	962.64	75.0	964.29
-31.5	962.48	40.0	964.10			-16.5	962.54		
-30.0	962.50	42.0	964.08			-15.7	962.79		
-28.0	962.50	44.0	964.07			-15.4	963.08		
-25.7	962.48	46.0	963.99			-14.8	963.20		
-24.0	962.40	47.0	963.96			-13.5	963.75		
-22.0	962.38	49.0	963.95			-12.0	963.72		
-20.0	962.37	50.0	963.89			-9.0	963.63		
-18.0	962.37	52.0	963.76			-6.0	963.65		
-16.2	962.35	55.0	963.79			-3.0	963.70		
-15.7	962.54	57.0	963.77			0.0	963.67		
-15.3	962.95	60.0	963.77			2.0	963.52		
-14.3	963.36	62.0	963.73			5.0	963.49		

Table 22. (Continued) Listing of horizontal stations and elevations for cross section PR163
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1995		1995		1995		1996		1996	
25 September		25 September		25 September		24 October		24 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-88.0	965.39	-15.1	963.03	58.0	963.85	-88.0	965.39	0.0	963.89
-86.0	965.01	-13.2	963.90	60.0	963.85	-85.0	964.70	2.0	963.72
-84.0	964.60	-12.0	964.00	62.0	963.85	-84.0	964.61	5.0	963.70
-83.0	964.68	-10.0	964.04	65.0	963.68	-83.0	964.69	8.0	963.68
-81.0	965.16	-8.0	964.04	66.0	963.71	-81.0	965.18	11.0	963.55
-79.0	965.46	-6.0	963.90	67.0	963.76	-79.0	965.45	13.0	963.52
-77.0	965.69	-5.0	963.88	68.0	963.95	-77.0	965.69	15.5	963.48
-75.0	965.54	-4.0	963.97	70.0	964.16	-76.7	965.67	17.5	963.62
-73.0	965.29	-3.0	963.90	72.0	964.17	-76.7	963.97	19.0	963.77
-71.7	965.20	-2.0	963.92			-74.8	962.47	21.0	963.95
-71.5	963.67	0.0	963.80			-73.6	962.35	23.0	964.09
-70.5	963.25	0.7	963.85			-72.7	961.94	26.0	964.17
-69.8	962.83	2.0	963.68			-70.0	961.92	28.0	964.21
-69.0	962.44	4.0	963.64			-67.0	961.93	30.0	964.22
-68.0	962.09	6.0	963.65			-64.0	962.10	33.0	964.25
-66.0	962.10	8.0	963.64			-61.0	962.21	36.0	964.26
-64.0	962.12	10.0	963.54			-58.0	962.32	39.0	964.21
-62.0	962.09	11.0	963.50			-55.0	962.36	42.0	964.15
-60.0	962.02	13.0	963.49			-52.0	962.35	46.0	964.06
-58.0	961.82	15.0	963.47			-49.0	962.33	50.0	963.95
-56.0	962.10	17.0	963.53			-46.5	962.01	54.0	963.80
-54.0	962.24	18.0	963.67			-44.0	961.99	57.0	963.86
-52.0	962.26	20.0	963.84			-41.0	962.24	60.0	963.87
-50.0	962.21	22.0	964.03			-38.0	962.29		
-48.0	962.18	24.0	964.09			-36.8	962.40		
-46.0	962.11	26.0	964.14			-36.0	962.35		
-44.0	962.14	28.0	964.16			-33.0	962.27		
-42.0	962.12	30.0	964.20			-30.0	962.45		
-40.0	962.06	32.0	964.24			-29.0	962.63		
-38.0	962.16	34.0	964.26			-27.0	962.66		
-35.6	962.29	35.0	964.28			-25.0	962.61		
-35.0	962.45	37.0	964.20			-22.0	962.74		
-34.4	962.66	39.0	964.16			-21.0	962.71		
-32.0	962.70	41.0	964.13			-19.0	962.91		
-30.0	962.71	43.0	964.12			-17.0	962.90		
-28.0	962.62	45.0	964.14			-15.5	962.96		
-26.0	962.62	46.0	964.04			-14.0	963.64		
-24.0	962.66	48.0	964.02			-13.0	963.90		
-22.0	962.75	50.0	963.93			-10.0	964.08		
-20.0	962.88	52.0	963.82			-8.0	964.06		
-18.0	962.99	54.0	963.78			-5.0	963.99		
-16.0	962.91	56.0	963.84			-2.0	963.98		

Table 22. (Continued) Listing of horizontal stations and elevations for cross section PR163

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1997		1997		1998		1998	
22 September		22 September		28 September		28 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-88.0	965.39	2.0	963.76	-100.0	965.12	2.0	963.76
-86.5	965.11	4.0	963.76	-97.0	965.21	4.0	963.72
-84.0	964.61	6.0	963.70	-94.0	965.39	7.0	963.75
-83.0	964.69	8.0	963.69	-91.0	965.42	10.0	963.62
-80.0	965.30	10.0	963.60	-88.0	965.39	13.0	963.54
-77.7	965.57	12.0	963.61	-86.0	965.03	15.0	963.52
-77.5	963.62	14.0	963.55	-83.7	964.61	17.0	963.61
-76.6	963.17	15.7	963.51	-82.0	964.92	20.0	963.87
-76.5	962.72	17.0	963.60	-80.0	965.29	23.0	964.10
-76.3	962.50	18.0	963.72	-79.0	965.42	26.0	964.18
-75.3	961.96	20.0	963.87	-79.0	964.13	28.0	964.22
-72.0	962.06	23.0	964.09	-78.0	963.28	30.0	964.24
-70.0	962.15	26.0	964.19	-76.9	962.65	33.0	964.26
-67.0	962.20	28.0	964.22	-75.0	961.99	36.0	964.27
-64.0	962.21	30.0	964.23	-73.0	961.70	39.0	964.21
-61.0	962.12	33.0	964.25	-71.0	961.65	42.0	964.16
-59.0	962.16	36.0	964.27	-68.5	962.01	45.0	964.17
-56.0	962.12	39.0	964.22	-66.0	962.14	48.0	964.07
-53.0	962.13	42.0	964.16	-63.0	962.21	50.0	963.98
-50.0	962.17	44.0	964.15	-60.0	962.20	53.0	963.85
-47.0	962.15	46.0	964.08	-57.0	962.22	56.0	963.87
-44.0	962.14	48.0	964.07	-54.0	962.22	59.0	963.88
-41.5	962.12	50.0	963.97	-51.0	962.17	62.0	963.86
-40.0	962.35			-48.0	962.30	65.0	963.71
-37.0	962.38			-45.0	962.32	67.0	963.79
-34.0	962.35			-42.0	962.35	69.0	964.07
-31.0	962.41			-39.0	962.25	72.0	964.20
-28.5	962.48			-36.0	962.28	75.0	964.32
-26.0	962.49			-33.0	962.48		
-23.0	962.61			-30.0	962.53		
-20.0	962.78			-27.0	962.52		
-17.0	962.80			-24.7	962.65		
-15.4	962.89			-22.0	962.72		
-14.6	963.38			-19.0	962.86		
-13.8	963.72			-15.8	962.96		
-12.0	963.99			-14.8	963.20		
-10.0	964.10			-13.0	963.94		
-8.0	964.08			-11.0	964.04		
-6.0	964.00			-8.0	964.06		
-4.0	964.03			-5.0	964.01		
-2.0	964.00			-2.0	963.99		
0.0	963.92			0.0	963.92		

Description of Cross Section PR164.8

Location: Township 6 South/Range 50 East--section 28

U. S. Geological Survey quadrangle (1:24,000): Lonesome Peak

Landowners--left bank: U. S. Government

--right bank: U. S. Government

Access: Left bank

Permission from: Gay Ranch

Distance from Moorhead Gaging Station: 49.6 kilometers

Azimuth of Section (degrees magnetic): 185

Reference Monuments

[Monuments at stations -1.5 and 0.0 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.17 meter above 1998 ground level;	-1.5	45°16'39.98"	105°36'35.00"	0.413	0.475	962.75
1/2-inch-rebar; 0.15 meter above 1998 ground level;	0.0					962.61
1/2-inch-rebar; 0.10 meter above 1998 ground level; 1.4 meters downstream from a 10-meter high willow tree (tallest of two willow trees among lower cottonwood trees)	121.0					961.37
1/2-inch-rebar; 0.17 meter above 1998 ground level; at riverward edge of 15-20 meter high cottonwood trees	150.0	45°16'35.38"	105°36'37.31"	0.664	0.957	962.29

See Figure 8 for location
of cross section

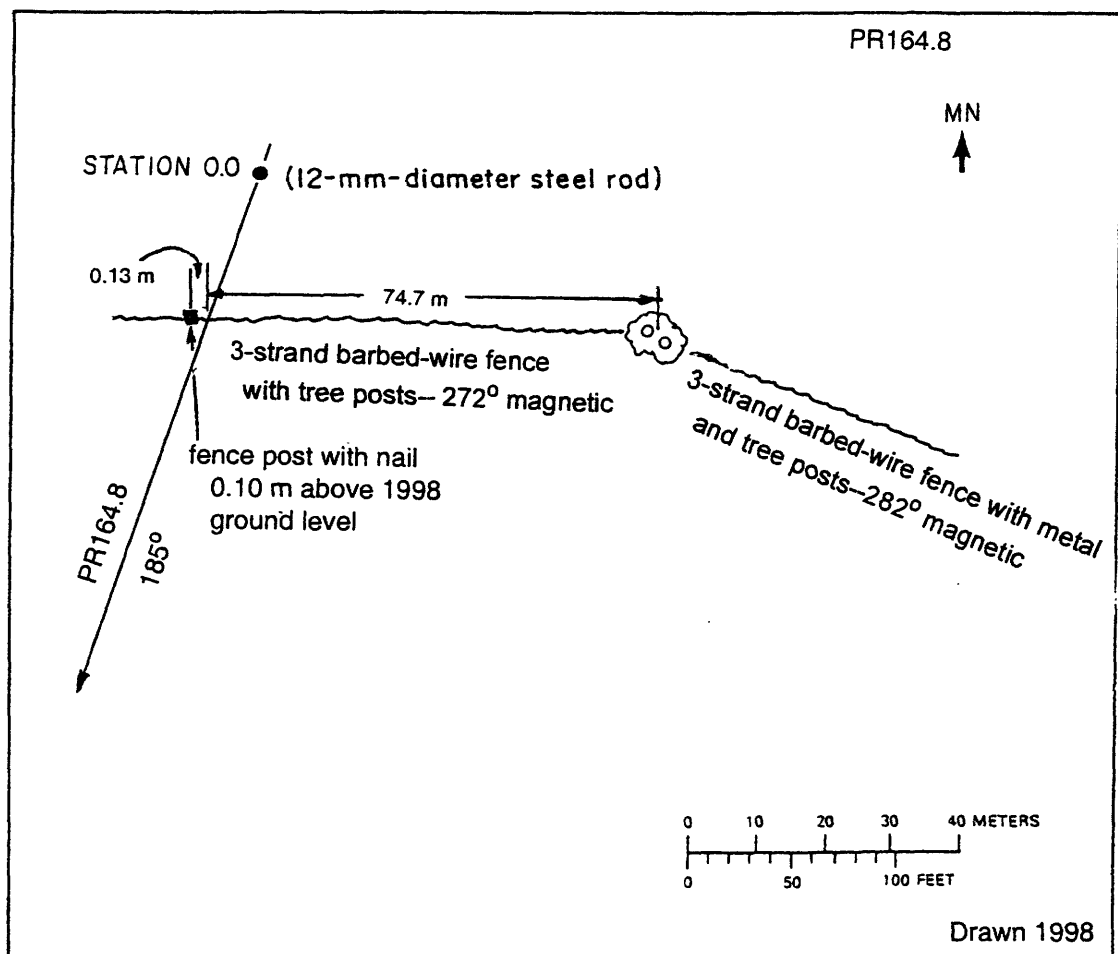


Figure 66. Upper: Location of cross section PR164.8 is shown in figure 8. Lower: Location of the reference monument on the left bank. MN is magnetic north.

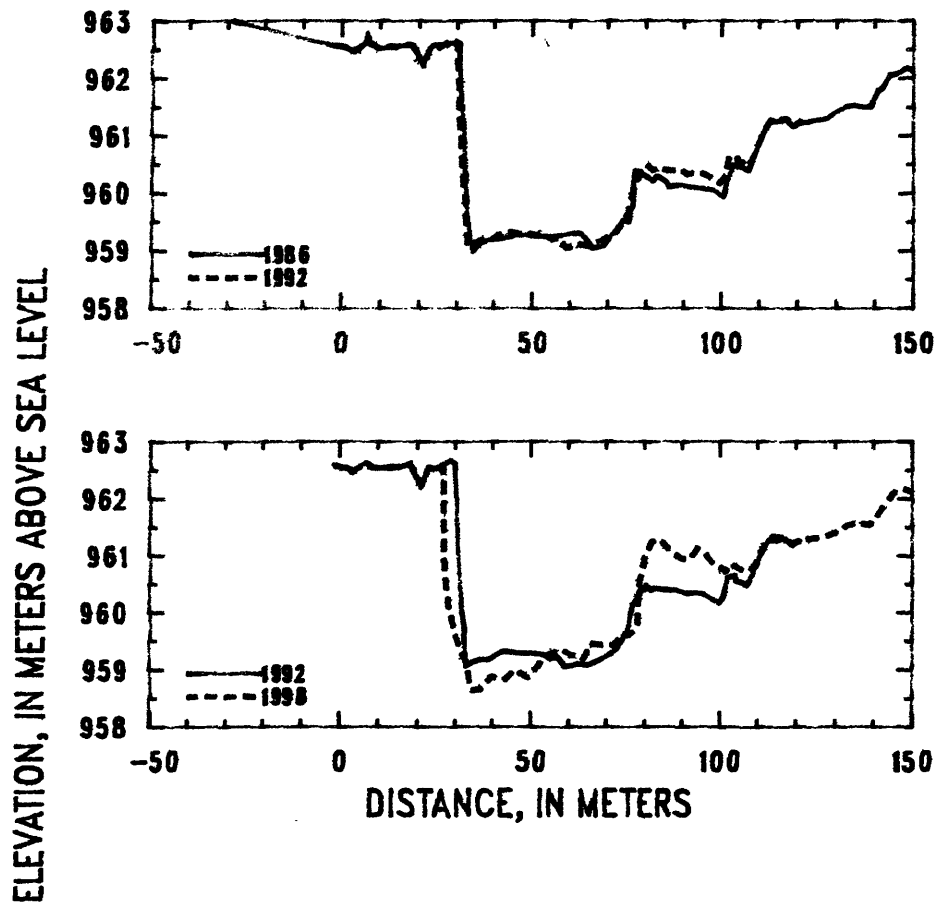


Figure 67. Profiles of cross section PR164.8 from 1986 to 1998.

Table 23. Listing of horizontal stations and elevations for cross section PR164.8

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1986		1986		1992		1992		1998	
25 August		25 August		30 August		30 August		1 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-63.0	963.55	74.0	959.53	-1.5	962.57	67.0	959.14	-1.5	962.58
-1.5	962.57	75.5	959.50	0.0	962.56	69.0	959.20	0.0	962.56
0.0	962.56	76.8	959.83	2.0	962.54	71.0	959.27	3.0	962.46
2.4	962.49	76.9	960.31	3.0	962.46	72.4	959.34	6.0	962.60
4.0	962.51	77.2	960.39	5.0	962.56	73.3	959.43	9.0	962.54
6.2	962.62	78.0	960.37	7.0	962.63	74.0	959.50	12.0	962.53
6.7	962.74	80.0	960.29	9.0	962.53	75.4	959.65	15.0	962.56
7.3	962.60	82.0	960.21	11.0	962.53	76.8	960.11	18.1	962.61
9.0	962.53	83.0	960.30	13.0	962.57	77.4	960.20	21.0	962.24
12.0	962.53	85.5	960.20	15.0	962.55	78.2	960.25	23.0	962.56
15.0	962.57	86.3	960.10	17.0	962.59	78.7	960.37	25.0	962.51
18.0	962.59	89.0	960.14	18.1	962.59	80.0	960.41	26.9	962.56
19.0	962.49	92.0	960.11	19.0	962.49	80.5	960.48	27.2	960.74
21.0	962.25	95.0	960.07	21.0	962.21	81.8	960.39	28.2	960.15
23.0	962.55	98.0	960.05	23.0	962.55	83.0	960.44	29.8	959.69
24.0	962.59	100.5	959.93	25.0	962.53	85.0	960.40	30.5	959.53
27.0	962.61	103.0	960.49	27.0	962.61	87.0	960.39	33.0	959.14
30.0	962.62	105.0	960.46	29.0	962.67	89.0	960.40	34.5	958.64
30.8	962.62	107.0	960.39	30.1	962.62	91.0	960.33	37.0	958.66
30.8	962.34	109.0	960.68	30.2	962.30	93.0	960.35	40.0	958.88
31.2	961.83	111.0	961.05	30.6	961.98	95.0	960.33	43.0	958.81
32.3	961.04	113.0	961.26	30.7	961.46	97.0	960.27	46.0	958.99
32.3	960.34	115.0	961.25	32.0	960.02	99.7	960.17	49.0	958.87
32.6	960.30	117.0	961.30	32.5	959.85	100.8	960.27	52.0	959.08
32.7	959.79	119.0	961.16	32.7	959.43	102.0	960.62	55.0	959.27
33.2	959.39	121.0	961.24	33.2	959.07	104.0	960.65	58.0	959.35
34.5	958.99	123.0	961.24	35.0	959.14	104.4	960.55	61.0	959.25
36.0	959.08	125.0	961.29	37.0	959.18	106.0	960.53	64.0	959.19
39.0	959.20	127.0	961.29	39.0	959.17	107.0	960.47	66.0	959.46
42.0	959.20	130.0	961.41	41.0	959.26	109.0	960.71	69.0	959.43
45.0	959.25	133.0	961.52	43.0	959.33	111.0	961.05	72.0	959.43
48.0	959.28	135.0	961.54	45.0	959.31	113.0	961.27	73.1	959.52
51.0	959.24	137.0	961.51	47.0	959.29	115.0	961.27	73.7	959.63
54.0	959.24	139.0	961.51	49.0	959.29	117.0	961.31	76.0	959.61
57.0	959.25	141.0	961.80	51.0	959.28	119.0	961.18	77.6	959.73
60.0	959.30	142.0	961.82	53.0	959.27	121.0	961.26	78.2	959.82
63.0	959.30	144.0	962.06	55.0	959.20			78.6	960.45
65.0	959.13	146.0	962.08	57.0	959.22			80.0	960.95
66.0	959.05	148.0	962.18	59.0	959.05			82.0	961.25
69.0	959.08	150.0	962.14	61.0	959.07			84.0	961.29
71.0	959.26			63.0	959.11			86.0	961.15
72.7	959.39			65.0	959.08			88.0	961.03

Table 23. (Continued) Listing of horizontal stations and elevations for cross section PR164.8

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1998	
1 October	
Sta.	Elev.
90.0	960.94
92.0	960.94
94.0	961.12
96.0	961.04
98.0	960.86
100.0	960.80
101.5	960.71
103.0	960.85
106.0	960.74
108.0	960.75
110.0	960.92
112.0	961.20
114.0	961.34
116.0	961.33
119.0	961.21
121.0	961.27
124.0	961.30
127.0	961.32
130.0	961.40
133.0	961.53
136.0	961.58
139.0	961.54
142.0	961.80
145.0	962.09
148.0	962.16
150.0	962.13

Description of Cross Section PR165.6

Location: Township 6 South/Range 50 East--section 28

U. S. Geological Survey quadrangle (1:24,000): Lonesome Peak

Landowners--left bank: Gay Ranch

--right bank: Daily Ranch

Access: Left bank

Permission from: Gay Ranch

Distance from Moorhead Gaging Station: 50.4 kilometers

Azimuth of Section (degrees magnetic): 105

Reference Monuments

[Monuments at stations -7.3 and -1.0 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.10 meter above 1998 ground level; under 3-strand, barbed-wire fence with tree posts	-7.3	45°16'49.90"	105°36'13.39"	0.334	0.513	961.60
1/2-inch-rebar; 0.13 meter above 1998 ground level;	-1.0					961.57
1/2-inch-rebar; 0.10 meter above 1998 ground level;	151.0	45°16'47.41"	105°36'07.06"	0.415	0.825	961.20

See Figure 8 for location
of cross section

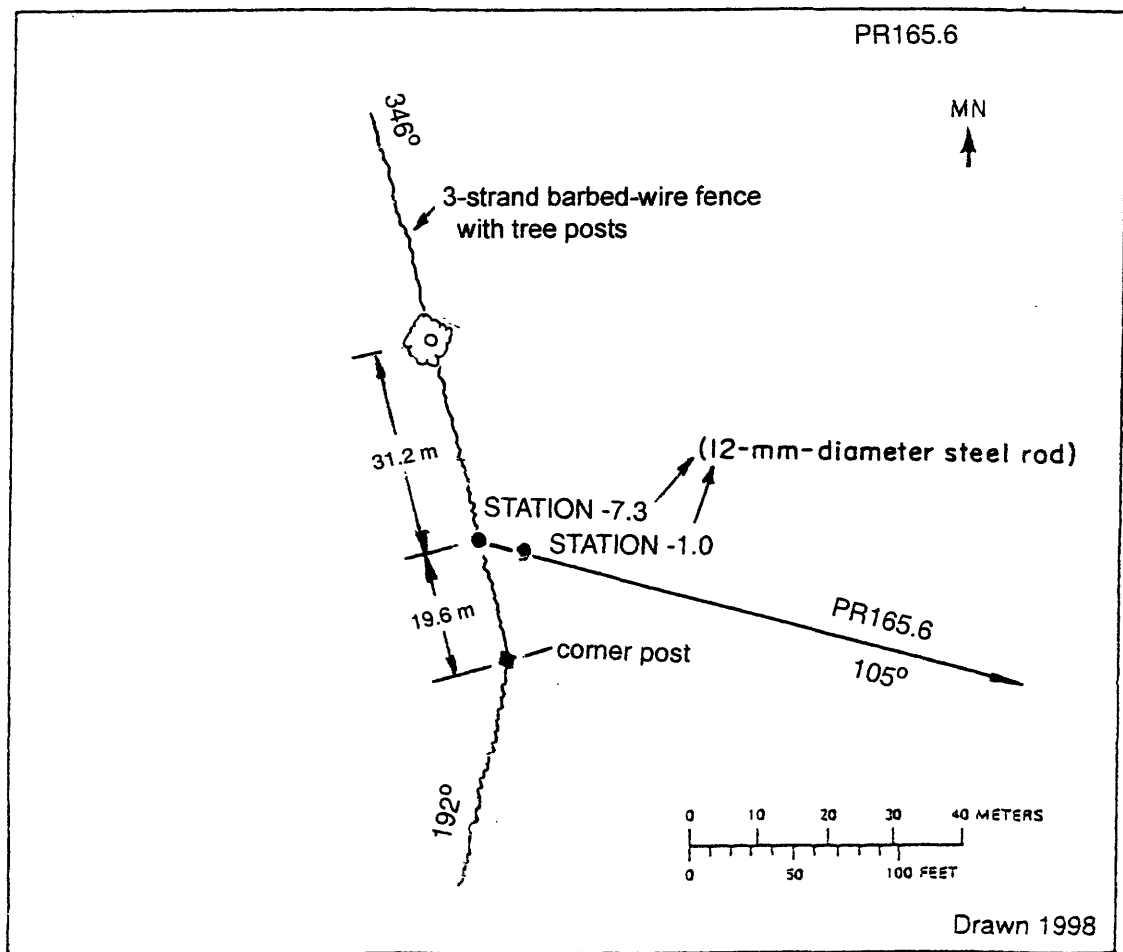


Figure 68. Upper: Location of cross section PR165.6 is shown in figure 8. Lower: Location of the reference monument on the left bank. MN is magnetic north.

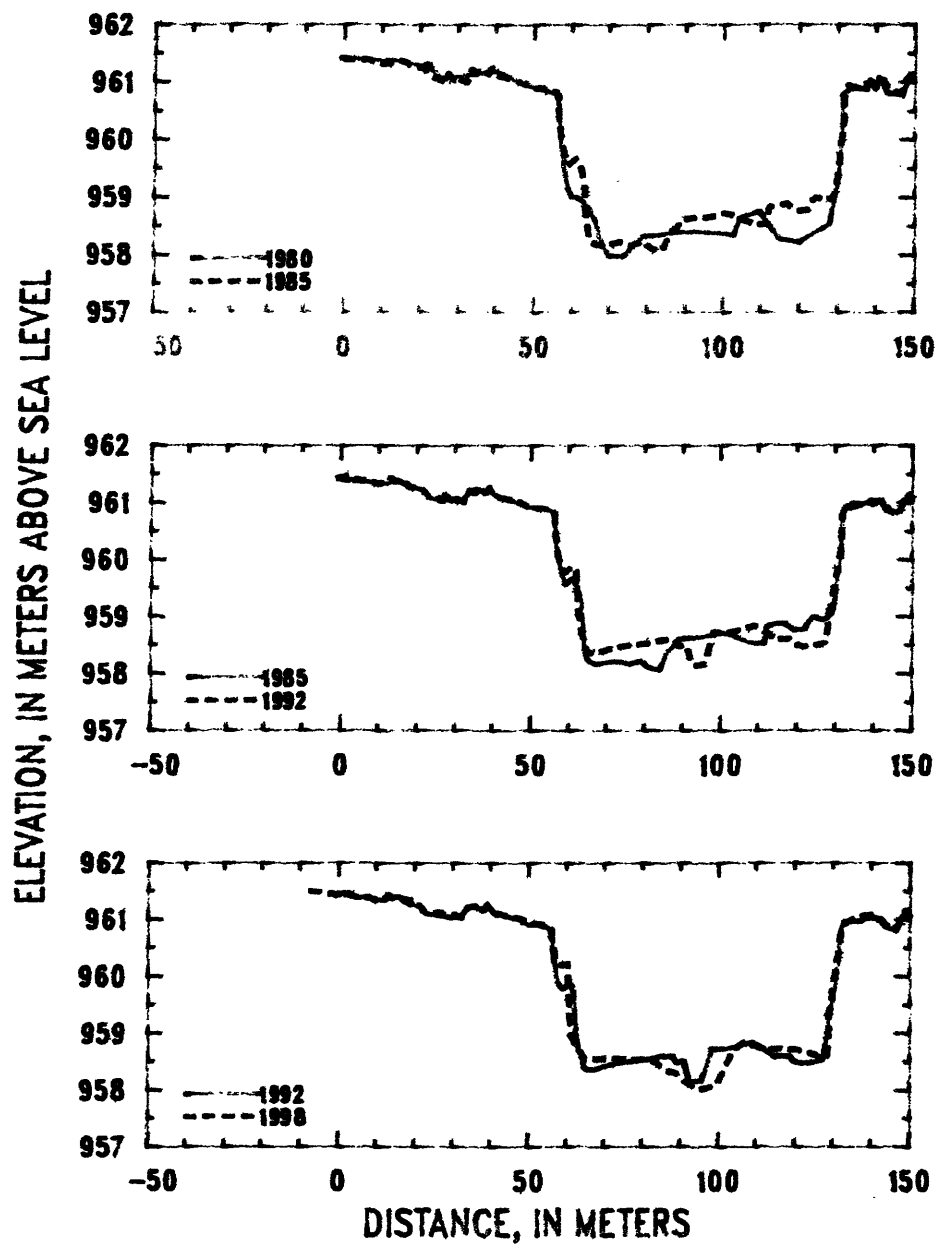


Figure 69. Profiles of cross section PR165.6 from 1980 to 1998.

Table 24. Listing of horizontal stations and elevations for cross section PR165.6

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1980		1980		1985		1985		1992	
20 October		20 October		29 September		29 September		30 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.0	961.43	128.0	958.54	0.0	961.41	86.0	958.38	-1.0	961.44
0.0	961.43	129.0	958.90	3.0	961.39	88.0	958.50	2.0	961.48
5.0	961.40	130.0	959.23	6.0	961.39	89.0	958.61	5.0	961.38
10.0	961.38	131.2	960.13	9.0	961.32	91.0	958.63	8.0	961.40
15.0	961.39	131.4	960.80	12.0	961.33	94.0	958.64	9.0	961.34
20.0	961.28	134.0	960.91	15.0	961.38	97.0	958.66	12.0	961.34
22.0	961.33	137.7	960.88	18.0	961.28	100.0	958.72	13.0	961.44
25.0	961.06	138.5	961.04	21.0	961.24	103.0	958.67	14.0	961.38
30.0	961.09	140.0	960.89	23.0	961.10	106.0	958.58	16.0	961.41
35.0	961.16	141.0	961.09	25.0	961.05	109.0	958.52	18.0	961.28
40.0	961.21	142.0	960.99	26.8	961.01	111.8	958.52	21.0	961.26
45.0	961.02	143.0	960.81	27.4	961.14	112.2	958.82	23.0	961.10
51.0	960.88	146.9	960.76	29.0	961.02	114.0	958.86	25.0	961.08
54.0	960.84	148.0	960.99	30.0	961.08	117.0	958.87	28.0	961.07
56.6	960.77	149.0	961.14	32.4	960.99	119.5	958.74	29.0	961.03
56.8	960.31			33.6	961.22	122.4	958.78	32.0	961.03
58.0	959.50			35.0	961.16	123.0	958.91	34.0	961.22
59.0	959.15			37.0	961.22	124.5	959.00	36.0	961.24
60.0	959.01			38.0	961.15	127.0	958.93	38.0	961.15
62.0	958.98			39.0	961.25	129.0	959.01	39.0	961.27
64.0	958.86			41.0	961.11	129.7	959.13	41.0	961.11
66.0	958.65			44.0	961.05	131.0	959.95	44.0	961.06
68.1	958.17			47.0	960.97	131.7	960.30	47.0	961.00
70.0	957.98			50.0	960.90	132.0	960.80	50.0	960.90
73.5	957.97			53.0	960.90	133.0	960.94	52.0	960.91
76.0	958.14			56.0	960.83	134.0	960.89	54.0	960.88
79.0	958.33			56.4	960.77	137.0	960.96	56.3	960.82
83.0	958.35			56.6	960.46	139.0	961.01	56.5	960.45
87.0	958.39			57.3	959.97	140.0	960.95	56.7	960.38
91.0	958.40			59.0	959.56	142.0	961.03	57.1	960.11
95.0	958.40			61.0	959.67	143.3	960.85	58.0	959.85
100.0	958.37			62.5	959.51	146.0	960.81	59.0	959.78
102.7	958.33			63.5	959.24	147.0	960.85	61.0	959.89
104.2	958.63			64.0	958.54	148.0	961.06	62.0	959.78
107.5	958.72			65.0	958.24	149.0	961.13	62.4	959.18
109.9	958.74			67.0	958.16	150.0	961.03	63.0	958.90
112.5	958.47			70.0	958.19			63.6	958.69
115.0	958.26			73.0	958.22			65.0	958.37
117.5	958.23			76.0	958.16			67.0	958.35
120.0	958.20			79.0	958.23			69.0	958.40
123.0	958.35			81.0	958.10			71.0	958.44
126.0	958.46			84.0	958.06			73.0	958.47

Table 24. (Continued) Listing of horizontal stations and elevations for cross section PR165.6

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1992		1992		1998		1998	
30 August		30 August		1 October		1 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
75.0	958.49	142.5	961.00	-7.3	961.51	83.0	958.52
77.0	958.51	144.0	960.84	-1.0	961.45	86.0	958.35
79.0	958.52	146.4	960.78	0.0	961.44	89.0	958.29
81.0	958.53	148.0	961.05	2.0	961.47	92.0	958.12
83.0	958.56	149.0	961.16	4.0	961.40	95.0	958.00
85.0	958.60	150.0	961.05	7.0	961.39	98.0	958.06
87.0	958.59	151.0	961.10	10.0	961.35	100.0	958.15
88.0	958.60			12.0	961.34	102.0	958.44
89.0	958.48			13.0	961.43	104.0	958.72
91.0	958.51			14.0	961.38	107.0	958.85
91.7	958.36			17.0	961.36	110.0	958.78
92.5	958.15			20.0	961.32	113.0	958.70
94.0	958.15			23.0	961.12	116.0	958.73
95.7	958.17			26.0	961.11	119.0	958.70
98.0	958.68			27.0	961.12	122.0	958.70
98.1	958.73			28.0	961.07	125.0	958.63
100.0	958.72			30.0	961.09	128.0	958.56
102.0	958.72			32.5	961.03	128.5	958.58
105.0	958.76			34.0	961.22	129.0	958.81
107.0	958.81			36.0	961.24	129.1	959.30
109.0	958.84			38.0	961.17	131.0	960.20
111.0	958.77			39.0	961.26	131.9	960.49
113.3	958.66			41.0	961.12	132.4	960.89
115.0	958.57			44.0	961.07	135.0	961.01
115.4	958.61			46.0	961.03	138.0	961.07
118.0	958.60			48.0	961.02	141.0	961.09
118.7	958.60			50.0	960.93	144.0	960.87
120.0	958.49			53.0	960.92	146.7	960.86
122.0	958.47			55.0	960.88	148.7	961.15
124.0	958.48			55.9	960.80	151.0	961.12
126.0	958.51			57.3	960.28		
127.4	958.53			58.0	960.20		
128.0	958.65			60.4	960.22		
128.6	959.07			60.6	959.84		
129.6	959.43			61.2	958.98		
131.6	960.16			62.7	958.78		
132.0	960.79			65.0	958.56		
133.0	960.96			68.0	958.55		
135.0	960.98			71.0	958.57		
137.0	960.96			74.0	958.56		
139.0	961.03			77.0	958.54		
141.0	961.04			80.0	958.55		

Description of Cross Section PR166.0

Location: Township 6 South/Range 50 East--section 28

U. S. Geological Survey quadrangle (1:24,000): Lonesome Peak

Landowners--left bank: Gay Ranch

--right bank: Gay Ranch

Access: Right bank

Permission from: Pat Daily

Distance from Moorhead Gaging Station: 50.8 kilometers

Azimuth of Section (degrees magnetic): 150

Reference Monuments

[Monuments at stations 0.0 and 20.0 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
Benchmark--1/2-inch-rebar; 0.07 meter above 1998 ground level; on riverward side of wooden gate post	0.0					960.96
1/2-inch-rebar; 0.05 meter above 1998 ground level	20.0	45°17'00.10"	105°35'59.67"	0.290	0.622	960.47
1/2-inch-rebar; 0.05 meter below 1998 ground level; among 2-3 meter cottonwoods	170.0					959.58
1/2-inch-rebar; 0.10 meter above 1998 ground level; in a row of 15-20 meter cottonwoods	196.0	45°16'54.62"	105°35'57.44"	0.509	0.562	960.15

See Figure 8 for location
of cross section

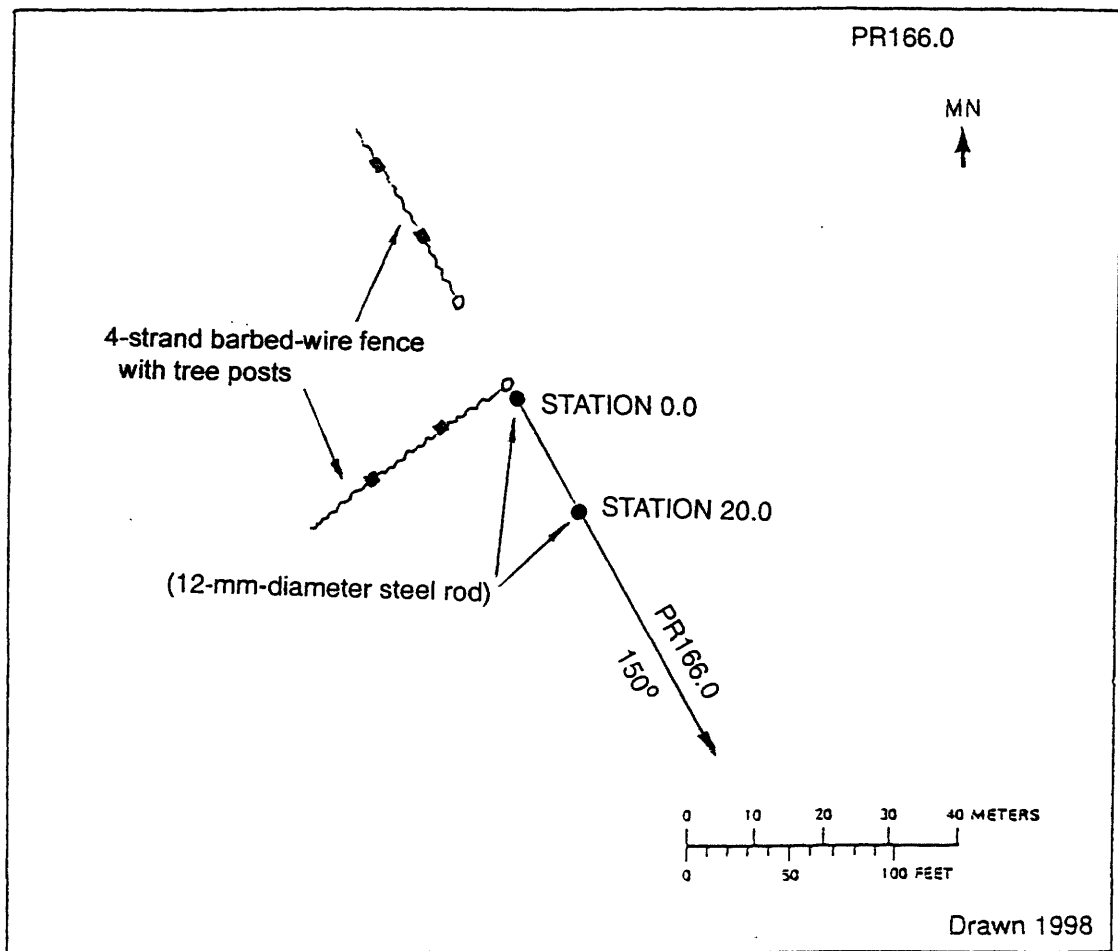


Figure 70. Upper: Location of cross section PR166.0 is shown in figure 8. Lower: Location of the reference monument on the left bank. MN is magnetic north.

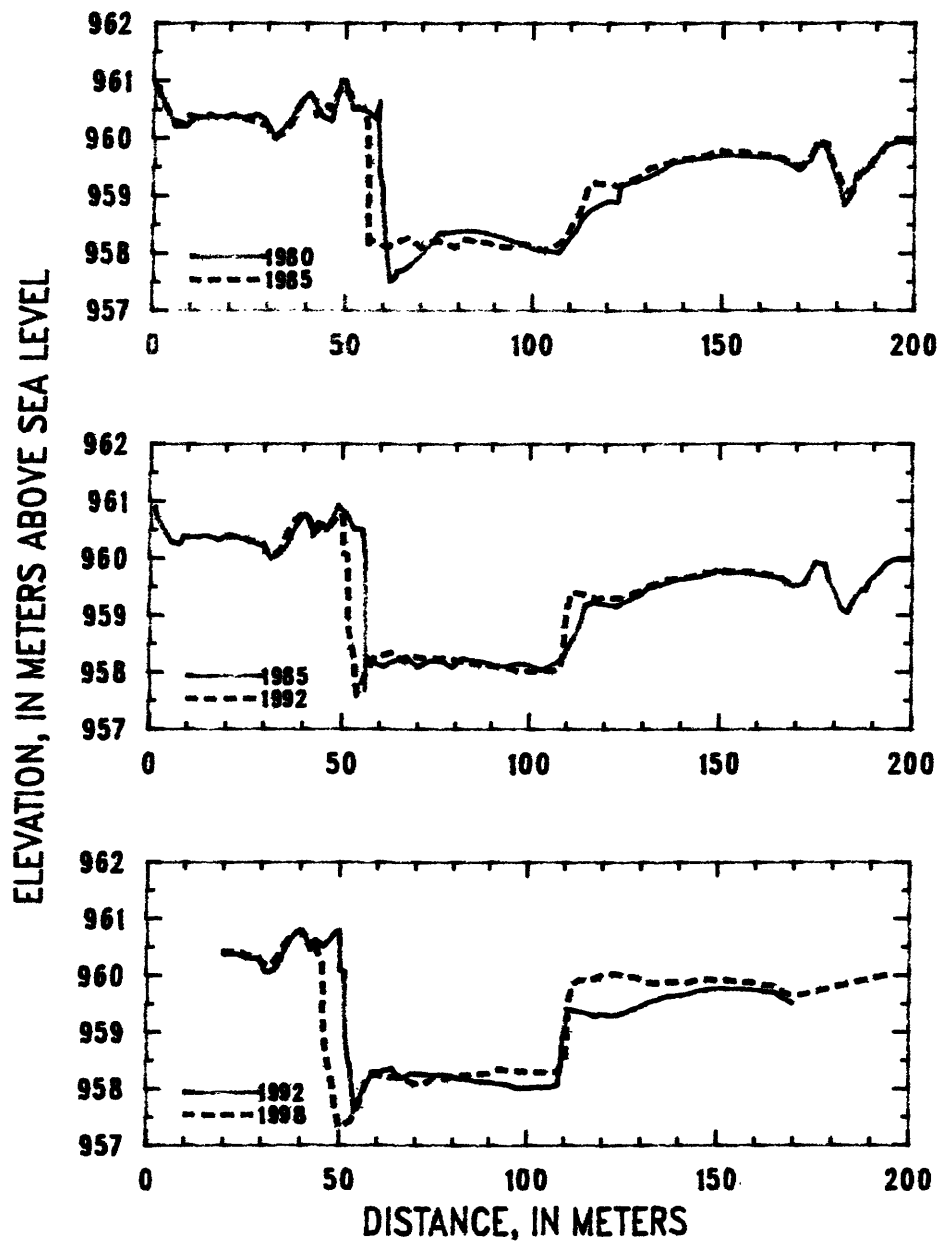


Figure 71. Profiles of cross section PR166.0 from 1980 to 1998.

Table 25. Listing of horizontal stations and elevations for cross section PR166.0

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1980		1980		1985		1985		1985	
19 October		19 October		29 September		29 September		29 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.0	960.96	112.0	958.40	1.0	960.89	94.0	958.10	198.0	959.97
2.0	960.79	113.0	958.57	3.0	960.59	97.0	958.16	200.0	959.99
5.7	960.21	115.0	958.72	5.6	960.29	100.0	958.12		
8.8	960.21	119.0	958.88	8.0	960.25	103.0	958.04		
11.0	960.36	120.0	958.91	9.0	960.38	106.0	958.12		
15.0	960.39	122.8	958.90	12.0	960.37	109.0	958.25		
20.0	960.39	123.3	959.18	15.0	960.41	110.3	958.45		
25.0	960.36	129.0	959.28	18.0	960.32	113.0	958.71		
27.0	960.41	133.0	959.41	21.0	960.42	115.0	959.18		
29.0	960.35	136.0	959.53	24.0	960.34	117.0	959.23		
32.0	960.01	140.0	959.62	27.0	960.28	120.0	959.21		
35.5	960.27	145.0	959.65	30.0	960.21	123.0	959.15		
39.0	960.67	150.0	959.71	31.6	960.00	126.0	959.27		
41.0	960.78	160.0	959.68	34.0	960.07	129.0	959.35		
44.0	960.38	165.0	959.65	36.0	960.24	131.0	959.48		
46.6	960.30	170.0	959.44	38.0	960.57	134.0	959.52		
49.0	961.01	173.0	959.61	40.5	960.77	137.0	959.60		
50.0	960.99	174.5	959.90	42.0	960.66	140.0	959.63		
52.0	960.51	177.0	959.88	42.5	960.40	143.0	959.67		
54.0	960.51	182.0	958.84	43.0	960.44	146.0	959.69		
56.0	960.45	183.3	958.95	45.0	960.59	149.0	959.79		
58.0	960.34	185.0	959.36	46.0	960.50	152.0	959.74		
58.9	960.55	187.0	959.40	49.0	960.92	155.0	959.76		
59.1	959.39	190.0	959.66	50.0	960.84	158.0	959.74		
59.8	959.13	192.2	959.85	51.0	960.79	161.0	959.70		
59.8	958.95	195.7	959.95	53.0	960.52	164.0	959.67		
60.3	958.55	200.0	959.93	55.3	960.50	166.0	959.64		
61.0	958.06			56.0	960.15	169.0	959.51		
62.0	957.51			56.3	958.07	172.0	959.55		
62.9	957.54			56.5	958.25	175.0	959.93		
64.0	957.68			58.0	958.17	177.5	959.89		
66.0	957.72			61.0	958.10	178.0	959.70		
70.0	957.96			64.0	958.20	180.0	959.38		
75.0	958.35			67.0	958.28	182.0	959.10		
80.0	958.38			70.0	958.09	183.5	959.04		
85.0	958.40			73.0	958.20	185.0	959.30		
90.0	958.31			76.0	958.20	187.0	959.44		
95.0	958.21			79.0	958.09	188.0	959.44		
100.0	958.08			82.0	958.24	189.0	959.60		
105.0	958.03			85.0	958.20	191.0	959.71		
107.0	958.01			88.0	958.18	193.0	959.89		
110.0	958.25			91.0	958.11	195.7	959.99		

Table 25. (Continued) Listing of horizontal stations and elevations for cross section PR166.0

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1992		1992		1992		1998		1998	
30 August		30 August		30 August		30 September		30 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
20.0	960.38	81.0	958.19	167.0	959.60	20.0	960.42	110.2	958.52
22.0	960.38	83.0	958.17	170.0	959.51	22.0	960.42	110.7	958.82
24.0	960.38	85.0	958.15			24.0	960.44	111.2	959.59
26.0	960.31	87.0	958.12			26.0	960.35	112.0	959.83
28.0	960.30	89.0	958.12			29.0	960.35	114.0	959.93
29.5	960.28	91.0	958.10			30.0	960.23	116.0	959.90
31.0	960.07	93.0	958.08			32.0	960.16	118.0	959.94
32.5	960.06	95.0	958.07			34.0	960.31	120.0	960.02
34.0	960.14	97.0	958.01			35.0	960.45	122.0	960.04
35.0	960.26	99.0	958.02			37.0	960.65	124.0	960.02
36.0	960.46	101.0	958.01			38.5	960.75	126.0	959.98
38.0	960.68	103.0	958.03			40.3	960.78	128.0	959.98
40.0	960.80	105.0	958.03			42.5	960.50	130.0	959.93
41.0	960.75	107.0	958.04			43.5	960.64	132.0	959.87
42.5	960.46	108.2	958.07			44.7	960.36	134.0	959.87
44.0	960.62	109.2	958.38			45.6	960.24	136.0	959.88
46.0	960.52	109.4	958.56			45.8	959.38	138.0	959.89
48.0	960.65	109.6	958.87			46.2	958.83	140.0	959.89
49.0	960.75	111.0	959.40			47.0	958.47	142.0	959.86
49.9	960.78	112.0	959.40			48.0	958.15	144.0	959.91
50.2	960.68	114.0	959.37			49.0	957.66	147.0	959.93
50.2	960.09	116.0	959.34			50.0	957.31	150.0	959.91
51.3	960.05	118.0	959.29			53.0	957.43	153.0	959.91
51.7	958.88	120.0	959.33			55.0	957.70	156.0	959.89
52.3	958.53	122.0	959.30			57.5	958.21	159.0	959.88
53.0	958.35	124.0	959.30			60.0	958.25	162.0	959.84
53.5	957.99	126.0	959.35			63.0	958.19	165.0	959.81
54.0	957.62	128.0	959.40			66.0	958.23	167.5	959.69
56.0	957.93	130.0	959.46			69.0	958.11	170.0	959.64
58.0	958.17	132.0	959.53			72.0	958.07	196.0	960.04
58.8	958.29	134.0	959.57			75.0	958.20		
61.0	958.30	136.0	959.62			78.0	958.16		
62.0	958.33	139.0	959.64			81.0	958.24		
64.0	958.35	142.0	959.66			84.0	958.24		
65.5	958.21	145.0	959.74			87.0	958.25		
67.0	958.19	148.0	959.75			90.0	958.28		
69.0	958.27	151.0	959.78			93.0	958.35		
71.0	958.25	154.0	959.77			96.0	958.32		
73.0	958.26	157.0	959.76			99.0	958.31		
75.0	958.23	160.0	959.75			102.0	958.28		
77.0	958.25	163.0	959.70			105.0	958.30		
79.0	958.23	165.0	959.70			108.0	958.29		

Description of Cross Section PR166.6

Location: Township 6 South/Range 50 East--section 28

U. S. Geological Survey quadrangle (1:24,000): Lonesome Peak

Landowners--left bank: Gay Ranch

--right bank: Gay Ranch

Access: Right bank

Permission from: Pat Daily

Distance from Moorhead Gaging Station: 51.2 kilometers

Azimuth of Section (degrees magnetic): 078

Reference Monuments

[Monument at station 151.0 was closest to leveling instrument; latitude and longitude for the monument at station 151.0 was calculated from the measured latitude and longitude of station 147.0]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.17 meter above 1998 ground level; in first row of 15-20 meters high cottonwoods, 0.25 meter diameter at breast height	-1.5	45°17'07.49"	105°35'45.17"	1.313	0.701	960.62
1/2-inch-rebar; 0.17 meter above 1998 ground level; in an area with salt cedars about 2 meters high	21.5	45°17'07.45"	105°35'44.09"	0.359	0.489	960.30
Benchmark--1/2-inch-rebar; 0.29 meter above 1998 ground level; at the base of a large solitary cottonwood 11 meters from the edge of the right bank in 1998; see head-note	151.0	45°17'07.31"	105°35'38.21"	0.462	0.447	960.46

See Figure 8 for location
of cross section

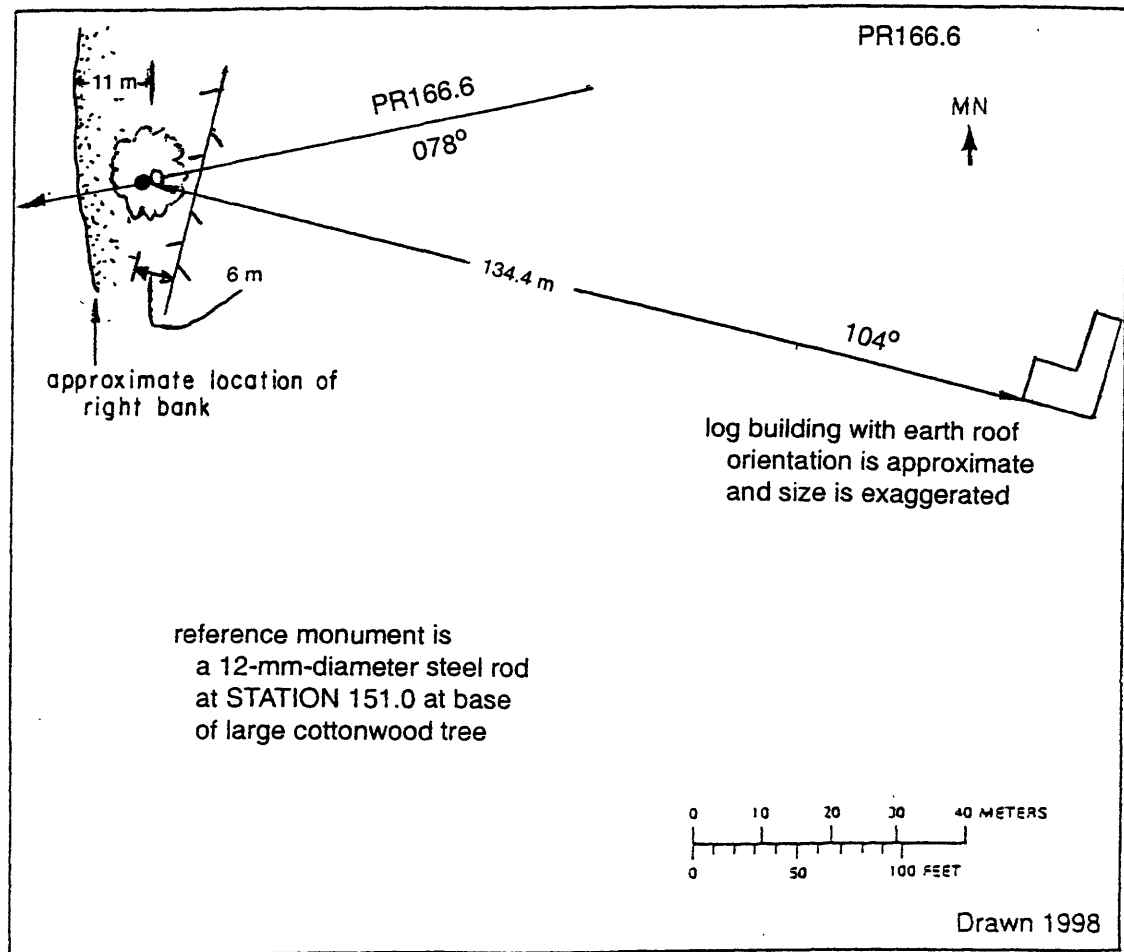


Figure 72. Upper: Location of cross section PR166.6 is shown in figure 8. Lower: Location of the reference monument on the right bank. MN is magnetic north.

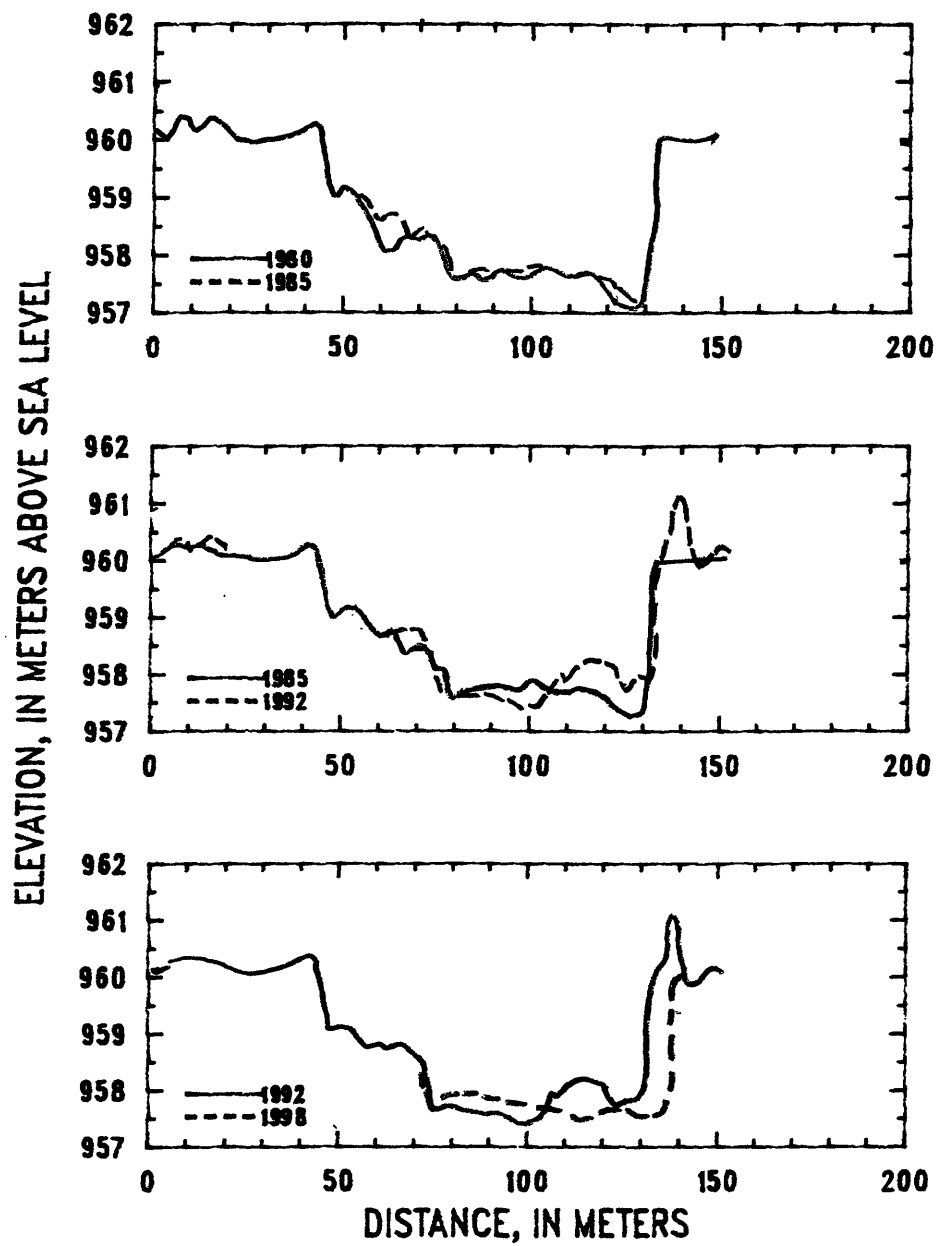


Figure 73. Profiles of cross section PR166.6 from 1980 to 1998.

Table 26. Listing of horizontal stations and elevations for cross section PR166.6

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1980		1980		1985		1985		1992	
19 October		19 October		29 September		29 September		30 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.5	960.41	97.0	957.66	3.0	960.13	102.0	957.79	8.0	960.34
0.0	960.23	100.0	957.61	5.0	960.09	105.0	957.73	10.0	960.36
2.0	960.18	102.0	957.76	7.0	960.31	108.0	957.71	13.0	960.33
5.4	960.11	105.0	957.76	10.0	960.28	111.0	957.72	17.0	960.31
6.7	960.36	110.0	957.70	13.0	960.29	114.0	957.72	20.0	960.21
9.4	960.36	115.0	957.68	16.0	960.29	117.0	957.73	21.5	960.13
11.0	960.20	120.0	957.54	19.0	960.19	120.0	957.69	24.0	960.07
12.0	960.29	124.0	957.30	21.5	960.10	123.0	957.53	26.0	960.02
14.0	960.33	127.0	957.17	25.0	959.99	126.0	957.31	28.0	960.09
17.0	960.30	129.2	957.07	28.0	960.04	129.0	957.26	31.0	960.06
21.5	960.13	130.1	957.63	31.0	960.01	131.0	957.48	34.0	960.09
23.0	960.12	130.9	957.57	34.0	960.06	132.2	957.91	37.0	960.11
26.0	959.99	131.8	958.05	37.0	960.08	132.5	958.33	40.0	960.22
30.0	960.01	132.1	958.23	40.0	960.18	133.4	959.09	42.0	960.28
33.0	960.03	132.4	958.38	43.0	960.30	134.0	960.03	43.5	960.34
36.0	960.09	132.6	959.95	44.5	960.24	135.7	960.06	44.5	960.25
36.6	960.03	133.0	960.05	46.0	959.73	138.0	960.07	46.0	959.75
40.0	960.21	137.0	960.07	47.3	959.19	141.0	960.04	48.0	959.14
42.4	960.24	141.0	960.06	48.6	958.98	144.0	960.02	49.0	959.04
44.4	960.27	145.0	960.07	49.7	958.96	147.0	960.04	51.0	959.15
46.0	959.69	150.0	960.10	51.0	959.10	150.0	960.09	53.0	959.14
47.5	959.12			54.0	959.04	151.0	960.07	55.0	959.05
49.0	958.97			57.0	958.92			57.0	958.96
51.0	959.11			58.2	958.67			59.0	958.77
54.0	959.02			60.0	958.59			61.0	958.79
57.0	958.90			63.0	958.68			63.0	958.82
59.7	958.35			65.0	958.67			65.0	958.76
61.2	958.27			67.8	958.33			68.0	958.81
62.0	958.06			69.0	958.44			69.0	958.79
63.8	958.02			71.0	958.49			71.0	958.63
65.0	958.22			73.0	958.39			73.0	958.50
70.0	958.23			75.0	958.43			73.4	958.40
75.0	958.25			76.0	958.03			74.0	957.91
76.0	958.06			77.2	957.90			74.5	957.83
77.0	957.92			79.0	957.51			76.7	957.49
78.0	957.75			81.0	957.61			78.4	957.65
80.0	957.60			84.0	957.65			80.0	957.66
84.0	957.62			87.0	957.70			82.0	957.63
87.0	957.60			90.0	957.72			84.0	957.62
90.0	957.59			93.0	957.74			86.0	957.60
92.0	957.69			96.0	957.73			88.0	957.60
94.0	957.61			99.0	957.76			90.0	957.60

Table 26. (Continued) Listing of horizontal stations and elevations for cross section PR166.6

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1992		1998		1998	
1 September		30 September		30 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
92.0	957.55	-1.5	960.45	73.3	957.95
94.0	957.52	0.0	960.31	75.0	957.60
96.0	957.49	2.0	960.20	77.0	957.58
98.0	957.44	5.0	960.15	78.0	957.67
100.0	957.42	6.0	960.28	78.6	957.90
102.0	957.46	8.0	960.36	81.0	957.89
104.0	957.57	10.0	960.32	84.0	957.88
105.7	957.67	12.0	960.34	87.0	957.89
106.1	957.83	14.0	960.32	90.0	957.83
106.8	957.87	16.0	960.33	93.0	957.84
107.5	957.79	18.0	960.26	96.0	957.78
110.0	957.99	20.0	960.24	99.0	957.76
113.0	958.08	21.5	960.15	102.0	957.67
116.0	958.11	24.0	960.10	105.0	957.63
119.0	958.09	26.0	960.03	108.0	957.60
121.5	958.06	28.0	960.11	111.0	957.50
121.9	957.93	30.0	960.08	114.0	957.48
122.3	957.85	32.0	960.08	117.0	957.50
124.0	957.62	34.0	960.09	120.0	957.57
126.0	957.69	36.0	960.13	123.0	957.60
128.0	957.74	38.0	960.22	126.0	957.56
130.0	957.76	40.0	960.23	129.0	957.57
132.4	957.72	42.0	960.29	132.0	957.46
133.0	957.84	43.0	960.33	135.0	957.44
133.2	958.21	44.0	960.28	138.0	957.45
133.7	959.19	45.0	960.09	139.2	957.97
133.8	959.97	47.0	959.46	140.0	960.56
134.3	960.11	48.0	959.31	141.0	960.07
135.6	960.26	50.0	959.21	142.7	959.78
136.8	960.33	52.0	959.24	145.0	959.92
138.0	960.93	54.0	959.17	147.1	960.06
138.5	961.09	56.0	959.16	150.0	960.17
139.3	960.89	58.0	959.07	151.0	960.18
139.8	960.99	60.0	959.03		
140.0	960.91	62.0	959.09		
141.2	960.08	64.0	959.17		
142.8	959.79	66.0	959.15		
145.0	959.90	68.0	959.21		
148.0	960.08	69.0	959.18		
150.0	960.16	70.0	958.96		
151.0	960.13	72.2	958.86		
		72.7	958.02		

Description of Cross Section PR167

Location: Township 6 South/Range 50 East--section 28

U. S. Geological Survey quadrangle (1:24,000): Lonesome Peak

Landowners--left bank: Gay Ranch

--right bank: Gay Ranch

Access: Right bank

Permission from: Pat Daily

Distance from Moorhead Gaging Station: 51.77 kilometers

Azimuth of Section (degrees magnetic): 006

Reference Monuments

[Monuments at stations 150.0 and 150.6 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.05 meter above 1998 ground level	-1.6					959.63
1/2-inch-rebar; 0.19 meter above 1998 ground level	10.0	45°17'17.69"	105°35'51.56"	0.319	0.542	959.84
1/2-inch-rebar; 0.02 meter above 1998 ground level	150.0					959.49
1/2-inch-rebar; bent, 0.16 meter above 1998 ground level	150.6	45°17'21.99"	105°35'49.34"	0.506	0.480	959.62
Benchmark--brass circular plate; offsection	---	45°17'21.96"	105°35'49.97"	0.527	0.490	959.79

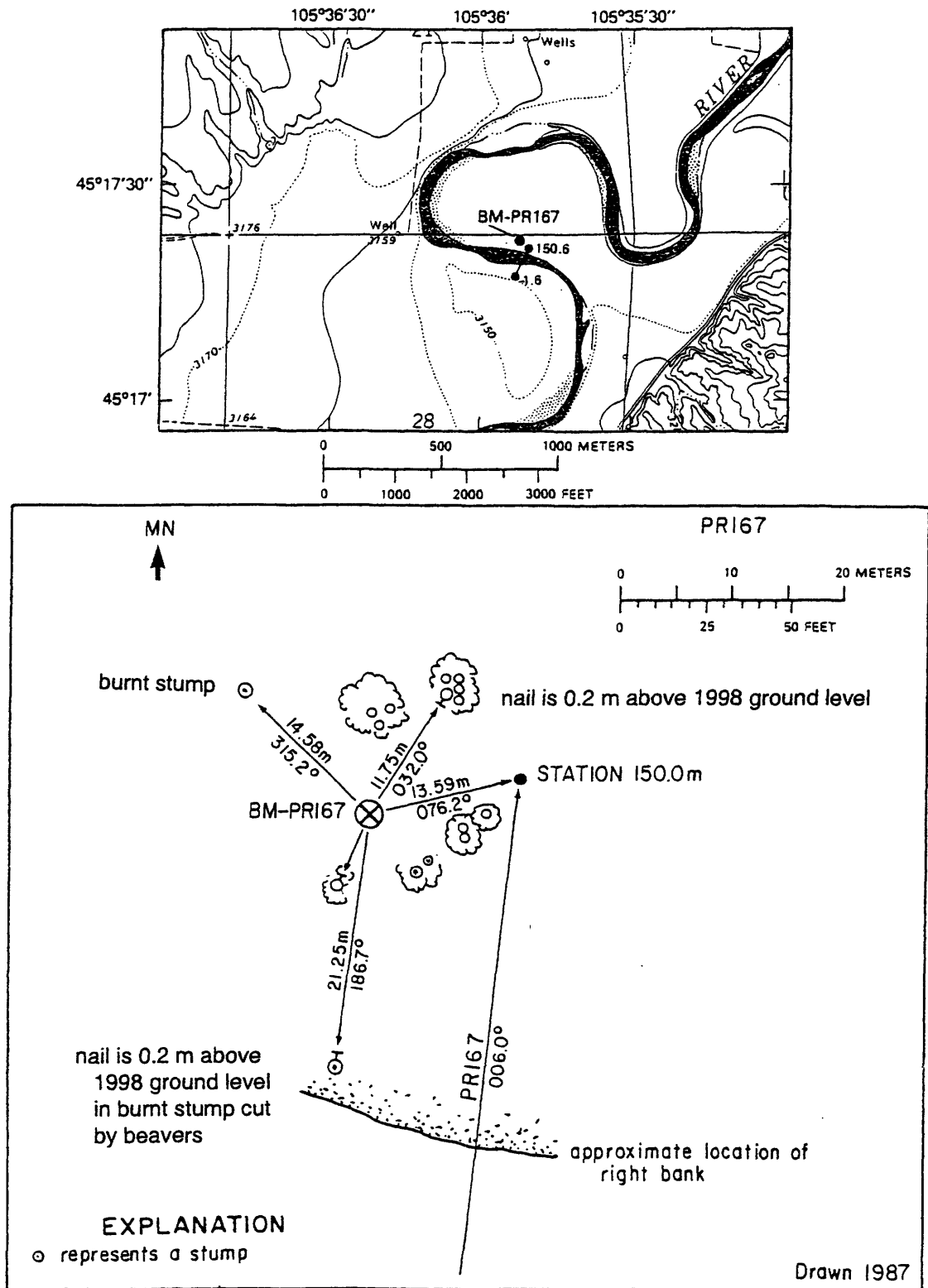


Figure 74. Upper: Location of cross section PR167, bench mark BM-PR167, and the left and right bank reference monuments in the Lonesome Peak quadrangle. Lower: Location of the bench mark on the left bank. MN is magnetic north.

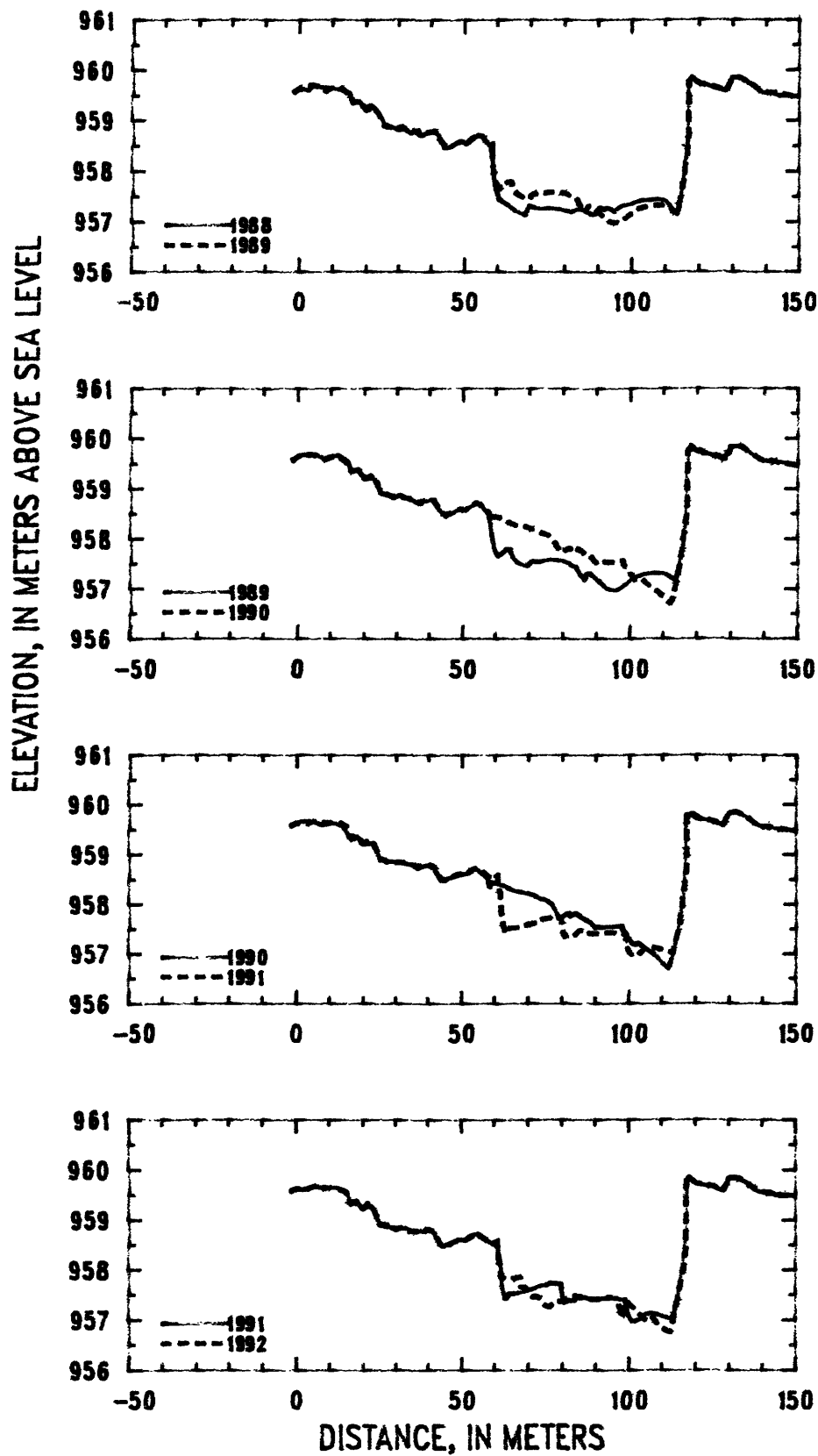


Figure 75. Profiles of cross section PR167 from 1988 to 1992.

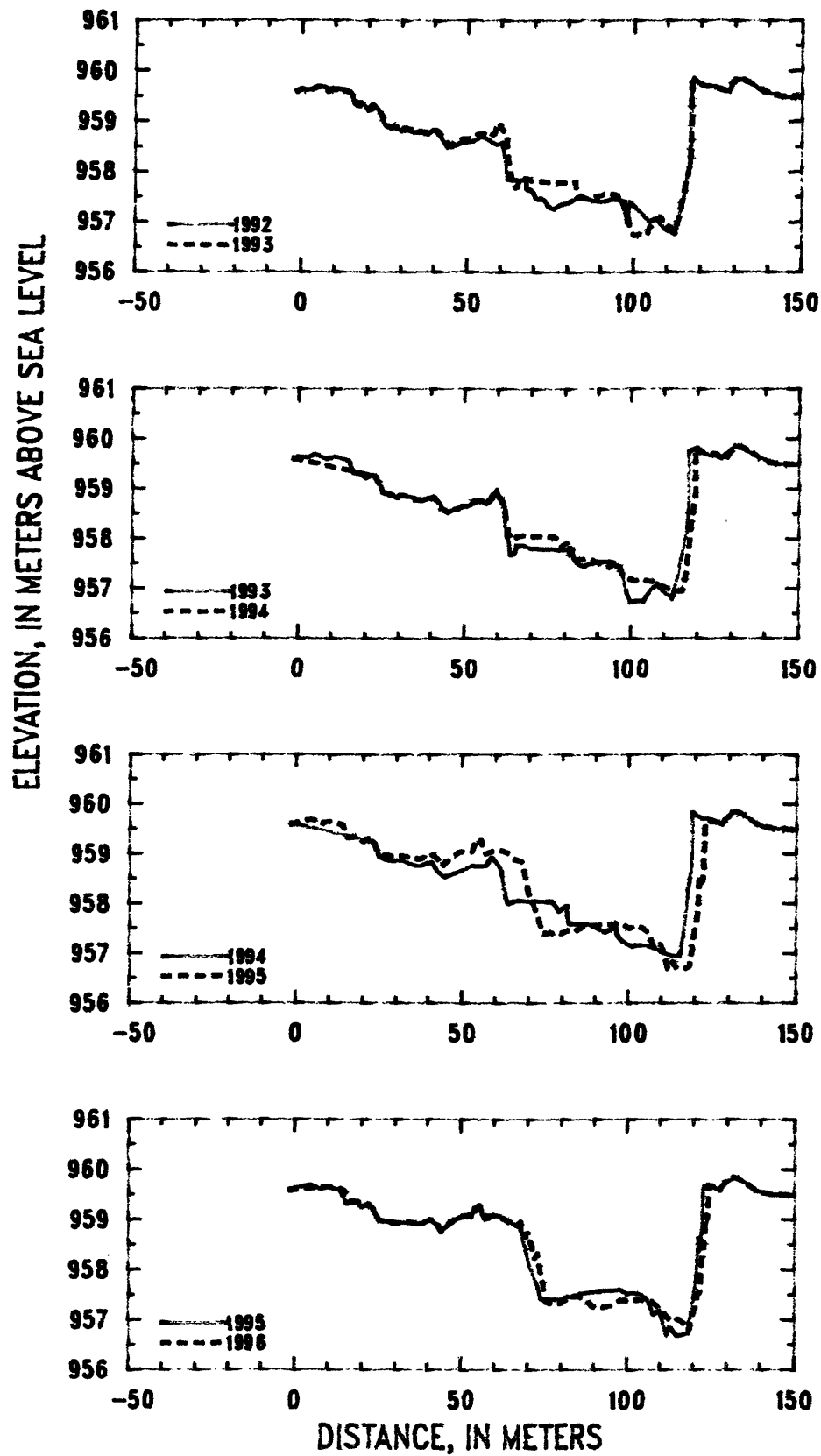


Figure 76. Profiles of cross section PR167 from 1992 to 1996.

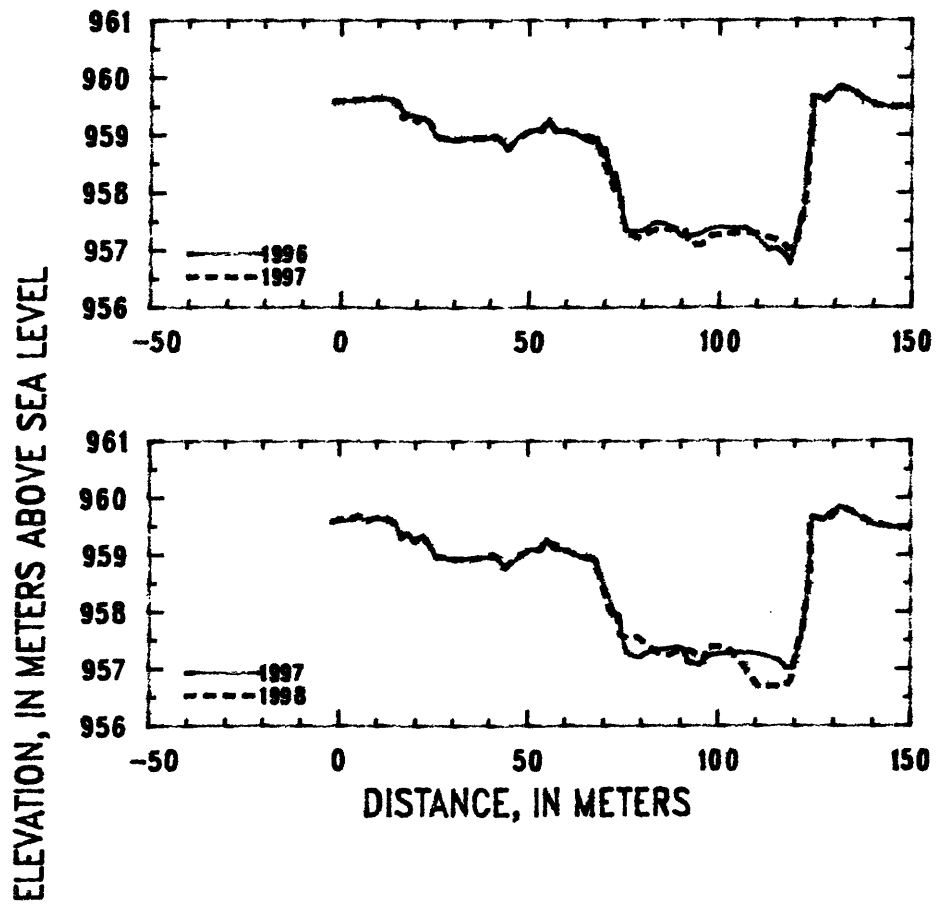


Figure 77. Profiles of cross section PR167 from 1996 to 1998.

Table 27. Listing of horizontal stations and elevations for cross section PR167

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1989		1990		1990	
20 September		20 September		20 September		20 September		20 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.6	959.57	69.6	957.45	138.0	959.58	-1.6	959.58	80.0	957.72
0.0	959.65	70.1	957.53	140.0	959.55	0.0	959.64	81.0	957.79
2.0	959.69	71.0	957.56	142.5	959.56	2.0	959.68	82.0	957.82
4.0	959.71	73.0	957.53	145.0	959.52	5.0	959.68	82.4	957.76
6.0	959.68	75.0	957.58	147.5	959.49	8.0	959.59	84.0	957.82
8.0	959.59	77.0	957.59	150.0	959.48	11.0	959.65	85.0	957.78
10.0	959.65	79.0	957.57	150.6	959.44	14.0	959.57	87.0	957.68
12.0	959.67	81.0	957.54	138.0	959.58	16.0	959.35	87.2	957.69
14.0	959.57	82.0	957.48	140.0	959.55	18.0	959.37	88.5	957.64
15.0	959.55	83.7	957.45	142.5	959.56	20.0	959.21	90.0	957.51
16.0	959.35	85.0	957.29	145.0	959.52	23.0	959.24	91.0	957.54
18.0	959.39	86.4	957.18	147.5	959.49	25.0	958.92	93.0	957.53
20.0	959.21	87.0	957.31	150.0	959.48	28.0	958.87	95.0	957.54
22.0	959.28	88.0	957.32	150.6	959.44	31.0	958.85	97.0	957.56
24.0	959.12	90.0	957.20			33.0	958.82	97.8	957.57
25.0	958.92	92.0	957.05			35.0	958.80	98.2	957.47
27.0	958.89	94.0	956.98			37.0	958.73	98.8	957.41
29.0	958.82	96.0	956.97			39.0	958.78	101.0	957.20
31.0	958.88	98.0	957.05			41.0	958.81	102.0	957.18
33.0	958.82	100.0	957.16			43.0	958.60	103.0	957.21
35.0	958.78	102.0	957.25			44.0	958.50	105.0	957.09
37.0	958.70	104.0	957.28			46.0	958.51	107.0	957.03
39.0	958.77	106.0	957.32			48.0	958.58	109.0	956.89
41.0	958.80	108.0	957.32			50.0	958.60	111.0	956.75
43.0	958.58	110.0	957.31			52.0	958.62	112.0	956.70
45.0	958.45	112.0	957.23			54.0	958.73	113.0	956.88
47.0	958.53	113.6	957.14			56.0	958.64	114.7	957.41
49.0	958.60	114.6	957.44			58.0	958.51	117.0	958.52
51.0	958.57	115.8	957.84			58.3	958.37	117.1	959.74
53.0	958.68	115.9	957.97			58.7	958.35	119.0	959.82
55.0	958.71	116.9	958.50			59.0	958.44	122.0	959.70
57.0	958.55	117.1	959.77			60.0	958.44	125.0	959.66
58.0	958.51	118.0	959.86			62.0	958.41	128.0	959.57
59.0	957.96	120.0	959.73			64.0	958.32	130.0	959.82
59.6	957.78	122.0	959.71			66.0	958.27	131.0	959.85
60.8	957.65	124.0	959.67			68.0	958.26	133.0	959.84
62.0	957.70	126.0	959.63			70.0	958.22	136.0	959.70
63.2	957.80	128.0	959.58			72.0	958.17	139.0	959.57
64.4	957.79	130.0	959.84			74.0	958.10	142.0	959.55
64.8	957.67	132.0	959.85			76.0	958.05	145.0	959.50
66.0	957.55	134.0	959.79			77.0	957.98	147.0	959.50
68.0	957.47	136.0	959.70			79.0	957.74	150.0	959.46
								150.6	959.44

Table 27. (Continued) Listing of horizontal stations and elevations for cross section PR167
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1991		1991		1992		1992	
4 September		4 September		4 September		1 September		1 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.6	959.58	72.0	957.63	140.0	959.55	-1.6	959.59	71.3	957.45
0.0	959.63	74.0	957.69	142.0	959.56	0.0	959.63	71.7	957.47
3.0	959.61	75.7	957.69	144.0	959.49	3.0	959.62	73.0	957.44
6.0	959.68	76.4	957.74	146.0	959.51	6.0	959.69	74.2	957.31
9.0	959.63	78.0	957.72	148.0	959.49	9.0	959.63	76.0	957.25
12.0	959.66	79.8	957.71	150.0	959.47	11.0	959.65	78.0	957.35
15.0	959.57	79.9	957.53	150.6	959.44	13.0	959.61	80.0	957.37
16.4	959.30	80.8	957.33	140.0	959.55	15.0	959.56	82.0	957.45
18.0	959.38	82.0	957.39	142.0	959.56	16.0	959.35	83.0	957.49
20.0	959.23	83.8	957.38	144.0	959.49	18.0	959.38	85.0	957.46
22.0	959.28	85.3	957.48	146.0	959.51	20.0	959.23	87.0	957.43
23.0	959.25	87.0	957.45	148.0	959.49	21.3	959.34	89.0	957.40
25.0	958.91	89.0	957.40	150.0	959.47	23.0	959.25	91.0	957.40
27.0	958.87	91.0	957.41	150.6	959.44	25.0	958.92	93.0	957.45
29.0	958.84	93.0	957.43			27.0	958.88	95.0	957.45
31.0	958.86	95.0	957.43			28.0	958.92	96.5	957.42
33.0	958.83	97.0	957.40			30.0	958.81	98.0	957.02
36.0	958.78	99.0	957.39			32.0	958.85	99.0	957.38
39.0	958.78	99.2	957.24			34.0	958.77	101.0	957.25
41.0	958.79	99.8	957.06			36.0	958.79	103.0	957.11
42.0	958.75	101.0	956.96			38.0	958.74	105.0	956.99
44.0	958.48	103.0	956.99			40.0	958.83	107.0	957.07
45.0	958.49	105.0	957.12			41.0	958.79	109.0	956.88
47.0	958.55	107.0	957.13			43.0	958.61	111.0	956.80
49.0	958.62	109.0	957.10			44.0	958.48	112.5	956.75
51.0	958.59	111.0	957.05			46.0	958.50	114.9	957.47
53.0	958.70	113.3	957.01			48.0	958.57	116.4	957.99
55.0	958.73	113.8	957.18			50.0	958.59	116.9	958.20
56.0	958.67	115.3	957.60			52.0	958.61	117.1	958.38
58.0	958.56	117.3	958.74			54.0	958.72	117.3	959.77
59.7	958.51	117.4	959.78			56.0	958.67	118.0	959.86
61.0	958.59	118.0	959.86			58.0	958.56	120.0	959.73
61.1	958.36	120.0	959.73			60.0	958.54	123.0	959.70
61.8	958.19	122.0	959.70			60.7	958.57	124.8	959.68
62.1	957.81	124.0	959.68			62.1	957.84	127.0	959.63
62.5	957.60	126.0	959.64			64.0	957.83	128.4	959.59
63.2	957.42	128.0	959.57			66.0	957.83	130.0	959.83
63.8	957.43	130.0	959.84			67.7	957.86	133.0	959.84
64.3	957.51	132.0	959.86			67.8	957.65	136.0	959.71
66.0	957.52	134.0	959.79			69.0	957.64	138.0	959.59
68.0	957.56	136.0	959.71			70.0	957.56	141.0	959.55
70.0	957.59	138.0	959.59			70.4	957.47	144.0	959.49

Table 27. (Continued) Listing of horizontal stations and elevations for cross section PR167
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1992		1993		1993		1993		1994	
1 September		2 September		2 September		2 September		20 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
147.0	959.49	-1.6	959.58	65.5	957.86	147.0	959.50	-1.6	959.61
150.0	959.48	0.0	959.64	68.0	957.87	150.0	959.48	23.0	959.25
150.6	959.45	3.0	959.62	70.0	957.80	150.6	959.46	25.0	958.93
		5.0	959.70	72.0	957.81			27.0	958.88
		8.0	959.59	74.0	957.79			29.0	958.85
		11.0	959.63	76.0	957.78			32.0	958.87
		13.0	959.61	78.0	957.77			35.0	958.79
		15.0	959.55	80.0	957.77			37.0	958.76
		16.5	959.31	82.6	957.80			39.0	958.80
		19.0	959.30	82.7	957.61			41.0	958.83
		20.0	959.22	84.0	957.50			43.0	958.62
		22.0	959.28	86.0	957.45			45.0	958.54
		23.0	959.26	88.0	957.49			47.0	958.58
		24.3	959.08	90.0	957.53			50.0	958.66
		25.0	958.93	92.0	957.55			53.0	958.76
		26.0	958.90	94.0	957.54			56.0	958.74
		28.0	958.89	95.0	957.52			57.5	958.77
		29.5	958.81	95.6	957.43			58.5	958.90
		31.0	958.87	97.0	957.44			59.1	958.94
		33.0	958.85	99.0	956.85			60.8	958.81
		35.0	958.82	100.0	956.72			61.8	958.65
		37.0	958.76	103.0	956.75			63.0	958.13
		39.0	958.80	104.0	956.74			64.0	957.98
		41.0	958.82	105.0	956.89			65.0	958.02
		42.0	958.75	108.0	957.10			67.0	958.07
		44.0	958.58	110.0	956.92			69.0	958.05
		45.0	958.52	112.0	956.86			71.0	958.04
		47.0	958.59	112.6	956.79			73.0	958.05
		49.0	958.66	115.0	957.51			75.0	958.03
		51.0	958.65	116.7	958.10			76.0	958.04
		53.0	958.73	117.2	958.47			77.0	958.04
		55.0	958.77	117.3	959.75			78.0	957.94
		56.5	958.70	119.0	959.80			79.0	957.84
		58.0	958.76	121.0	959.71			80.0	957.89
		59.5	958.99	124.0	959.67			81.5	957.96
		60.5	958.83	127.0	959.61			81.6	957.71
		62.0	958.71	129.0	959.74			82.0	957.60
		62.0	958.33	131.0	959.86			83.0	957.58
		62.7	958.03	134.0	959.79			85.0	957.59
		63.3	957.89	137.0	959.66			87.0	957.60
		63.7	957.68	140.0	959.58			89.0	957.56
		65.0	957.69	144.0	959.49			91.0	957.48

Table 27. (Continued) Listing of horizontal stations and elevations for cross section PR167
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1994		1995		1995		1995		1996	
20 September		1 October		1 October		1 October		21 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
93.0	957.42	-1.6	959.59	76.0	957.41	146.0	959.51	-1.6	959.59
95.0	957.49	2.0	959.66	78.0	957.41	148.0	959.49	10.0	959.65
96.2	957.54	5.0	959.69	80.0	957.40	150.0	959.48	12.5	959.65
96.8	957.36	8.0	959.60	82.0	957.47	150.6	959.45	15.0	959.57
98.0	957.25	10.0	959.65	84.0	957.45			17.0	959.35
101.0	957.15	12.0	959.62	86.0	957.54			19.0	959.35
104.0	957.17	14.0	959.57	88.0	957.54			21.0	959.31
107.0	957.13	15.5	959.32	90.0	957.55			23.0	959.26
110.0	957.04	18.7	959.35	92.0	957.57			25.0	958.99
113.0	956.95	20.0	959.24	94.0	957.58			27.0	958.95
115.5	956.93	22.0	959.32	96.0	957.58			30.0	958.91
116.7	957.35	23.0	959.28	98.0	957.60			33.0	958.96
118.0	958.27	24.0	959.12	100.0	957.50			36.0	958.94
118.3	958.39	25.0	958.98	102.0	957.54			38.0	958.93
119.2	958.80	26.0	958.97	104.0	957.51			40.0	958.97
119.2	959.83	28.0	958.95	106.0	957.42			41.0	959.00
122.0	959.71	30.0	958.95	108.0	957.10			43.0	958.91
125.0	959.69	33.0	958.94	110.0	957.18			44.3	958.75
126.0	959.65	35.0	958.93	112.0	956.71			47.0	958.95
128.0	959.58	37.0	958.90	113.0	956.85			49.0	959.05
130.0	959.76	39.0	958.94	115.0	956.68			51.0	959.08
131.0	959.84	41.0	958.99	117.0	956.68			53.0	959.10
133.0	959.84	43.0	958.88	118.5	956.73			55.4	959.28
136.0	959.72	44.0	958.74	120.5	957.62			57.0	959.07
139.0	959.58	45.0	958.81	121.0	957.86			59.0	959.07
141.0	959.53	47.0	958.92	121.2	958.37			61.0	959.08
144.0	959.48	49.0	959.03	121.5	958.55			63.0	959.00
147.0	959.50	51.0	959.06	121.9	958.41			65.0	958.93
150.0	959.48	53.0	959.05	122.3	958.50			67.0	958.88
150.6	959.45	54.0	959.23	122.7	958.90			68.0	958.95
		54.5	959.17	122.8	959.51			69.7	958.66
		55.6	959.28	123.2	959.67			70.1	958.74
		57.0	959.00	126.0	959.65			72.0	958.22
		58.0	959.01	128.0	959.57			72.8	958.31
		60.0	959.09	129.0	959.69			73.3	958.19
		62.0	959.07	132.4	959.85			75.0	957.51
		64.0	959.00	134.0	959.80			75.5	957.35
		66.0	958.88	136.0	959.71			77.0	957.32
		68.0	958.84	138.0	959.60			80.0	957.33
		70.0	958.20	140.0	959.56			83.0	957.47
		73.3	957.62	142.0	959.52			85.0	957.47
		74.0	957.41	144.0	959.49			88.0	957.39

Table 27. (Continued) Listing of horizontal stations and elevations for cross section PR167
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1997		1997		1998		1998	
21 October		21 September		21 September		30 September		30 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
89.5	957.26	-1.6	959.58	95.0	957.07	-1.6	959.58	79.0	957.56
92.0	957.23	10.0	959.64	98.0	957.25	0.0	959.62	81.0	957.44
95.0	957.28	12.5	959.63	101.0	957.27	3.0	959.64	84.0	957.28
98.0	957.38	14.7	959.59	104.0	957.30	5.0	959.70	87.0	957.25
101.0	957.40	16.4	959.29	107.0	957.28	7.5	959.60	90.0	957.34
104.0	957.39	18.0	959.39	110.0	957.28	10.0	959.65	93.0	957.32
107.0	957.38	20.0	959.24	113.0	957.21	12.0	959.66	96.0	957.13
110.0	957.22	22.0	959.34	116.0	957.16	14.0	959.59	97.5	957.40
113.0	957.00	23.7	959.19	118.0	957.01	15.5	959.49	100.0	957.40
115.0	957.03	25.3	958.97	119.7	957.04	16.5	959.32	103.0	957.34
117.0	956.94	27.0	958.95	121.3	957.51	18.0	959.39	106.0	957.12
118.6	956.77	30.0	958.92	122.1	957.73	20.0	959.24	108.0	956.92
119.8	957.05	33.0	958.93	123.2	958.31	21.5	959.34	111.0	956.67
121.3	957.51	36.0	958.95	123.3	958.64	23.0	959.26	114.0	956.71
121.8	957.53	39.0	958.97	124.1	959.09	25.0	958.98	117.0	956.68
122.8	958.45	42.0	958.96	124.4	959.66	28.0	958.96	119.0	956.79
123.2	958.53	44.2	958.76	127.4	959.62	30.0	958.93	121.1	957.57
123.8	959.11	45.5	958.84	129.0	959.71	33.0	958.94	122.0	957.70
124.0	959.03	48.0	958.98	131.6	959.85	36.0	958.93	122.6	958.03
124.3	959.10	51.0	959.10	134.0	959.79	39.0	958.97	123.9	958.59
124.5	959.69	53.5	959.08	136.0	959.69	41.0	959.02	123.9	959.68
126.0	959.67	55.0	959.28	138.5	959.58	43.0	958.92	126.5	959.64
128.0	959.62	57.0	959.11	141.0	959.52	44.0	958.79	128.5	959.61
130.0	959.78	59.0	959.09	144.0	959.48	46.0	958.90	131.5	959.83
132.0	959.85	62.0	959.03	147.0	959.49	48.0	959.00	134.0	959.78
135.0	959.77	64.0	958.96	150.0	959.48	51.0	959.09	137.0	959.66
138.0	959.61	66.0	958.98	150.6	959.46	53.0	959.10	140.0	959.54
141.0	959.53	67.8	958.92			55.0	959.28	142.0	959.53
144.0	959.48	69.0	958.68			56.0	959.21	145.0	959.49
147.0	959.49	71.0	958.30			58.0	959.17	150.0	959.48
150.0	959.48	73.0	957.96			60.0	959.09	150.6	959.46
150.6	959.46	74.0	957.94			63.0	958.99		
		75.0	957.51			65.0	958.96		
		76.0	957.30			67.0	958.92		
		78.0	957.22			67.5	958.92		
		80.0	957.21			69.2	958.60		
		81.0	957.27			71.2	958.09		
		83.0	957.34			72.7	957.88		
		86.0	957.35			73.4	957.97		
		89.0	957.39			74.1	957.80		
		91.0	957.34			74.4	957.60		
		92.0	957.12			77.0	957.52		

Description of Cross Section PR167.5

Location: Township 6 South/Range 50 East--section 21

U. S. Geological Survey quadrangle (1:24,000): Lonesome Peak

Landowners--left bank: Gay Ranch

--right bank: Gay Ranch

Access: Left bank

Permission from: Gay Ranch

Distance from Moorhead Gaging Station: 52.3 kilometers

Azimuth of Section (degrees magnetic): 057

Reference Monuments

[Monument at station 0.0 and 22.0 was closest to leveling instrument; the monuments for this section were not surveyed using the Global Positioning System so that the monuments have been located on an aerial photo and the corresponding latitude and longitude have been measured on a 1:24000 topographic map]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.06 meter above 1998 ground level; on a 6-meter high terrace; 0.06 meter riverward of corner fence post	0.0					963.34
1/2-inch-rebar; 0.05 meter above 1998 ground level; on a 6-meter high terrace; under a rock pile	22.0					963.29
1/2-inch-rebar; 0.13 meter above 1998 ground level	150.0					959.18
1/2-inch-rebar; 0.10 meter above 1998 ground level; on the left bank of a chute channel	220.0					959.32

See Figure 8 for location
of cross section

PR167.5

This cross section was not
surveyed in 1998 and no
map was made showing
the location of the
reference monuments.

Figure 78. Upper: Location of cross section PR167.5 is shown in figure 8. Lower: Section was not surveyed in 1998 and a map of the reference monuments was not made.

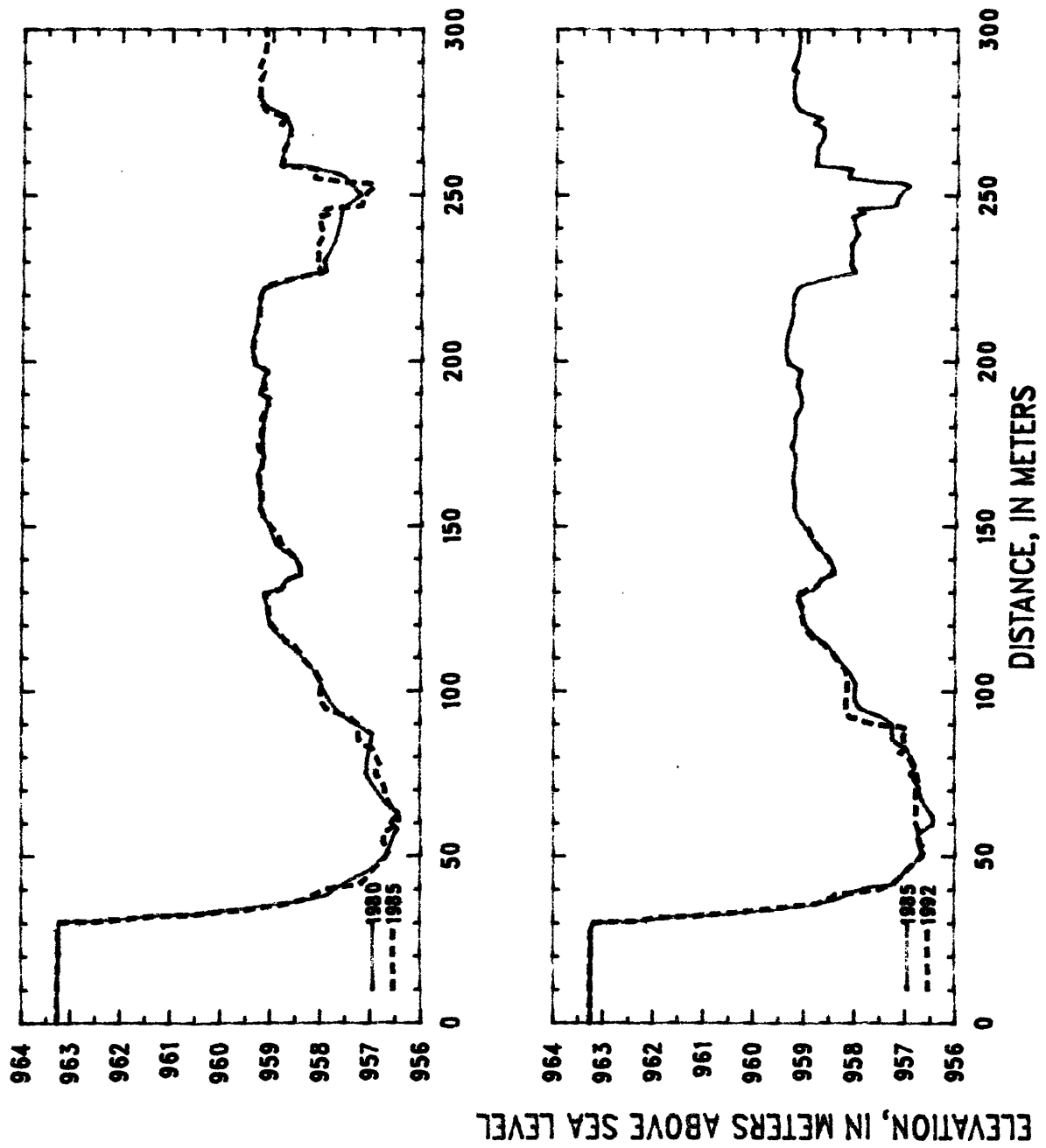


Figure 79. Profiles of cross section PR167.5 from 1980 to 1992.

Table 28. Listing of horizontal stations and elevations for cross section PR167.5

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1980		1980		1985		1985		1985	
20 October		20 October		2 October		2 October		2 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.0	963.28	131.0	958.77	0.0	963.27	90.0	957.27	199.0	959.32
2.0	963.24	133.4	958.69	4.4	963.27	91.8	957.40	202.0	959.38
5.0	963.26	135.0	958.38	6.9	963.27	92.8	957.59	205.0	959.37
10.0	963.26	140.0	958.50	10.6	963.26	94.6	957.90	208.0	959.33
15.0	963.26	144.0	958.88	13.3	963.27	97.0	958.01	211.0	959.27
20.0	963.22	150.0	959.04	17.5	963.24	100.0	958.01	214.0	959.22
22.0	963.23	155.0	959.21	21.0	963.23	102.0	957.97	217.0	959.23
25.0	963.24	160.0	959.19	22.0	963.24	106.0	958.11	220.0	959.21
30.0	963.21	165.0	959.26	24.4	963.24	109.0	958.31	222.0	959.14
30.5	963.20	170.0	959.12	28.1	963.25	111.0	958.40	223.2	959.01
30.6	962.23	174.0	959.19	30.4	963.17	113.5	958.52	225.0	958.52
32.3	961.26	177.0	959.16	30.4	962.45	115.0	958.69	226.6	958.01
32.5	960.39	180.0	959.15	32.0	961.36	117.0	958.80	229.0	958.12
33.1	960.23	185.0	959.09	32.3	960.63	120.0	958.98	232.0	958.08
36.2	958.43	188.7	959.04	33.1	960.09	123.0	959.04	235.0	958.11
38.2	957.85	190.0	959.22	34.1	959.38	126.0	959.06	238.0	957.95
40.2	957.69	195.0	959.13	35.8	958.61	129.0	959.12	240.0	958.03
43.4	957.30	197.0	959.08	36.7	958.34	131.0	958.76	243.3	958.09
46.0	956.97	199.0	959.33	38.0	958.16	133.8	958.64	244.4	957.84
50.0	956.68	201.0	959.36	40.0	957.88	135.3	958.38	245.6	957.96
53.0	956.60	205.0	959.39	40.9	957.53	138.0	958.43	246.0	957.80
57.0	956.50	210.0	959.28	41.3	957.23	141.0	958.56	246.5	957.31
58.0	956.44	215.0	959.24	43.0	957.08	144.0	958.78	247.0	957.20
60.0	956.60	220.0	959.19	45.0	957.00	147.0	958.86	250.0	957.14
63.0	956.42	222.0	959.14	48.0	956.77	150.0	959.02	252.5	956.94
66.0	956.70	224.0	958.72	51.0	956.63	153.0	959.15	253.6	957.13
69.0	956.84	226.0	958.30	54.0	956.74	156.0	959.21	253.8	957.56
72.0	956.99	227.0	957.91	57.0	956.74	159.0	959.16	254.7	957.94
75.0	957.09	230.0	957.97	59.5	956.43	162.0	959.22	255.0	958.16
80.0	957.04	235.0	957.76	62.0	956.42	165.0	959.23	256.0	958.17
84.0	956.99	240.0	957.65	65.0	956.60	168.0	959.16	257.5	958.09
87.0	956.96	246.0	957.58	69.0	956.72	171.0	959.16	258.0	958.22
90.0	957.30	250.0	957.21	71.0	956.72	174.0	959.27	258.8	958.82
91.5	957.48	256.0	957.61	74.0	956.86	177.0	959.17	261.0	958.77
94.2	957.70	258.5	958.24	75.0	956.91	180.0	959.17	264.0	958.77
100.0	957.95	259.0	958.84	77.0	956.78	183.0	959.18	267.0	958.64
105.0	958.08	270.0	958.63	80.0	956.88	186.0	959.06	269.8	958.63
110.0	958.35	274.0	958.76	83.0	956.99	189.0	959.05	271.6	958.85
115.0	958.73	277.0	959.17	83.4	957.07	192.0	959.16	273.0	958.70
120.0	959.01	280.0	959.28	84.0	957.16	195.0	959.12	274.6	958.96
125.0	959.07			85.5	957.25	197.0	959.07	275.4	959.14
129.6	959.13			88.0	957.26	198.0	959.18	278.0	959.25

Table 28. (Continued) Listing of horizontal stations and elevations for cross section PR167.5

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1985		1992		1992	
2 October		27 August		27 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
281.0	959.26	0.0	963.29	80.3	956.95
284.0	959.27	1.8	963.25	81.0	957.03
287.0	959.16	10.2	963.27	81.5	957.10
288.0	959.28	13.3	963.28	82.2	957.02
291.0	959.17	16.4	963.26	83.0	956.98
293.0	959.14	22.0	963.23	85.2	957.02
296.0	959.11	25.6	963.25	86.5	957.04
299.0	959.14	27.0	963.26	88.4	956.95
300.0	959.17	29.0	963.23	89.3	957.12
301.0	958.96	30.0	963.18	89.7	957.42
		30.4	962.98	90.0	957.63
		30.6	962.28	91.0	957.93
		31.2	962.08	91.7	957.98
		31.6	961.83	91.9	958.10
		31.9	961.15	93.0	958.15
		33.1	960.28	95.0	958.18
		34.0	959.70	97.0	958.16
		35.6	958.75	99.0	958.13
		36.2	958.56	101.0	958.13
		37.4	958.41	103.0	958.12
		38.4	958.36	105.0	958.15
		39.6	957.57	107.0	958.21
		40.7	957.36	110.0	958.37
		42.0	957.19	112.0	958.46
		44.0	957.04	114.0	958.58
		46.0	956.92	116.0	958.80
		48.0	956.79	118.0	958.93
		50.0	956.63	120.0	959.00
		52.0	956.60	123.0	959.05
		54.0	956.72	126.0	959.06
		56.0	956.74	128.0	959.13
		58.0	956.74	129.5	959.10
		60.0	956.80	132.0	958.72
		62.0	956.77	134.0	958.62
		64.0	956.79	135.3	958.42
		66.0	956.77	136.0	958.42
		68.0	956.79	138.0	958.46
		70.0	956.78	140.0	958.51
		72.0	956.74	143.0	958.70
		74.0	956.75	146.0	958.85
		77.0	956.83	149.0	958.93
		79.0	956.90		

Description of Cross Section PR168.5

Location: Township 6 South/Range 50 East--section 21

U. S. Geological Survey quadrangle (1:24,000): Lonesome Peak

Landowners--left bank: Gay Ranch

--right bank: Gay Ranch

Access: Left bank--high bank; Right bank--point bar

Permission from: Gay Ranch

Distance from Moorhead Gaging Station: 53.3 kilometers

Azimuth of Section (degrees magnetic): 221

Reference Monuments

[Monuments at stations -1.0 and 0.0 were closest to leveling instrument before 1998 and monuments at station 151.0 was closest to leveling instrument in 1998]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.23 meter above 1998 ground level	-16.0	45°17'34.14"	105°35'34.22"	0.257	0.772	958.61
1/2-inch-rebar; 0.14 meter above 1998 ground level	-1.0					958.75
1/2-inch-rebar; 0.03 meter above 1998 ground level	0.0					958.67
1/2-inch-rebar; 0.12 meter above 1998 ground level	151.0	45°17'31.06"	105°35'40.53"	0.819	0.460	958.40

See Figure 8 for location
of cross section

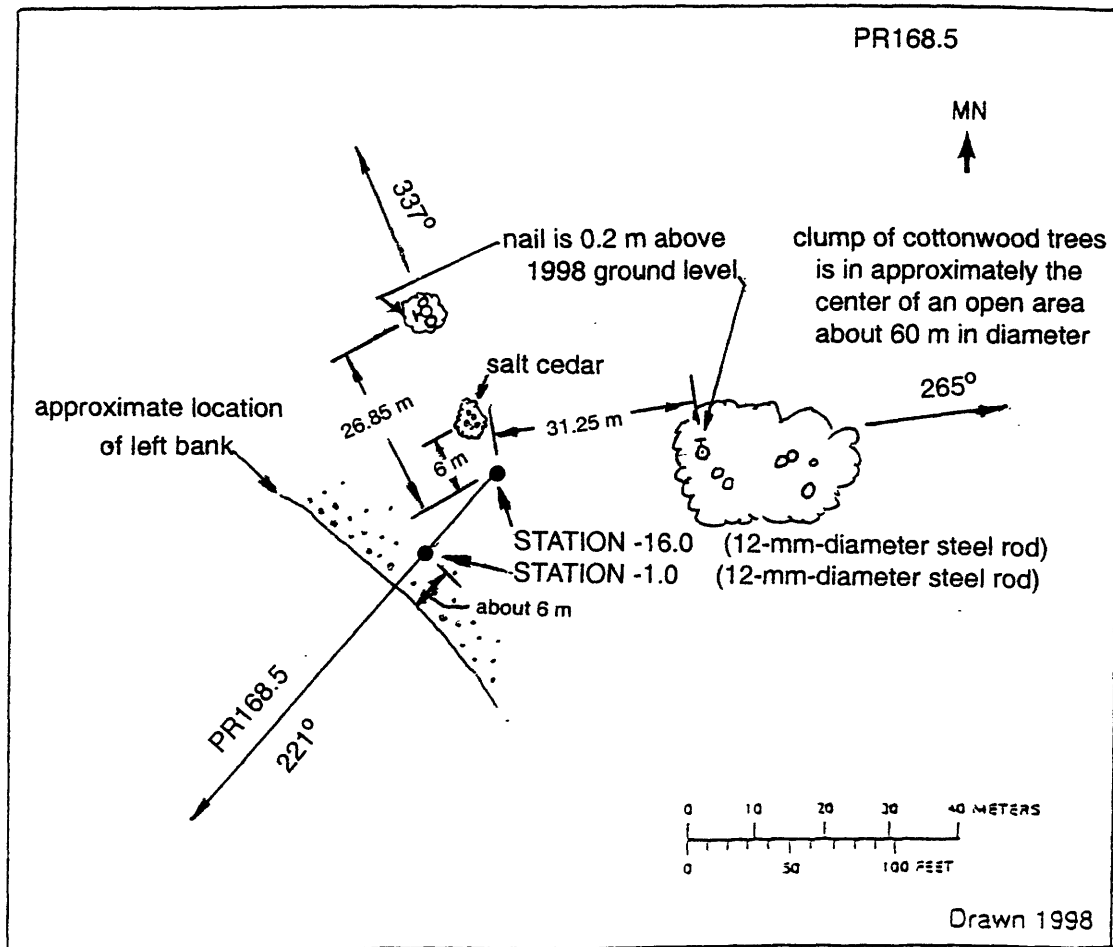


Figure 80. Upper: Location of cross section PR168.5 is shown in figure 8. Lower: Location of the reference monument on the left bank. MN is magnetic north.

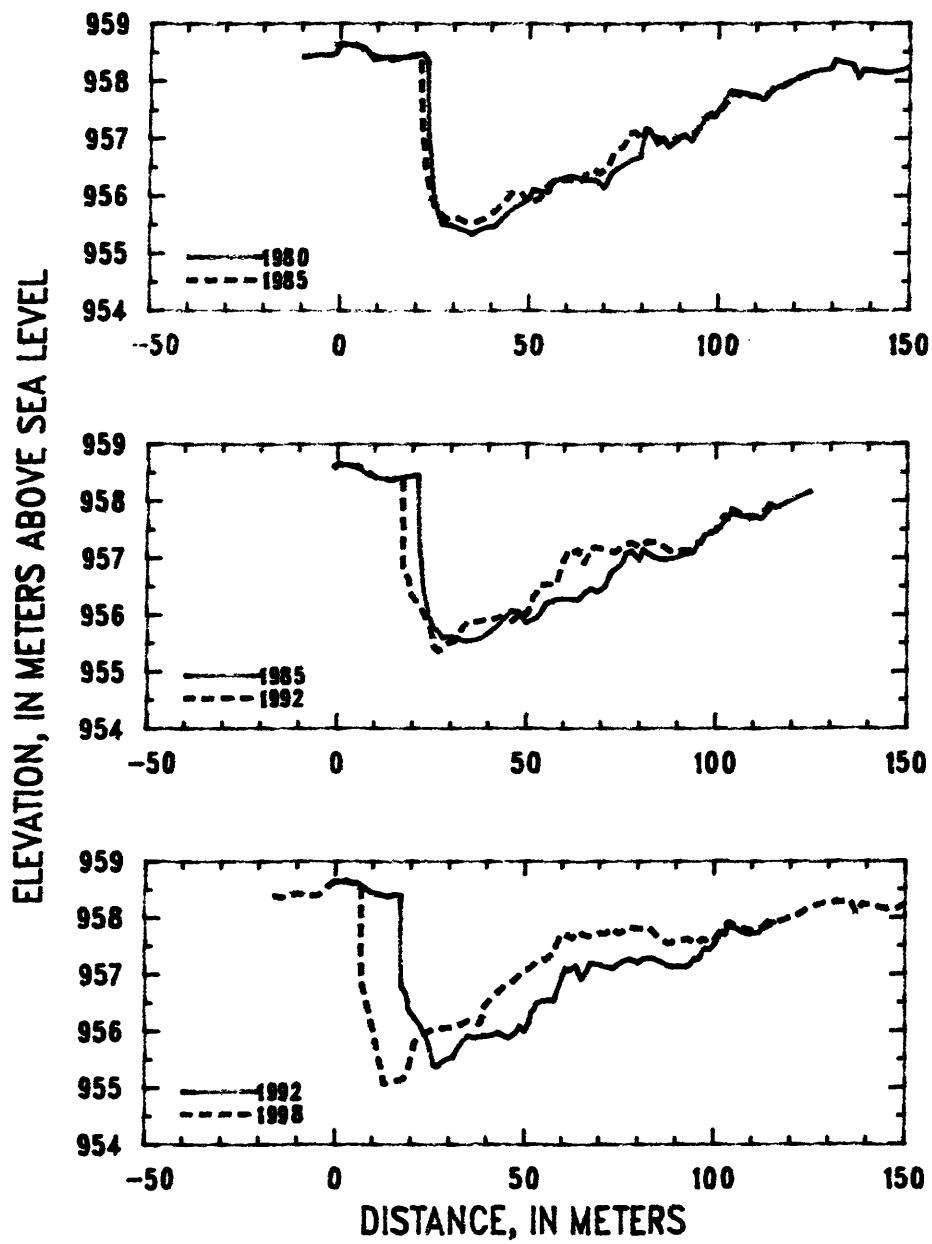


Figure 81. Profiles of cross section PR168.5 from 1980 to 1998.

Table 29. Listing of horizontal stations and elevations for cross section PR168.5

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1980		1980		1985		1985		1992	
20 October		20 October		7 October		7 October		1 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-10.0	958.43	82.0	957.14	-1.0	958.61	85.0	956.98	-1.0	958.60
-5.0	958.46	84.0	956.91	0.0	958.64	88.0	956.97	0.0	958.64
-2.5	958.46	85.5	957.00	3.0	958.63	91.0	957.05	2.0	958.64
-1.0	958.49	87.0	956.86	5.0	958.60	94.0	957.09	4.0	958.61
0.0	958.65	91.0	957.06	8.0	958.46	97.0	957.40	6.0	958.61
3.0	958.63	93.0	956.96	11.0	958.40	100.0	957.45	8.0	958.51
6.0	958.60	97.0	957.39	14.0	958.37	102.0	957.62	10.0	958.42
7.0	958.56	99.0	957.38	17.0	958.41	104.0	957.79	12.0	958.42
9.0	958.38	103.3	957.83	20.0	958.45	107.0	957.73	14.0	958.37
11.0	958.40	106.0	957.81	21.4	958.46	110.0	957.74	16.0	958.42
13.0	958.43	110.0	957.73	21.6	957.67	112.0	957.69	17.3	958.40
16.0	958.41	112.0	957.68	22.0	957.04	115.0	957.91	17.5	956.79
19.0	958.43	115.0	957.88	22.5	956.81	116.0	957.87	18.0	956.73
22.0	958.48	120.0	958.02	22.7	956.54	119.0	957.98	19.0	956.63
23.3	958.36	125.0	958.17	23.5	956.21	122.0	958.08	19.4	956.37
23.5	957.11	129.6	958.21	25.0	955.83	125.0	958.16	21.0	956.23
24.0	956.79	130.7	958.36	28.0	955.60			22.4	956.10
25.0	956.05	135.5	958.28	31.0	955.62			23.0	956.01
26.0	955.73	137.0	958.06	34.0	955.53			24.6	955.80
27.0	955.51	138.0	958.19	37.0	955.55			26.0	955.39
29.0	955.50	140.0	958.19	40.0	955.67			27.0	955.37
32.0	955.43	145.0	958.14	43.0	955.84			29.0	955.50
35.0	955.33	150.0	958.23	46.0	956.07			31.0	955.54
38.0	955.44	151.0	958.26	48.0	956.05			33.0	955.77
41.0	955.46			50.0	955.85			35.0	955.91
44.0	955.67			53.0	955.95			37.0	955.88
47.0	955.82			55.3	956.21			39.0	955.91
50.0	955.93			58.0	956.28			41.0	955.92
51.0	956.10			61.0	956.29			43.0	955.97
54.0	956.06			64.0	956.26			45.0	955.89
55.3	956.07			65.3	956.38			46.0	955.88
56.3	956.26			67.5	956.46			48.0	955.99
61.0	956.36			69.0	956.39			48.7	956.08
65.0	956.29			70.0	956.45			49.9	956.00
68.0	956.28			71.0	956.50			50.6	956.09
70.0	956.15			72.5	956.75			51.0	956.14
71.0	956.25			75.5	956.90			51.7	956.33
72.0	956.41			76.4	957.08			52.5	956.37
74.0	956.50			78.0	957.12			53.0	956.48
77.0	956.63			80.0	956.97			55.0	956.54
79.4	956.68			81.0	957.15			57.0	956.55
81.0	957.18			83.0	957.04			58.0	956.54

Table 29. (Continued) Listing of horizontal stations and elevations for cross section PR168.5
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1992		1998		1998	
1 September		2 October		2 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
58.7	956.71	-16.0	958.38	75.0	957.71
59.6	956.86	-13.0	958.35	78.0	957.83
60.0	956.98	-10.0	958.43	81.0	957.81
60.7	957.04	-7.0	958.39	83.0	957.82
61.0	957.11	-4.0	958.41	85.0	957.68
62.0	957.07	-1.0	958.61	88.0	957.53
63.9	957.15	0.0	958.65	91.0	957.58
65.3	956.91	2.0	958.66	93.0	957.63
67.0	957.08	4.0	958.62	95.4	957.52
67.6	957.19	6.9	958.57	97.0	957.62
69.0	957.19	7.0	956.89	99.7	957.54
71.0	957.15	9.4	956.20	102.0	957.79
73.0	957.12	12.0	955.40	104.0	957.91
73.6	957.10	13.0	955.07	107.0	957.80
75.0	957.18	18.0	955.15	110.0	957.77
76.0	957.23	19.0	955.29	113.0	957.82
78.0	957.27	21.0	955.80	116.0	957.89
80.0	957.20	22.5	955.93	119.0	957.98
82.0	957.29	24.5	955.98	121.1	958.01
84.0	957.29	26.0	956.03	125.0	958.16
86.0	957.22	29.0	956.05	128.0	958.24
88.0	957.13	32.0	956.08	131.0	958.28
91.0	957.14	35.0	956.17	134.0	958.27
93.0	957.13	38.0	956.12	136.0	958.28
95.0	957.27	38.8	956.21	137.4	958.06
96.0	957.26	39.0	956.41	139.0	958.25
97.5	957.45	41.0	956.55	142.0	958.19
99.0	957.44	44.0	956.74	145.0	958.15
100.0	957.50	47.0	956.88	148.0	958.15
102.0	957.74	50.0	957.05	151.0	958.27
103.0	957.69	53.0	957.20		
103.5	957.85	56.0	957.28		
105.0	957.84	58.0	957.40		
107.0	957.75	59.5	957.68		
109.0	957.70	61.0	957.70		
112.0	957.73	63.0	957.63		
114.0	957.94	64.0	957.74		
116.0	957.90	66.0	957.70		
		68.0	957.65		
		70.0	957.72		
		72.0	957.73		
		73.0	957.82		

Description of Cross Section PR169.2

Location: Township 6 South/Range 50 East--section 22 and 27

U. S. Geological Survey quadrangle (1:24,000): Lonesome Peak

Landowners--left bank: EB Ranch

--right bank: Daily Ranch

Access: Left bank

Permission from: EB Ranch

Distance from Moorhead Gaging Station: 54.0 kilometers

Azimuth of Section (degrees magnetic): 114

Reference Monuments

[Monuments at stations 151.0 and 154.6 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.17 meter above 1998 ground level	-1.0	45°17'24.67"	105°35'23.82"	0.466	0.495	957.69
1/2-inch-rebar; 0.13 meter above 1998 ground level; 0.25 meter downriver from a cotton-wood tree (0.50 meter diameter at breast height) with a nail 1.6meter above 1998 ground level	151.0					958.05
1/2-inch-rebar; 0.15 meter above 1998 ground level; under 2-strand, barbed-wire fence with tree posts	154.5	45°17'21.59"	105°35'18.17"	0.534	0.924	958.96

See Figure 8 for location
of cross section

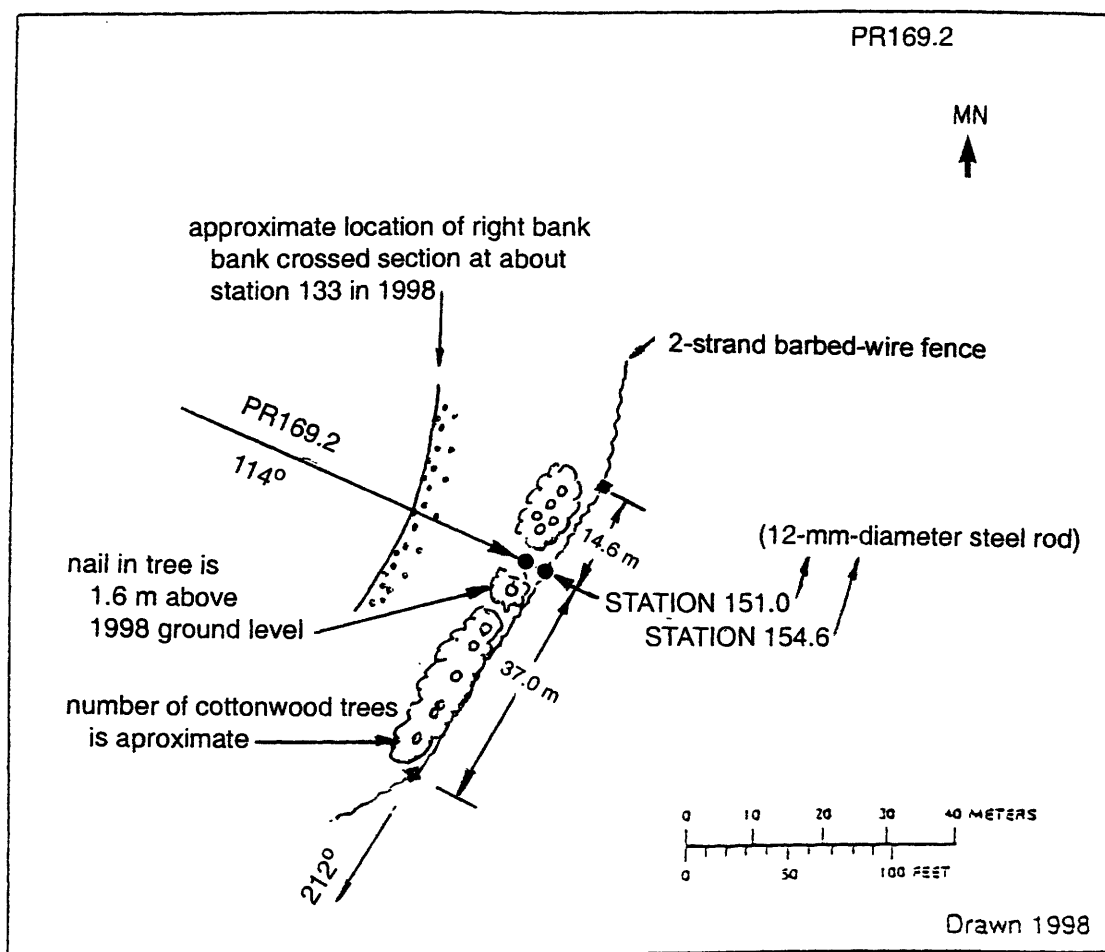


Figure 82. Upper: Location of cross section PR169.2 is shown in figure 8. Lower: Location of the reference monuments on the right bank. MN is magnetic north.

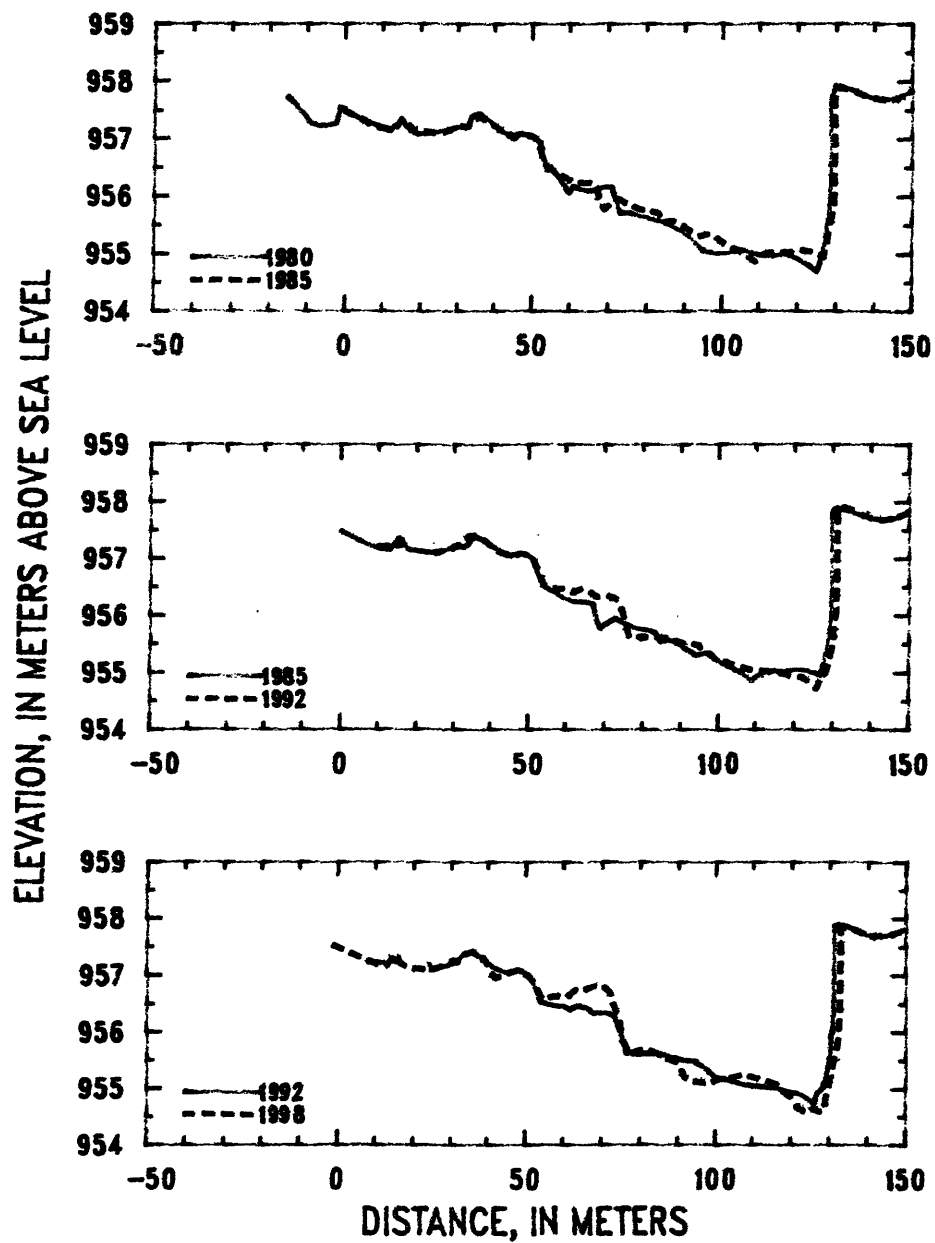


Figure 83. Profiles of cross section PR169.2 from 1980 to 1998.

Table 30. Listing of horizontal stations and elevations for cross section PR169.2

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1980		1990		1985		1985		1992	
21 October		21 October		5 October		5 October		2 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-15.0	957.73	110.0	954.98	0.0	957.49	106.0	955.01	10.0	957.22
-11.0	957.46	114.0	954.94	4.0	957.36	109.0	954.85	16.0	957.24
-9.0	957.29	117.0	955.00	7.0	957.26	112.0	955.01	20.0	958.12
-6.0	957.21	120.0	954.92	10.0	957.19	115.0	955.03	25.0	957.09
-2.0	957.26	123.0	954.80	13.0	957.15	118.0	955.02	28.0	957.16
-1.0	957.55	125.0	954.68	15.4	957.36	121.0	955.07	31.0	957.21
0.0	957.51	126.0	954.80	18.0	957.16	124.0	955.04	34.0	957.40
3.0	957.38	127.7	955.31	21.0	957.13	127.0	954.94	36.0	957.42
6.0	957.30	128.6	956.05	24.0	957.10	128.7	955.48	38.0	957.32
9.0	957.25	128.7	957.70	27.0	957.13	129.7	955.93	41.0	957.17
12.0	957.13	130.0	957.92	30.0	957.23	129.8	957.81	43.0	957.10
15.0	957.35	134.0	957.87	33.0	957.21	131.0	957.90	46.0	957.04
17.0	957.17	138.0	957.74	36.0	957.39	134.0	957.84	48.0	957.10
19.4	957.07	142.0	957.68	39.0	957.28	137.0	957.77	50.0	957.05
23.0	957.10	146.0	957.69	42.0	957.14	140.0	957.70	51.5	956.95
27.0	957.14	150.0	957.83	45.0	957.04	143.0	957.68	54.0	956.54
30.0	957.20	151.0	957.89	47.0	957.09	146.0	957.70	56.0	956.49
33.0	957.23	154.6	958.82	50.0	957.05	149.0	957.79	58.0	956.46
34.0	957.39			51.5	956.96	151.0	957.91	60.0	956.47
36.0	957.44			53.0	956.63	154.6	958.82	62.0	956.39
39.0	957.30			54.0	956.51			64.0	956.47
42.0	957.13			56.0	956.44			66.0	956.42
45.0	957.00			59.0	956.32			67.0	956.36
47.0	957.10			62.0	956.23			68.0	956.32
50.0	957.04			65.0	956.24			70.0	956.35
52.0	956.93			66.9	956.20			72.0	956.32
54.0	956.44			68.1	955.86			73.3	956.27
55.0	956.49			69.0	955.77			74.5	956.06
58.0	956.25			70.0	955.83			76.3	955.63
60.0	956.05			72.6	955.96			78.4	955.64
61.0	956.17			75.0	955.86			79.5	955.59
65.0	956.08			78.0	955.77			80.1	955.62
70.0	956.17			81.0	955.75			82.0	955.62
71.0	956.15			83.3	955.70			84.0	955.62
73.0	955.71			84.3	955.55			86.0	955.62
75.0	955.71			87.0	955.58			88.0	955.55
80.0	955.63			90.0	955.48			89.6	955.55
85.0	955.55			91.0	955.42			91.5	955.48
90.0	955.38			94.0	955.30			93.0	955.49
95.0	955.05			97.0	955.35			94.7	955.48
100.0	954.99			100.0	955.20			95.0	955.43
105.0	955.07			103.0	955.09			97.0	955.36

Table 30. (Continued) Listing of horizontal stations and elevations for cross section PR169.2

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1992		1998		1998	
2 September		2 October		2 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
98.0	955.30	-1.0	957.52	95.0	955.11
100.0	955.19	0.0	957.50	98.0	955.08
102.0	955.18	2.0	957.42	101.0	955.17
104.0	955.13	4.0	957.38	104.0	955.18
106.0	955.10	7.0	957.27	107.0	955.24
108.0	955.06	10.0	957.21	110.0	955.21
110.0	955.04	13.0	957.17	113.0	955.13
112.0	955.02	15.3	957.36	116.0	955.08
114.0	955.01	17.0	957.19	118.0	954.95
116.0	955.01	19.0	957.13	120.0	954.85
118.0	954.96	22.0	957.11	122.0	954.64
120.0	954.93	25.0	957.10	124.0	954.56
122.0	954.92	28.0	957.17	126.0	954.64
124.0	954.84	30.0	957.25	128.0	954.57
126.1	954.71	32.0	957.23	129.0	954.68
127.0	954.93	34.0	957.37	130.9	955.38
128.5	955.00	36.0	957.42	132.5	955.90
129.6	955.31	39.0	957.29	132.9	956.50
130.3	955.60	42.0	956.95	133.0	957.84
130.5	955.94	45.0	957.03	135.0	957.84
130.9	955.99	48.0	957.09	137.6	957.77
131.2	956.63	51.0	956.97	140.0	957.68
131.3	957.86	52.0	956.88	143.0	957.69
132.0	957.89	54.5	956.57	146.0	957.73
133.0	957.90	58.0	956.64	149.0	957.78
135.0	957.86	61.0	956.62	151.0	957.91
138.0	957.75	63.0	956.74	154.6	958.83
141.0	957.69	65.0	956.73		
144.0	957.68	68.0	956.81		
147.0	957.74	70.0	956.82		
150.0	957.82	72.0	956.70		
		74.4	956.22		
		75.4	955.84		
		76.0	955.77		
		77.3	955.59		
		79.0	955.66		
		81.0	955.69		
		84.0	955.64		
		87.0	955.54		
		90.1	955.45		
		90.4	955.38		
		92.0	955.16		

Description of Cross Section PR169.8

Location: Township 6 South/Range 50 East--section 22

U. S. Geological Survey quadrangle (1:24,000): Lonesome Peak

Landowners--left bank: E. B. Ranch

--right bank: E. B. Ranch

Access: Left bank

Permission from: E. B. Ranch

Distance from Moorhead Gaging Station: 54.6 kilometers

Azimuth of Section (degrees magnetic): 127

Reference Monuments

[Monument at station 0.0 was closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.20 meter above 1998 ground level; 0.05 meter riverward of an orange metal fence post	0.0	45°17'41.85"	105°35'16.46"	0.268	0.779	958.45
1/2-inch-rebar; 0.13 meter above 1998 ground level; in a clearing landward of first group of 15-20 meter high cottonwood trees	151.0	45°17'38.07"	105°35'12.05"	0.390	0.438	957.42

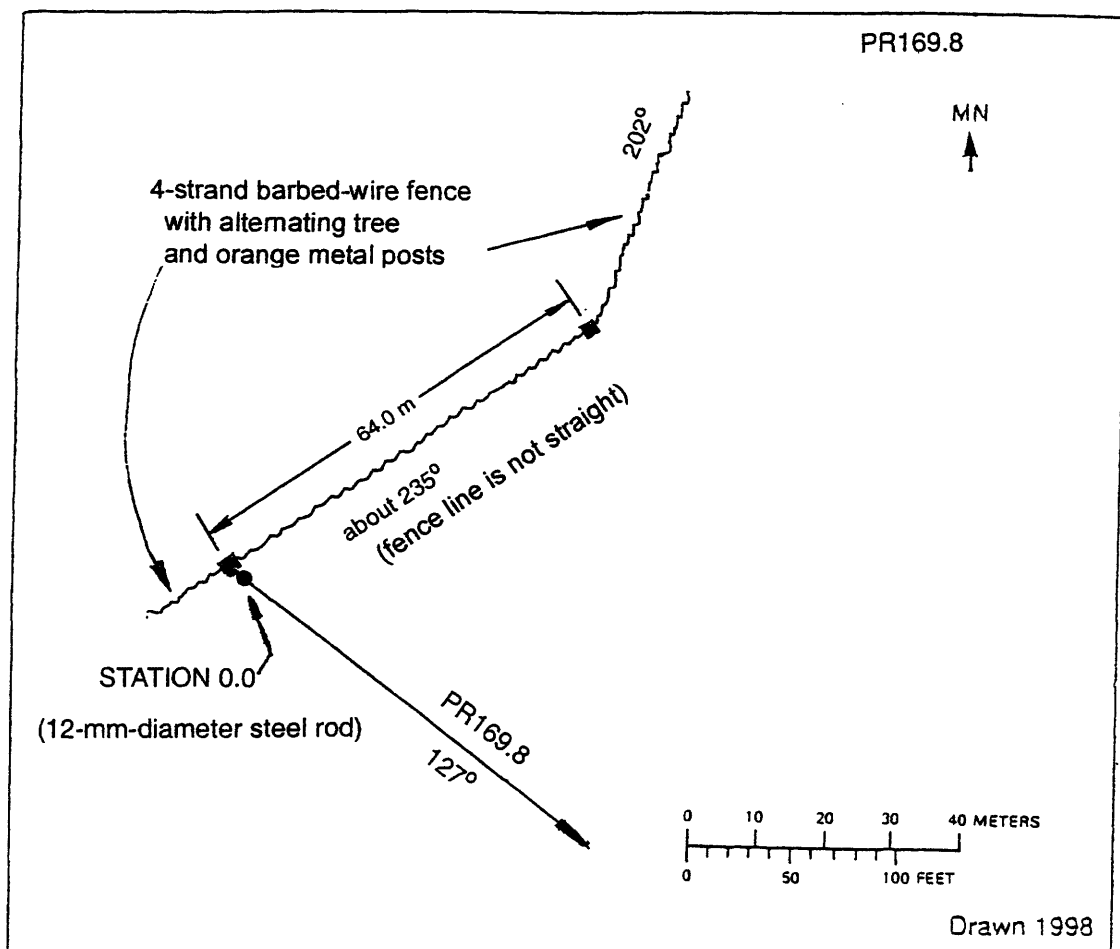
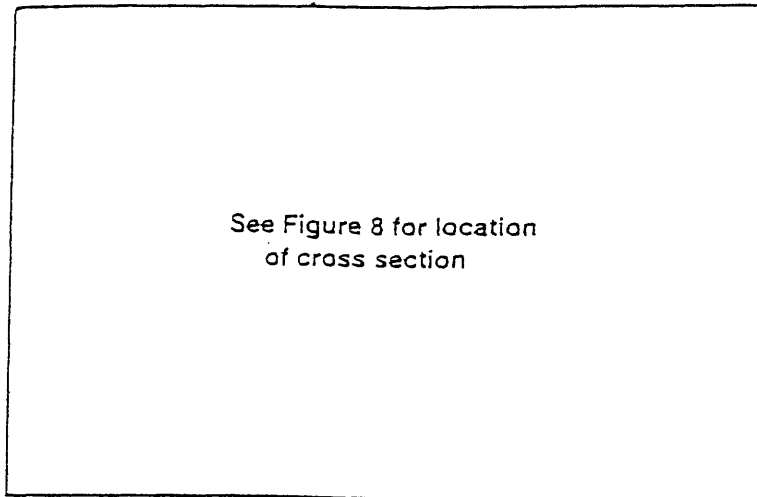


Figure 84. Upper: Location of cross section PR169.8 is shown in figure 8. Lower: Location of the reference monuments on the left bank. MN is magnetic north.

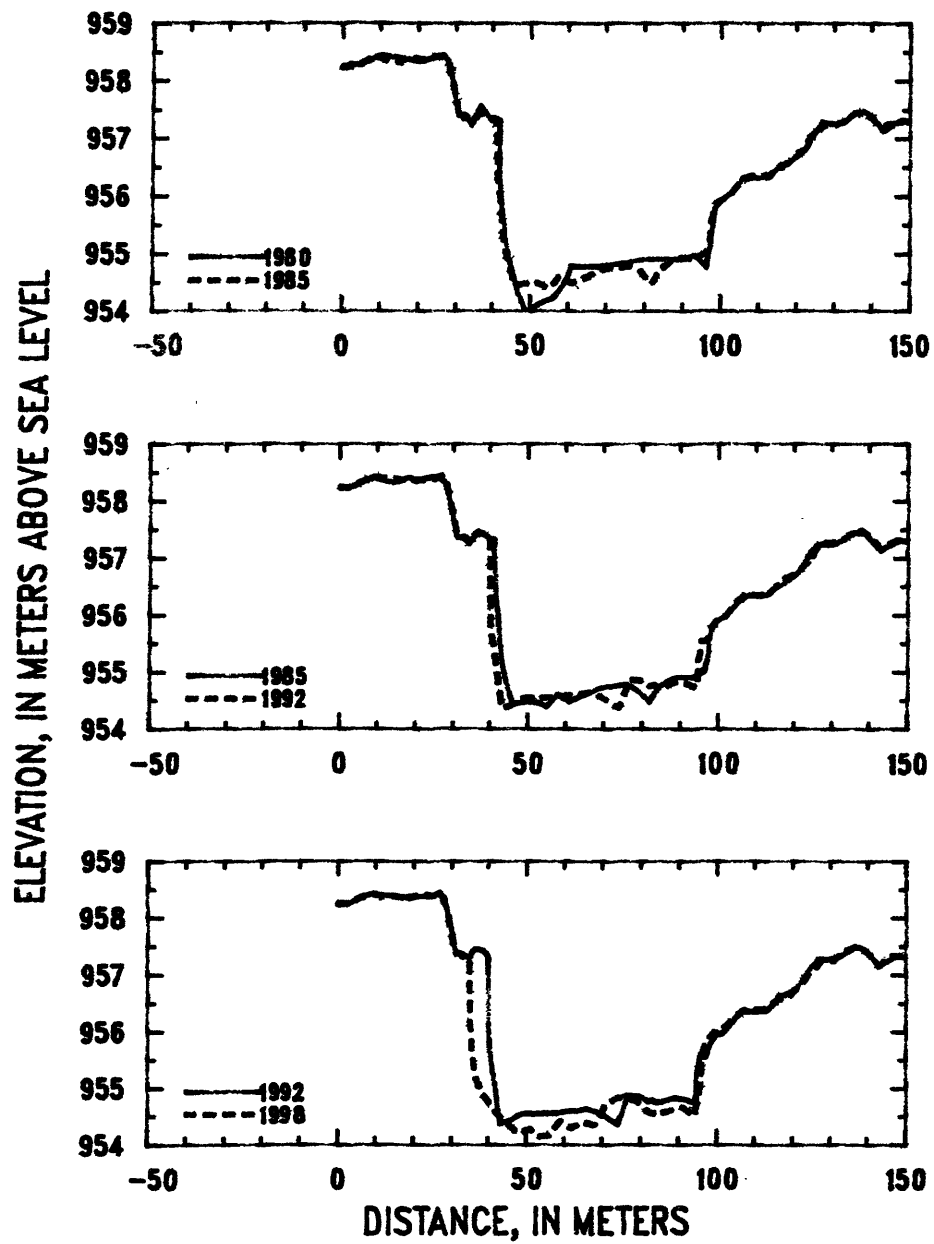


Figure 85. Profiles of cross section PR169.8 from 1980 to 1998.

Table 31. Listing of horizontal stations and elevations for cross section PR169.8

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1980		1980		1985		1985		1992	
21 October		21 October		5 October		5 October		2 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
0.0	958.24	120.0	956.68	0.0	958.25	97.2	955.23	0.0	958.24
2.0	958.28	122.8	956.82	3.0	958.24	97.4	955.57	3.0	958.24
5.0	958.28	124.0	957.06	6.0	958.34	99.0	955.88	6.0	958.35
10.0	958.45	126.0	957.16	9.0	958.43	102.0	955.98	9.0	958.43
15.0	958.42	127.0	957.29	12.0	958.34	105.0	956.22	12.0	958.40
20.0	958.34	130.0	957.25	15.0	958.33	108.0	956.35	15.0	958.39
25.0	958.42	133.0	957.29	18.0	958.42	111.0	956.35	17.0	958.37
26.6	958.46	135.0	957.42	21.0	958.38	113.0	956.36	20.0	958.37
28.2	958.32	138.0	957.48	24.0	958.43	115.0	956.47	25.0	958.39
30.9	957.40	140.0	957.39	26.0	958.43	118.0	956.57	26.8	958.44
32.7	957.40	142.8	957.14	28.0	958.32	121.0	956.74	28.0	958.34
34.3	957.23	144.0	957.25	29.0	958.04	122.6	956.85	30.0	957.76
37.0	957.56	150.0	957.32	30.0	957.73	123.7	957.04	31.2	957.38
40.0	957.32	151.0	957.30	31.0	957.37	125.0	957.04	33.0	957.37
42.0	957.31			33.0	957.35	127.0	957.25	35.0	957.28
42.0	956.31			34.6	957.25	130.0	957.23	36.0	957.41
42.6	955.82			36.3	957.42	133.0	957.31	37.0	957.46
44.0	955.09			38.0	957.44	136.0	957.45	39.0	957.42
45.0	954.78			40.0	957.34	139.0	957.43	40.1	957.32
47.1	954.26			41.1	957.33	142.0	957.20	40.2	955.79
49.0	953.96			41.6	956.22	143.0	957.13	41.5	955.21
53.0	954.14			42.2	955.98	145.0	957.21	42.3	954.78
56.0	954.21			43.0	955.28	148.0	957.32	43.3	954.37
59.0	954.43			43.8	954.99	151.0	957.27	46.0	954.43
61.0	954.78			46.0	954.45			48.0	954.53
65.0	954.78			49.0	954.47			50.0	954.56
68.0	954.78			52.0	954.48			52.0	954.54
75.0	954.84			55.0	954.39			54.0	954.55
80.0	954.90			58.0	954.61			56.0	954.56
85.0	954.91			61.0	954.48			58.0	954.55
90.0	954.89			64.0	954.57			60.0	954.59
93.0	954.97			67.0	954.66			62.0	954.60
96.2	954.77			70.0	954.75			64.0	954.61
97.2	955.10			73.0	954.76			66.0	954.64
98.4	955.78			76.0	954.79			68.0	954.60
100.0	955.91			79.0	954.68			70.0	954.54
103.0	956.05			82.0	954.47			72.0	954.45
106.0	956.32			84.0	954.72			74.0	954.37
110.0	956.31			87.0	954.86			76.3	954.77
113.0	956.33			90.0	954.93			76.4	954.87
116.0	956.55			93.0	954.90			79.0	954.87
118.0	956.57			96.0	955.00			80.5	954.83

Table 31. (Continued) Listing of horizontal stations and elevations for cross section PR169.8

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1992		1998		1998	
2 September		1 October		1 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
82.0	954.75	0.0	958.25	95.6	955.17
83.4	954.79	3.0	958.25	96.1	955.62
84.0	954.75	6.0	958.36	97.0	955.81
86.0	954.75	9.0	958.42	99.0	955.98
88.0	954.82	12.0	958.39	101.0	956.00
90.0	954.82	15.0	958.38	104.0	956.21
92.0	954.79	17.0	958.36	107.0	956.38
94.0	954.74	18.0	958.44	110.0	956.39
94.5	954.74	19.0	958.35	113.0	956.41
94.6	955.21	22.0	958.42	116.0	956.57
95.6	955.55	25.0	958.39	119.0	956.63
97.0	955.55	27.0	958.41	122.0	956.80
98.0	955.77	28.0	958.34	125.0	957.06
100.0	955.95	29.0	958.07	128.0	957.26
101.5	955.96	30.9	957.38	131.0	957.25
103.0	956.07	32.0	957.38	134.0	957.42
105.0	956.25	34.0	957.26	137.0	957.51
107.0	956.37	35.0	957.24	140.0	957.40
110.0	956.35	35.2	956.13	143.0	957.15
113.0	956.37	36.3	955.28	146.0	957.33
115.5	956.51	38.0	954.93	149.0	957.32
116.4	956.62	39.4	954.82	151.0	957.30
118.0	956.65	42.0	954.56		
120.0	956.71	45.0	954.37		
122.5	956.85	48.0	954.21		
124.0	957.06	51.0	954.28		
127.0	957.28	53.0	954.15		
130.0	957.26	56.0	954.16		
133.0	957.32	59.0	954.42		
136.0	957.46	62.0	954.29		
138.0	957.49	65.0	954.41		
140.0	957.40	68.0	954.35		
143.0	957.15	71.0	954.72		
145.0	957.24	74.0	954.84		
148.0	957.34	76.0	954.83		
151.0	957.29	79.0	954.77		
		82.0	954.57		
		85.0	954.54		
		88.0	954.62		
		91.0	954.66		
		94.0	954.51		
		95.0	954.83		

Description of Cross Section PR170.5

Location: Township 6 South/Range 50 East--section 22

U. S. Geological Survey quadrangle (1:24,000): Lonesome Peak

Landowners--left bank: Daily or Rice Ranch

--right bank: Rice or Daily Ranch

Access: Right bank

Permission from: Daily Ranch

Distance from Moorhead Gaging Station: 55.3 kilometers

Azimuth of Section (degrees magnetic): 101

Reference Monuments

[Monuments at stations 150.0 and 168.95 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.13 meter above 1998 ground level; under 4-strand, barbed-wire and 1-strand electric-wire fence with mostly metal and some tree posts	-33.7	45°17'57.44"	105°35'00.38"	0.523	0.711	957.07
1/2-inch-rebar; 0.16 meter above 1998 ground level	-1.0					956.93
1/2-inch-rebar; 0.14 meter above 1998 ground level; 0.30 meter downstream from a 3-strand rusty and 1-strand galvanized, barbed-wire fence with tree posts	150.0					957.22
1/2-inch-rebar; 0.12 meter above 1998 ground level; under a 2-strand, barbed-wire fence with tree posts	168.95	45°17'54.69"	105°34'51.91"	0.411	0.578	957.06

See Figure 8 for location
of cross section

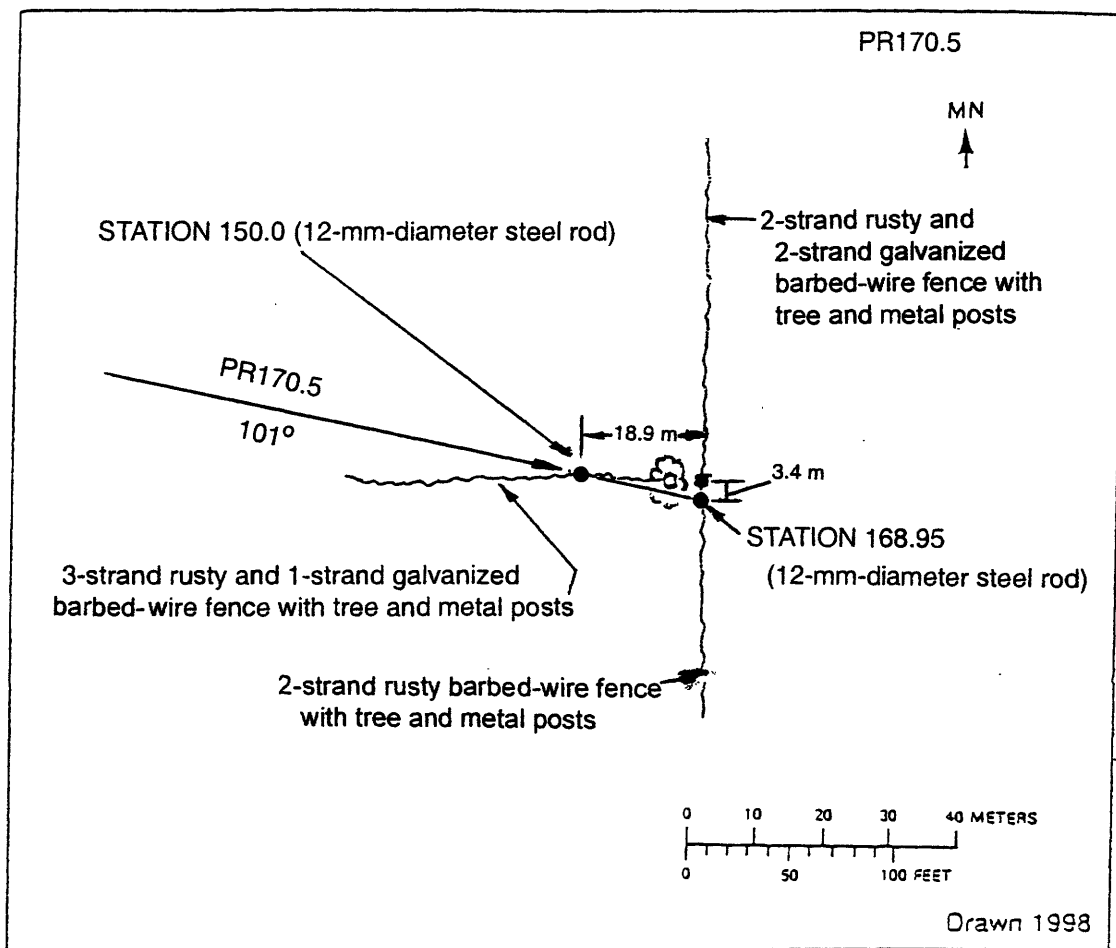


Figure 86. Upper: Location of cross section PR170.5 is shown in figure 8. Lower: Location of the reference monuments on the right bank. MN is magnetic north.

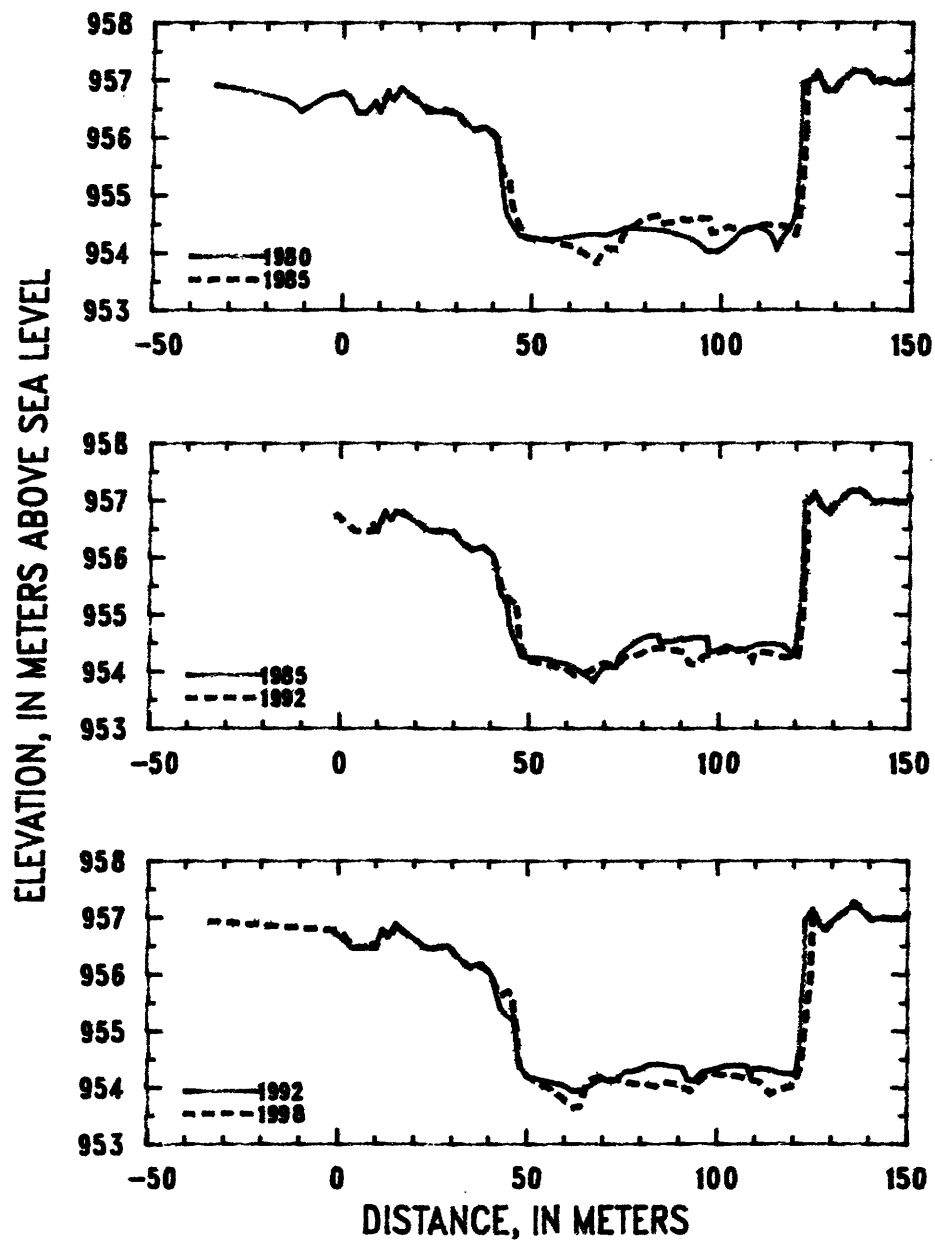


Figure 87. Profiles of cross section PR170.5 from 1980 to 1998.

Table 32. Listing of horizontal stations and elevations for cross section PR170.5

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1980		1980		1985		1985		1992	
21 October		21 October		5 October		5 October		2 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-33.7	956.91	113.0	954.33	8.7	956.58	99.0	954.35	-1.0	956.76
-25.0	956.83	114.6	954.06	10.0	956.47	102.0	954.45	4.0	956.46
-15.0	956.67	116.0	954.25	12.0	956.80	105.0	954.35	7.0	956.46
-11.0	956.46	118.5	954.48	13.5	956.66	108.0	954.42	10.0	956.46
-5.0	956.71	119.5	954.68	15.0	956.80	111.0	954.48	11.7	956.77
-1.0	956.76	120.6	955.53	18.0	956.71	114.0	954.48	13.5	956.66
0.0	956.79	121.2	956.94	21.0	956.56	117.0	954.45	15.4	956.88
1.7	956.72	124.0	957.02	24.0	956.47	119.4	954.28	17.0	956.76
4.0	956.43	125.4	957.12	27.0	956.49	120.5	954.54	20.0	956.64
6.0	956.41	127.0	956.82	30.0	956.43	121.8	955.63	23.0	956.47
8.6	956.62	129.5	956.82	32.0	956.26	122.0	956.12	26.0	956.46
10.0	956.45	131.0	956.98	35.0	956.13	122.1	956.01	29.0	956.51
12.0	956.75	133.0	957.06	38.0	956.19	122.2	956.96	32.0	956.27
13.4	956.66	135.0	957.17	40.0	956.07	124.0	957.00	35.0	956.13
15.5	956.86	138.5	957.14	40.8	956.02	125.0	957.13	38.0	956.19
17.0	956.78	140.0	956.97	42.4	955.40	127.0	956.85	40.0	956.05
22.5	956.46	142.6	957.02	43.6	955.24	129.0	956.76	41.0	955.94
25.0	956.47	145.0	956.93	44.2	955.25	132.0	957.01	43.0	955.39
30.0	956.43	148.0	956.97	45.0	954.80	135.0	957.17	45.0	955.25
35.0	956.13	150.0	957.11	46.2	954.58	138.0	957.15	46.0	955.22
38.0	956.18	158.0	956.82	48.0	954.27	141.0	956.95	46.4	955.26
40.0	956.04	165.0	957.05	50.0	954.23	143.0	956.99	47.0	955.00
41.0	955.98	168.9	956.93	52.0	954.24	146.0	956.96	47.6	954.50
42.5	955.12			55.0	954.21	149.0	956.96	47.9	954.38
43.3	954.69			58.0	954.15			50.0	954.19
45.0	954.49			61.0	954.11			52.0	954.16
47.0	954.30			64.0	953.99			54.0	954.12
50.0	954.27			67.0	953.82			56.0	954.10
55.0	954.20			70.0	954.09			58.0	954.06
60.0	954.28			73.0	954.08			60.0	954.04
65.0	954.33			74.0	954.29			62.0	953.94
70.0	954.31			76.0	954.41			64.0	953.95
75.0	954.45			79.0	954.56			66.0	954.01
80.0	954.42			82.0	954.64			68.0	954.09
85.0	954.40			84.2	954.64			70.0	954.16
90.0	954.30			84.7	954.51			72.0	954.12
93.0	954.22			88.0	954.53			74.0	954.17
96.0	954.03			90.0	954.59			76.0	954.29
99.0	954.02			91.0	954.56			78.0	954.29
102.0	954.14			94.0	954.60			80.0	954.33
106.0	954.41			96.9	954.59			82.0	954.41
110.0	954.46			97.4	954.34			85.0	954.42

Table 32. (Continued) Listing of horizontal stations and elevations for cross section PR170.5

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1992		1998		1998	
2 September		2 October		2 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
88.0	954.37	-33.7	956.93	96.0	954.17
91.0	954.34	-1.0	956.77	99.0	954.25
92.2	954.14	1.0	956.72	102.0	954.21
94.0	954.11	4.0	956.47	105.0	954.20
96.0	954.28	7.0	956.47	108.0	954.13
98.5	954.31	8.5	956.57	111.0	954.11
100.0	954.34	10.0	956.46	114.0	953.88
102.0	954.38	12.0	956.78	117.0	953.97
104.0	954.39	14.0	956.67	120.0	954.02
106.0	954.38	15.5	956.91	121.8	954.35
108.0	954.37	17.0	956.76	124.5	955.97
108.8	954.19	20.0	956.63	124.8	956.40
109.3	954.32	23.0	956.46	125.0	957.13
111.0	954.34	26.0	956.47	127.0	956.85
113.0	954.33	29.0	956.50	128.7	956.79
115.0	954.28	32.0	956.27	131.0	956.98
117.0	954.24	35.0	956.12	134.0	957.11
119.0	954.25	37.0	956.18	136.0	957.27
120.6	954.21	40.0	956.06	138.0	957.17
121.0	954.37	42.0	955.76	140.5	956.96
121.9	954.96	43.0	955.63	143.0	957.00
122.1	955.55	45.0	955.71	146.0	956.96
122.9	956.11	46.0	955.59	148.0	956.97
123.0	956.94	47.2	954.99	150.0	957.07
124.0	957.02	47.4	954.62	169.0	956.95
125.0	957.13	48.1	954.32		
127.0	956.85	50.0	954.20		
128.0	956.79	53.0	954.08		
130.0	956.92	56.0	953.99		
132.7	957.06	59.0	953.83		
135.0	957.18	62.0	953.65		
137.0	957.18	64.0	953.65		
140.5	956.96	66.0	954.11		
144.0	957.01	69.0	954.20		
147.0	956.97	72.0	954.13		
149.0	956.98	75.0	954.13		
150.0	957.10	78.0	954.07		
		81.0	954.06		
		84.0	954.02		
		87.0	954.09		
		90.0	954.05		
		93.0	953.93		

Description of Cross Section PR175

Location: Township 6 South/Range 50 East--section 15

U. S. Geological Survey quadrangle (1:24,000): Lonesome Peak

Landowners--left bank: Emmons Family

--right bank: Emmons Family

Access: Left bank

Permission from: Emmons Family

Distance from Moorhead Gaging Station: 58.32 kilometers

Azimuth of Section (degrees magnetic): 058

Reference Monuments

[Russian olive trees block the line of sight between stations -1.7 and 100.0; leveling instrument was setup near station 140.0]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
Benchmark--brass circular plate; offsection	--	45°18'59.74"	105°34'37.31"	0.468	0.546	953.58
1/2-inch-rebar; 0.19 meter above 1998 ground level; on a fence line with 4-strands of barbed-wire and 1-strand of electric wire	-39.3					953.49
1/2-inch-rebar; 0.08 meter above 1998 ground level	-1.7					953.65
1/2-inch-rebar; 0.17 meter above 1998 ground level	-0.7	45°18'59.45"	105°34'36.23"	0.310	0.614	953.77
1/2-inch-rebar; 0.05 meter below 1998 ground level	0.0					
1/2-inch-rebar; 0.11 meter above 1998 ground level	99.9					952.95
1/2-inch-rebar; 0.04 meter above 1998 ground level	100.0					952.79
1/2-inch-rebar; 0.05 meter below 1998 ground level	124.0					952.84
1/2-inch-rebar; 0.12 meter above 1998 ground level	125.0	45°19'00.71"	105°34'30.74"	0.225	0.549	953.05
1/2-inch-rebar; 0.08 meter above 1998 ground level; on riverward side of large log; elevation is ±0.02 meter	250.0					952.95
1/2-inch-rebar; 0.03 meter above 1998 ground level; elevation is ±0.01 meter	300.0					953.18
1/2-inch-rebar; 0.16 meter above 1998 ground level; elevation is ±0.03 meter	320.0	45°19'02.68"	105°34'22.25"	0.485	0.565	953.56

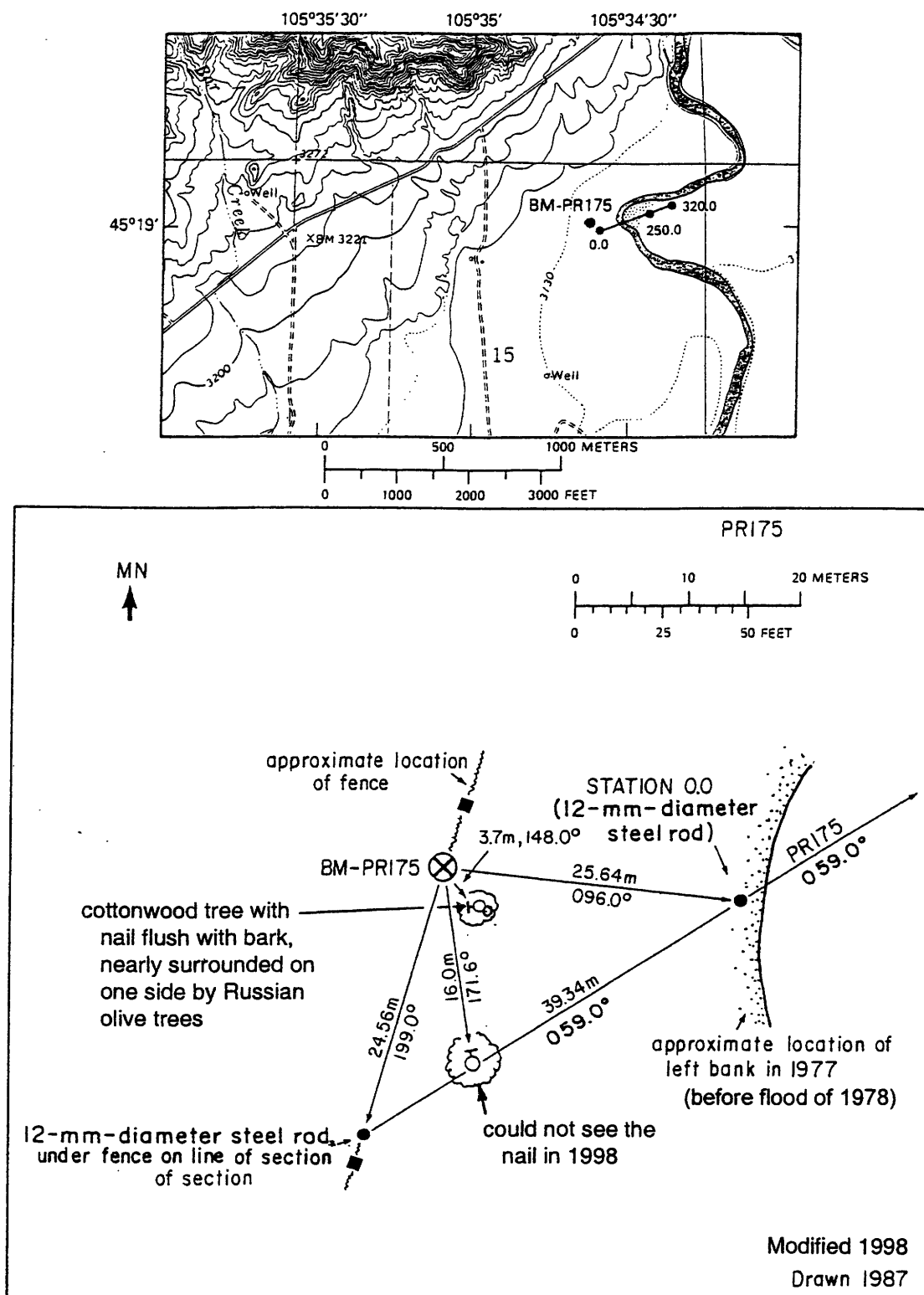


Figure 88. Upper: Location of cross section PR175, bench mark BM-PR175, and the left and right bank reference monuments in the Lonesome Peak quadrangle. Lower: Location of the bench mark on the left bank. MN is magnetic north.

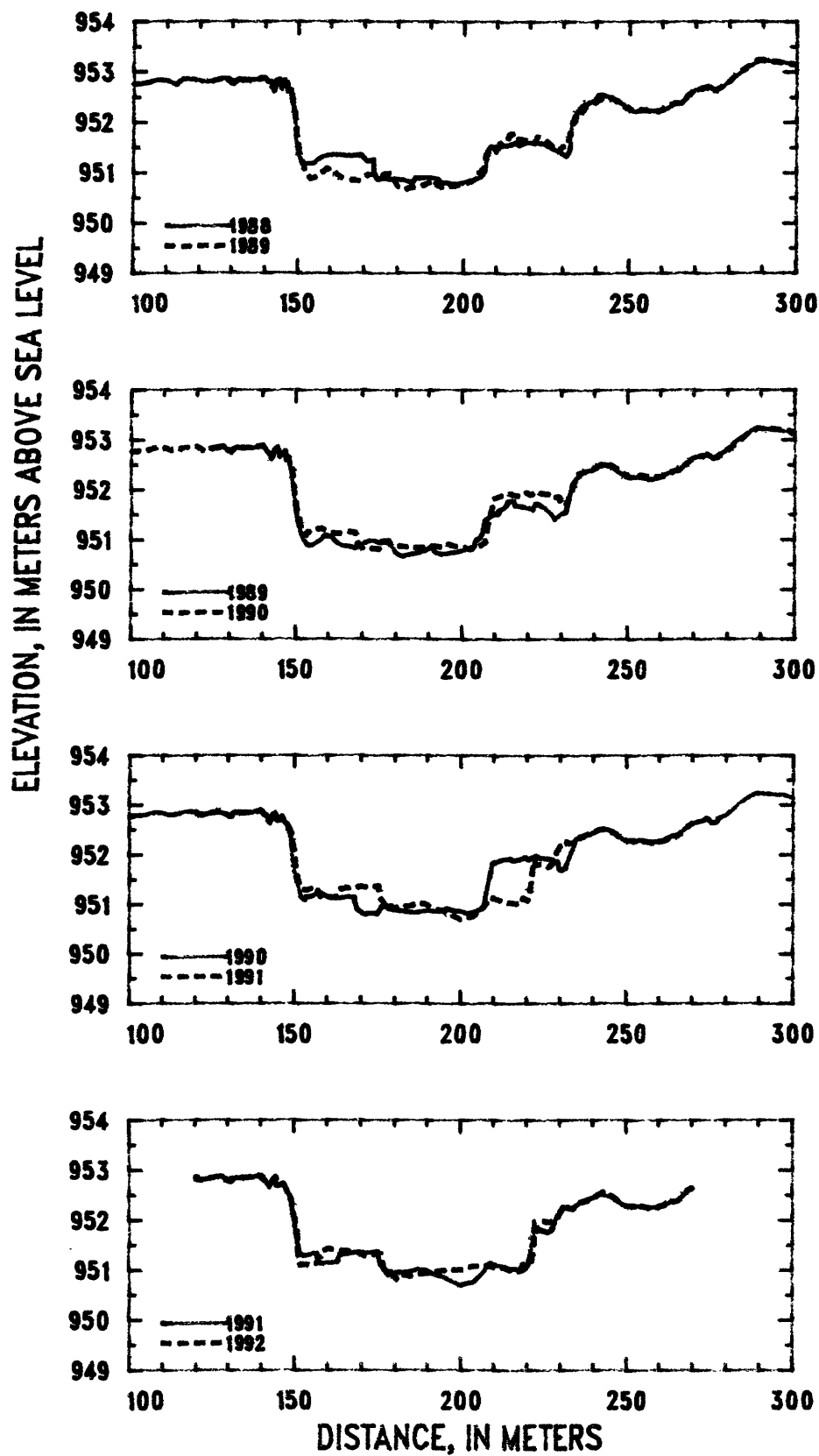


Figure 89. Profiles of cross section PR175 from 1988 to 1992.

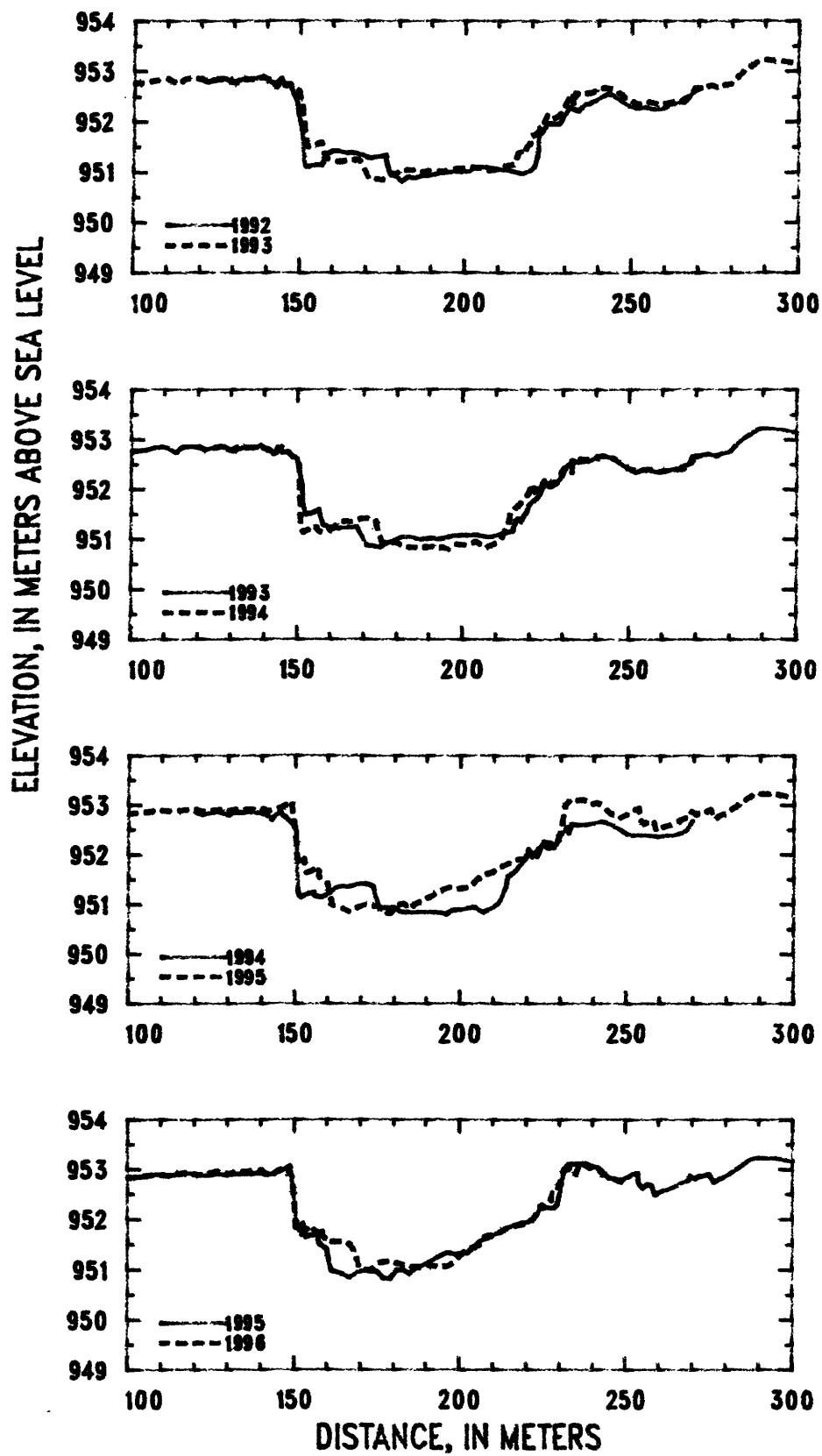


Figure 90. Profiles of cross section PR175 from 1992 to 1996.

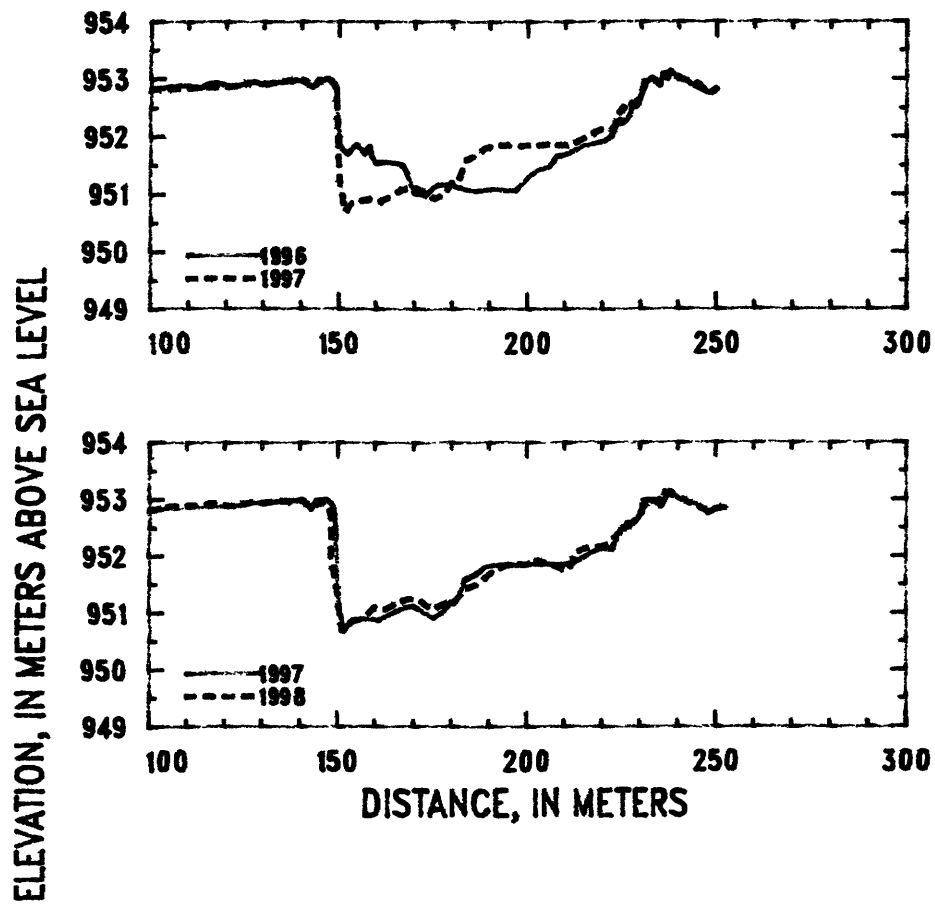


Figure 91. Profiles of cross section PR175 from 1996 to 1998.

Table 33. Listing of horizontal stations and elevations for cross section PR175

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1989		1990		1990	
22 September		22 September		22 September		21 September		21 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
124.0	952.82	186.0	950.72	257.0	952.20	94.8	952.95	157.0	951.22
126.0	952.85	188.0	950.74	260.0	952.24	95.0	952.90	158.0	951.23
128.0	952.87	190.0	950.82	263.0	952.36	96.0	952.75	160.0	951.15
130.0	952.76	191.0	950.86	266.0	952.39	98.0	952.75	162.0	951.12
132.0	952.85	192.0	950.75	268.0	952.54	100.0	952.76	164.0	951.12
134.0	952.84	194.0	950.69	270.0	952.64	102.0	952.79	166.0	951.16
136.0	952.84	196.0	950.73	272.0	952.69	104.0	952.78	168.1	951.14
138.0	952.86	198.0	950.75	274.0	952.71	106.0	952.83	168.2	951.05
140.0	952.88	200.0	950.78	276.0	952.63	108.0	952.85	169.0	950.88
141.0	952.80	202.0	950.83	279.0	952.74	110.0	952.84	171.0	950.79
142.8	952.63	203.8	950.86	282.0	952.94	112.0	952.79	173.0	950.82
143.6	952.81	204.3	950.99	285.0	953.07	114.0	952.80	175.0	950.80
144.4	952.85	205.8	951.05	288.0	953.23	116.0	952.85	176.3	950.96
145.3	952.66	206.4	951.15	290.0	953.23	118.0	952.87	177.7	950.98
146.7	952.77	206.9	951.37	295.0	953.20	120.0	952.86	178.3	950.92
147.3	952.59	209.0	951.49	300.0	953.14	122.0	952.78	180.0	950.89
148.0	952.63	210.9	951.51			124.0	952.81	182.0	950.87
148.3	952.49	211.3	951.58			126.0	952.85	184.0	950.85
149.0	952.27	213.6	951.68			128.0	952.85	186.0	950.83
150.0	951.63	214.0	951.77			130.4	952.75	188.0	950.84
150.6	951.36	215.7	951.79			132.0	952.85	190.0	950.87
152.5	950.98	216.2	951.68			134.0	952.84	192.0	950.87
154.0	950.87	218.0	951.66			136.0	952.84	194.0	950.86
156.0	950.91	220.0	951.64			138.0	952.86	196.0	950.92
157.3	950.98	221.5	951.60			140.0	952.90	198.0	950.86
159.0	951.08	222.4	951.73			141.0	952.79	200.0	950.86
161.1	951.05	224.0	951.69			141.7	952.79	202.0	950.81
162.0	950.96	226.0	951.58			142.7	952.64	204.0	950.84
164.0	950.88	228.0	951.40			143.6	952.81	205.0	950.86
166.0	950.87	230.0	951.52			144.5	952.83	207.0	950.94
168.0	950.83	231.4	951.56			145.2	952.69	207.4	951.05
170.0	950.90	233.0	952.01			146.4	952.76	208.0	951.30
171.6	950.97	234.0	952.19			147.3	952.63	208.7	951.49
173.0	950.99	236.0	952.31			148.0	952.61	209.0	951.58
174.1	950.98	238.0	952.38			148.4	952.49	209.3	951.63
175.5	950.93	240.0	952.40			148.8	952.48	209.8	951.82
176.2	950.98	243.0	952.52			149.0	952.40	211.0	951.87
177.4	950.98	245.0	952.47			149.8	951.77	213.0	951.90
178.0	950.99	247.0	952.37			152.1	951.13	215.0	951.93
180.0	950.72	250.0	952.24			153.3	951.08	216.0	951.88
182.0	950.65	252.0	952.26			153.8	951.15	218.0	951.89
184.0	950.70	255.0	952.24			155.0	951.14	219.6	951.95

Table 33. (Continued) Listing of horizontal stations and elevations for cross section PR175

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1990		1990		1991		1991		1991	
21 September		21 September		1 September		1 September		1 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
220.5	951.90	289.0	953.23	120.0	952.85	180.0	950.91	257.0	952.24
221.7	951.93	292.0	953.22	121.0	952.80	181.0	950.95	260.0	952.26
223.0	951.98	295.0	953.20	124.0	952.82	183.0	950.95	262.0	952.28
224.0	951.93	298.0	953.18	126.0	952.85	185.0	950.97	264.0	952.38
226.0	951.92	300.0	953.14	128.0	952.88	187.0	951.02	266.0	952.39
227.7	951.90	305.0	953.21	130.0	952.78	189.0	951.02	268.0	952.53
228.0	951.86	310.0	953.20	131.0	952.76	191.1	950.95	270.0	952.62
229.4	951.86	315.0	953.29	132.0	952.84	193.0	950.89		
229.8	951.71	320.0	953.39	134.0	952.84	195.0	950.86		
230.3	951.68			136.0	952.85	197.0	950.79		
231.7	951.72			138.0	952.85	200.0	950.68		
233.0	951.96			140.0	952.89	202.0	950.73		
234.0	952.15			142.7	952.66	204.0	950.76		
235.0	952.32			144.0	952.82	205.2	950.83		
237.0	952.36			145.0	952.68	207.0	950.95		
239.0	952.40			147.0	952.70	209.0	951.14		
240.0	952.43			148.4	952.53	211.0	951.11		
242.0	952.51			149.2	952.45	214.0	951.05		
244.0	952.52			149.6	952.17	217.0	951.01		
246.0	952.46			150.2	952.06	218.4	951.01		
248.0	952.35			150.3	951.82	219.0	951.13		
250.0	952.26			151.2	951.48	220.2	951.08		
252.0	952.24			152.3	951.29	220.7	951.16		
254.0	952.30			154.0	951.28	222.3	951.92		
256.0	952.26			156.0	951.34	222.7	951.81		
258.0	952.25			157.0	951.33	224.0	951.81		
260.0	952.26			157.3	951.21	226.4	951.75		
262.0	952.30			158.2	951.12	227.7	951.81		
264.0	952.38			160.0	951.14	229.5	952.13		
266.0	952.40			162.0	951.15	231.0	952.27		
268.0	952.53			163.2	951.16	233.0	952.23		
270.0	952.61			164.0	951.30	234.0	952.23		
272.0	952.67			166.0	951.33	236.0	952.34		
273.4	952.68			168.0	951.34	238.0	952.40		
274.5	952.74			170.0	951.36	240.0	952.44		
275.4	952.67			172.0	951.34	242.0	952.51		
276.0	952.63			174.0	951.36	244.0	952.50		
277.3	952.65			175.2	951.37	246.0	952.45		
278.0	952.72			175.7	951.13	248.0	952.34		
280.0	952.78			177.0	951.01	250.0	952.28		
283.0	952.95			178.0	950.90	252.0	952.29		
286.0	953.11			179.0	950.97	254.0	952.28		

Table 33. (Continued) Listing of horizontal stations and elevations for cross section PR175
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1992		1992		1993		1993		1993	
28 August		28 August		30 August		30 August		30 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
120.0	952.86	187.0	950.92	100.0	952.76	162.0	951.20	228.0	952.11
122.0	952.79	189.0	950.93	102.0	952.78	164.0	951.22	230.0	952.28
124.0	952.83	191.0	950.94	104.0	952.78	166.0	951.24	230.5	952.39
127.0	952.87	193.0	950.97	106.0	952.82	168.0	951.24	232.4	952.56
130.0	952.78	195.0	950.99	108.0	952.84	169.0	951.12	232.6	952.33
133.0	952.85	197.0	951.01	110.0	952.86	171.0	950.87	232.7	952.33
136.0	952.85	199.0	951.00	112.0	952.79	173.0	950.86	233.0	952.57
139.0	952.90	201.0	951.01	113.5	952.74	175.0	950.83	235.0	952.55
142.0	952.75	203.0	951.07	115.0	952.84	177.0	950.94	237.0	952.58
143.0	952.75	205.0	951.10	117.0	952.87	179.0	950.95	238.0	952.57
144.4	952.86	207.0	951.10	118.0	952.87	181.0	951.04	240.0	952.64
145.4	952.70	209.0	951.06	120.0	952.85	183.0	951.04	242.0	952.68
147.0	952.72	211.0	951.04	122.0	952.80	185.0	951.04	244.0	952.65
148.5	952.51	213.0	951.05	124.0	952.83	187.0	950.98	246.0	952.58
149.3	952.41	215.0	951.00	126.0	952.84	189.0	951.01	248.0	952.48
149.6	952.19	217.0	950.96	128.0	952.86	191.0	951.03	250.0	952.40
150.4	951.95	219.0	951.00	130.0	952.78	193.0	950.99	252.0	952.33
151.0	951.73	221.0	951.11	131.0	952.77	195.0	951.02	254.0	952.39
151.4	951.20	221.4	951.21	133.0	952.84	197.0	951.06	256.0	952.38
152.0	951.10	221.7	951.32	135.0	952.85	199.0	951.07	258.0	952.34
154.0	951.12	222.0	951.39	137.0	952.84	201.0	951.09	260.0	952.35
156.0	951.14	222.4	951.86	139.0	952.89	203.0	951.08	262.0	952.39
157.0	951.13	223.0	951.79	141.0	952.82	205.0	951.08	264.0	952.42
157.4	951.20	225.0	951.98	143.0	952.68	207.0	951.03	265.0	952.40
157.9	951.33	227.0	951.96	144.0	952.83	209.0	951.04	266.0	952.46
159.0	951.38	228.5	951.97	145.3	952.74	211.0	951.09	268.0	952.51
160.3	951.43	230.0	952.14	147.0	952.74	213.0	951.13	269.0	952.66
162.0	951.42	231.6	952.30	148.0	952.68	215.0	951.16	270.0	952.65
164.0	951.38	233.0	952.24	149.0	952.63	215.5	951.28	272.0	952.69
166.0	951.39	234.0	952.21	150.0	952.60	216.0	951.38	274.0	952.72
168.0	951.34	236.0	952.35	151.0	952.24	216.7	951.41	276.0	952.66
169.7	951.34	238.0	952.38	151.1	952.13	217.5	951.35	278.0	952.73
170.5	951.29	240.0	952.44	151.4	952.09	218.5	951.49	280.0	952.75
172.0	951.28	243.0	952.56	151.4	951.92	219.5	951.57	281.6	952.87
174.0	951.31	246.0	952.47	152.0	951.64	219.7	951.68	284.0	953.02
176.2	951.34	249.0	952.30	152.5	951.49	221.0	951.76	286.0	953.10
176.3	951.20	252.0	952.26	154.5	951.51	222.0	951.80	288.0	953.20
177.5	950.95	254.0	952.29	156.0	951.57	223.0	951.90	290.0	953.23
179.0	950.92	257.0	952.23	156.7	951.59	224.5	952.13	295.0	953.21
181.0	950.80	260.0	952.26	156.8	951.50	225.4	952.11	300.0	953.14
183.0	950.90	263.0	952.37	157.9	951.28	226.0	952.05	305.0	953.22
185.0	950.87	266.0	952.39	160.0	951.23	227.0	952.08	310.0	953.21
		269.0	952.60					315.0	953.27
		271.0	952.67					320.0	953.40

Table 33. (Continued) Listing of horizontal stations and elevations for cross section PR175
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1994		1994		1995		1995		1995	
21 September		21 September		30 September		30 September		30 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
120.0	952.86	196.0	950.79	-1.7	953.56	91.0	952.95	161.4	950.98
122.0	952.80	198.0	950.89	-0.7	953.59	94.0	952.98	163.0	950.94
124.0	952.83	201.0	950.90	0.0	953.53	96.0	952.84	165.0	950.90
127.0	952.87	204.0	950.95	1.3	953.52	98.0	952.81	167.0	950.84
130.0	952.79	207.0	950.83	1.4	953.33	99.9	952.83	169.0	950.93
132.0	952.85	210.0	950.92	3.0	952.68	100.0	952.83	171.0	950.98
134.0	952.84	212.0	951.04	4.0	952.50	102.0	952.84	173.0	950.95
138.0	952.86	213.3	951.25	5.0	952.50	104.0	952.85	175.0	950.97
141.0	952.82	213.9	951.35	6.0	952.51	106.0	952.86	177.0	950.83
143.0	952.70	214.3	951.56	7.0	952.58	108.0	952.89	179.0	950.81
145.4	952.86	215.0	951.60	8.7	952.67	110.0	952.89	181.0	950.99
146.4	952.77	217.0	951.69	10.5	952.54	112.0	952.88	183.0	951.01
147.0	952.75	218.0	951.79	12.0	952.72	114.0	952.88	185.0	950.91
148.5	952.65	219.7	951.93	13.0	952.82	116.0	952.90	187.0	951.03
149.9	952.59	220.3	952.11	15.0	952.82	118.0	952.92	189.0	951.08
150.4	952.49	221.0	952.05	18.0	952.88	120.0	952.91	191.0	951.15
151.0	951.21	221.6	951.95	20.0	952.86	122.0	952.87	193.0	951.22
151.8	951.13	222.4	952.03	22.0	952.87	124.0	952.87	195.0	951.29
152.5	951.16	223.0	951.97	24.0	952.77	126.0	952.90	197.0	951.34
155.0	951.24	224.0	952.16	26.0	952.75	128.0	952.91	199.0	951.29
155.8	951.24	225.0	952.24	28.0	952.80	130.0	952.87	201.0	951.33
155.9	951.17	226.0	952.14	31.0	952.82	132.0	952.90	202.5	951.33
157.5	951.13	228.0	952.15	34.0	952.87	134.0	952.90	203.8	951.40
159.0	951.14	229.2	952.28	37.0	952.87	136.0	952.91	205.0	951.51
161.0	951.24	229.4	952.35	39.5	952.85	138.0	952.91	207.0	951.59
163.0	951.35	232.0	952.55	40.8	952.78	140.0	952.93	209.0	951.63
164.5	951.36	232.6	952.45	43.0	952.96	142.0	952.88	211.0	951.70
166.0	951.34	233.5	952.61	46.0	952.94	144.0	952.91	213.0	951.78
168.0	951.39	236.0	952.60	49.0	952.95	146.0	952.95	215.0	951.84
170.0	951.41	239.0	952.62	52.0	952.95	148.0	953.03	217.0	951.90
172.0	951.42	242.0	952.68	55.0	952.94	148.8	953.06	219.0	951.92
173.6	951.35	245.0	952.63	58.0	952.93	149.8	952.62	221.0	951.95
174.4	951.15	248.0	952.50	61.0	952.93	150.8	951.87	223.0	952.05
174.9	951.07	250.0	952.41	64.0	952.89	151.7	951.78	224.5	952.26
175.5	950.93	253.0	952.38	67.0	952.86	152.4	951.90	226.0	952.25
177.0	950.92	256.0	952.40	70.0	952.87	152.8	951.91	228.0	952.22
180.0	950.94	259.0	952.35	73.0	952.88	153.6	951.63	229.2	952.27
182.0	950.84	262.0	952.38	76.0	952.89	155.0	951.67	230.4	952.52
185.0	950.84	266.0	952.42	79.0	952.89	157.3	951.74	231.5	953.01
188.0	950.84	268.0	952.48	82.0	952.89	157.4	951.54	233.0	953.11
191.0	950.85	270.0	952.69	85.0	952.92	158.0	951.47	235.0	953.10
194.0	950.83			88.0	952.92	160.0	951.41	237.0	953.12

Table 33. (Continued) Listing of horizontal stations and elevations for cross section PR175
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1995		1996		1996		1997		1997	
30 September		23 October		23 October		17 September		17 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
239.0	953.02	99.9	952.83	200.0	951.27	99.9	952.82	211.0	951.86
241.0	953.06	103.0	952.85	202.2	951.40	124.0	952.89	212.0	951.86
243.0	952.96	106.0	952.88	204.0	951.44	125.0	952.93	214.0	951.94
245.0	952.82	109.0	952.89	206.0	951.48	128.0	952.95	217.0	952.05
247.0	952.81	112.0	952.87	208.0	951.66	131.0	952.91	220.0	952.14
248.0	952.75	113.5	952.85	211.0	951.70	134.0	952.97	222.0	952.13
250.0	952.81	115.0	952.92	214.0	951.81	136.0	952.97	222.8	952.13
251.0	952.84	118.0	952.94	217.0	951.87	138.0	953.00	224.0	952.37
252.0	952.90	121.0	952.88	220.0	951.91	141.0	952.98	225.3	952.51
253.6	952.93	124.0	952.90	222.5	952.02	143.0	952.82	226.0	952.48
254.0	952.70	127.0	952.96	223.7	952.24	144.5	952.99	226.7	952.59
255.2	952.62	130.0	952.90	224.7	952.29	147.0	953.01	228.0	952.57
256.5	952.69	133.0	952.95	225.0	952.23	148.0	952.97	229.3	952.63
258.0	952.68	136.0	952.95	226.0	952.26	149.0	952.85	230.1	952.75
259.0	952.47	138.5	953.00	227.5	952.38	149.7	952.50	231.0	952.98
261.0	952.56	140.0	952.98	227.8	952.54	150.3	951.27	233.0	952.99
263.0	952.59	143.0	952.86	229.0	952.53	151.8	950.69	234.0	952.98
265.0	952.66	145.0	952.96	231.0	952.86	153.5	950.84	235.5	952.87
267.0	952.73	147.0	953.02	231.3	952.95	155.0	950.87	238.0	953.15
269.0	952.77	149.0	952.92	233.0	953.02	158.0	950.91	240.0	953.01
269.5	952.87	149.4	952.84	235.0	952.89	161.0	950.87	242.0	952.97
271.0	952.80	150.6	951.81	236.0	953.10	164.0	950.98	245.0	952.92
272.0	952.86	152.5	951.69	238.0	953.11	167.0	951.08	248.0	952.74
274.0	952.87	155.0	951.87	240.0	953.04	170.0	951.12	250.0	952.83
275.0	952.91	157.0	951.70	242.0	952.99	173.0	951.01		
276.5	952.72	158.4	951.83	243.0	952.91	175.5	950.91		
278.0	952.80	159.0	951.64	246.0	952.82	178.0	951.01		
280.0	952.84	160.0	951.54	248.0	952.75	180.0	951.20		
282.0	952.95	163.0	951.56	249.0	952.75	181.0	951.17		
284.0	953.03	166.0	951.53	250.0	952.84	182.0	951.26		
286.0	953.13	167.0	951.49			183.8	951.59		
288.0	953.21	167.8	951.41			185.0	951.62		
290.0	953.23	170.0	951.02			187.0	951.70		
292.0	953.22	173.0	950.98			189.0	951.80		
295.0	953.22	176.0	951.15			192.0	951.85		
300.0	953.15	179.0	951.18			194.0	951.85		
305.0	953.24	182.0	951.11			196.0	951.85		
310.0	953.22	185.0	951.07			198.0	951.83		
315.0	953.26	188.0	951.05			200.0	951.85		
320.0	953.39	191.0	951.10			203.0	951.85		
		194.0	951.06			206.0	951.87		
		197.0	951.07			209.0	951.85		

Table 33. (Continued) Listing of horizontal stations and elevations for cross section PR175

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1998		1998	
27 September		27 September	
Sta.	Elev.	Sta.	Elev.
100.0	952.83	209.0	951.79
103.0	952.85	210.7	951.74
106.0	952.88	212.3	951.87
109.0	952.90	213.1	952.07
112.0	952.90	216.0	952.15
115.0	952.91	219.0	952.17
118.0	952.94	222.0	952.22
121.0	952.88	224.0	952.40
124.0	952.89	226.0	952.47
125.0	952.93	228.0	952.59
128.0	952.96	230.0	952.70
131.0	952.94	231.5	952.93
134.0	952.97	233.0	952.99
137.0	952.97	235.0	952.95
140.0	953.00	236.0	953.14
143.0	952.86	238.0	953.09
146.0	952.97	240.0	953.05
147.7	952.89	243.0	952.94
148.3	952.69	246.0	952.85
148.3	951.98	248.5	952.76
149.3	951.63	250.0	952.84
151.3	950.70	300.0	953.15
154.0	950.86	320.0	953.39
157.0	950.90		
160.0	951.10		
163.0	951.07		
166.0	951.19		
169.0	951.25		
172.0	951.21		
175.0	951.06		
178.0	951.16		
181.0	951.21		
184.0	951.43		
187.0	951.51		
189.0	951.62		
192.0	951.77		
195.0	951.85		
198.0	951.86		
200.0	951.86		
202.3	951.86		
203.0	951.93		
206.0	951.87		

Description of Cross Section PR180

Location: Township 6 South/Range 50 East--section 12

U. S. Geological Survey quadrangle (1:24,000): Lonesome Peak

Landowners--left bank: EB Ranch

--right bank: U. S. Government

Access: Left bank

Permission from: Dick Wilson

Distance from Moorhead Gaging Station: 63.10 kilometers

Azimuth of Section (degrees magnetic): 103

Reference Monuments

[Monuments at stations -40.0 and -62.0 were closest to leveling instrument; brass circular plate benchmark was lost to the river after 1996]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.18 meter above 1998 ground level and about 2-3 meters upstream from a cottonwood tree	-62.0	45°19'51.46"	105°32'38.16"	0.615	0.711	950.15
1/2-inch-rebar; bent, 0.14 meter above 1998 ground level	-40.0					949.99
1/2-inch-rebar; 0.12 meter above 1998 ground level	73.0	45°19'49.49"	105°32'32.61"	0.241	0.559	949.13
1/2-inch-rebar; at 1978 ground level; could not find pin in 1998	102.0					948.91
1/2-inch-rebar; 0.03 meter above 1998 ground level; 0.40 meter upstream from section	103.4					948.96
1/2-inch-rebar; 0.22 meter above 1998 ground level	111.3	45°19'48.94"	105°32'31.04"	0.339	0.508	949.77

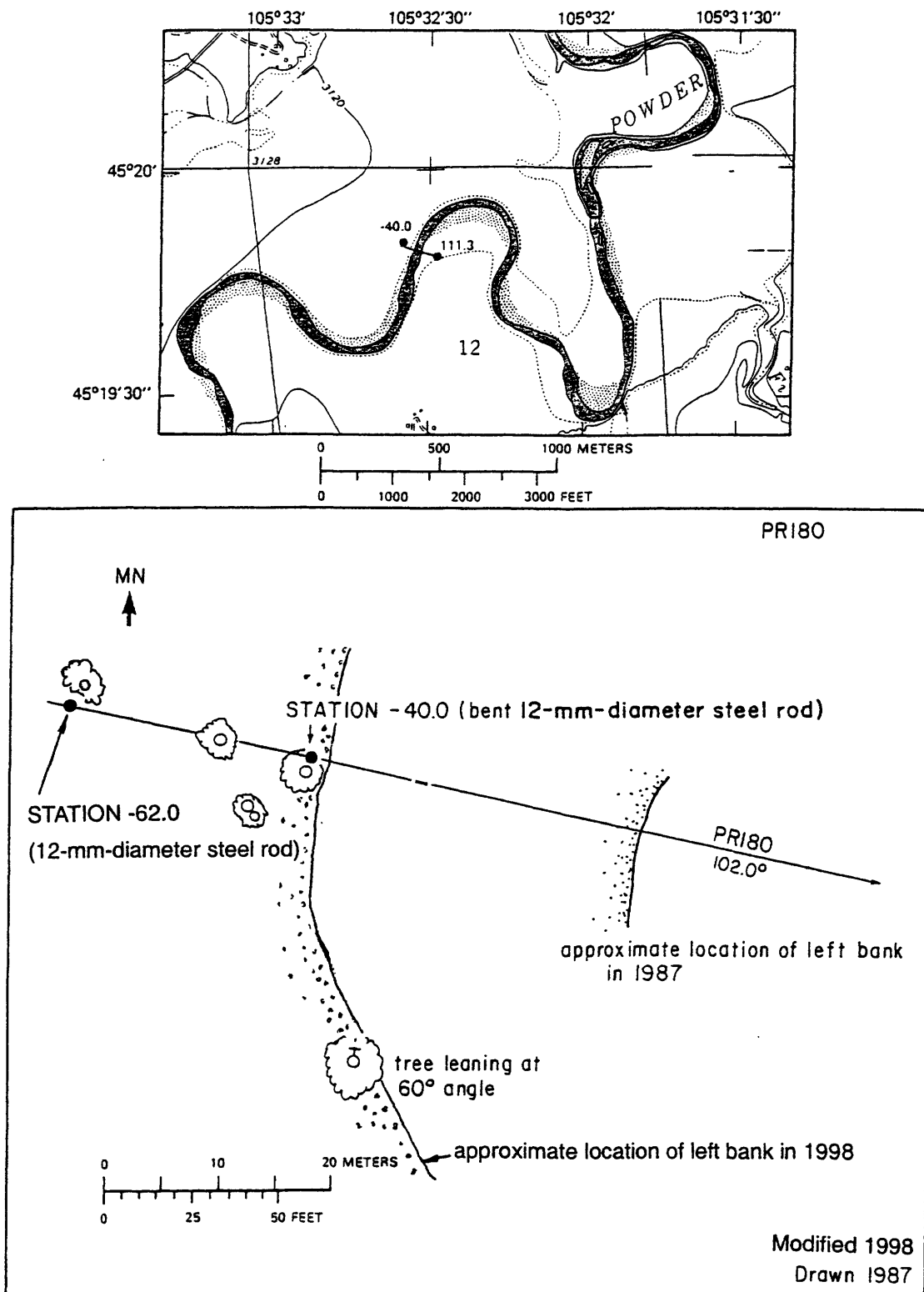


Figure 92. Upper: Location of cross section PR180 and the left and right bank reference monuments in the Lonesome Peak quadrangle. Bench mark PR180 was lost to the river in 1996. Lower: Location of the reference monuments on the left bank. MN is magnetic north.

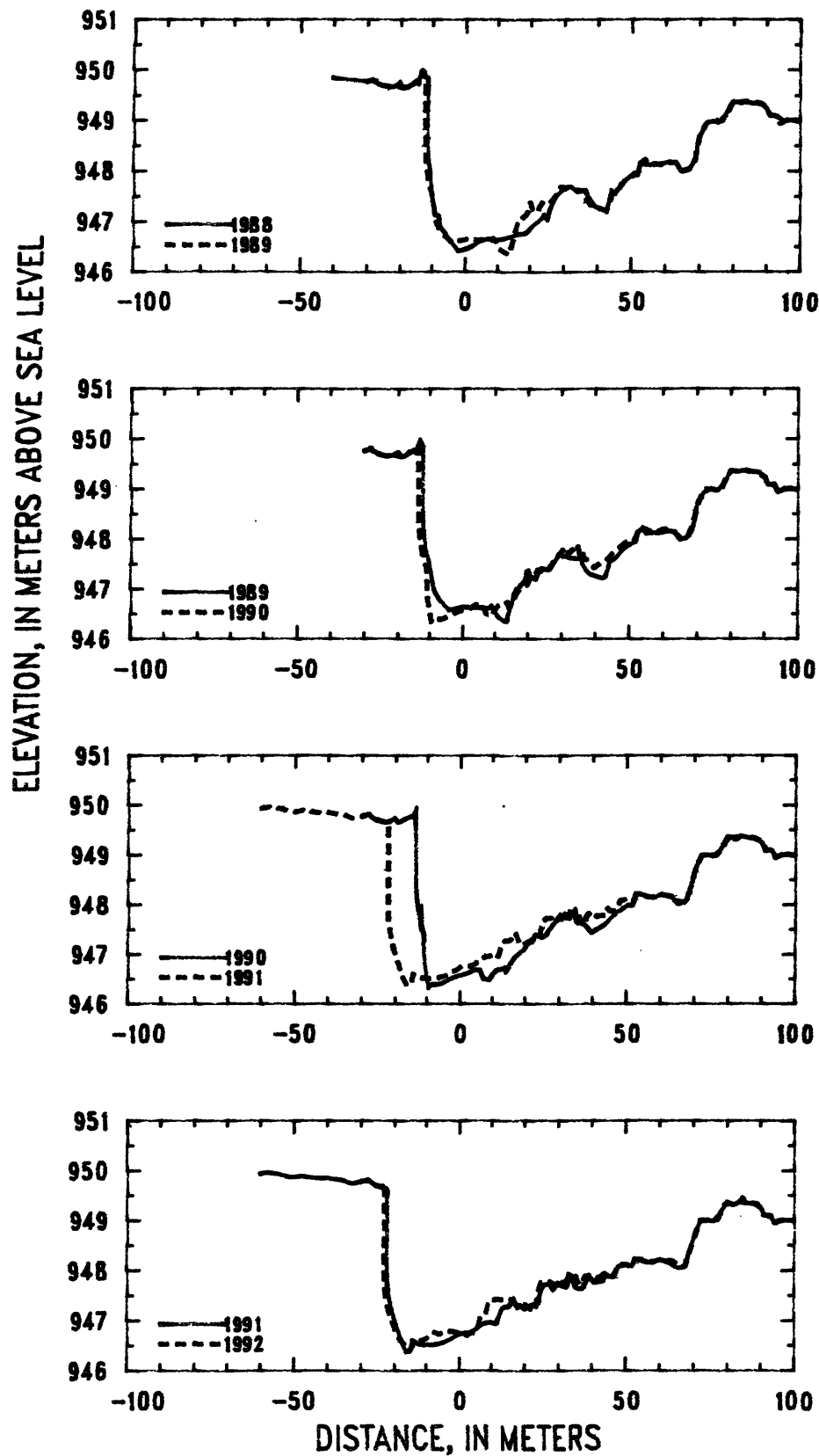


Figure 93. Profiles of cross section PR180 from 1988 to 1992.

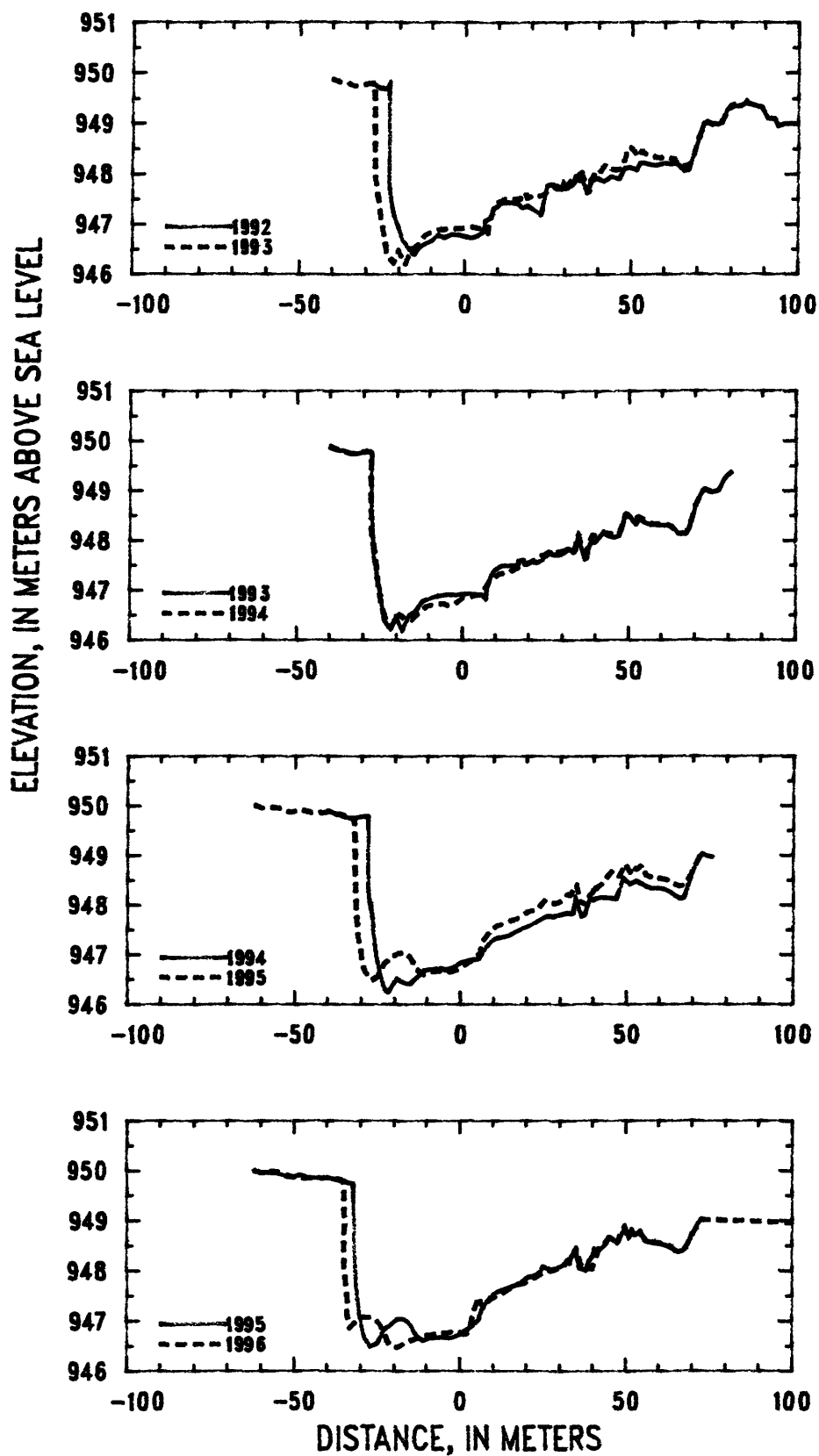


Figure 94. Profiles of cross section PR180 from 1992 to 1996.

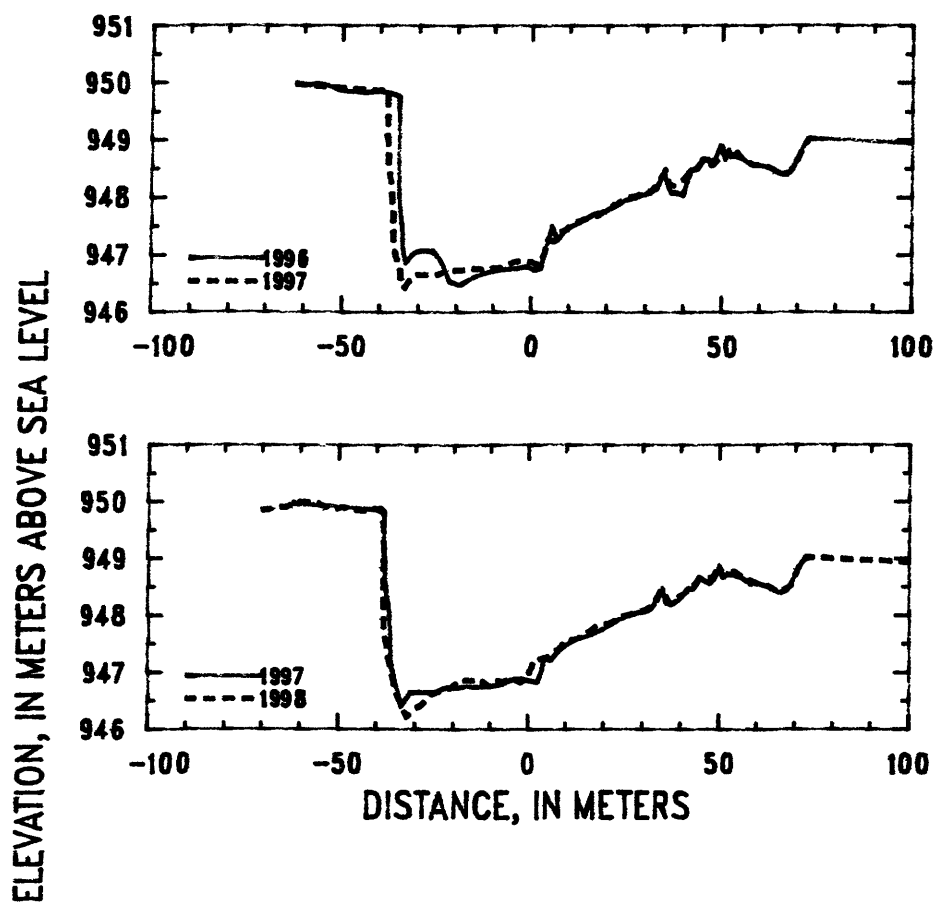


Figure 95. Profiles of cross section PR180 from 1996 to 1998.

Table 34. Listing of horizontal stations and elevations for cross section PR180

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1989		1990		1990	
23 September		23 September		23 September		22 September		22 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-30.0	949.76	24.0	947.42	94.0	948.94	-30.0	949.77	26.0	947.39
-28.0	949.80	26.0	947.40	96.0	949.01	-28.0	949.82	26.5	947.46
-27.0	949.76	28.0	947.55	98.0	949.00	-26.0	949.71	28.0	947.59
-25.0	949.69	29.0	947.69	100.0	948.99	-24.0	949.67	29.0	947.69
-23.0	949.66	31.0	947.68	103.5	948.91	-22.0	949.66	30.2	947.79
-21.0	949.69	33.0	947.62	111.3	949.55	-20.0	949.74	30.6	947.75
-19.0	949.64	35.0	947.61			-19.0	949.65	31.6	947.82
-17.0	949.69	36.0	947.61			-17.0	949.72	32.0	947.73
-15.0	949.77	36.4	947.47			-15.0	949.78	32.5	947.73
-14.3	949.74	38.0	947.32			-14.3	949.75	32.9	947.77
-13.0	949.98	40.0	947.27			-13.6	949.88	34.0	947.82
-12.2	949.86	42.0	947.21			-13.4	948.36	34.7	947.90
-12.1	948.23	42.9	947.24			-13.2	948.11	35.7	947.63
-11.0	947.71	44.3	947.55			-12.1	947.62	36.0	947.63
-10.3	947.59	46.0	947.62			-11.9	947.78	36.3	947.71
-9.1	947.16	48.0	947.80			-11.6	947.50	36.7	947.63
-8.5	946.96	50.0	947.88			-11.0	947.43	38.0	947.58
-7.5	946.84	51.9	947.95			-10.8	946.86	39.6	947.43
-6.0	946.71	52.4	948.13			-9.4	946.33	41.0	947.49
-4.0	946.58	54.0	948.22			-8.5	946.39	43.0	947.56
-2.0	946.61	55.0	948.11			-6.0	946.40	45.0	947.71
0.0	946.64	57.0	948.13			-4.0	946.47	47.0	947.83
2.0	946.63	59.0	948.11			-2.0	946.53	49.0	947.94
4.0	946.63	61.0	948.17			0.0	946.58	50.5	947.99
6.0	946.63	63.0	948.16			2.0	946.60	51.6	947.98
8.0	946.61	65.0	947.99			4.0	946.69	52.0	948.05
9.0	946.66	67.0	948.02			6.0	946.69	52.6	948.20
11.0	946.44	68.0	948.12			7.0	946.50	54.0	948.22
13.0	946.36	68.7	948.20			9.0	946.48	56.0	948.16
13.7	946.35	70.0	948.67			11.0	946.66	58.0	948.14
15.7	946.85	72.0	948.93			13.0	946.71	60.0	948.20
15.8	946.90	74.0	949.01			14.0	946.74	62.0	948.18
16.5	947.01	76.0	948.97			14.3	946.66	63.0	948.18
17.0	947.00	78.0	949.11			16.0	946.85	64.0	948.09
18.0	947.10	80.0	949.37			16.8	946.95	65.0	948.01
19.1	947.16	82.0	949.34			18.0	947.01	66.0	948.03
19.4	947.23	84.0	949.38			19.8	947.10	67.4	948.06
19.6	947.36	86.0	949.34			20.6	947.22	69.0	948.39
20.0	947.38	88.0	949.35			22.0	947.25	69.3	948.44
20.5	947.25	90.0	949.25			22.6	947.38	70.0	948.67
22.3	947.20	91.0	949.10			23.0	947.40	71.0	948.82
22.7	947.31	93.0	949.09			24.6	947.34	72.1	948.99

Table 34. (Continued) Listing of horizontal stations and elevations for cross section PR180
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1990		1991		1991		1991		1992	
22 September		1 September		1 September		1 September		28 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
74.0	949.00	-60.0	949.93	13.2	947.23	69.3	948.43	-30.0	949.78
76.0	948.97	-58.0	949.96	13.9	947.28	70.4	948.74	-28.0	949.81
77.0	949.01	-56.0	949.95	15.3	947.28	72.0	948.99	-26.0	949.70
79.0	949.26	-54.0	949.92	16.8	947.44	74.0	949.00	-25.0	949.70
80.0	949.37	-52.0	949.88	18.0	947.26	76.0	948.98	-24.0	949.68
82.0	949.35	-50.0	949.86	18.8	947.30	78.0	949.13	-23.4	949.68
84.0	949.38	-48.0	949.89	20.0	947.23	80.0	949.37	-22.9	949.76
86.0	949.35	-46.0	949.87	22.0	947.31	82.0	949.31	-22.9	947.82
88.0	949.32	-44.0	949.85	24.0	947.35	84.0	949.37	-22.5	947.51
90.0	949.24	-42.0	949.83	24.9	947.65	86.0	949.35	-21.5	947.17
91.0	949.09	-40.0	949.86	26.0	947.73	88.0	949.34	-20.5	947.00
93.0	949.09	-38.0	949.82	27.5	947.73	90.0	949.26	-19.0	946.70
94.0	948.94	-36.0	949.82	28.5	947.62	91.0	949.11	-17.0	946.53
96.0	949.00	-33.0	949.74	29.6	947.73	93.0	949.09	-16.0	946.42
98.0	949.01	-30.0	949.77	31.0	947.70	94.0	948.95	-15.0	946.39
		-28.0	949.82	32.6	947.67	96.0	949.01	-14.0	946.50
		-26.0	949.71	32.9	947.73	98.0	949.00	-12.0	946.60
		-24.0	949.67	33.0	947.85	100.0	948.99	-10.0	946.64
		-23.0	949.65	34.0	947.89	102.0	948.92	-8.0	946.78
		-22.2	949.61	35.2	947.65	104.0	948.95	-6.0	946.72
		-22.4	947.78	36.0	947.63	106.0	949.07	-4.0	946.79
		-22.2	947.74	37.5	947.64	108.0	949.34	-2.0	946.79
		-21.5	947.39	38.4	947.80	111.3	949.55	0.0	946.75
		-20.0	947.01	39.5	947.85			2.0	946.70
		-18.2	946.65	40.8	947.75			4.0	946.76
		-16.4	946.37	42.0	947.77			5.7	946.85
		-15.4	946.40	43.3	947.78			6.0	946.99
		-14.8	946.44	44.1	947.93			6.2	947.06
		-14.3	946.60	45.0	947.87			8.0	947.13
		-12.0	946.52	46.5	947.87			8.8	947.31
		-10.0	946.52	48.0	948.08			10.0	947.35
		-8.0	946.51	50.0	948.12			10.6	947.42
		-6.0	946.53	52.0	948.08			12.0	947.43
		-4.0	946.58	52.7	948.22			13.5	947.44
		-2.2	946.65	54.0	948.21			15.0	947.42
		0.0	946.75	56.0	948.16			16.0	947.42
		2.0	946.75	58.0	948.15			17.5	947.32
		4.0	946.78	60.0	948.21			19.0	947.36
		6.0	946.89	62.0	948.19			21.0	947.27
		8.0	946.96	64.0	948.09			22.9	947.18
		10.0	946.97	66.0	948.04			23.1	947.23
		11.5	946.93	67.4	948.07			24.7	947.77

Table 34. (Continued) Listing of horizontal stations and elevations for cross section PR180
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1992		1992		1993		1993		1993	
28 August		28 August		31 August		31 August		31 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
26.0	947.80	84.6	949.45	-40.0	949.87	19.0	947.52	75.0	948.96
28.0	947.77	85.0	949.39	-38.0	949.82	21.0	947.58	77.0	949.00
29.0	947.71	87.0	949.35	-36.0	949.82	22.3	947.55	79.0	949.27
29.6	947.83	89.0	949.33	-34.0	949.74	24.0	947.60	81.0	949.38
30.0	947.72	91.0	949.10	-32.0	949.75	26.5	947.77		
31.0	947.73	93.0	949.09	-31.0	949.75	27.0	947.72		
31.7	947.84	94.0	948.94	-30.0	949.77	29.0	947.71		
32.0	947.77	96.0	949.00	-29.0	949.80	31.0	947.78		
32.7	947.82	98.0	949.00	-27.4	949.77	31.6	947.84		
33.4	947.96	100.0	948.98	-27.3	948.40	32.6	947.82		
34.2	947.96	102.0	948.92	-27.0	947.86	33.3	947.76		
35.0	947.91	104.0	948.95	-26.4	947.54	33.9	947.80		
36.2	947.72	106.0	949.09	-26.2	947.50	34.8	948.11		
37.5	947.75	108.0	949.34	-25.5	947.10	36.9	947.62		
38.0	947.88	111.3	949.56	-25.2	947.07	37.5	947.65		
40.0	947.92			-23.5	946.38	38.0	947.85		
41.0	947.86			-21.5	946.22	39.0	948.00		
42.0	947.84			-20.0	946.47	39.8	947.97		
44.0	947.95			-18.0	946.20	41.0	948.06		
46.4	947.89			-16.0	946.50	42.3	948.18		
48.0	948.12			-14.0	946.57	43.5	948.10		
50.0	948.12			-12.0	946.78	45.0	948.07		
51.6	948.07			-10.0	946.83	46.0	948.07		
52.7	948.21			-8.0	946.87	47.0	948.10		
54.0	948.22			-6.0	946.89	48.0	948.32		
56.0	948.17			-4.0	946.92	48.6	948.51		
58.0	948.16			-2.0	946.89	50.0	948.50		
60.0	948.21			0.0	946.92	52.0	948.32		
62.0	948.20			2.0	946.93	53.0	948.45		
64.0	948.19			4.0	946.91	55.0	948.34		
66.0	948.05			6.0	946.90	57.0	948.33		
67.4	948.07			7.0	946.82	59.0	948.31		
69.0	948.39			7.5	947.07	61.0	948.30		
71.0	948.82			8.2	947.19	63.0	948.29		
72.0	949.00			8.7	947.32	65.0	948.14		
74.0	949.01			10.0	947.42	67.0	948.14		
76.0	948.97			12.0	947.49	68.0	948.20		
77.0	949.01			14.0	947.49	69.0	948.40		
79.0	949.28			16.0	947.50	70.0	948.65		
80.0	949.36			16.9	947.50	71.0	948.82		
82.0	949.33			17.1	947.60	72.0	948.95		
84.0	949.38			18.5	947.61	73.0	949.02		

Table 34. (Continued) Listing of horizontal stations and elevations for cross section PR180
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1994		1994		1995		1995		1996	
18 September		18 September		30 September		30 September		22 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-40.0	949.89	36.5	947.76	-62.0	950.00	17.0	947.71	-62.0	949.99
-37.0	949.81	37.4	947.79	-60.0	949.95	19.0	947.78	-59.0	949.95
-34.0	949.74	38.0	947.93	-58.0	949.96	20.5	947.87	-56.5	949.99
-32.0	949.75	39.0	948.12	-55.0	949.95	22.0	947.88	-54.0	949.97
-30.0	949.78	40.0	948.10	-53.0	949.89	23.6	947.94	-51.0	949.87
-27.8	949.79	42.0	948.15	-51.0	949.86	25.0	948.08	-46.5	949.84
-27.7	948.24	44.0	948.15	-48.0	949.91	27.0	948.02	-44.0	949.83
-27.3	948.05	46.0	948.13	-46.0	949.86	29.0	948.04	-42.0	949.85
-27.2	948.02	46.8	948.12	-44.0	949.84	31.0	948.11	-40.0	949.86
-26.6	947.77	49.0	948.54	-42.0	949.85	32.3	948.22	-37.0	949.82
-25.5	947.08	51.0	948.42	-40.0	949.87	33.0	948.20	-35.0	949.76
-24.5	946.71	53.0	948.48	-38.0	949.82	34.6	948.41	-34.9	948.02
-22.7	946.29	55.0	948.40	-36.0	949.83	35.0	948.40	-34.0	947.43
-21.7	946.24	57.0	948.33	-34.0	949.74	36.0	948.06	-33.8	947.06
-20.0	946.42	60.0	948.33	-32.1	949.74	38.0	948.00	-33.0	946.86
-19.0	946.52	62.0	948.31	-31.4	947.72	39.0	948.20	-31.0	947.03
-17.0	946.42	64.0	948.21	-30.4	947.15	40.0	948.26	-29.0	947.08
-15.0	946.41	66.0	948.13	-29.0	946.67	40.6	948.41	-26.0	947.07
-14.0	946.48	67.3	948.14	-27.0	946.48	41.0	948.33	-24.2	946.93
-11.7	946.60	69.0	948.44	-25.0	946.55	42.2	948.40	-21.5	946.53
-11.0	946.67	70.5	948.76	-23.0	946.82	43.5	948.48	-19.0	946.47
-8.5	946.70	72.0	948.96	-21.0	946.91	45.3	948.66	-16.0	946.59
-5.5	946.73	73.0	949.02	-19.0	947.03	47.5	948.55	-13.0	946.66
-4.4	946.69	76.0	948.96	-17.0	947.04	49.5	948.82	-10.0	946.71
-2.5	946.72			-15.0	946.95	51.0	948.66	-7.0	946.75
-1.8	946.75			-13.0	946.69	51.7	948.78	-4.0	946.76
0.0	946.84			-11.0	946.60	53.0	948.71	-1.0	946.80
3.0	946.88			-9.0	946.65	54.5	948.79	1.0	946.73
5.6	946.92			-7.0	946.66	56.0	948.59	2.5	946.76
8.0	947.18			-5.0	946.68	58.0	948.55	5.5	947.48
11.0	947.33			-3.0	946.65	60.0	948.53	7.0	947.26
14.0	947.36			-1.0	946.69	62.0	948.51	9.0	947.42
17.0	947.47			1.0	946.78	64.0	948.43	11.0	947.50
20.0	947.55			3.0	946.85	66.0	948.37	13.0	947.55
23.0	947.66			5.0	946.98	67.5	948.39	15.0	947.64
26.0	947.77			5.8	947.02	68.5	948.48	17.0	947.72
28.0	947.76			6.4	947.17	70.0	948.68	19.0	947.74
30.5	947.81			7.0	947.30	71.0	948.82	21.0	947.80
32.0	947.85			9.0	947.45	72.0	948.96	23.0	947.88
33.0	947.82			11.0	947.58	73.0	949.02	25.0	947.95
33.8	947.83			13.0	947.61			27.0	947.99
34.6	948.13			15.0	947.67			29.0	948.03

Table 34. (Continued) Listing of horizontal stations and elevations for cross section PR180
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1997		1997		1998		1998	
22 October		22 September		22 September		24 September		24 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
31.0	948.08	-62.0	949.97	40.0	948.30	-70.0	949.86	10.0	947.56
32.3	948.18	-40.0	949.86	42.0	948.47	-68.0	949.87	12.5	947.58
33.0	948.14	-39.0	949.89	43.3	948.47	-66.0	949.91	15.0	947.65
35.0	948.44	-38.0	949.82	45.0	948.65	-64.0	949.90	18.0	947.81
36.3	948.14	-38.0	949.05	47.5	948.55	-62.0	949.98	21.0	947.85
37.0	948.08	-37.8	948.98	49.0	948.67	-59.0	950.01	24.0	947.96
38.0	948.08	-37.6	948.49	50.0	948.85	-57.0	949.98	27.0	948.03
40.0	948.03	-37.0	948.28	51.0	948.69	-55.0	949.95	30.0	948.07
42.0	948.47	-36.4	947.75	53.0	948.73	-53.0	949.90	33.0	948.18
43.3	948.49	-36.3	947.18	56.0	948.66	-51.0	949.86	35.0	948.45
45.0	948.66	-35.8	947.04	58.0	948.55	-49.0	949.91	37.5	948.21
46.5	948.66	-33.6	946.42	61.0	948.56	-47.0	949.87	40.0	948.34
47.4	948.56	-31.0	946.64	64.0	948.45	-43.6	949.84	43.0	948.49
49.5	948.88	-28.0	946.65	66.0	948.38	-41.0	949.88	45.0	948.68
50.8	948.68	-25.0	946.64	68.0	948.44	-40.0	949.87	48.0	948.65
51.7	948.81	-22.0	946.75	70.0	948.68	-38.2	949.80	50.0	948.86
52.4	948.70	-19.0	946.73	72.0	948.94	-38.1	947.71	51.0	948.67
54.0	948.78	-16.0	946.76	73.0	949.02	-37.3	947.45	54.0	948.77
56.0	948.62	-13.0	946.75			-36.8	947.24	57.0	948.63
58.0	948.56	-10.0	946.76			-35.0	946.67	60.0	948.57
60.0	948.55	-7.0	946.79			-33.0	946.34	63.0	948.50
63.0	948.50	-4.0	946.88			-32.0	946.21	66.0	948.39
65.0	948.40	-1.0	946.88			-30.0	946.35	69.0	948.53
67.0	948.40	2.3	946.81			-28.0	946.44	71.0	948.85
68.3	948.46	3.6	947.04			-26.0	946.60	73.0	949.02
70.0	948.69	4.1	947.26			-24.0	946.67	103.4	948.93
72.0	948.96	6.0	947.22			-22.0	946.67	111.3	949.55
73.0	949.02	8.0	947.39			-20.0	946.77		
103.4	948.94	11.0	947.52			-18.0	946.88		
111.3	949.55	14.0	947.61			-16.0	946.86		
		17.0	947.67			-14.0	946.88		
		20.0	947.77			-12.0	946.83		
		23.0	947.90			-10.0	946.75		
		26.0	948.00			-8.0	946.85		
		29.0	948.06			-6.0	946.84		
		31.0	948.07			-4.0	946.91		
		33.0	948.17			-2.0	946.82		
		34.2	948.34			0.0	946.94		
		35.3	948.46			1.5	947.22		
		36.3	948.23			2.5	947.22		
		37.8	948.19			5.0	947.27		
		39.0	948.26			7.5	947.38		

Description of Cross Section PR183

Location: Township 6 South/Range 50 East--section 1

U. S. Geological Survey quadrangle (1:24,000): Lonesome Peak

Landowners--left bank: EB Ranch

--right bank: EB Ranch

Access: Left bank

Permission from: Dick Wilson

Distance from Moorhead Gaging Station: 67.85 kilometers

Azimuth of Section (degrees magnetic): 059

Reference Monuments

[Monuments at stations 100.0 and 101.1 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; 0.17 meter above 1998 ground level	-6.9	45°20'32.09"	105°32'16.66"	0.311	0.685	945.95
1/2-inch-rebar; 0.05 meter above 1998 ground level	0.0					945.67
1/2-inch-rebar; at 1998 ground level	100.0					945.68
1/2-inch-rebar; 0.10 meter above 1998 ground level	101.1	45°20'33.12	105°32'11.92	0.688	0.602	945.86
Benchmark--brass circular plate; slightly off section	~127.9	45°20'33.33"	105°32'10.76"	0.531	0.504	945.89

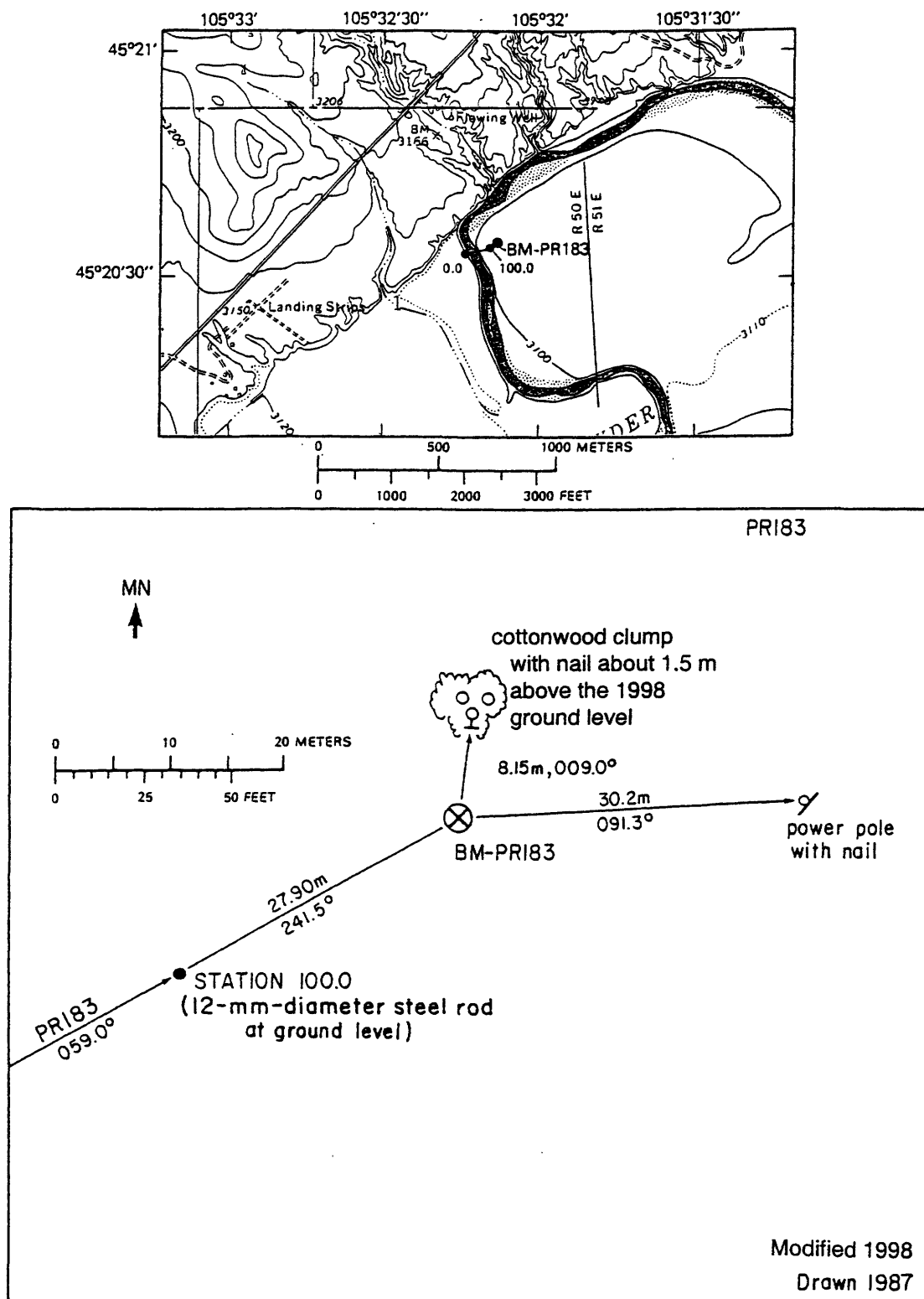


Figure 96. Upper: Location of cross section PR183, bench mark BM-PR183, and the left and right bank reference monuments in the Lonesome Peak quadrangle. Lower: Location of the reference monuments on the left bank. MN is magnetic north.

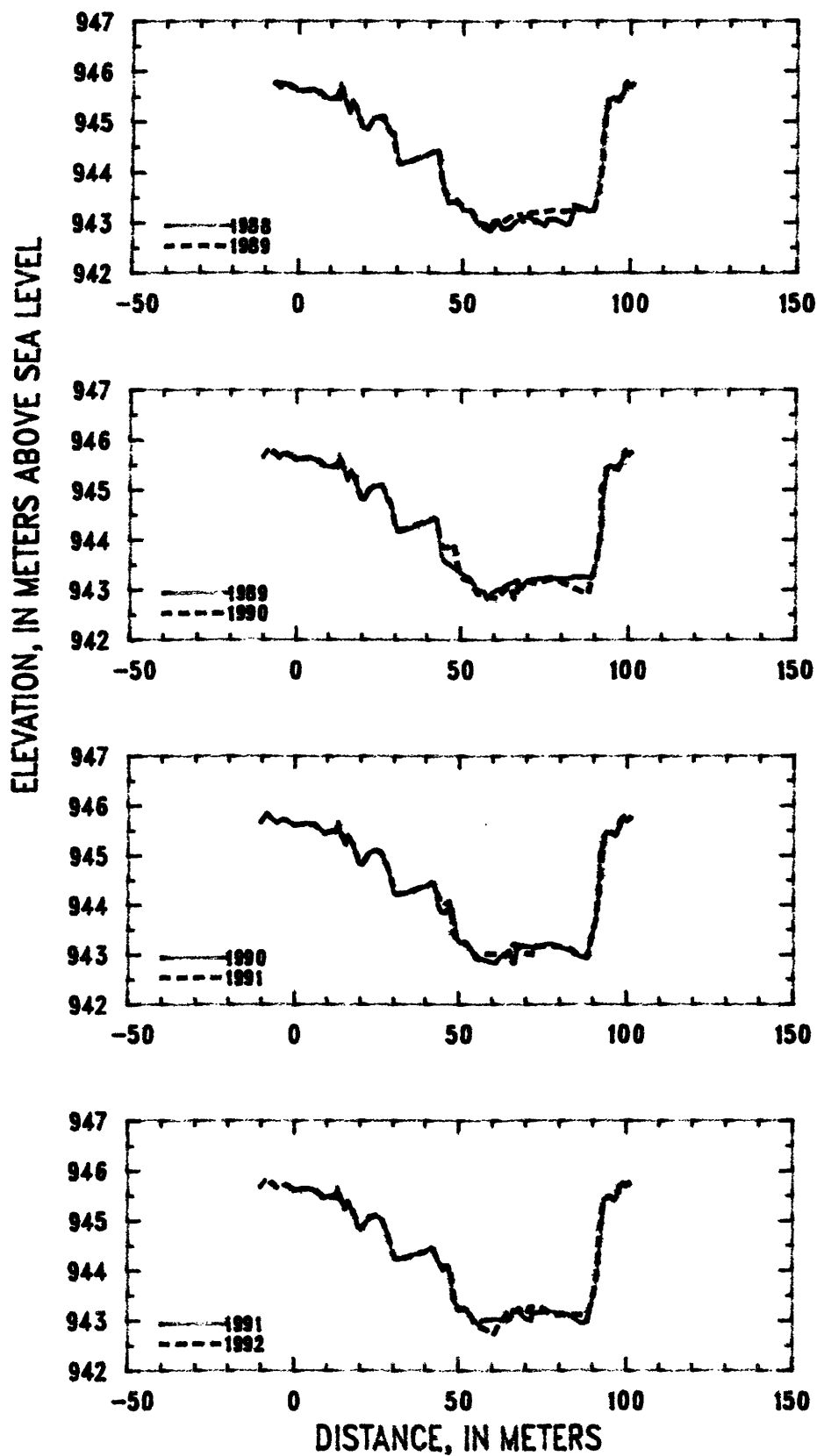


Figure 97. Profiles of cross section PR183 from 1988 to 1992.

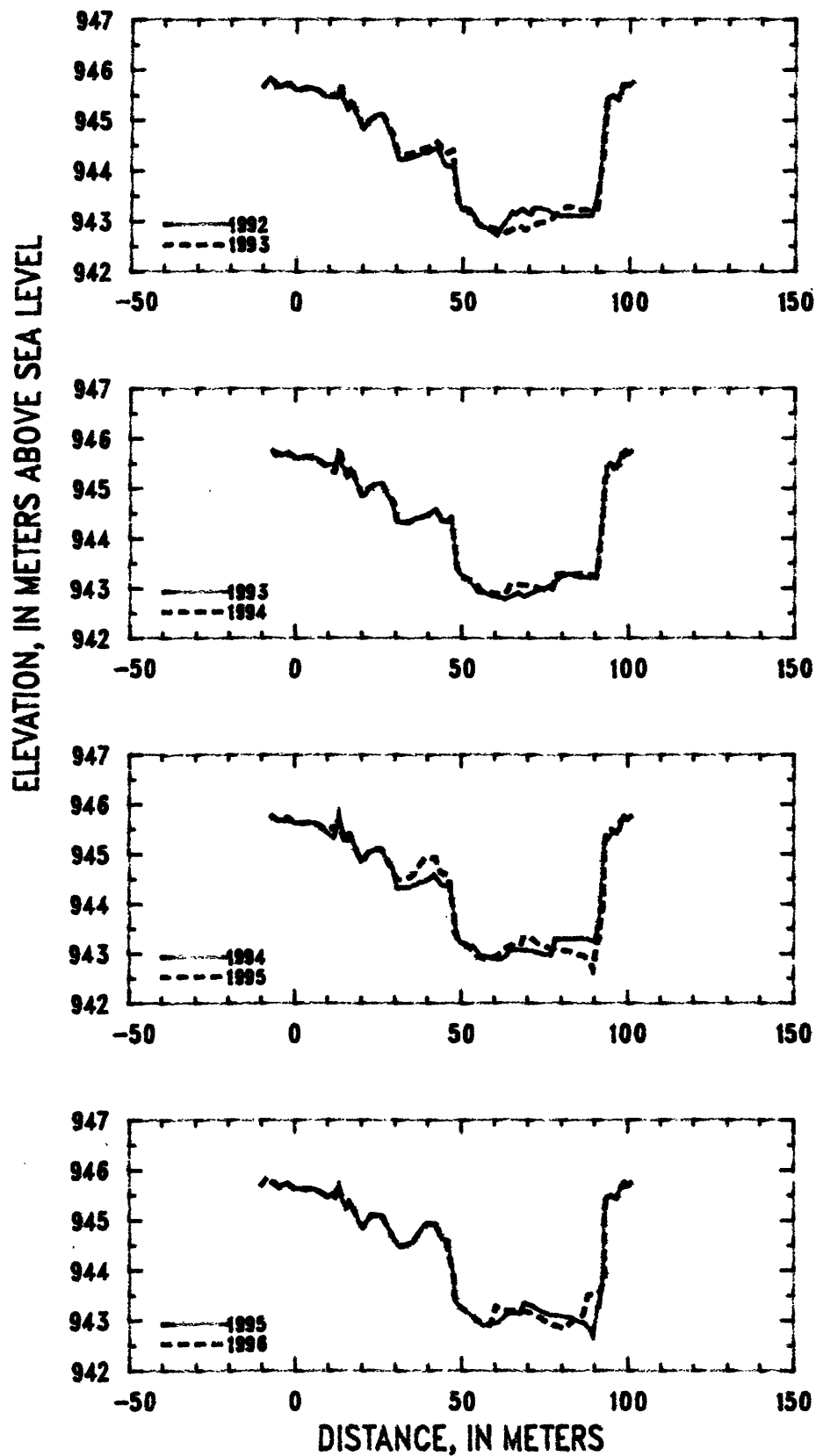


Figure 98. Profiles of cross section PR183 from 1992 to 1996.

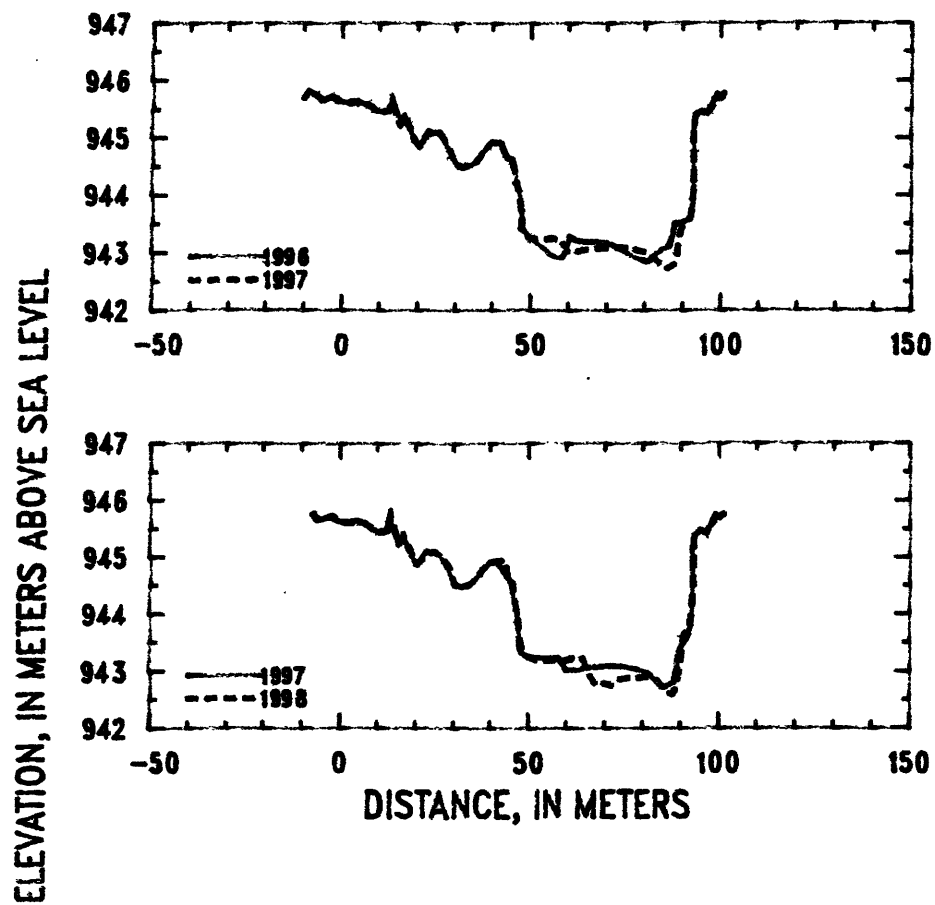


Figure 99. Profiles of cross section PR183 from 1996 to 1998.

Table 35. Listing of horizontal stations and elevations for cross section PR183

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1990		1990		1991	
23 September		23 September		22 September		22 September		2 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-7.0	945.79	57.0	942.96	-10.0	945.66	47.9	943.92	0.0	945.61
-5.0	945.66	58.0	942.82	-8.0	945.84	48.5	943.71	3.0	945.63
-3.0	945.75	60.0	942.98	-7.0	945.77	49.5	943.35	6.0	945.63
-1.0	945.68	62.0	943.02	-5.0	945.65	50.0	943.27	9.0	945.45
0.0	945.61	64.0	943.11	-3.0	945.73	51.0	943.21	12.0	945.50
2.0	945.62	66.0	943.17	-1.0	945.67	53.0	943.17	12.7	945.45
4.0	945.63	67.0	943.18	0.0	945.61	55.0	942.92	13.4	945.63
6.0	945.62	68.0	943.04	1.0	945.61	57.0	942.91	15.4	945.25
8.0	945.50	70.0	943.19	3.0	945.64	59.0	942.85	16.5	945.38
10.0	945.47	72.0	943.22	5.0	945.65	61.0	942.83	18.0	945.19
12.6	945.46	74.0	943.23	7.0	945.58	63.0	943.00	19.6	944.85
13.3	945.68	76.0	943.25	9.0	945.45	65.0	943.09	21.0	944.87
14.0	945.51	77.0	943.26	11.0	945.47	66.0	942.84	23.0	945.08
15.6	945.22	79.0	943.22	12.0	945.50	66.7	942.83	25.0	945.10
16.5	945.39	81.0	943.24	12.8	945.47	67.2	943.11	26.3	945.06
17.6	945.28	83.0	943.23	13.4	945.63	69.0	943.18	28.0	944.80
19.5	944.89	84.0	943.27	14.0	945.50	71.0	943.15	28.6	944.69
20.6	944.82	85.0	943.26	15.5	945.24	73.0	943.13	30.5	944.23
21.6	944.93	87.0	943.26	16.4	945.39	75.0	943.20	32.0	944.22
23.0	945.07	89.0	943.23	18.0	945.20	77.0	943.22	34.0	944.25
25.0	945.10	89.6	943.32	19.6	944.84	79.0	943.19	36.0	944.28
26.0	945.10	91.0	943.74	20.6	944.82	81.0	943.13	38.0	944.34
26.8	945.00	91.9	944.21	22.0	945.01	83.0	943.08	40.0	944.36
27.7	944.79	92.0	944.64	24.0	945.10	85.0	942.99	42.0	944.46
28.7	944.72	93.0	945.16	26.0	945.10	87.0	942.94	42.6	944.43
30.0	944.31	93.5	945.44	26.8	944.97	88.2	942.92	43.3	944.27
30.6	944.18	94.6	945.49	28.5	944.75	89.3	943.29	45.6	944.00
31.5	944.17	96.0	945.43	30.0	944.27	90.7	943.64	47.0	944.07
33.0	944.20	97.8	945.55	30.4	944.22	91.9	944.27	47.6	943.92
35.0	944.24	98.6	945.75	32.0	944.21	92.0	945.05	48.3	943.42
37.0	944.30	100.0	945.68	34.0	944.24	92.8	945.14	50.0	943.26
39.0	944.33	101.0	945.76	36.0	944.28	93.3	945.41	52.0	943.24
41.0	944.40			38.0	944.34	94.0	945.48	53.5	943.11
42.6	944.43			40.0	944.36	96.0	945.43	56.0	942.91
43.1	944.33			42.0	944.45	96.7	945.41	57.4	943.01
44.4	943.67			42.6	944.43	97.7	945.56	60.0	943.02
45.2	943.56			43.0	944.33	99.0	945.78	62.0	943.03
47.0	943.50			44.0	943.95	100.0	945.69	64.0	942.98
50.0	943.33			44.4	943.91	101.1	945.77	65.6	943.04
52.0	943.25			45.0	943.85			66.4	943.21
53.0	943.20			46.0	943.85			68.0	943.19
55.0	942.99			47.0	943.93			70.0	943.03

Table 35. (Continued) Listing of horizontal stations and elevations for cross section PR183
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1992		1992		1993		1993	
2 September		28 August		28 August		31 August		31 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
71.7	943.00	-10.0	945.67	53.4	943.11	-7.0	945.78	51.0	943.24
72.0	943.17	-8.0	945.85	55.0	942.90	-6.0	945.67	53.0	943.09
74.0	943.17	-7.0	945.77	57.0	942.85	-4.0	945.67	55.0	942.92
77.0	943.18	-5.0	945.66	59.0	942.78	-2.0	945.73	57.0	942.91
80.0	943.16	-3.0	945.73	60.4	942.71	0.0	945.62	59.0	942.85
83.0	943.12	-1.0	945.68	62.0	942.90	1.0	945.61	61.0	942.81
85.0	943.02	0.0	945.61	64.0	943.08	3.0	945.64	63.0	942.77
87.0	942.94	1.0	945.62	65.0	943.18	5.0	945.64	65.0	942.84
88.5	942.97	3.0	945.64	66.0	943.15	7.0	945.59	67.0	942.91
88.9	943.13	5.0	945.64	68.0	943.24	9.0	945.46	69.0	942.83
91.0	943.75	7.0	945.58	70.0	943.15	11.0	945.49	71.0	942.92
91.8	944.28	9.0	945.47	70.7	943.15	12.5	945.48	73.0	942.98
92.8	945.09	11.0	945.47	71.0	943.25	13.6	945.68	75.0	943.01
93.4	945.43	12.7	945.47	73.0	943.29	14.0	945.52	77.0	943.07
95.0	945.48	13.3	945.62	75.0	943.25	15.6	945.23	79.0	943.20
96.6	945.41	14.0	945.47	77.0	943.16	16.7	945.39	81.0	943.29
97.6	945.54	15.6	945.24	79.0	943.12	18.0	945.21	83.0	943.30
98.0	945.70	16.5	945.37	81.0	943.11	20.0	944.85	85.0	943.23
99.0	945.76	18.0	945.18	83.0	943.12	21.0	944.87	87.0	943.23
100.0	945.69	20.3	944.82	85.0	943.11	22.0	945.01	89.0	943.21
101.1	945.76	22.0	945.00	87.0	943.12	24.0	945.09	90.0	943.23
		24.0	945.10	88.8	943.11	26.0	945.11	90.6	943.26
		26.0	945.11	89.7	943.34	28.0	944.83	91.0	943.79
		28.0	944.79	90.5	943.59	29.0	944.73	92.0	944.26
		30.0	944.35	91.0	943.78	30.0	944.41	92.5	944.73
		30.8	944.22	91.8	944.22	30.5	944.34	93.4	945.44
		32.0	944.22	92.0	944.71	31.0	944.33	94.5	945.50
		34.0	944.25	93.0	945.22	33.0	944.33	96.5	945.41
		36.0	944.29	93.5	945.43	35.0	944.36	98.0	945.70
		38.0	944.34	95.0	945.49	37.0	944.41	100.0	945.69
		40.0	944.37	96.6	945.41	39.0	944.45	101.1	945.76
		42.0	944.45	98.1	945.69	40.0	944.46		
		42.7	944.42	100.0	945.69	41.0	944.53		
		44.0	944.19	101.1	945.76	42.0	944.58		
		45.0	944.09			43.0	944.51		
		46.0	944.08			44.0	944.35		
		47.0	944.10			45.0	944.35		
		48.0	943.81			46.3	944.37		
		48.6	943.48			46.9	944.41		
		49.0	943.34			48.1	943.53		
		50.0	943.22			48.4	943.39		
		52.0	943.23			49.5	943.29		

Table 35. (Continued) Listing of horizontal stations and elevations for cross section PR183
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1994		1994		1995		1995		1996	
18 September		18 September		29 September		29 September		22 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-7.0	945.75	75.0	942.98	-7.0	945.77	48.0	943.42	-10.0	945.69
-4.0	945.67	77.0	942.97	-5.0	945.67	49.0	943.30	-8.5	945.83
-1.0	945.68	77.9	943.16	-2.0	945.74	51.0	943.20	-7.0	945.79
0.0	945.62	78.0	943.28	0.0	945.64	53.0	943.09	-4.5	945.66
1.0	945.62	80.0	943.31	2.0	945.62	55.0	942.94	-2.5	945.74
3.0	945.64	82.0	943.29	4.0	945.63	57.0	942.88	0.0	945.63
6.0	945.63	84.0	943.30	6.0	945.63	59.0	942.90	3.0	945.63
9.0	945.47	86.0	943.31	8.0	945.54	61.0	942.95	6.0	945.62
12.0	945.32	88.0	943.29	10.0	945.46	63.0	943.08	8.0	945.55
12.7	945.48	90.5	943.24	12.0	945.54	65.0	943.16	10.0	945.46
13.5	945.82	91.0	943.48	12.6	945.46	67.0	943.13	12.6	945.48
14.5	945.46	91.8	944.11	13.5	945.70	68.0	943.16	13.3	945.70
16.0	945.26	93.0	945.22	14.1	945.49	69.0	943.35	14.2	945.50
17.0	945.38	96.0	945.46	15.5	945.23	71.0	943.31	15.9	945.27
20.0	944.86	97.3	945.47	16.5	945.39	73.0	943.21	16.7	945.38
22.0	945.00	99.0	945.76	18.0	945.21	75.0	943.16	19.0	945.01
24.0	945.09	100.0	945.69	19.0	945.01	77.0	943.10	20.5	944.85
26.0	945.11	101.1	945.76	20.0	944.87	79.0	943.09	23.0	945.10
28.0	944.83			21.0	944.89	81.0	943.06	24.0	945.10
29.5	944.72			22.0	945.00	83.0	943.05	26.0	945.11
30.8	944.30			23.0	945.09	85.0	942.98	28.0	944.85
32.0	944.32			25.0	945.10	87.0	942.95	30.0	944.57
34.0	944.33			26.4	945.08	89.0	942.79	31.0	944.49
36.0	944.38			28.0	944.85	89.7	942.66	33.0	944.49
38.0	944.43			30.0	944.58	91.0	943.27	35.0	944.54
40.0	944.47			31.0	944.48	91.5	943.27	37.0	944.72
42.0	944.59			32.0	944.49	91.7	943.43	39.0	944.87
44.0	944.38			33.0	944.50	91.9	943.71	40.0	944.94
45.7	944.35			34.0	944.53	92.6	943.96	41.0	944.92
46.6	944.41			35.0	944.55	93.0	945.13	42.3	944.93
48.5	943.47			36.0	944.60	93.6	945.45	44.0	944.65
49.6	943.23			37.0	944.72	95.0	945.49	45.3	944.63
53.5	943.15			38.0	944.82	96.6	945.42	47.6	943.85
56.0	942.94			39.0	944.91	98.1	945.68	47.9	943.52
58.0	942.93			40.0	944.95	99.0	945.76	48.1	943.38
60.0	942.88			41.5	944.92	100.0	945.69	50.0	943.25
62.0	942.87			42.4	944.93	101.1	945.76	53.0	943.09
64.0	942.95			43.0	944.75			56.0	942.93
64.6	943.07			44.0	944.63			58.5	942.90
67.0	943.08			45.0	944.61			59.6	943.04
70.0	943.07			46.0	944.59			60.3	943.28
73.0	943.02			47.8	943.76			63.0	943.19

Table 35. (Continued) Listing of horizontal stations and elevations for cross section PR183
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1997		1997		1998		1998	
22 October		22 September		22 September		23 September		23 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
66.0	943.18	-7.0	945.77	72.0	943.10	-7.0	945.79	64.0	943.26
69.0	943.19	-5.0	945.66	75.0	943.09	-6.0	945.67	66.0	942.94
72.0	943.12	-2.5	945.73	78.0	943.05	-4.0	945.69	68.0	942.74
75.0	942.99	0.0	945.63	81.0	943.00	-2.0	945.75	70.0	942.79
78.0	942.90	2.5	945.63	83.0	942.87	0.0	945.63	72.0	942.75
81.0	942.83	5.0	945.65	86.0	942.72	2.0	945.61	74.0	942.86
84.0	943.03	7.0	945.59	88.5	942.82	4.0	945.62	76.0	942.89
86.6	943.10	10.0	945.45	89.4	943.32	6.0	945.62	78.0	942.88
87.7	943.37	12.5	945.49	90.0	943.44	8.0	945.54	80.0	942.91
88.1	943.50	13.0	945.67	91.0	943.52	10.0	945.44	82.0	942.91
90.0	943.52	14.3	945.45	92.2	943.63	12.7	945.48	84.0	942.83
92.0	943.58	15.5	945.23	93.0	944.09	13.4	945.77	86.0	942.65
92.9	943.88	16.7	945.40	93.0	945.19	14.5	945.45	88.0	942.60
93.0	945.18	19.4	944.95	93.4	945.38	16.0	945.26	89.0	942.73
93.5	945.43	20.5	944.87	95.0	945.48	16.7	945.40	90.4	943.40
95.0	945.48	23.0	945.12	96.5	945.44	19.0	945.05	91.0	943.66
96.7	945.43	25.0	945.11	97.8	945.55	20.0	944.88	92.2	943.72
98.1	945.68	26.5	945.05	99.0	945.75	22.0	944.98	93.1	944.21
100.0	945.69	28.0	944.88	100.0	945.69	23.0	945.09	93.4	945.34
101.0	945.78	30.0	944.57	101.0	945.76	25.0	945.11	95.0	945.49
		32.0	944.48			27.0	945.00	96.7	945.42
		34.0	944.52			29.0	944.82	97.7	945.54
		36.0	944.61			30.3	944.51	99.0	945.75
		38.0	944.79			32.0	944.48	100.0	945.69
		40.0	944.94			34.0	944.51	101.1	945.76
		42.0	944.92			36.0	944.61		
		43.7	944.69			38.0	944.80		
		45.0	944.62			40.0	944.92		
		45.8	944.48			42.0	944.94		
		46.4	944.18			44.0	944.95		
		47.1	944.06			44.6	944.60		
		47.5	943.79			45.4	944.62		
		47.6	943.42			47.0	944.00		
		48.2	943.32			47.8	943.55		
		50.0	943.25			48.3	943.41		
		52.0	943.23			49.7	943.26		
		55.0	943.24			52.0	943.19		
		58.0	943.24			54.0	943.17		
		60.0	943.02			56.0	943.20		
		63.0	943.03			58.0	943.17		
		66.0	943.07			60.0	943.20		
		69.0	943.09			62.0	943.23		

Description of Cross Section PR191

Location: Township 5 South/Range 50 East--section 25

U. S. Geological Survey quadrangle (1:24,000): Eldon Mountain

Landowners--left bank: Doug and Lucille Randall

--right bank: Doug and Lucille Randall

Access: Left bank

Permission from: Doug, Lucille, or Craig Randall

Distance from Moorhead Gaging Station: 76.53 kilometers

Azimuth of Section (degrees magnetic): 177

Reference Monuments

[Monuments at stations -0.4 and 0.0 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
Benchmark--brass circular plate; offsection under a fenceline	---	45°22'18.87"	105°29'27.95"	0.166	0.521	938.00
1/2-inch-rebar; 0.18 meter above 1998 ground level	-0.4	45°22'18.53"	105°29'28.83"	0.273	0.395	937.99
1/2-inch-rebar; at 1998 ground level	0.0					937.70
1/2-inch-rebar; could not find in 1998, about 0.3 meter below 1998 ground level	130.0					936.09
1/2-inch-rebar; could not find in 1998; 0.27 meter above 1977 ground level and possible bent and buried in 1978; may be slightly offsection when PR191 was re-established in 1978; elevation was measured in 1977	150.3					936.63
1/2-inch-rebar; 0.21 meter above 1998 ground level	151.6					937.08
1/2-inch-rebar; 0.16 meter above 1998 ground level	186.0	45°22'12.61"	105°27'56.40"	0.174	0.450	936.93

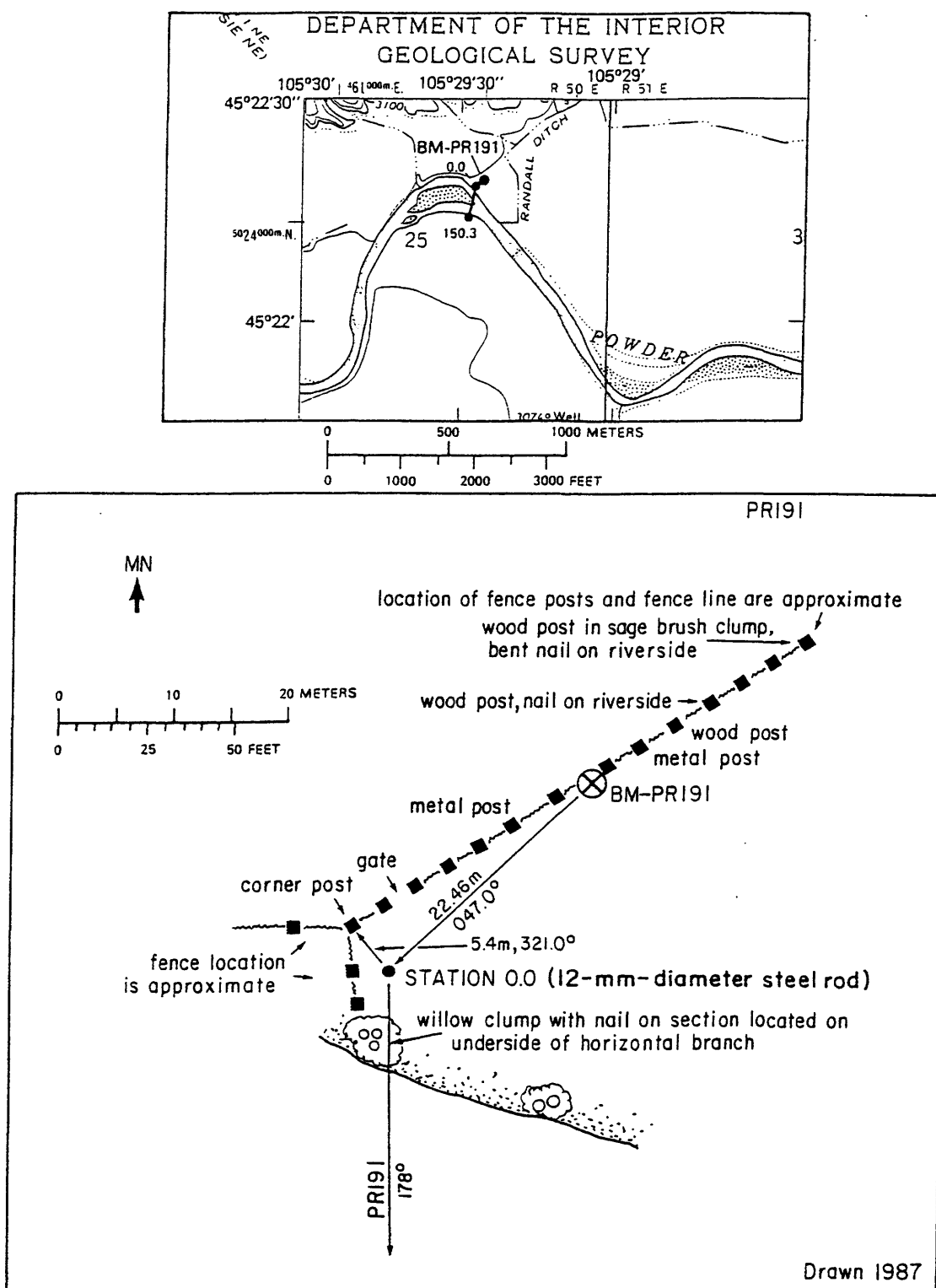


Figure 100. Upper: Location of cross section PR191, bench mark BM-PR191, and the left and right bank reference monuments in the Eldon Mountain quadrangle. Lower: Location of the bench mark on the left bank. MN is magnetic north.

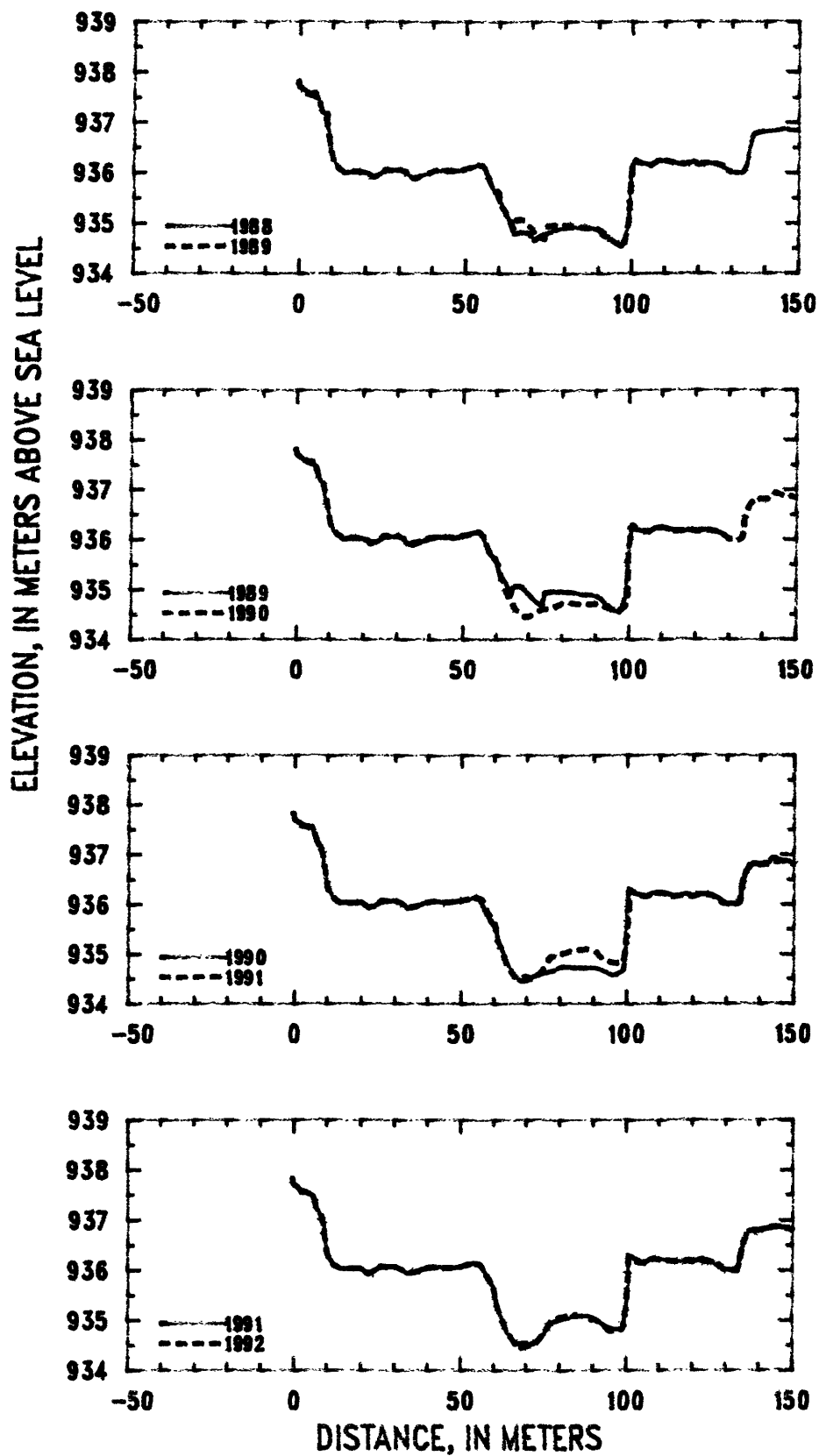


Figure 101. Profiles of cross section PR191 from 1988 to 1992.

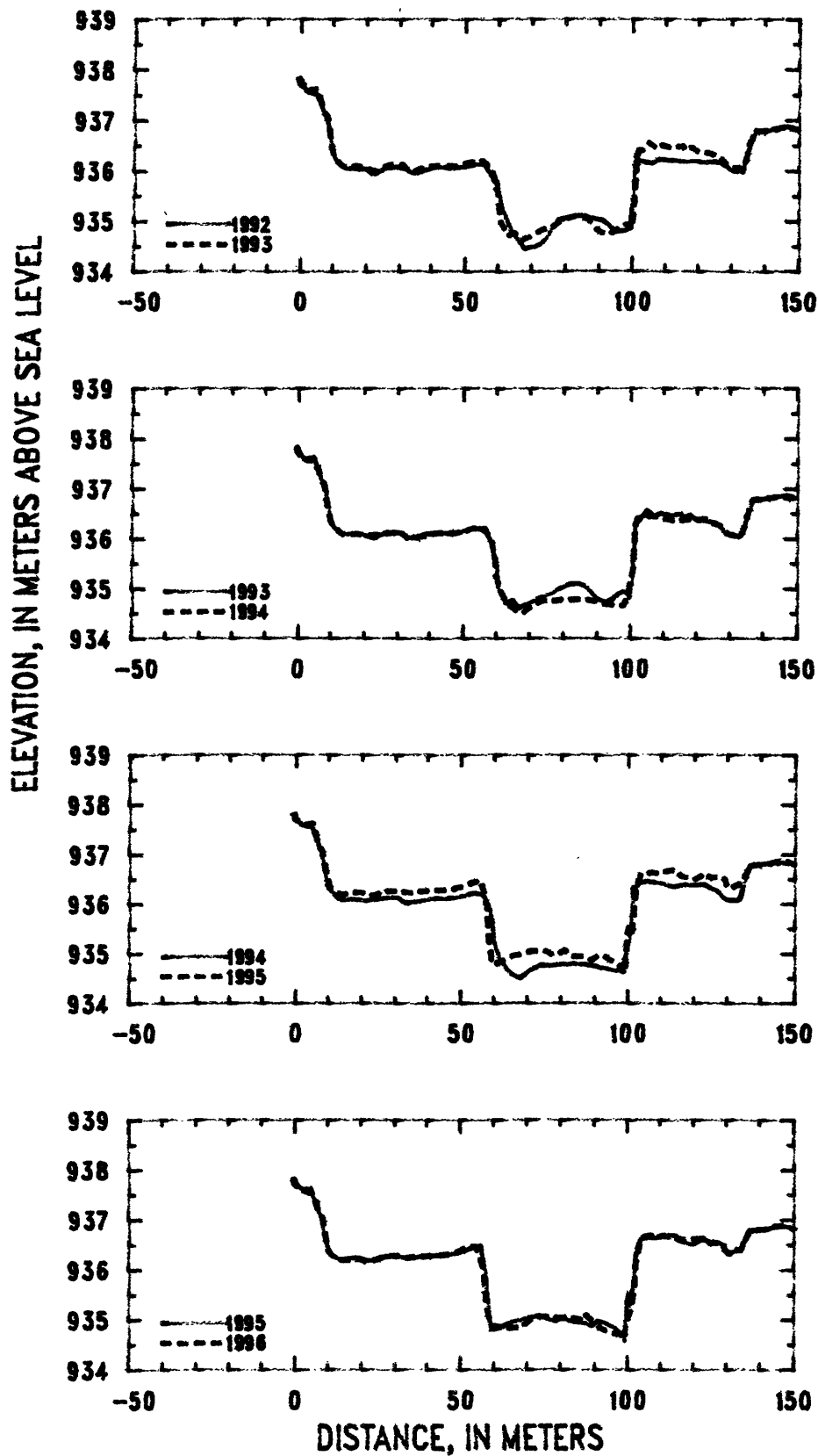


Figure 102. Profiles of cross section PR191 from 1992 to 1996.

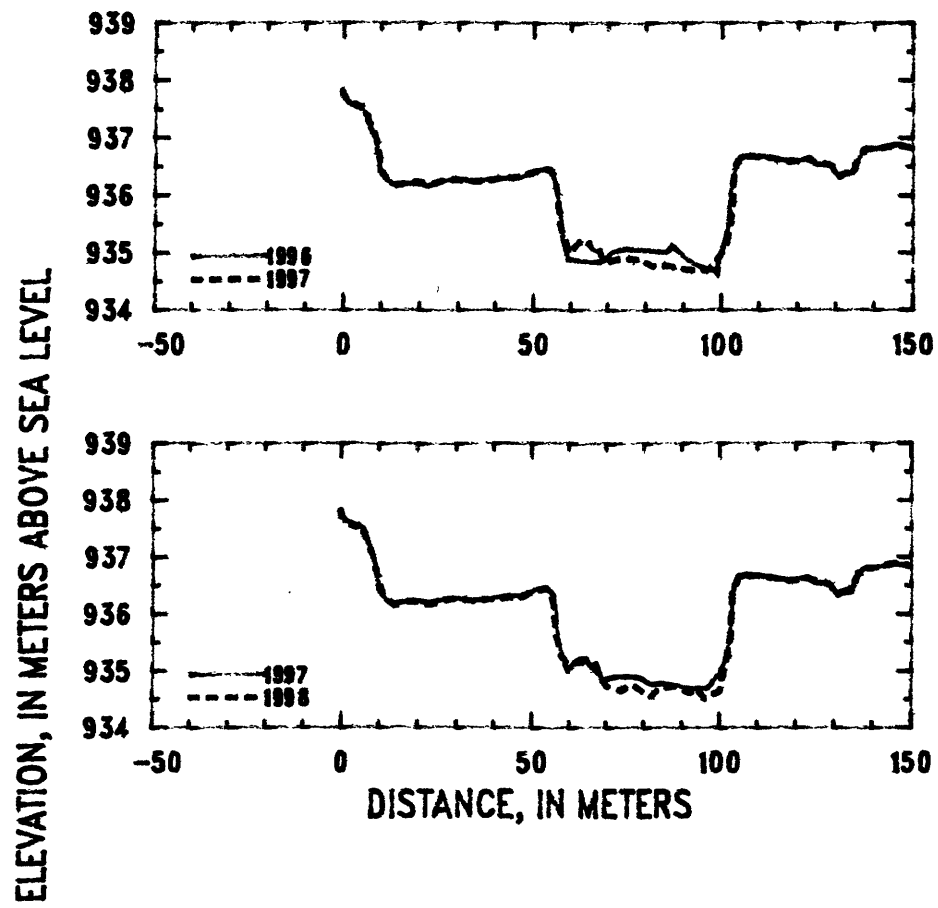


Figure 103. Profiles of cross section PR191 from 1996 to 1998.

Table 36. Listing of horizontal stations and elevations for cross section PR191

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1990		1990		1990	
21 September		21 September		23 September		23 September		23 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-0.4	937.83	67.0	935.08	-0.4	937.83	70.0	934.46	138.0	936.83
0.0	937.70	67.9	935.06	0.0	937.70	72.0	934.54	140.0	936.81
1.0	937.67	69.0	934.96	1.0	937.66	74.0	934.61	142.0	936.82
2.0	937.58	70.0	934.91	3.0	937.57	76.0	934.62	144.0	936.94
4.0	937.53	71.0	934.82	5.5	937.55	78.0	934.67	146.0	936.88
5.0	937.50	73.0	934.71	7.0	937.19	80.0	934.74	148.0	936.87
6.0	937.45	74.0	934.69	8.0	937.15	82.0	934.75	150.0	936.84
7.0	937.19	74.7	934.95	9.0	936.85	84.0	934.73	151.6	936.85
8.0	937.13	76.0	934.96	10.2	936.31	86.0	934.72		
9.0	936.73	78.0	934.97	12.0	936.12	88.0	934.71		
10.3	936.28	80.0	934.97	14.0	936.04	90.0	934.73		
12.0	936.09	82.0	934.96	16.0	936.04	92.0	934.69		
14.0	936.00	84.0	934.94	18.0	936.03	94.0	934.63		
16.0	936.03	86.0	934.90	20.0	936.04	96.0	934.56		
18.0	936.02	88.0	934.90	22.0	935.94	98.0	934.63		
20.0	936.02	90.0	934.87	24.0	935.96	99.0	934.67		
22.0	935.91	91.0	934.85	26.0	936.08	99.5	934.92		
24.0	935.95	93.0	934.71	28.0	936.06	99.7	935.51		
26.0	936.06	95.0	934.61	30.0	936.08	100.3	936.24		
28.0	936.04	97.0	934.54	32.0	936.03	101.0	936.29		
30.0	936.07	98.0	934.62	34.0	935.93	102.0	936.23		
32.0	936.02	99.2	935.08	36.0	935.95	104.0	936.19		
33.0	935.92	99.5	935.57	38.0	936.00	106.0	936.15		
35.0	935.88	100.6	936.26	40.0	936.05	108.0	936.24		
37.0	935.96	102.0	936.22	42.0	936.06	110.0	936.25		
39.0	936.00	104.0	936.17	44.0	936.06	112.0	936.22		
41.0	936.05	106.0	936.15	46.0	936.05	114.0	936.17		
43.0	936.05	108.0	936.24	48.0	936.05	116.0	936.17		
45.0	936.04	110.0	936.25	50.0	936.08	118.0	936.22		
47.0	936.04	112.0	936.22	52.0	936.10	120.0	936.16		
49.0	936.05	114.0	936.17	54.0	936.14	122.0	936.20		
51.0	936.09	116.0	936.17	54.7	936.16	124.0	936.20		
53.0	936.13	118.0	936.20	56.0	936.07	126.0	936.17		
55.0	936.15	120.0	936.16	57.0	935.91	128.0	936.11		
56.0	936.07	122.0	936.19	59.0	935.65	130.0	936.01		
58.0	935.72	124.0	936.19	59.2	935.67	132.0	936.01		
60.0	935.61	126.0	936.17	61.0	935.48	133.0	935.99		
61.0	935.33	128.0	936.12	61.4	935.26	133.9	936.03		
62.0	935.25	130.0	936.00	62.5	935.13	134.2	936.06		
63.6	935.06			63.3	934.92	134.5	936.30		
64.6	934.89			65.6	934.65	134.8	936.44		
65.4	935.07			68.0	934.46	136.0	936.67		

Table 36. (Continued) Listing of horizontal stations and elevations for cross section PR191
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1991		1992		1992		1993	
2 September		2 September		29 August		29 August		3 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-0.4	937.84	70.0	934.55	-0.5	937.83	70.0	934.48	-0.4	937.84
0.0	937.70	71.0	934.50	0.0	937.70	72.0	934.51	2.0	937.58
1.0	937.68	73.0	934.56	1.0	937.66	74.0	934.62	5.0	937.62
2.0	937.58	75.0	934.69	2.0	937.57	76.0	934.82	7.0	937.20
4.0	937.54	75.8	934.77	4.0	937.55	78.0	935.02	8.5	937.06
6.0	937.47	77.0	934.94	6.0	937.47	80.7	935.06	10.2	936.31
7.0	937.20	79.0	934.99	7.0	937.20	83.0	935.11	11.0	936.21
8.4	937.06	82.0	935.04	8.0	937.12	85.0	935.11	13.0	936.10
9.1	936.85	85.0	935.08	8.5	937.06	87.4	935.08	15.0	936.07
10.2	936.31	88.0	935.10	9.0	936.83	89.0	935.03	17.0	936.11
12.4	936.09	91.0	935.03	10.3	936.29	91.0	935.02	19.0	936.09
14.0	936.03	92.0	934.95	12.0	936.12	93.0	934.91	21.0	936.04
16.0	936.03	95.0	934.84	14.0	936.05	95.0	934.79	23.0	936.00
18.0	936.03	97.0	934.81	16.0	936.04	97.0	934.79	25.0	936.08
20.0	936.04	99.0	934.84	18.0	936.04	99.0	934.83	27.0	936.13
22.0	935.93	99.7	935.13	20.0	936.05	99.7	935.08	29.0	936.13
24.0	935.98	100.6	935.93	22.0	935.93	100.4	935.71	31.0	936.12
26.0	936.08	100.7	936.30	24.0	935.98	100.8	936.27	33.0	936.00
28.0	936.06	102.0	936.26	26.0	936.08	102.0	936.20	35.0	936.00
30.0	936.08	104.0	936.19	28.0	936.07	104.0	936.16	37.0	936.05
32.0	936.04	106.0	936.16	30.0	936.08	106.0	936.14	39.0	936.10
34.0	935.94	108.0	936.23	32.0	936.03	108.0	936.23	41.0	936.10
36.0	935.96	111.0	936.23	34.0	935.95	110.0	936.21	43.0	936.11
38.0	936.01	114.0	936.16	36.0	935.96	113.0	936.19	45.0	936.10
40.0	936.05	117.0	936.18	38.0	936.00	116.0	936.18	47.0	936.10
42.0	936.07	120.0	936.15	40.0	936.06	119.0	936.20	49.0	936.13
44.0	936.06	123.0	936.23	42.0	936.07	122.0	936.17	51.0	936.17
46.0	936.04	126.0	936.17	44.0	936.07	125.0	936.19	53.0	936.20
48.0	936.05	128.5	936.04	46.0	936.05	127.0	936.16	54.0	936.20
50.0	936.08	130.0	936.01	48.0	936.06	128.0	936.12	55.0	936.20
52.0	936.10	132.0	936.00	50.0	936.08	130.0	936.00	56.0	936.18
54.0	936.14	133.0	936.00	52.0	936.11	132.0	935.99	57.0	936.11
56.0	936.12	134.0	936.04	54.0	936.14	133.6	935.99	58.9	935.90
56.5	936.09	135.0	936.42	56.0	936.13	135.0	936.39	59.3	935.67
58.0	935.84	136.0	936.66	57.0	936.01	136.0	936.63	59.7	935.63
60.0	935.65	137.0	936.78	59.0	935.77	137.3	936.80	60.2	935.44
60.6	935.54	139.0	936.81	59.6	935.79	139.0	936.80	60.4	935.11
61.0	935.31	141.0	936.81	60.9	935.31	141.0	936.80	61.0	934.96
62.0	935.18	144.0	936.85	62.5	935.08	144.0	936.86	63.0	934.71
64.0	934.78	147.0	936.87	64.0	934.79	147.0	936.88	65.0	934.76
66.7	934.52	150.0	936.80	66.0	934.61	150.0	936.79	67.0	934.61
68.0	934.54	151.6	936.87	68.0	934.45	151.6	936.87	70.0	934.70

Table 36. (Continued) Listing of horizontal stations and elevations for cross section PR191
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1993		1993		1994		1994		1995	
3 September		3 September		19 September		19 September		30 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
73.0	934.83	143.0	936.83	-0.4	937.81	88.0	934.77	-0.4	937.82
76.0	934.87	147.0	936.87	0.0	937.70	90.0	934.75	0.0	937.70
79.0	935.01	150.0	936.81	2.0	937.58	92.0	934.70	1.0	937.66
81.0	935.07	151.6	936.88	4.0	937.55	94.0	934.68	3.0	937.59
83.0	935.10			5.0	937.60	96.0	934.66	5.0	937.62
85.0	935.10			7.0	937.18	98.0	934.66	7.0	937.20
87.0	935.03			8.0	937.07	99.2	934.90	8.0	937.07
90.0	934.78			10.0	936.34	100.8	935.39	10.4	936.35
93.0	934.72			11.0	936.25	101.5	936.30	12.0	936.25
95.0	934.81			13.0	936.10	103.0	936.41	14.0	936.18
97.0	934.92			15.0	936.07	105.0	936.46	16.0	936.21
99.0	934.93			18.0	936.09	108.0	936.44	18.0	936.23
99.7	934.83			21.0	936.05	111.0	936.39	20.0	936.23
100.6	935.20			25.0	936.09	114.0	936.34	22.0	936.17
100.7	935.54			28.0	936.12	117.0	936.39	24.0	936.18
101.2	935.90			31.0	936.13	120.0	936.38	26.0	936.26
101.3	936.22			33.0	936.01	123.0	936.40	28.0	936.27
101.8	936.40			36.0	936.03	125.0	936.31	30.0	936.27
103.0	936.41			39.0	936.07	127.0	936.27	32.0	936.25
104.0	936.46			42.0	936.11	129.0	936.12	34.0	936.23
105.0	936.56			45.0	936.11	130.0	936.08	36.0	936.24
106.0	936.50			48.0	936.12	132.0	936.07	38.0	936.26
107.0	936.43			51.0	936.16	133.5	936.07	40.0	936.27
109.0	936.51			53.0	936.21	134.2	936.15	42.0	936.27
111.0	936.47			55.0	936.21	136.0	936.65	44.0	936.29
113.0	936.47			56.5	936.21	137.0	936.78	46.0	936.29
115.3	936.50			58.6	935.95	139.0	936.80	48.0	936.32
116.0	936.41			59.8	935.56	142.0	936.82	50.0	936.34
118.0	936.47			59.9	935.27	145.0	936.85	52.0	936.39
120.0	936.38			61.7	934.89	150.0	936.80	53.3	936.43
122.0	936.37			64.0	934.68	151.6	936.88	55.0	936.45
124.0	936.33			66.0	934.55	186.0	936.86	56.1	936.47
126.0	936.31			68.0	934.50			57.8	935.96
128.0	936.17			70.0	934.62			58.5	935.31
129.0	936.10			72.0	934.71			59.4	934.79
130.0	936.06			74.0	934.77			61.0	934.81
132.0	936.06			76.0	934.76			63.0	934.86
133.0	936.04			78.0	934.76			65.0	934.94
134.0	936.09			80.0	934.79			67.0	934.97
135.5	936.55			82.0	934.77			69.0	935.00
137.0	936.78			84.0	934.79			71.0	935.05
140.0	936.79			86.0	934.78			73.0	935.06

Table 36. (Continued) Listing of horizontal stations and elevations for cross section PR191
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1995		1995		1996		1996		1997	
30 September		30 September		22 October		22 October		17 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
75.0	935.06	142.0	936.81	-0.4	937.82	98.0	934.70	-0.4	937.83
77.0	934.98	144.0	936.86	1.0	937.65	99.0	934.61	1.0	937.65
79.0	934.97	146.0	936.88	2.0	937.59	99.5	934.94	3.3	937.58
81.0	935.07	148.0	936.86	4.0	937.55	101.0	935.20	6.0	937.51
83.0	934.95	150.0	936.81	6.0	937.45	102.0	935.59	7.0	937.26
85.0	934.94	151.6	936.88	7.0	937.19	102.4	936.09	8.0	937.11
87.0	934.94	142.0	936.81	8.4	937.02	104.0	936.58	9.0	936.92
89.0	934.86	144.0	936.86	10.0	936.40	105.5	936.67	10.0	936.43
91.0	934.96	146.0	936.88	11.0	936.31	107.0	936.69	12.0	936.24
93.0	934.94	148.0	936.86	13.0	936.20	109.0	936.66	14.0	936.19
95.0	934.86	150.0	936.81	16.0	936.20	111.0	936.68	17.0	936.22
97.0	934.79	151.6	936.88	19.0	936.22	114.0	936.63	20.0	936.24
99.0	934.59			22.0	936.16	117.0	936.60	23.0	936.19
99.7	935.31			25.0	936.21	120.0	936.61	26.0	936.26
100.0	935.47			28.0	936.27	123.0	936.63	29.0	936.28
100.7	935.32			31.0	936.28	125.0	936.54	32.0	936.27
101.3	935.47			34.0	936.23	128.0	936.54	35.0	936.23
102.3	936.25			37.0	936.27	129.0	936.50	38.0	936.26
102.6	936.38			40.0	936.28	130.0	936.38	41.0	936.30
104.0	936.61			43.0	936.29	131.0	936.34	44.0	936.32
105.0	936.64			46.0	936.30	133.0	936.40	47.0	936.33
107.0	936.64			49.0	936.36	134.5	936.39	50.0	936.41
109.0	936.62			52.0	936.45	137.0	936.78	53.0	936.46
111.0	936.66			54.6	936.46	138.0	936.81	54.0	936.45
113.0	936.70			56.0	936.24	141.0	936.81	55.7	936.35
115.0	936.68			57.3	935.80	144.0	936.87	56.6	936.01
116.0	936.57			57.7	935.41	147.0	936.89	57.2	935.49
118.0	936.53			58.2	935.18	150.0	936.81	59.6	935.00
120.0	936.49			59.5	934.88	151.6	936.87	62.5	935.20
122.0	936.57			62.0	934.87	186.0	936.77	64.5	935.22
123.0	936.63			65.0	934.84			65.3	935.13
125.0	936.53			68.0	934.84			66.3	935.05
127.0	936.55			71.0	935.00			67.3	935.13
129.5	936.50			74.0	935.08			69.0	934.83
130.0	936.36			77.0	935.07			70.5	934.86
131.0	936.30			80.0	935.04			73.0	934.90
133.0	936.39			83.0	935.03			76.0	934.90
134.5	936.40			86.0	935.01			79.0	934.88
135.5	936.59			87.0	935.13			82.0	934.76
137.0	936.79			89.0	935.01			85.0	934.78
138.0	936.80			92.0	934.82			88.0	934.75
140.0	936.81			95.0	934.75			91.0	934.70

Table 36. (Continued) Listing of horizontal stations and elevations for cross section PR191
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1997		1998		1998	
17 September		24 September		24 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
94.0	934.69	-0.4	937.84	92.0	934.61
97.0	934.70	0.0	937.72	94.0	934.70
99.5	934.93	2.0	937.58	96.0	934.51
101.3	935.15	4.0	937.54	98.0	934.59
102.5	935.50	5.3	937.59	100.0	934.64
103.0	935.85	8.0	937.08	101.8	935.27
103.2	936.27	11.0	936.32	102.9	935.59
103.6	936.47	14.0	936.15	103.3	936.36
105.0	936.65	17.0	936.22	105.0	936.67
107.0	936.70	19.0	936.23	108.0	936.67
109.0	936.68	22.0	936.17	111.0	936.68
111.0	936.67	25.0	936.20	114.0	936.64
114.0	936.64	28.0	936.27	117.0	936.58
117.0	936.59	31.0	936.28	120.0	936.60
120.0	936.59	34.0	936.22	123.0	936.63
123.0	936.64	37.0	936.26	126.0	936.58
125.0	936.54	40.0	936.26	129.0	936.52
127.0	936.54	43.0	936.29	130.0	936.41
129.0	936.51	45.0	936.30	131.5	936.38
131.0	936.33	48.0	936.32	133.0	936.40
133.0	936.39	51.0	936.41	135.0	936.48
134.5	936.39	54.0	936.46	136.5	936.75
136.0	936.67	55.4	936.34	138.0	936.81
138.0	936.81	56.1	936.03	141.0	936.81
140.0	936.81	56.2	935.75	144.0	936.88
143.0	936.84	57.9	935.27	147.0	936.90
146.0	936.89	60.0	935.10	150.0	936.84
149.0	936.83	62.0	935.16	151.6	936.88
151.6	936.88	64.0	935.16	186.0	936.77
		66.0	935.12		
		68.0	934.95		
		70.0	934.73		
		72.0	934.71		
		74.0	934.65		
		76.0	934.75		
		78.0	934.73		
		80.0	934.61		
		82.0	934.55		
		84.0	934.68		
		86.0	934.71		
		88.0	934.74		
		90.0	934.70		

Description of Cross Section PR194

Location: Township 5 South/Range 51 East--section 30

U. S. Geological Survey quadrangle (1:24,000): Eldon Mountain

Landowners--left bank: Doug and Lucille Randall

--right bank: Doug and Lucille Randall

Access: Right bank

Permission from: John Stuver

Distance from Moorhead Gaging Station: 80.08 kilometers

Azimuth of Section (degrees magnetic): 225

Reference Monuments

[Monuments at stations 96.0, 113.3, and 113.8 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
Benchmark--brass circular plate; offsection	---	45°22'17.71"	105°27'51.05"	0.409	0.765	934.41
1/2-inch-rebar; bent, 0.13 meter above 1998 ground level	-1.2	45°22'16.99"	105°27'51.85"	0.507	1.047	934.32
1/2-inch-rebar; flush with 1998 ground level	0.0					934.19
1/2-inch-rebar; bent, 0.09 meter above 1998 ground level	96.0					934.21
1/2-inch-rebar; 0.03 meter above 1998 ground level	113.3					933.97
1/2-inch-rebar; 0.16 meter above 1998 ground level	113.8	45°22'15.09"	105°27'56.40"	0.174	0.450	934.11

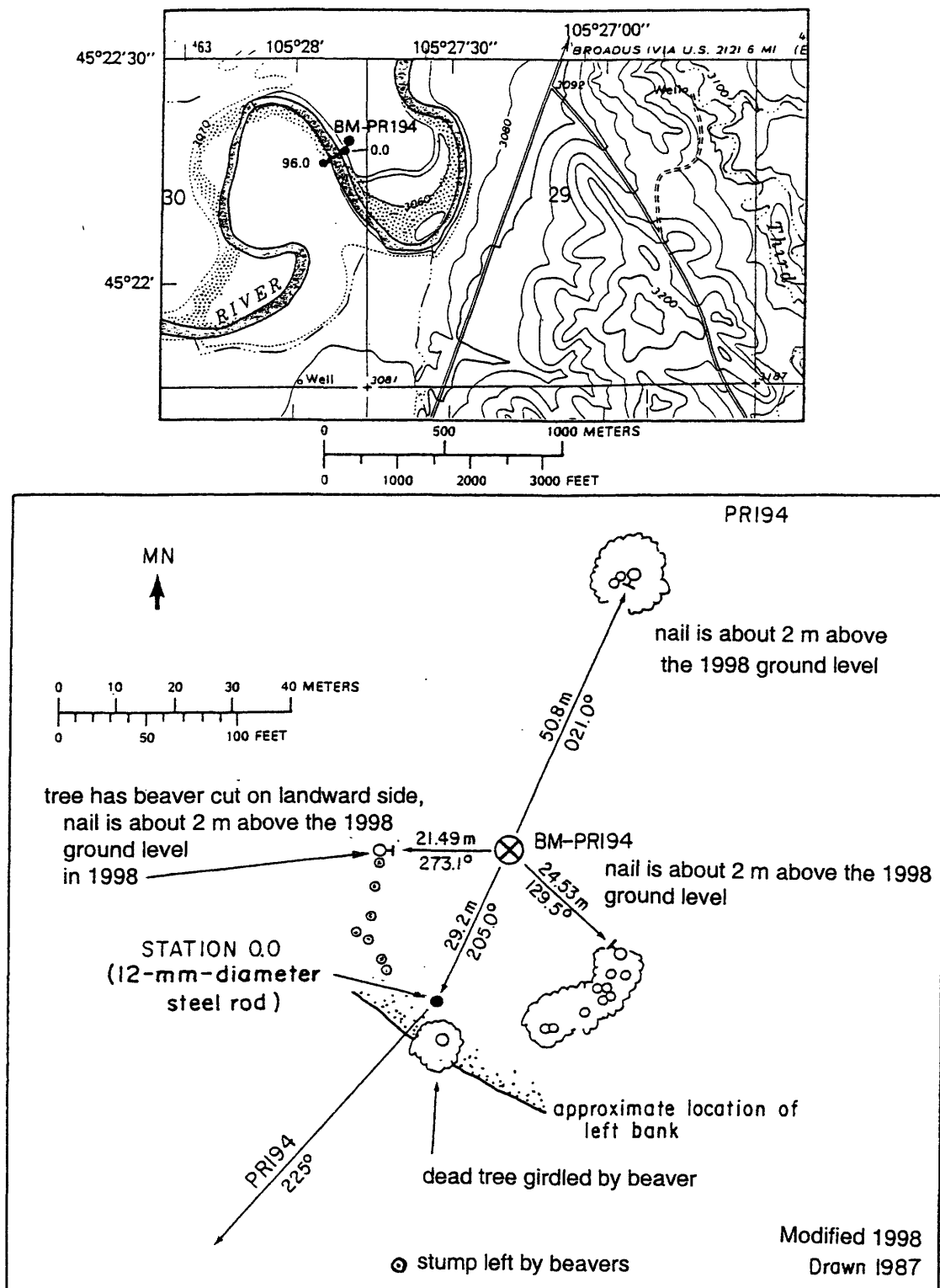


Figure 104. Upper: Location of cross section PR194, bench mark BM-PR194, and the left and right bank reference monuments in the Eldon Mountain quadrangle. Lower: Location of the bench mark on the left bank. MN is magnetic north.

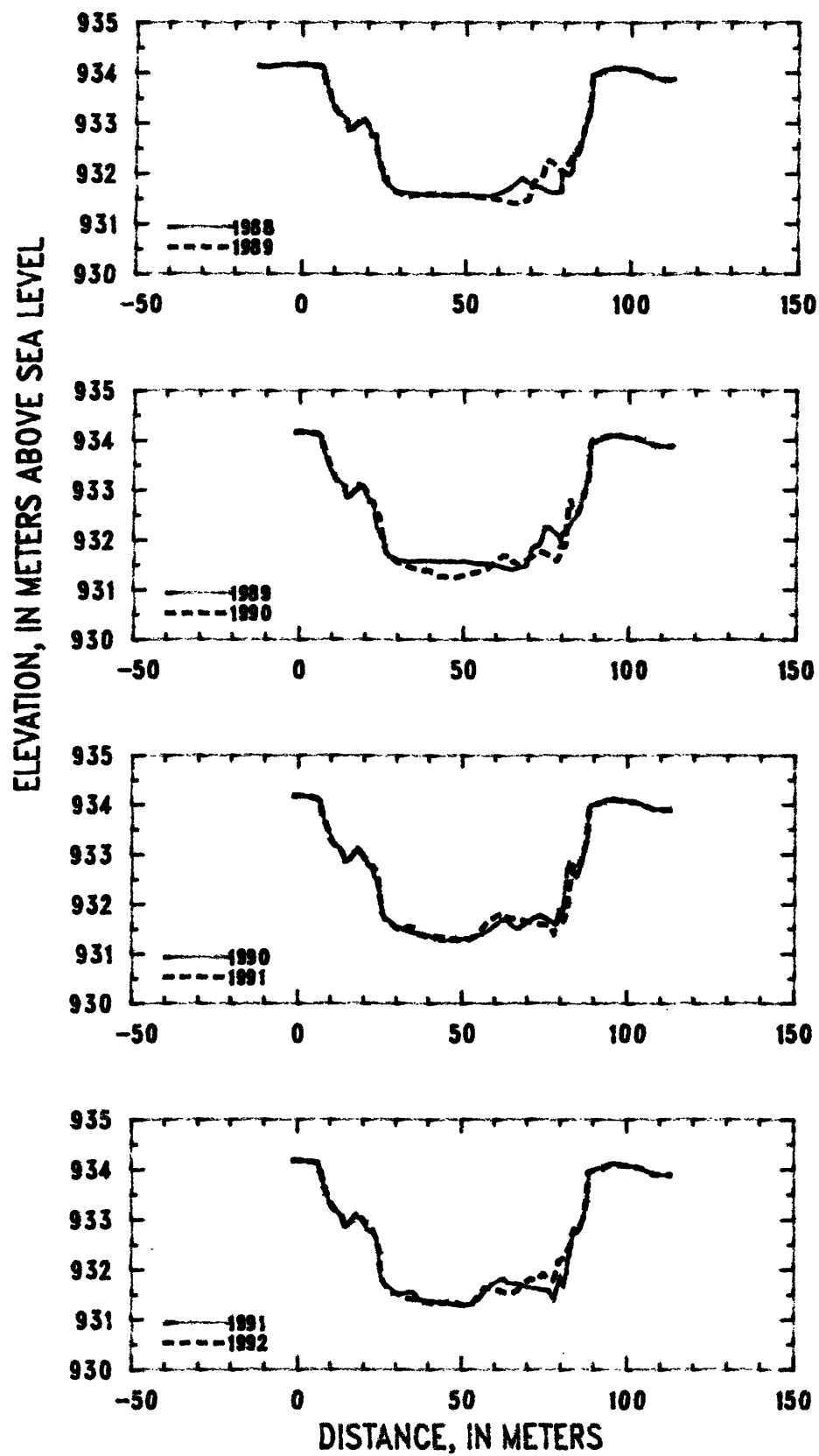


Figure 105. Profiles of cross section PR194 from 1988 to 1992.

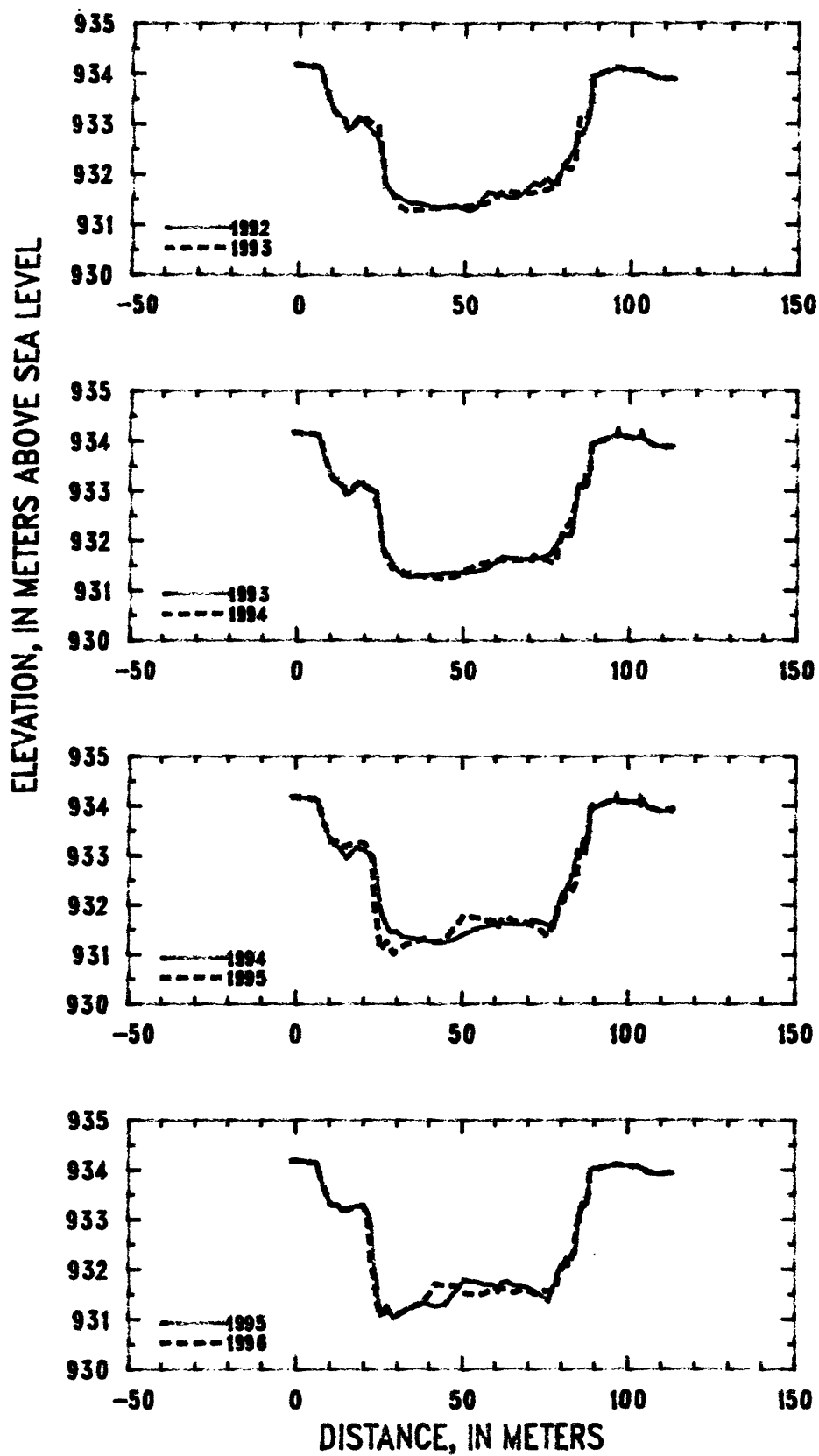


Figure 106. Profiles of cross section PR194 from 1992 to 1996.

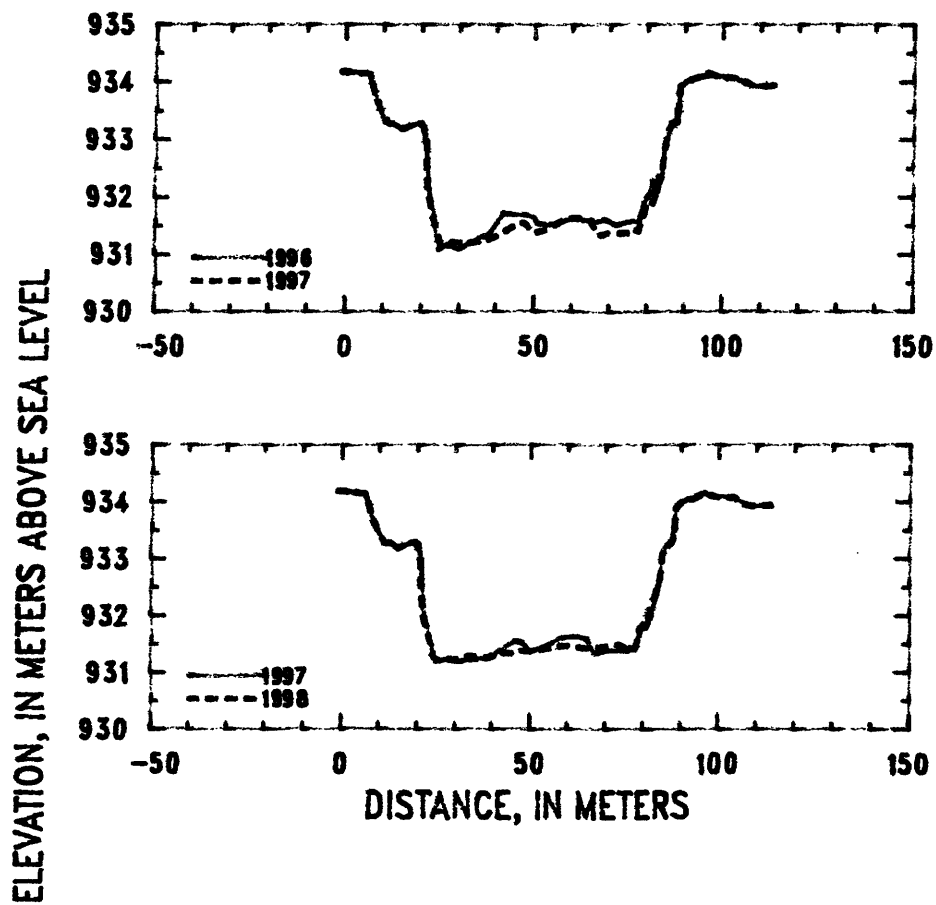


Figure 107. Profiles of cross section PR194 from 1996 to 1998.

Table 37. Listing of horizontal stations and elevations for cross section PR194

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1990		1990		1991	
20 September		20 September		20 September		20 September		3 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.2	934.17	61.0	931.47	-1.2	934.18	62.0	931.69	-1.2	934.18
0.0	934.18	63.0	931.44	0.0	934.18	64.3	931.69	0.0	934.18
2.0	934.17	65.0	931.40	3.0	934.16	65.3	931.56	2.0	934.18
4.0	934.15	67.0	931.44	5.0	934.16	67.0	931.50	4.0	934.15
6.0	934.13	69.3	931.48	6.8	934.09	69.0	931.59	6.7	934.09
6.8	934.09	70.4	931.78	7.0	934.05	71.0	931.68	7.7	933.76
7.1	933.92	71.0	931.86	7.2	933.94	72.0	931.73	9.0	933.53
8.0	933.72	72.0	931.89	9.0	933.55	74.0	931.78	10.4	933.25
10.0	933.33	73.0	931.91	11.0	933.21	75.0	931.73	11.4	933.18
11.0	933.23	73.8	932.00	13.0	933.13	76.6	931.68	13.0	933.13
12.0	933.17	74.6	932.26	13.7	933.08	78.5	931.59	14.6	932.86
13.6	933.10	76.0	932.26	14.5	932.85	79.2	931.71	16.0	932.92
14.2	932.89	78.0	932.15	15.0	932.87	79.6	931.89	18.0	933.11
14.5	932.86	79.0	932.10	17.0	932.99	80.9	931.90	20.0	932.95
15.0	932.87	79.5	931.99	18.3	933.13	81.3	932.30	21.3	932.78
17.0	933.01	80.0	932.13	20.0	933.01	82.0	932.70	23.0	932.76
17.8	933.04	82.0	932.25	21.0	932.85	82.6	932.81	23.9	932.66
18.1	933.13	83.0	932.40	21.5	932.78	83.0	932.68	24.4	932.48
20.0	933.00	84.8	932.55	22.6	932.76	84.7	932.55	25.4	931.87
21.2	932.76	86.4	932.93	23.3	932.56	85.1	932.60	26.4	931.72
22.6	932.76	87.9	933.26	24.2	932.48	86.1	932.75	28.0	931.66
23.2	932.31	88.4	933.61	24.9	932.22	87.0	932.99	30.0	931.52
24.6	932.08	88.6	933.96	25.3	931.95	88.0	933.29	32.0	931.50
25.4	932.06	89.0	934.04	25.9	931.88	88.7	933.97	34.0	931.56
26.2	931.81	90.0	933.98	26.3	931.75	91.0	934.05	35.6	931.54
27.0	931.70	92.0	934.05	28.0	931.65	94.0	934.10	36.2	931.50
29.0	931.63	94.0	934.09	30.0	931.55	96.0	934.11	36.8	931.41
31.0	931.59	96.0	934.10	32.0	931.51	99.0	934.08	39.0	931.35
33.0	931.56	98.0	934.10	34.0	931.44	102.0	934.06	41.0	931.37
35.0	931.57	100.0	934.06	36.0	931.43	105.0	933.98	44.0	931.34
37.0	931.59	102.0	934.05	38.0	931.39	108.0	933.89	46.0	931.32
39.0	931.59	104.0	934.00	40.0	931.38	111.0	933.89	48.0	931.30
41.0	931.59	106.0	933.95	42.0	931.29	113.3	933.88	50.0	931.28
43.0	931.57	108.0	933.89	44.0	931.27			52.0	931.29
45.0	931.57	110.0	933.87	46.0	931.27			54.0	931.34
47.0	931.56	112.0	933.86	48.0	931.26			56.0	931.49
49.0	931.57	113.3	933.87	50.0	931.29			57.6	931.63
51.0	931.57			52.0	931.33			59.0	931.69
53.0	931.52			54.0	931.35			61.0	931.78
55.0	931.51			56.0	931.40			63.0	931.82
57.0	931.52			58.0	931.46			63.6	931.75
59.0	931.49			60.0	931.57			65.0	931.71

Table 37. (Continued) Listing of horizontal stations and elevations for cross section PR194
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1992		1992		1993		1993	
3 September		1 September		1 September		2 September		2 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
67.0	931.72	-1.2	934.18	71.0	931.82	-1.2	934.18	72.0	931.65
69.0	931.67	0.0	934.18	73.0	931.78	0.0	934.19	74.0	931.68
71.0	931.63	3.0	934.16	74.4	931.90	3.0	934.16	76.0	931.72
73.0	931.61	5.0	934.15	75.0	931.91	5.0	934.15	77.0	931.79
75.0	931.58	6.4	934.13	76.0	931.83	6.6	934.11	78.0	931.92
76.5	931.59	7.0	934.00	78.0	931.80	8.0	933.73	80.0	932.14
78.1	931.40	7.8	933.75	79.6	932.19	10.4	933.25	82.0	932.09
78.8	931.60	10.0	933.34	80.6	932.21	11.0	933.20	83.3	932.30
79.9	931.85	12.0	933.17	82.5	932.43	13.0	933.15	83.8	932.73
80.9	931.69	13.6	933.11	83.3	932.54	14.5	932.92	84.3	932.90
82.1	931.99	14.5	932.88	84.0	932.81	16.0	932.98	84.7	933.12
82.3	932.19	16.0	932.94	85.5	932.79	18.0	933.14	85.5	933.12
82.6	932.26	18.0	933.12	87.0	933.02	19.5	933.18	86.0	933.06
82.9	932.42	20.0	933.00	88.0	933.36	20.0	933.08	87.0	933.11
83.8	932.76	22.0	932.83	88.3	933.58	22.0	933.00	88.0	933.36
84.1	932.81	23.0	932.79	88.5	933.95	23.5	932.99	88.4	933.64
84.9	932.74	24.0	932.60	90.0	933.98	24.0	932.71	88.6	933.94
85.6	932.78	25.0	932.35	93.0	934.03	25.0	932.29	90.0	933.99
86.6	932.93	25.6	931.91	96.0	934.12	25.5	931.83	93.0	934.05
88.0	933.28	26.0	931.77	99.0	934.08	25.7	931.77	96.0	934.13
88.4	933.63	27.0	931.67	102.0	934.06	28.0	931.60	100.0	934.07
88.6	933.95	29.0	931.56	105.0	934.00	30.0	931.37	103.0	934.07
90.0	933.99	31.0	931.51	108.0	933.89	32.0	931.29	106.0	933.96
92.0	934.05	33.0	931.42	111.0	933.89	34.0	931.27	109.0	933.88
94.0	934.08	35.0	931.42	113.3	933.88	36.0	931.30	111.0	933.90
96.0	934.11	37.0	931.39			38.0	931.30	113.3	933.88
99.0	934.07	39.0	931.36			40.0	931.33		
102.0	934.06	41.0	931.32			42.0	931.33		
105.0	933.99	43.0	931.35			44.0	931.36		
108.0	933.90	45.0	931.33			46.0	931.35		
111.0	933.89	47.0	931.38			48.0	931.38		
113.3	933.89	49.0	931.33			50.0	931.36		
		51.0	931.27			52.0	931.38		
		53.0	931.30			54.0	931.39		
		55.0	931.48			56.0	931.42		
		57.0	931.63			58.0	931.48		
		59.0	931.62			60.0	931.58		
		61.0	931.59			62.0	931.68		
		63.0	931.55			64.0	931.66		
		65.0	931.53			66.0	931.64		
		67.0	931.58			68.0	931.64		
		69.4	931.74			70.0	931.62		

Table 37. (Continued) Listing of horizontal stations and elevations for cross section PR194
[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1994		1994		1995		1995		1996	
20 September		20 September		1 October		1 October		16 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-1.2	934.18	79.0	931.96	-1.2	934.18	72.0	931.56	-1.2	934.18
0.0	934.19	80.0	932.20	0.0	934.19	74.0	931.48	0.0	934.19
3.0	934.16	80.9	932.28	2.0	934.18	76.0	931.36	3.0	934.15
5.0	934.16	82.0	932.34	4.0	934.16	77.5	931.65	6.0	934.15
6.0	934.14	83.6	932.71	6.5	934.13	78.5	931.70	6.6	934.12
6.6	934.11	84.5	933.06	8.5	933.60	78.6	931.79	8.0	933.73
9.0	933.52	85.2	933.14	10.0	933.37	79.0	931.93	10.5	933.30
10.5	933.26	86.3	933.09	10.5	933.29	79.5	931.98	13.0	933.28
13.0	933.16	86.7	933.26	12.8	933.28	80.0	932.08	15.0	933.18
14.9	932.94	87.3	933.10	13.9	933.17	80.5	932.06	17.0	933.24
17.0	933.10	87.7	933.33	16.0	933.23	81.6	932.20	20.0	933.29
18.0	933.18	88.0	933.32	18.0	933.27	83.0	932.24	20.5	933.23
20.0	933.12	88.4	933.62	20.0	933.27	84.4	932.44	21.7	932.81
22.7	933.01	88.6	933.93	21.0	933.18	85.2	933.04	22.1	932.14
24.5	932.43	90.0	933.99	22.4	932.94	86.0	933.12	23.3	931.74
24.9	932.02	92.0	934.03	23.3	931.93	86.2	933.26	24.6	931.08
25.7	931.80	95.0	934.10	23.7	931.82	87.0	933.27	27.0	931.17
26.5	931.66	96.4	934.12	25.0	931.10	87.8	933.32	30.0	931.09
28.0	931.45	96.6	934.20	27.0	931.26	89.0	934.01	33.0	931.19
30.0	931.47	97.0	934.09	29.0	931.01	90.0	934.04	36.0	931.29
32.0	931.35	99.0	934.09	31.0	931.12	92.0	934.04	38.0	931.32
35.0	931.33	101.0	934.06	33.0	931.21	94.0	934.09	40.0	931.49
38.0	931.29	103.3	934.06	35.0	931.23	97.0	934.12	42.0	931.72
41.0	931.26	103.6	934.16	37.0	931.29	99.0	934.08	45.0	931.69
44.0	931.24	104.0	934.09	39.0	931.33	101.0	934.07	48.0	931.68
47.0	931.27	104.4	934.12	41.0	931.26	103.0	934.06	50.0	931.64
50.0	931.38	105.0	934.02	43.0	931.27	105.0	934.01	51.0	931.53
52.0	931.46	106.5	933.92	45.0	931.30	107.0	933.95	54.0	931.50
55.0	931.53	109.0	933.88	47.0	931.49	109.0	933.91	57.0	931.53
58.0	931.57	111.0	933.89	49.0	931.64	111.0	933.92	60.0	931.63
60.0	931.61	113.3	933.88	50.6	931.80	113.3	933.94	63.0	931.61
62.0	931.63			53.0	931.75	113.8	933.95	66.0	931.55
64.0	931.62			55.0	931.74			69.0	931.61
66.0	931.61			57.0	931.68			72.0	931.51
69.0	931.61			59.0	931.69			75.0	931.58
71.0	931.63			60.0	931.67			78.0	931.58
71.3	931.70			61.0	931.54			78.5	931.68
73.0	931.67			62.3	931.73			79.1	931.92
75.0	931.63			64.0	931.76			81.3	932.10
77.0	931.56			66.0	931.67			81.6	932.28
77.7	931.56			68.0	931.67			81.9	932.25
78.0	931.63			70.0	931.62			82.1	932.09

Table 37. (Continued) Listing of horizontal stations and elevations for cross section PR194
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1997		1997		1998		1998	
16 October		24 September		24 September		23 September		23 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
82.9	932.10	-1.2	934.18	85.4	933.15	-1.2	934.19	74.0	931.50
83.1	932.22	0.0	934.19	87.0	933.29	0.0	934.20	76.0	931.40
84.0	932.33	3.0	934.15	87.7	933.30	2.5	934.18	78.0	931.45
84.5	932.82	6.3	934.15	88.3	933.57	4.5	934.16	79.1	931.78
86.0	933.10	9.0	933.55	88.6	933.92	6.5	934.14	81.1	931.81
86.5	933.32	11.5	933.28	90.0	934.00	8.0	933.74	82.0	932.13
87.9	933.30	13.0	933.29	92.0	934.06	10.0	933.40	84.0	932.48
88.4	933.58	15.0	933.19	94.0	934.09	11.5	933.27	84.7	932.69
88.6	933.92	17.0	933.24	96.0	934.16	13.0	933.30	85.4	933.19
90.0	934.00	18.5	933.29	99.0	934.09	15.0	933.19	87.4	933.27
92.0	934.06	20.0	933.28	102.0	934.08	17.0	933.24	88.2	933.47
94.0	934.09	20.5	933.23	105.0	934.04	19.0	933.29	88.6	933.89
95.0	934.11	21.3	932.93	108.0	933.93	20.0	933.27	90.0	933.99
97.0	934.12	21.7	932.15	111.0	933.93	20.9	932.95	92.0	934.03
100.0	934.08	22.8	931.71	113.3	933.94	21.0	932.38	94.0	934.08
103.0	934.08	25.0	931.19	113.8	933.95	21.8	931.93	96.0	934.14
106.0	933.96	28.0	931.22			22.4	931.81	98.0	934.11
109.0	933.92	31.0	931.18			24.4	931.25	100.0	934.07
111.0	933.93	34.0	931.21			26.5	931.21	102.0	934.08
113.3	933.95	37.0	931.22			28.5	931.24	104.0	934.09
113.8	933.95	40.0	931.30			30.0	931.23	106.0	933.96
		43.0	931.41			32.0	931.26	108.0	933.93
		46.0	931.55			34.0	931.30	110.0	933.91
		47.6	931.54			36.0	931.28	112.0	933.94
		50.0	931.36			38.0	931.25	113.3	933.94
		53.0	931.42			40.0	931.27	113.8	933.94
		56.0	931.52			42.0	931.35		
		59.0	931.63			44.0	931.34		
		62.0	931.64			46.0	931.33		
		65.0	931.61			48.0	931.39		
		67.0	931.33			50.0	931.38		
		70.0	931.38			52.0	931.39		
		73.0	931.38			54.0	931.42		
		76.0	931.38			56.0	931.44		
		76.5	931.44			58.0	931.47		
		77.8	931.41			60.0	931.47		
		79.0	931.69			62.0	931.45		
		79.8	931.86			64.0	931.43		
		81.0	931.83			66.0	931.44		
		82.8	932.11			68.0	931.45		
		83.3	932.45			70.0	931.46		
		84.3	932.53			72.0	931.49		

Description of Cross Section PR200A

Location: Township 5 South/Range 51 East--section 8

U. S. Geological Survey quadrangle (1:24,000): Broadus

Landowners--left bank: Doug and Lucille Randall

--right bank: Doug and Lucille Randall

Access: Left bank

Permission from: Doug and Lucille Randall or Craig Randall

Distance from Moorhead Gaging Station: 86.28 kilometers

Azimuth of Section (degrees magnetic): 140

Reference Monuments

[Monument at station -6.4 was closest to the first leveling instrument location and monuments at stations 100.0 and 110.0 were closest to the second leveling instrument location]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
Benchmark--1/2-inch-rebar; 0.05 meter above 1998 ground level	-6.4	45°24'32.43"	105°27'02.73"	0.223	0.652	927.80
1/2-inch-rebar; 0.17 meter above 1998 ground level	100.0	45°24'29.33"	105°27'00.54"	0.275	0.496	926.41
1/2-inch-rebar; bent, 0.07 meter above 1998 ground level; 0.70 meter downstream from section	110.0					926.32
1/2-inch-rebar; 0.10 meter above 1998 ground level	250.0					926.91
1/2-inch-rebar; 0.09 meter above 1998 ground level	275.0	45°24'24.28"	105°26'56.95"	0.768	0.687	926.85
1/2-inch-rebar; offsection, 0.14 meter above 1998 ground level; on riverward side of only wooden fence post in a 5-strand barbed-wire fence with metal posts	---					927.93

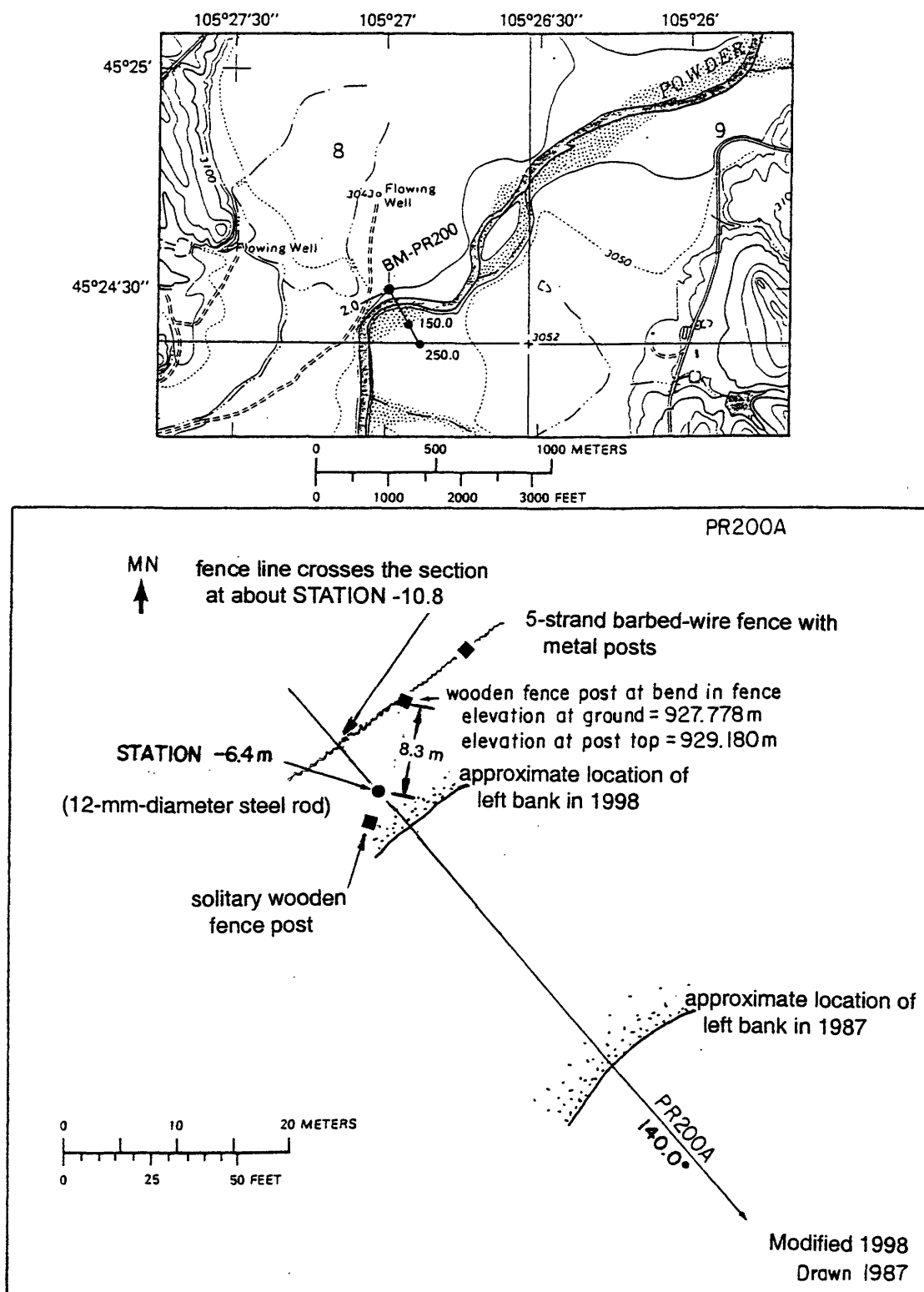


Figure 108. Upper: Location of cross section PR200A and the left and right bank reference monuments in the Broadus quadrangle. Lower: Location of the reference monuments on the left bank. MN is magnetic north.

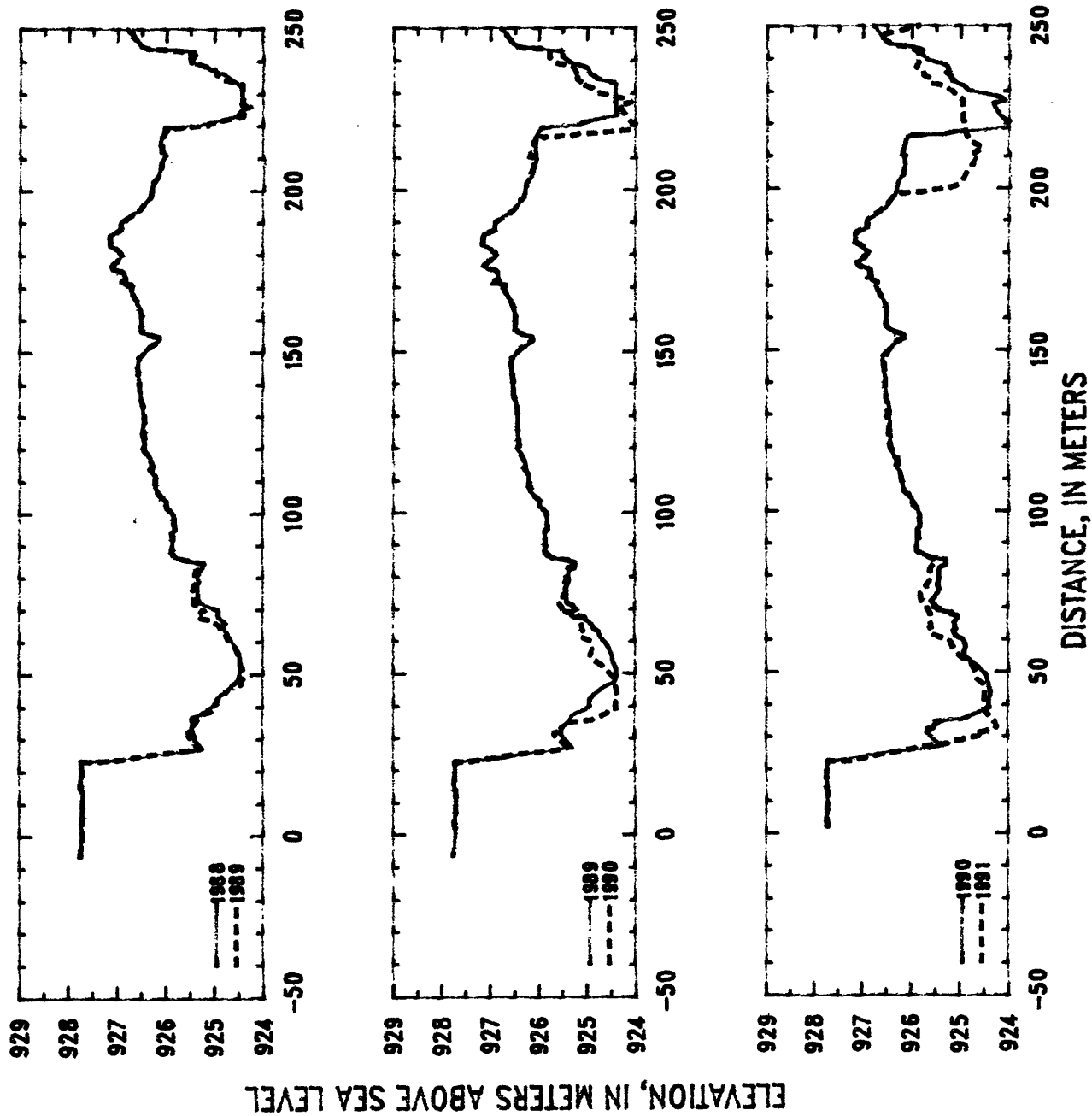


Figure 109. Profiles of cross section PR200A from 1988 to 1991.

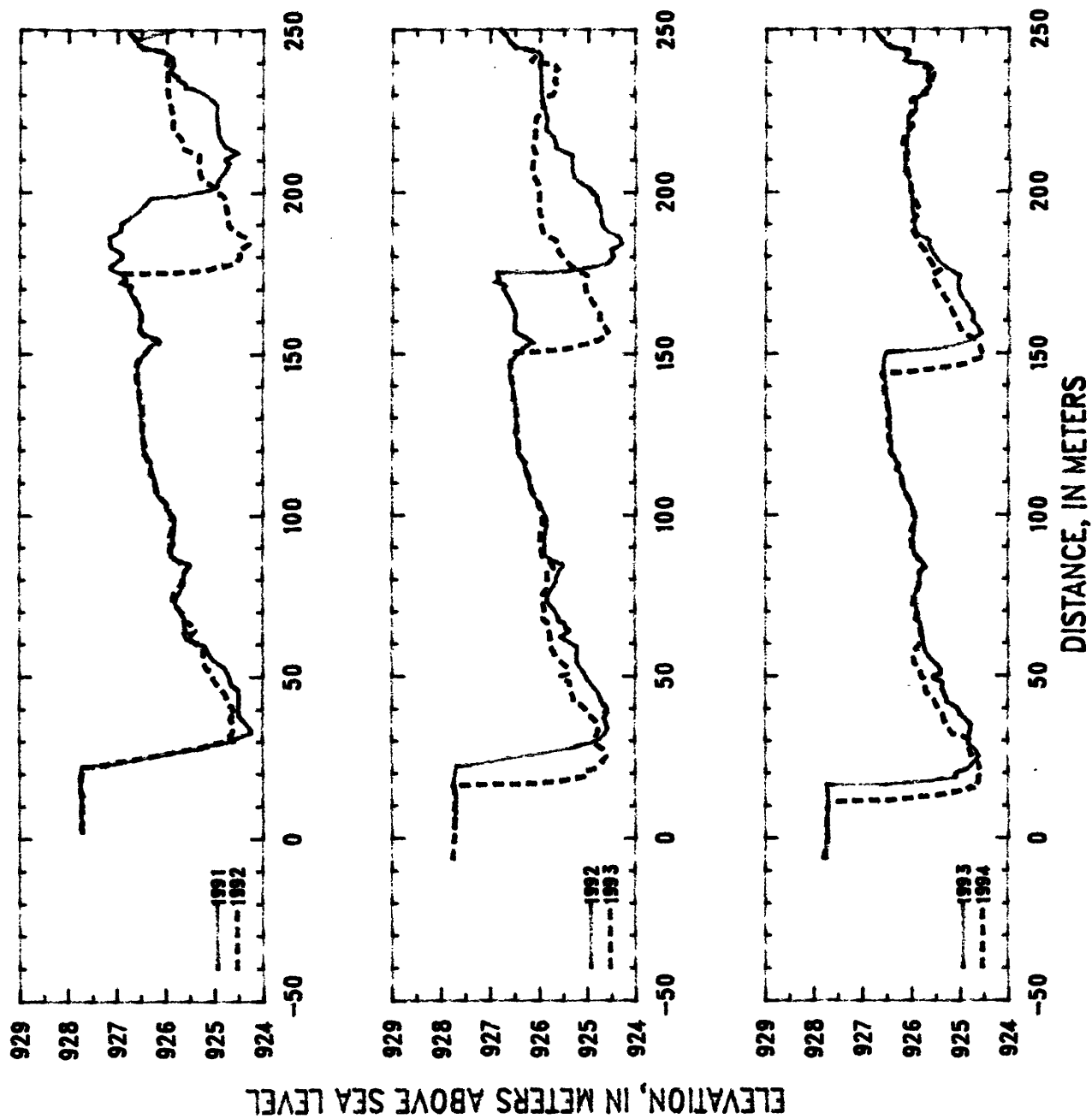


Figure 110. Profiles of cross section PR200A from 1991 to 1994.

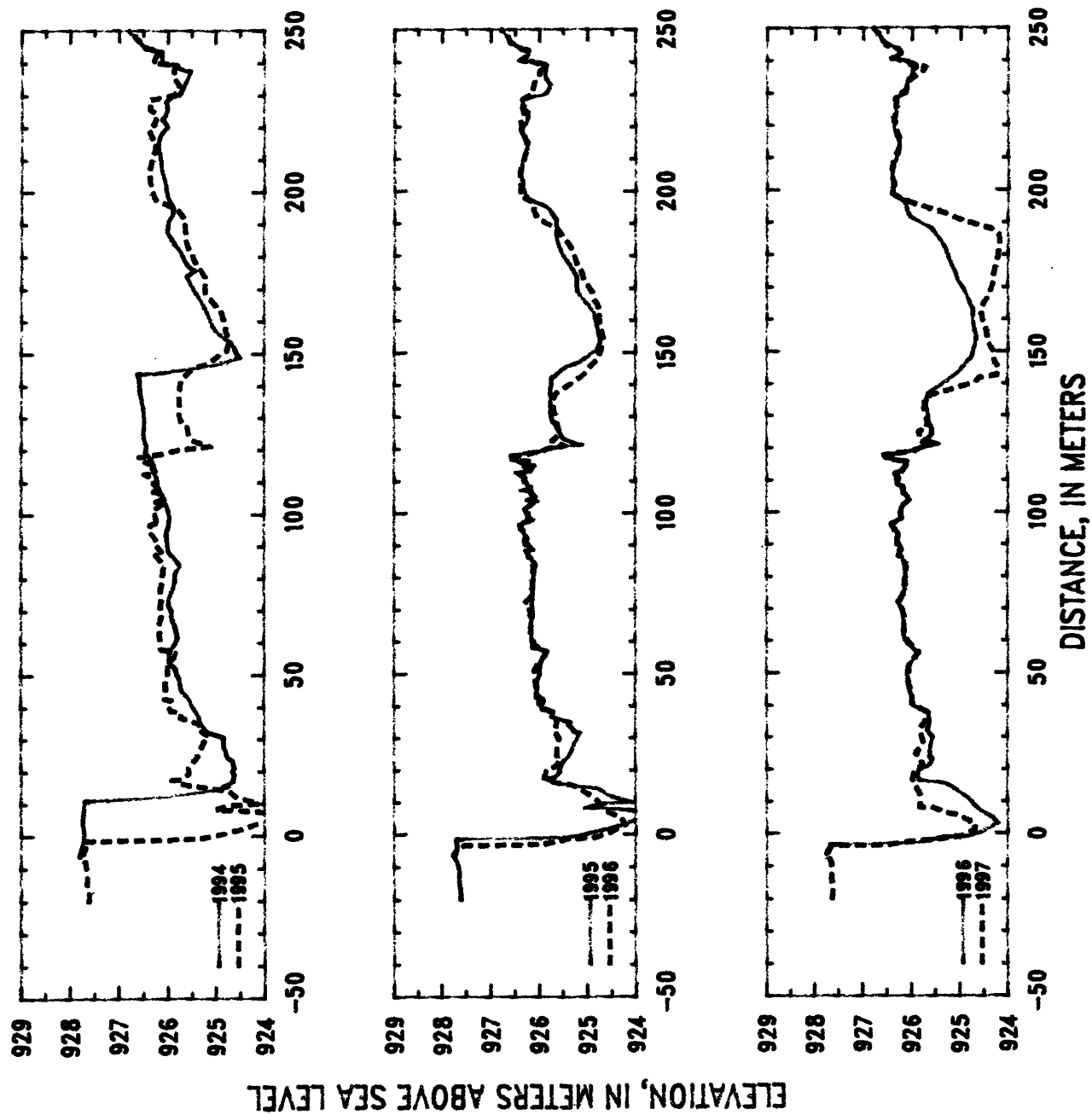


Figure 111. Profiles of cross section PR200A from 1994 to 1997.

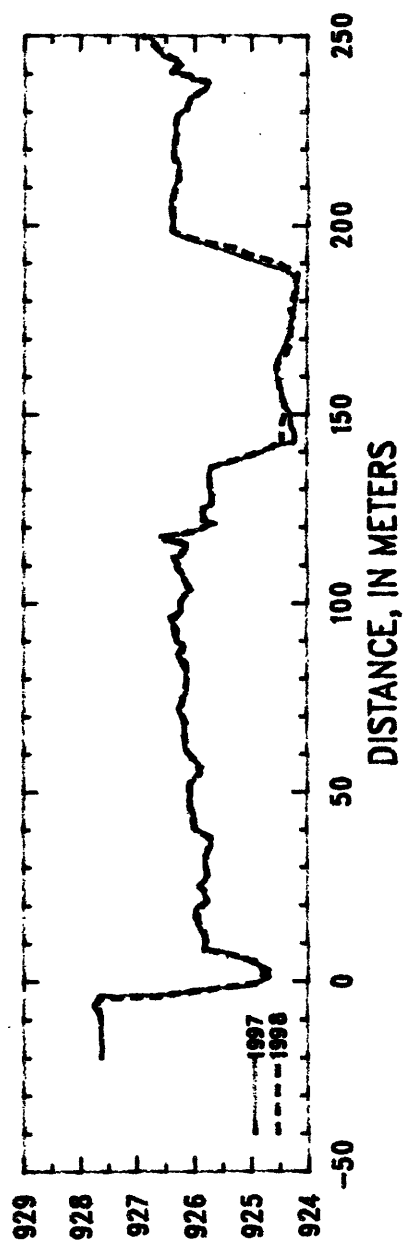


Figure 112. Profiles of cross section PR200A from 1997 to 1998.

Table 38. Listing of horizontal stations and elevations for cross section PR200A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1989		1989		1990	
21 September		21 September		21 September		21 September		23 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-6.4	927.76	67.4	925.27	136.0	926.53	204.0	926.16	2.0	927.70
0.0	927.69	68.6	925.35	138.0	926.55	206.0	926.12	3.0	927.74
4.0	927.72	69.8	925.19	140.0	926.54	208.0	926.07	5.0	927.75
6.0	927.70	70.2	925.26	142.0	926.58	210.0	926.07	7.0	927.70
8.0	927.70	71.2	925.28	144.0	926.58	212.0	926.07	10.0	927.71
10.0	927.70	71.8	925.41	146.0	926.60	214.0	926.06	12.0	927.70
12.0	927.69	73.0	925.43	148.0	926.56	216.0	926.08	14.0	927.70
14.0	927.71	75.0	925.42	150.0	926.42	218.0	926.00	17.0	927.73
16.0	927.76	76.0	925.45	150.9	926.37	219.3	925.95	20.0	927.72
18.0	927.72	77.0	925.42	153.3	926.13	220.2	925.13	22.0	927.70
20.0	927.72	79.0	925.36	154.3	926.11	220.7	925.11	22.6	927.69
22.0	927.71	81.0	925.39	154.7	926.15	221.1	924.96	22.7	927.44
23.0	927.72	82.3	925.36	155.6	926.37	221.7	924.82	24.0	926.88
23.1	927.38	82.7	925.23	156.6	926.51	223.0	924.39	25.2	926.42
23.9	926.74	84.5	925.23	158.0	926.51	225.0	924.39	26.5	925.57
25.0	926.44	86.0	925.71	160.0	926.50	227.0	924.46	27.2	925.40
27.0	925.29	86.6	925.82	162.0	926.51	228.0	924.41	29.0	925.53
29.0	925.42	88.0	925.88	164.0	926.55	230.0	924.44	31.0	925.68
31.0	925.52	90.0	925.85	166.0	926.60	232.0	924.44	31.7	925.68
33.0	925.53	92.0	925.85	168.0	926.69	233.0	924.43	31.8	925.62
35.0	925.38	94.0	925.88	169.7	926.76	234.4	924.83	32.3	925.65
37.0	925.31	94.8	925.80	170.8	926.69	235.1	924.86	32.6	925.53
38.0	925.20	96.0	925.80	171.0	926.92	236.0	924.97	33.3	925.52
38.5	925.08	98.0	925.83	171.5	926.82	237.6	925.01	34.5	925.40
40.0	924.93	100.0	925.83	174.0	926.88	238.3	925.13	34.8	925.46
42.0	924.94	102.0	925.99	174.8	926.87	238.8	925.28	35.0	925.37
43.3	924.87	104.0	925.99	175.7	927.08	240.0	925.43	35.7	924.89
44.6	924.74	106.0	926.15	176.7	927.16	241.0	925.52	36.1	924.84
46.0	924.64	108.0	926.23	178.0	927.01	242.0	925.51	38.0	924.52
47.0	924.44	110.0	926.22	180.0	926.87	243.0	925.54	39.0	924.39
49.0	924.39	112.0	926.22	182.0	927.01	243.8	926.13	41.0	924.43
50.0	924.39	114.0	926.28	183.0	927.14	244.0	926.39	43.0	924.36
52.0	924.42	116.0	926.31	185.0	927.14	245.0	926.54	45.0	924.40
54.0	924.48	118.0	926.34	186.0	927.15	247.5	926.67	47.0	924.45
56.0	924.49	120.0	926.46	188.0	926.91	249.0	926.72	49.0	924.46
58.0	924.56	122.0	926.42	190.0	926.90	250.0	926.81	50.0	924.55
59.0	924.59	124.0	926.43	192.0	926.71	251.0	926.82	52.0	924.67
61.3	924.74	126.0	926.45	194.0	926.53	253.0	926.93	53.0	924.76
63.2	924.77	128.0	926.44	196.0	926.42			53.8	924.82
63.8	924.86	130.0	926.43	198.0	926.30			54.4	924.89
65.0	924.88	132.0	926.45	200.0	926.29			55.4	924.91
66.7	925.02	134.0	926.48	202.0	926.28			55.6	924.93

Table 38. (Continued) Listing of horizontal stations and elevations for cross section PR200A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1990		1990		1990		1990		1991	
23 September		23 September		23 September		23 September		3 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
58.0	924.86	121.0	926.41	200.0	926.29	243.6	925.97	2.0	927.70
60.0	924.93	124.0	926.43	202.0	926.28	244.0	926.39	3.0	927.72
61.0	925.09	127.0	926.45	203.7	926.19	245.0	926.53	6.0	927.73
62.8	925.14	130.0	926.43	203.9	926.16	247.0	926.64	9.0	927.72
63.3	925.07	133.0	926.47	205.0	926.17	250.0	926.80	12.0	927.69
65.3	925.12	136.0	926.53	207.0	926.13	253.0	926.94	15.0	927.76
66.7	925.03	139.0	926.55	208.0	926.13	256.0	926.98	18.0	927.73
67.4	925.04	142.0	926.55	209.0	926.17	262.0	926.79	21.0	927.73
67.9	925.18	145.0	926.60	210.0	926.13	265.0	926.79	22.4	927.69
68.3	925.17	148.0	926.58	210.4	926.22	270.0	926.75	22.4	927.22
69.0	925.45	150.0	926.43	212.0	926.15	275.0	926.76	24.0	926.71
69.5	925.42	151.0	926.36	213.0	926.14			26.0	926.00
70.0	925.54	152.0	926.32	215.0	926.10			27.3	925.58
70.4	925.49	153.3	926.14	216.0	926.06			27.6	925.29
71.9	925.60	154.5	926.14	216.1	925.87			28.6	925.07
72.4	925.53	156.0	926.44	216.4	925.93			30.0	924.60
74.0	925.47	157.4	926.53	216.6	925.31			30.2	924.58
75.6	925.41	159.0	926.50	217.3	925.16			30.7	924.66
77.0	925.48	161.0	926.49	217.5	924.82			32.5	924.25
79.0	925.41	163.0	926.51	218.8	923.90			33.2	924.24
81.0	925.43	165.0	926.57	220.0	923.94			35.0	924.30
82.4	925.40	167.0	926.65	221.0	924.12			37.0	924.45
83.0	925.29	169.6	926.75	223.0	924.23			39.0	924.52
84.7	925.26	170.8	926.69	226.0	924.36			42.0	924.50
86.0	925.72	172.1	926.91	227.0	924.10			44.0	924.50
88.0	925.90	172.5	926.82	228.0	924.19			46.0	924.51
90.0	925.85	175.0	926.89	229.0	924.51			47.4	924.65
92.0	925.88	176.0	927.11	230.0	924.80			50.0	924.69
94.0	925.89	177.0	927.12	230.3	924.88			52.0	924.76
95.0	925.81	178.0	927.00	231.3	924.91			53.0	924.81
97.0	925.81	180.0	926.87	233.0	925.18			55.0	925.02
99.0	925.82	182.0	927.02	233.3	925.14			56.0	925.08
101.0	925.90	183.2	927.18	234.0	925.21			58.0	925.16
103.0	925.97	185.0	927.14	234.7	925.20			59.4	925.20
104.0	926.00	186.0	927.16	235.6	925.31			61.4	925.56
106.0	926.15	187.7	926.88	236.0	925.23			63.4	925.63
109.0	926.19	189.9	926.91	237.5	925.27			63.7	925.57
112.0	926.23	192.0	926.68	238.3	925.35			66.0	925.63
114.0	926.33	194.0	926.51	239.4	925.69			68.0	925.61
114.6	926.25	196.0	926.44	241.0	925.80			70.0	925.70
116.0	926.29	197.4	926.34	242.0	925.81			72.0	925.80
119.0	926.42	198.0	926.32	242.6	925.79			74.0	925.82

Table 38. (Continued) Listing of horizontal stations and elevations for cross section PR200A
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1991		1991		1992		1992	
3 September		3 September		3 September		29 August		29 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
76.0	925.70	170.0	926.76	233.6	925.62	3.0	927.73	75.0	925.84
78.0	925.62	170.9	926.70	234.8	925.77	7.0	927.69	77.0	925.73
80.0	925.60	172.0	926.92	235.5	925.78	10.0	927.71	79.0	925.65
82.0	925.62	172.5	926.82	237.3	925.93	13.0	927.68	81.0	925.64
84.0	925.49	174.6	926.86	239.6	925.83	16.0	927.77	83.0	925.57
84.7	925.49	176.0	927.11	240.6	925.89	19.0	927.72	84.0	925.51
86.0	925.75	176.8	927.14	241.6	925.87	22.2	927.68	84.6	925.52
87.3	925.89	179.0	926.92	243.6	926.07	22.3	927.46	86.0	925.77
89.0	925.90	180.0	926.86	244.0	926.35	24.0	926.78	87.5	925.90
90.9	925.83	181.0	926.89	245.0	926.52	26.0	926.01	89.0	925.92
93.0	925.86	183.0	927.13	247.0	926.65	28.0	925.27	91.0	925.89
95.0	925.81	186.0	927.16	250.0	925.82	28.6	925.15	93.0	925.90
97.0	925.81	188.0	926.90	253.0	926.93	29.8	924.82	95.0	925.87
99.0	925.81	190.0	926.91	256.0	926.96	32.0	924.64	97.0	925.84
100.2	925.85	192.6	926.65	262.0	926.79	34.0	924.59	99.0	925.86
102.0	925.98	195.0	926.48	265.0	926.79	36.3	924.65	101.0	925.93
104.0	925.99	197.0	926.37	270.0	926.77	37.0	924.68	104.0	926.01
106.0	926.15	198.3	926.28	275.0	926.75	38.7	924.58	106.0	926.15
109.0	926.19	198.7	925.75	277.0	926.76	39.0	924.65	108.0	926.20
112.0	926.24	199.6	925.44			39.9	924.60	111.0	926.22
114.0	926.29	200.4	925.16			40.9	924.64	113.0	926.30
117.0	926.30	201.4	924.97			41.0	924.68	116.0	926.30
120.0	926.44	204.0	924.90			43.0	924.75	119.0	926.44
123.0	926.46	206.0	924.79			45.0	924.79	122.0	926.41
126.0	926.47	208.0	924.73			47.0	924.92	125.0	926.50
129.0	926.49	209.0	924.69			49.0	925.03	128.0	926.45
132.0	926.47	210.0	924.80			51.0	925.08	131.0	926.45
135.0	926.53	211.3	924.66			53.0	925.20	134.0	926.49
138.0	926.55	212.2	924.53			55.0	925.24	137.0	926.53
141.0	926.53	212.6	924.56			57.0	925.23	140.0	926.55
144.0	926.57	213.0	924.65			59.0	925.21	143.0	926.61
147.0	926.56	214.0	924.79			60.0	925.35	146.0	926.59
150.0	926.42	216.0	924.88			61.0	925.47	148.0	926.55
152.0	926.33	218.0	924.93			62.2	925.57	150.0	926.42
154.0	926.11	220.0	924.95			63.5	925.41	150.9	926.37
154.7	926.15	223.0	924.98			64.0	925.37	152.0	926.31
156.0	926.45	225.0	924.98			64.5	925.45	153.4	926.13
157.5	926.54	227.0	924.95			66.5	925.50	154.6	926.24
160.0	926.50	228.5	925.08			67.0	925.61	156.0	926.44
163.0	926.51	230.0	925.18			69.0	925.64	157.0	926.51
166.0	926.61	232.0	925.47			71.0	925.75	159.0	926.51
168.0	926.68	232.1	925.61			73.0	925.86	161.0	926.49

Table 38. (Continued) Listing of horizontal stations and elevations for cross section PR200A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1992		1992		1993		1993		1993	
29 August		29 August		3 September		3 September		3 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
163.0	926.51	219.0	925.89	-6.4	927.77	61.0	925.78	140.0	926.54
165.0	926.56	221.0	925.86	0.0	927.72	63.0	925.80	142.0	926.58
167.0	926.64	223.0	925.85	2.0	927.70	65.0	925.82	144.0	926.58
169.0	926.71	225.0	925.91	3.0	927.74	66.5	925.85	146.0	926.60
170.0	926.75	227.0	925.93	6.0	927.71	67.5	925.94	148.0	926.57
170.9	926.69	229.0	925.96	9.0	927.71	69.0	925.86	150.0	926.52
172.0	926.91	231.0	925.98	12.0	927.70	71.0	925.92	150.3	926.51
172.7	926.81	233.0	925.96	14.0	927.71	73.0	925.95	150.4	926.44
174.0	926.87	235.0	925.98	16.3	927.75	75.0	925.95	150.6	926.01
174.9	926.88	237.0	925.97	16.5	926.50	77.0	925.85	151.8	925.29
175.0	926.05	239.0	926.02	16.7	926.19	79.0	925.83	154.0	924.78
175.2	925.69	241.0	925.97	17.7	925.52	81.0	925.83	156.0	924.56
175.5	925.39	242.0	925.96	18.0	925.43	82.5	925.84	158.0	924.64
176.0	925.12	243.0	926.02	18.7	925.08	83.5	925.71	160.0	924.77
176.6	925.02	243.4	926.06	20.0	925.09	85.0	925.76	162.0	924.74
177.0	924.82	244.5	926.48	20.7	925.01	86.0	925.85	164.0	924.84
178.0	924.56	246.0	926.61	21.0	924.89	87.0	925.93	166.0	924.91
180.0	924.46	248.0	926.67	23.0	924.73	89.0	925.99	168.0	925.03
182.0	924.52	250.0	926.82	25.0	924.61	91.0	925.99	170.0	925.07
184.0	924.29	252.0	926.89	27.0	924.68	93.0	925.99	172.0	925.07
186.0	924.35	254.0	926.96	29.0	924.84	95.0	925.97	174.0	925.02
188.0	924.62	256.6	926.92	31.0	924.84	97.0	925.93	175.8	925.26
190.0	924.72	260.0	926.93	33.0	924.78	98.0	925.93	177.0	925.36
192.0	924.73	262.0	926.79	35.0	924.78	100.0	925.93	179.0	925.49
194.0	924.76	265.0	926.78	37.3	924.92	101.0	925.95	181.0	925.59
195.0	924.75	268.0	926.76	38.0	925.01	103.0	926.03	183.5	925.67
197.0	924.84	271.0	926.76	39.0	925.03	105.0	926.08	185.0	925.67
198.2	924.81	273.0	926.75	40.0	925.07	107.0	926.16	187.0	925.93
199.0	924.84	275.0	926.75	41.0	925.15	109.0	926.20	189.0	925.98
199.4	924.91			42.0	925.31	110.0	926.21	191.0	925.96
200.0	924.90			44.0	925.32	112.0	926.23	194.0	926.02
200.5	924.97			46.0	925.40	114.0	926.30	197.0	926.02
201.0	924.97			48.0	925.37	116.0	926.30	200.0	926.03
203.0	925.18			48.5	925.42	119.0	926.44	203.0	926.06
204.4	925.29			49.0	925.57	121.0	926.42	206.0	926.17
206.0	925.33			50.1	925.56	124.0	926.45	209.0	926.14
208.0	925.34			50.5	925.41	127.0	926.46	212.0	926.08
210.0	925.35			52.0	925.40	130.0	926.45	214.0	926.15
211.3	925.32			53.0	925.46	132.0	926.48	217.0	926.09
213.5	925.68			55.0	925.62	134.0	926.49	220.0	926.10
215.0	925.69			57.0	925.71	136.0	926.52	223.0	926.07
217.0	925.72			59.0	925.77	138.0	926.53	224.0	925.97

Table 38. (Continued) Listing of horizontal stations and elevations for cross section PR200A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1993		1994		1994		1994		1994	
3 September		18 September		18 September		18 September		18 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
226.0	925.93	-6.4	927.80	72.0	925.99	154.0	924.73	243.6	926.13
228.0	925.96	-1.8	927.72	74.0	925.97	157.0	925.01	244.3	926.45
229.0	925.92	0.0	927.71	76.0	925.91	160.0	925.10	245.4	926.52
230.0	925.71	4.0	927.74	78.0	925.85	163.0	925.19	247.0	926.62
232.0	925.66	6.0	927.73	80.0	925.84	166.0	925.30	250.0	926.82
233.0	925.64	8.0	927.71	82.0	925.83	169.0	925.42	275.0	926.76
234.3	925.71	10.9	927.69	84.0	925.73	172.0	925.56	243.6	926.13
235.6	925.66	11.3	927.20	86.0	925.85	174.0	925.62	244.3	926.45
237.0	925.71	11.7	926.34	88.0	925.97	175.7	925.43	245.4	926.52
238.0	925.62	13.5	925.30	90.0	926.01	177.3	925.60	247.0	926.62
239.4	925.71	15.2	924.76	92.0	926.02	180.0	925.70	250.0	926.82
239.8	926.05	15.5	924.82	94.0	926.04	182.0	925.76	275.0	926.76
240.2	926.19	17.0	924.63	96.0	925.97	184.0	925.87	243.6	926.13
242.0	926.07	19.0	924.61	98.5	925.95	185.0	925.90	244.3	926.45
243.4	926.08	20.0	924.67	100.5	925.96	188.0	926.01	245.4	926.52
244.4	926.48	21.2	924.60	103.0	926.04	191.0	925.99	247.0	926.62
246.0	926.61	23.2	924.64	105.0	926.07	193.0	925.88	250.0	926.82
248.0	926.67	24.4	924.76	107.0	926.16	195.0	925.88	275.0	926.76
250.0	926.81	27.0	924.81	110.0	926.21	197.0	925.96	243.6	926.13
253.0	926.91	28.0	924.85	112.0	926.24	200.0	926.04	244.3	926.45
256.0	926.93	30.6	924.84	114.0	926.32	203.0	926.05	245.4	926.52
260.0	926.92	31.4	924.96	115.0	926.26	206.0	926.11		
262.0	926.79	32.1	925.17	117.0	926.32	209.0	926.14		
270.0	926.77	34.0	925.27	119.0	926.45	212.0	926.17		
275.0	926.76	36.0	925.34	121.0	926.43	215.0	926.21		
		38.0	925.38	123.0	926.48	218.0	926.14		
		40.0	925.48	125.0	926.51	220.0	926.00		
		42.5	925.55	127.0	926.47	221.5	926.04		
		45.0	925.72	129.0	926.47	222.5	926.12		
		47.0	925.74	132.0	926.48	224.0	926.03		
		49.0	925.76	135.0	926.53	226.0	925.99		
		50.0	925.82	137.0	926.56	228.0	926.05		
		52.0	925.84	139.0	926.58	229.0	925.96		
		54.0	925.97	141.0	926.59	230.4	925.74		
		56.0	925.98	142.0	926.58	232.0	925.69		
		58.0	925.92	143.7	926.63	234.0	925.62		
		60.0	925.81	144.0	926.15	236.0	925.56		
		62.0	925.78	144.3	925.98	237.5	925.52		
		64.0	925.83	146.4	925.01	238.4	925.77		
		66.0	925.86	148.8	924.49	239.4	925.81		
		68.0	925.92	150.7	924.59	239.8	926.10		
		70.0	925.91	152.5	924.64	241.0	926.13		

Table 38. (Continued) Listing of horizontal stations and elevations for cross section PR200A
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1995		1995		1995		1995		1996	
29 September		29 September		29 September		29 September		23 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-20.0	927.62	42.6	926.06	107.0	926.31	176.5	925.34	-6.4	927.76
-17.0	927.61	44.0	926.05	107.2	926.18	179.0	925.45	-6.0	927.71
-15.0	927.66	46.0	926.04	108.0	926.20	181.0	925.54	-3.5	927.66
-11.0	927.63	48.0	926.03	110.0	926.29	183.0	925.59	-3.1	925.96
-8.0	927.70	50.0	925.98	111.0	926.30	185.0	925.63	-1.9	925.53
-6.4	927.77	52.0	926.00	112.4	926.46	187.0	925.63	-1.2	925.37
-4.0	927.67	54.0	925.95	113.0	926.22	189.0	925.66	-1.2	924.89
-1.8	927.71	55.2	925.87	114.5	926.30	191.0	925.63	0.4	924.54
-1.5	927.69	56.9	925.82	114.9	926.19	193.0	925.72	3.0	924.21
-1.2	925.91	57.7	925.99	116.0	926.39	195.0	925.84	5.0	924.32
-0.7	925.31	58.0	926.13	116.7	926.56	197.5	926.25	7.0	924.59
0.0	925.03	60.0	926.14	117.8	926.58	200.0	926.33	10.0	924.77
0.9	924.77	62.0	926.16	118.0	926.45	203.0	926.36	12.0	924.93
2.0	924.47	64.0	926.16	119.0	926.05	206.0	926.38	14.0	925.14
6.5	923.59	66.0	926.17	120.1	925.74	209.0	926.32	15.5	925.31
7.5	924.15	68.0	926.11	121.2	925.12	211.0	926.30	16.5	925.83
8.2	924.99	70.0	926.15	123.0	925.49	213.0	926.24	18.0	925.89
9.3	924.76	72.0	926.14	125.0	925.58	215.0	926.22	20.0	925.84
10.0	924.11	74.0	926.12	126.5	925.60	216.5	926.32	21.3	925.63
12.0	924.57	76.0	926.13	127.9	925.62	218.0	926.37	23.0	925.56
14.1	924.76	78.0	926.11	128.5	925.73	219.2	926.40	24.0	925.63
15.0	925.19	80.0	926.10	130.0	925.76	221.0	926.26	27.0	925.63
16.0	925.68	82.0	926.08	132.0	925.77	223.0	926.22	30.0	925.56
17.3	925.88	84.0	926.06	134.0	925.75	224.5	926.24	32.0	925.69
17.6	925.68	88.0	926.27	136.0	925.77	225.5	926.36	35.0	925.62
19.4	925.56	88.5	926.12	138.0	925.78	227.0	926.34	37.7	925.67
21.0	925.57	90.0	926.22	140.0	925.73	228.5	926.36	40.0	925.99
23.0	925.46	91.0	926.28	142.0	925.73	230.0	925.86	42.0	925.99
25.0	925.34	92.0	926.24	143.0	925.64	231.0	925.79	45.0	926.05
27.0	925.30	95.0	926.39	145.0	925.48	233.0	925.75	48.0	926.09
29.0	925.23	96.8	926.34	146.0	925.36	235.0	925.88	51.0	926.09
31.5	925.14	97.3	926.17	146.8	925.15	237.5	925.88	54.0	925.97
32.0	925.27	97.8	926.13	149.0	924.96	239.2	925.84	56.0	925.85
33.0	925.31	98.0	926.22	151.0	924.77	239.4	925.95	59.0	926.09
34.0	925.39	100.0	926.26	154.0	924.71	239.7	925.98	62.0	926.17
35.0	925.35	101.0	926.30	157.0	924.80	240.0	926.32	65.0	926.16
36.7	925.74	102.0	926.20	160.0	924.83	242.0	926.22	68.0	926.15
38.0	925.71	103.0	926.11	163.0	924.89	243.6	926.20	70.0	926.21
38.9	925.94	103.5	926.05	166.0	925.06	245.0	926.49	72.0	926.29
40.0	925.96	104.0	926.22	169.0	925.21	247.0	926.62	74.0	926.16
41.4	925.88	105.0	926.07	172.0	925.21	250.0	926.80	77.0	926.11
42.1	925.91	106.5	926.16	174.0	925.22			80.0	926.13

Table 38. (Continued) Listing of horizontal stations and elevations for cross section PR200A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1996		1997		1997		1997	
23 October		23 October		17 September		17 September		17 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
83.0	926.10	172.0	925.07	-20.0	927.64	54.0	925.96	126.0	925.68
88.0	926.28	174.6	925.11	-17.0	927.61	56.5	925.86	128.0	925.67
89.0	926.19	177.0	925.21	-14.0	927.65	58.0	925.97	130.0	925.72
91.0	926.31	180.0	925.27	-11.7	927.63	60.0	926.10	132.0	925.74
93.0	926.27	183.0	925.36	-9.0	927.64	62.0	926.16	134.0	925.74
96.0	926.40	186.0	925.51	-6.4	927.77	64.0	926.16	136.0	925.68
98.0	926.19	188.0	925.59	-5.0	927.69	66.0	926.16	138.0	925.19
100.0	926.23	191.5	926.04	-3.8	927.66	68.0	926.16	139.5	924.86
102.0	926.18	194.0	926.13	-3.8	926.81	70.0	926.21	140.6	924.67
104.0	926.04	196.5	926.15	-3.5	926.45	72.0	926.26	141.8	924.61
106.0	926.16	198.5	926.42	-2.7	926.11	74.0	926.18	142.5	924.23
108.0	926.18	200.0	926.38	-2.4	926.02	76.0	926.14	144.0	924.21
108.5	926.29	203.0	926.38	-1.5	925.20	78.0	926.12	145.0	924.21
110.0	926.30	206.0	926.39	-0.6	924.91	80.0	926.13	147.0	924.31
112.0	926.34	209.0	926.32	1.0	924.69	82.0	926.12	150.0	924.31
112.5	926.22	212.0	926.26	3.0	924.69	84.0	926.12	153.0	924.44
114.0	926.11	215.0	926.25	4.5	924.91	86.0	926.28	156.0	924.47
115.7	926.09	218.0	926.36	5.5	925.03	89.0	926.18	159.0	924.53
116.5	926.51	221.5	926.39	6.4	925.28	90.0	926.30	162.0	924.58
117.6	926.50	224.0	926.31	7.9	925.57	92.0	926.28	165.0	924.51
119.0	925.94	227.0	926.32	8.2	925.83	93.0	926.27	168.0	924.38
120.0	925.80	228.0	926.37	10.0	925.81	96.0	926.41	171.0	924.32
121.0	925.47	229.0	926.27	12.0	925.81	98.0	926.20	174.0	924.30
122.5	925.73	230.0	926.12	15.0	925.94	100.0	926.24	177.0	924.24
124.0	925.59	232.0	926.12	17.0	925.99	102.0	926.17	180.0	924.21
126.0	925.58	234.0	926.08	19.5	925.94	103.5	926.03	183.0	924.18
128.0	925.67	235.0	926.00	21.0	925.77	105.0	926.14	186.0	924.20
131.0	925.67	237.0	925.99	23.0	925.80	106.0	926.17	188.0	924.37
134.0	925.72	238.0	925.91	25.0	925.92	107.9	926.20	189.5	924.73
137.0	925.66	239.0	925.95	27.0	925.78	109.0	926.28	191.0	925.06
140.0	925.35	240.0	926.13	29.0	925.76	110.5	926.26	193.0	925.38
142.0	925.15	240.5	926.39	31.0	925.81	112.0	926.36	195.0	925.84
144.0	924.99	241.5	926.27	33.0	925.80	112.5	926.21	197.0	926.20
146.0	924.91	243.0	926.23	35.0	925.71	114.0	926.12	198.5	926.40
148.0	924.76	245.0	926.50	38.0	925.69	115.6	926.11	200.0	926.37
151.0	924.71	246.0	926.61	40.0	925.97	116.4	926.50	202.0	926.36
154.0	924.66	248.0	926.66	42.0	925.99	117.5	926.56	204.0	926.42
157.0	924.73	250.0	926.80	44.0	926.00	119.0	925.96	207.0	926.40
160.0	924.77	275.0	926.76	46.0	926.06	121.0	925.63	210.0	926.33
163.0	924.74			48.0	926.08	122.0	925.84	213.0	926.26
166.0	924.85			50.0	926.05	124.0	925.84	216.0	926.26
169.0	924.91			52.0	926.06	125.0	925.86	219.0	926.35

Table 38. (Continued) Listing of horizontal stations and elevations for cross section PR200A

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1997		1998		1998		1998	
17 September		27 September		27 September		27 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
222.0	926.36	-9.9	927.64	88.5	926.16	187.0	924.17
224.0	926.31	-7.5	927.67	91.0	926.31	190.0	924.53
227.0	926.32	-6.4	927.75	95.0	926.36	191.8	924.93
229.0	926.30	-6.0	927.72	98.0	926.20	194.0	925.31
231.0	926.11	-4.4	927.66	100.0	926.25	196.0	925.90
233.0	926.10	-4.0	926.58	103.0	926.09	198.2	926.36
234.8	925.98	-3.2	926.36	104.0	926.04	200.0	926.36
236.0	925.80	-0.6	924.91	106.0	926.16	203.0	926.37
238.0	925.73	0.2	924.82	107.5	926.16	206.0	926.38
238.4	925.81	2.3	924.76	109.0	926.27	209.0	926.33
238.6	926.04	5.0	924.90	111.0	926.30	212.0	926.27
239.8	926.10	7.0	925.35	113.0	926.21	215.0	926.27
240.5	926.40	8.3	925.76	114.5	926.14	218.0	926.37
242.3	926.21	10.0	925.79	116.0	926.11	221.0	926.33
243.5	926.29	13.0	925.83	116.5	926.49	224.0	926.29
244.5	926.54	16.0	925.94	117.5	926.48	227.0	926.33
246.0	926.62	19.0	925.93	119.0	925.96	228.8	926.29
248.0	926.67	21.0	925.76	121.1	925.67	230.0	926.14
250.0	926.81	23.0	925.77	122.0	925.80	232.0	926.11
		25.0	925.90	124.0	925.85	234.0	926.03
		28.0	925.76	126.0	925.70	236.0	925.80
		30.0	925.80	128.0	925.67	238.0	925.76
		33.0	925.79	130.0	925.71	238.6	926.05
		36.0	925.73	133.0	925.74	239.4	926.07
		38.0	925.73	136.0	925.69	240.4	926.40
		40.0	925.98	138.0	925.20	243.0	926.23
		43.0	926.03	139.6	924.89	246.0	926.59
		46.0	926.06	142.0	924.43	250.0	926.90
		49.0	926.09	145.0	924.46		
		52.0	926.07	148.0	924.44		
		55.0	925.88	151.0	924.36		
		58.0	925.96	154.0	924.45		
		61.0	926.14	157.0	924.50		
		64.0	926.15	160.0	924.53		
		66.0	926.15	163.0	924.56		
		68.0	926.11	166.0	924.36		
		70.0	926.20	169.0	924.30		
		73.0	926.22	172.0	924.30		
		76.0	926.15	175.0	924.23		
		79.0	926.11	178.0	924.33		
		82.0	926.11	181.0	924.24		
		85.0	926.24	184.0	924.21		

Description of Cross Section PR206

Location: Township 5 South/Range 51 East--section 2

U. S. Geological Survey quadrangle (1:24,000): Broadus

Landowners--left bank: Ron and Twila Talcott

--right bank: Charles and Shirley Russell

Access: Right bank

Permission from: Charles or Shirley Russell

Distance from Moorhead Gaging Station: 92.19 kilometers

Azimuth of Section (degrees magnetic): 266

Reference Monuments

[Monuments at stations 101.9 and 139.6 were closest to leveling instrument]

Description	Station (m)	GPS-NAD83 (1992)		Measurement		Elevation (NGVD1929) (m)
		Latitude	Longitude	Standard deviation (m)	Horizontal precision (m)	
1/2-inch-rebar; bent flat on 1998 ground level	-50.0					921.06
1/2-inch-rebar; 0.29 meter above 1998 ground level	-43.25	45°26'03.23"	105°23'33.50"	0.404	0.434	921.00
1/2-inch-rebar; upstream bolt in upstream circular concrete footing; offsection at station 101.9	101.9					921.50
Benchmark--brass circular plate; off section at about 102.0	~102.0	45°26'02.44"	105°23'26.94"	0.409	0.775	921.32
1/2-inch-rebar; 0.11 meter above 1998 ground level; under a 5-strand, barbed-wire fence line	139.6	45°26'02.25"	105°23'25.23"	0.639	0.500	921.24

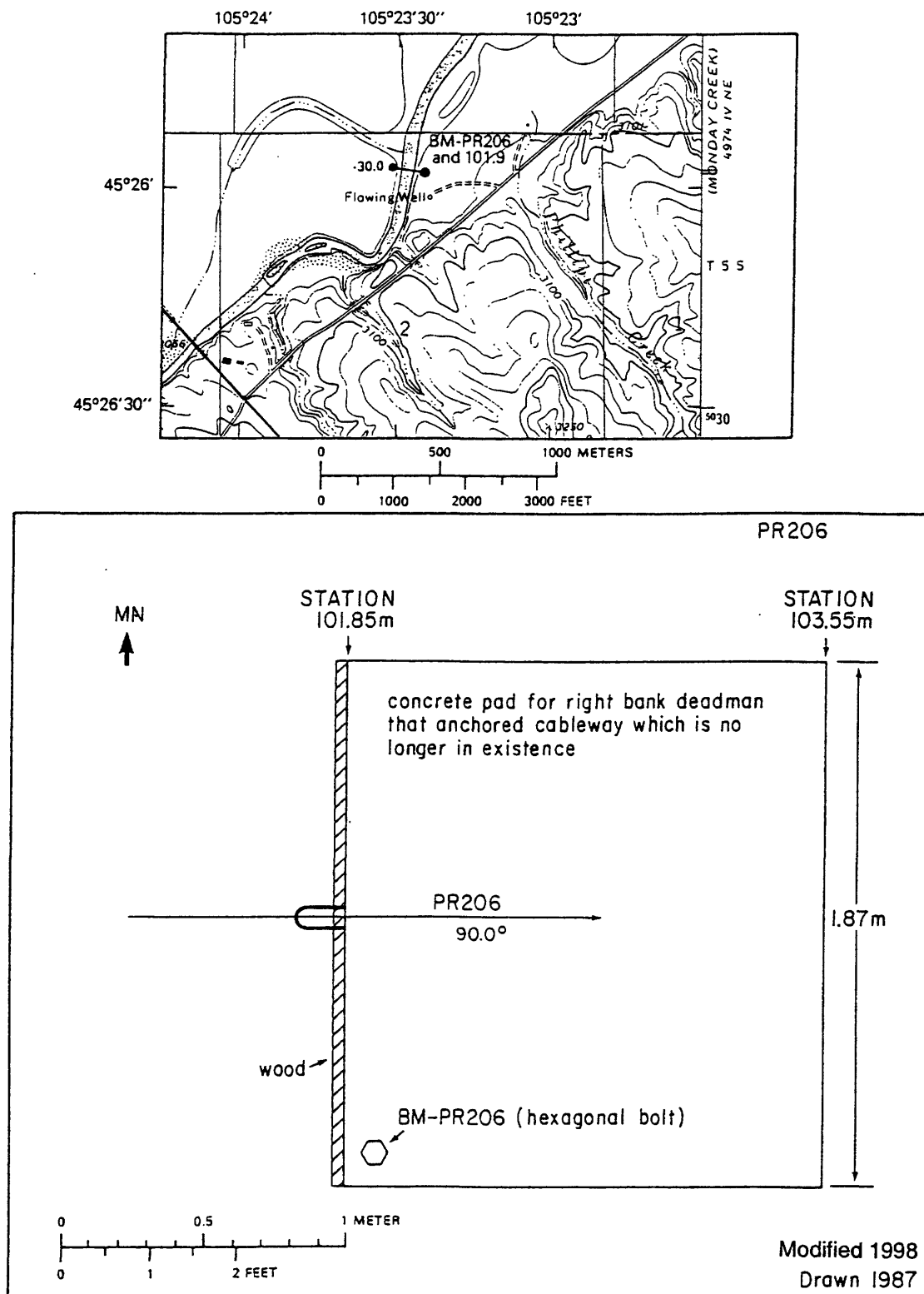


Figure 113. Upper: Location of cross section PR206, bench mark BM-PR206, and the left and right bank reference monuments in the Eldon Mountain quadrangle. Lower: Location of the bench mark on the right bank. MN is magnetic north.

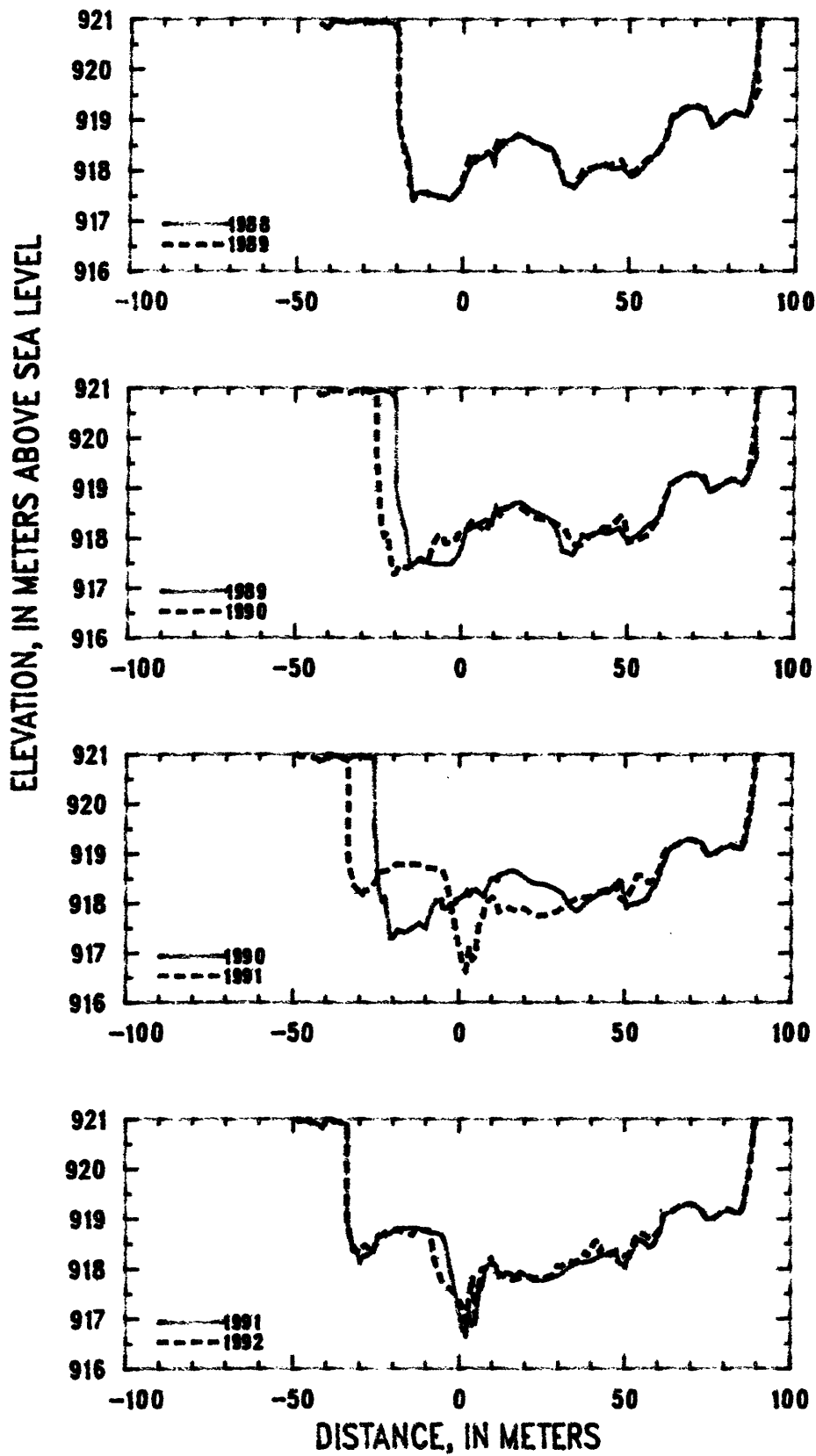


Figure 114. Profiles of cross section PR206 from 1988 to 1992.

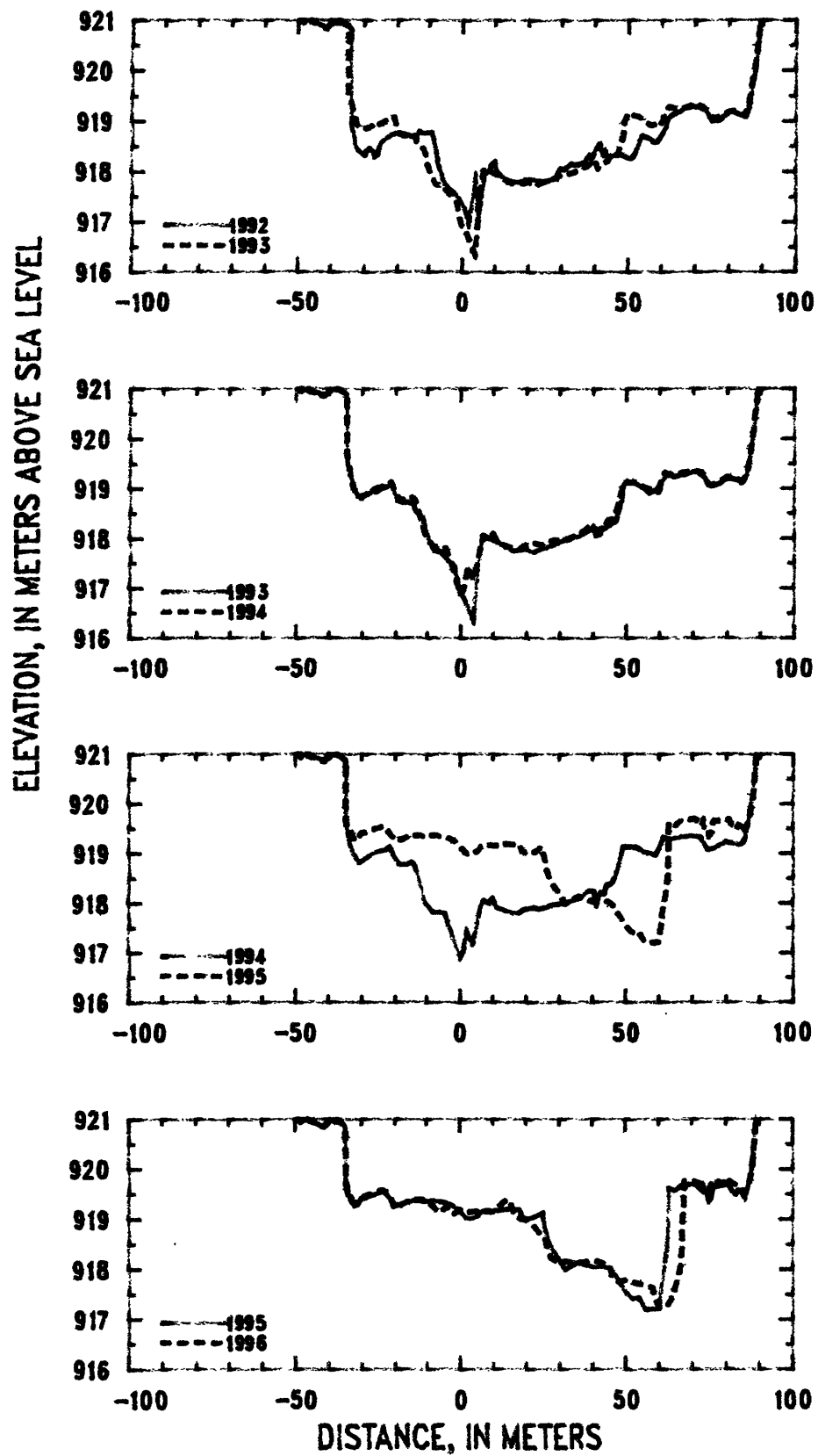


Figure 115. Profiles of cross section PR206 from 1992 to 1996.

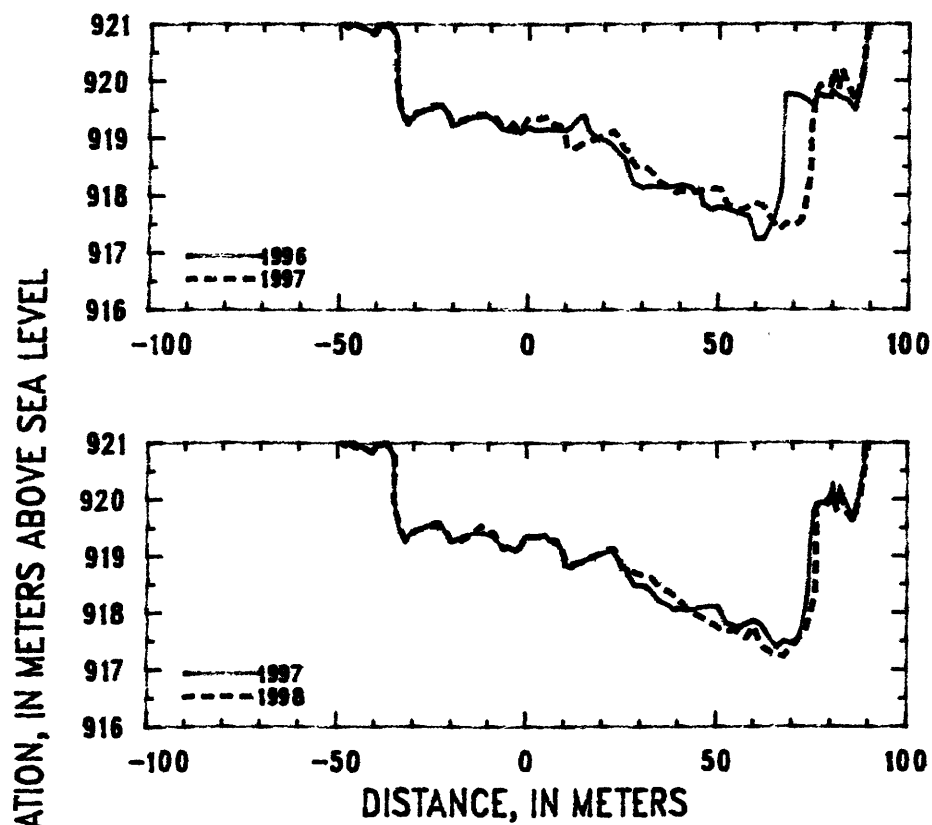


Figure 116. Profiles of cross section PR206 from 1996 to 1998.

Table 39. Listing of horizontal stations and elevations for cross section PR206

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1989		1989		1990		1990		1990	
23 September		23 September		24 September		24 September		24 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-30.0	920.98	33.7	917.67	-43.0	920.91	12.3	918.57	80.0	919.13
-28.0	920.93	34.7	917.76	-42.0	920.85	14.0	918.62	82.0	919.18
-26.0	920.93	36.6	918.07	-40.0	920.90	16.0	918.68	84.0	919.15
-24.0	920.98	38.0	918.04	-37.0	920.98	18.0	918.63	85.0	919.08
-21.0	920.90	40.0	918.07	-34.0	920.91	20.0	918.53	86.3	919.23
-19.7	920.78	42.0	918.14	-30.0	920.98	22.0	918.43	87.5	919.72
-19.6	919.10	44.0	918.09	-28.0	920.93	24.0	918.39	88.1	919.99
-19.0	918.77	46.0	918.15	-25.7	920.94	26.0	918.38	88.9	920.59
-17.5	918.31	47.7	918.21	-25.6	919.52	28.0	918.33	89.2	921.35
-16.5	918.13	49.0	918.07	-25.0	919.24	30.0	918.26	90.0	921.39
-16.0	917.83	50.2	917.95	-24.5	918.60	31.4	918.20	92.0	921.42
-15.0	917.42	52.0	918.00	-24.1	918.25	33.0	917.98	94.0	921.33
-13.0	917.55	54.0	918.11	-23.2	918.03	34.1	917.89	96.0	921.30
-11.0	917.55	56.0	918.25	-22.4	918.11	35.6	917.84	98.0	921.26
-9.0	917.49	58.0	918.30	-21.7	917.84	36.9	917.90	100.0	921.22
-7.0	917.48	60.0	918.47	-20.6	917.29	39.0	918.06		
-5.0	917.47	61.0	918.61	-19.7	917.30	41.0	918.12		
-3.0	917.48	63.0	919.08	-18.5	917.46	43.0	918.22		
-1.0	917.62	65.0	919.16	-16.0	917.41	45.0	918.21		
0.1	917.81	67.0	919.26	-14.0	917.50	46.0	918.27		
1.0	918.06	69.0	919.29	-13.0	917.57	46.2	918.31		
2.0	918.27	71.0	919.29	-12.0	917.60	48.2	918.46		
3.3	918.35	73.0	919.19	-10.0	917.49	49.0	918.44		
3.7	918.22	74.0	919.07	-8.5	917.86	50.0	918.07		
6.0	918.31	75.0	918.93	-7.0	918.05	50.5	917.91		
8.0	918.37	77.0	918.97	-5.2	918.07	52.0	917.97		
9.4	918.29	79.0	919.08	-4.8	917.90	54.0	917.99		
10.8	918.63	81.0	919.19	-3.2	917.90	56.5	918.07		
11.3	918.51	83.0	919.14	-2.7	917.95	58.0	918.27		
12.0	918.49	85.0	919.07	-1.0	918.01	59.0	918.33		
12.4	918.59	86.0	919.20	-0.9	918.08	60.2	918.49		
14.0	918.60	89.0	919.63	0.0	918.10	61.0	918.74		
16.0	918.70	88.0	919.86	1.1	918.15	62.3	918.89		
18.0	918.73	88.8	920.50	1.9	918.17	63.0	919.05		
20.0	918.64	89.2	921.36	2.5	918.25	65.0	919.18		
22.0	918.54	91.0	921.40	3.2	918.16	67.0	919.23		
24.0	918.49	93.0	921.37	4.0	918.26	69.0	919.30		
26.0	918.43	95.0	921.29	5.0	918.28	71.0	919.28		
28.0	918.28	97.0	921.27	7.6	918.13	73.2	919.24		
29.6	918.06	99.0	921.23	9.9	918.48	74.9	918.98		
30.7	917.75	101.0	921.24	11.2	918.51	76.0	918.99		
32.5	917.71			11.9	918.46	78.0	919.05		

Table 39. (Continued) Listing of horizontal stations and elevations for cross section PR206
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1991		1991		1991		1992		1992	
3 September		3 September		3 September		29 August		29 August	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-50.0	921.06	10.3	918.13	82.0	919.17	-50.0	921.05	8.3	918.00
-48.0	920.95	11.5	918.06	85.0	919.09	-48.0	920.96	8.7	918.04
-46.0	920.96	12.3	917.83	86.0	919.25	-47.0	921.17	9.0	918.14
-43.0	920.91	14.2	917.91	89.0	920.60	-45.0	920.94	10.0	918.21
-41.0	920.83	15.0	917.92	89.4	921.30	-43.0	920.92	10.6	918.04
-39.6	921.00	17.3	917.86	89.7	921.37	-41.0	920.83	11.0	917.98
-37.0	920.98	18.6	917.93	91.0	921.41	-40.0	920.97	13.0	917.87
-35.0	920.92	20.0	917.89	94.0	921.33	-38.0	920.94	15.0	917.80
-33.6	920.88	22.0	917.78	97.0	921.29	-36.0	920.95	17.0	917.78
-33.6	919.00	24.0	917.75	100.0	921.22	-33.7	920.83	19.0	917.83
-33.0	918.69	26.0	917.77			-33.6	918.93	21.0	917.85
-32.3	918.54	28.0	917.81			-33.0	918.76	23.0	917.82
-32.2	918.38	30.0	917.85			-32.4	918.49	25.0	917.80
-30.3	918.25	32.0	917.96			-31.0	918.38	27.0	917.85
-29.8	918.12	34.0	918.04			-29.7	918.32	28.3	917.88
-29.0	918.23	36.0	918.11			-29.4	918.41	29.5	918.03
-27.0	918.29	38.0	918.12			-28.3	918.47	29.7	918.06
-24.8	918.48	40.0	918.14			-26.8	918.38	31.0	918.05
-24.6	918.65	42.0	918.22			-26.6	918.29	33.0	918.15
-23.0	918.64	44.0	918.27			-26.0	918.32	35.0	918.13
-21.0	918.69	46.0	918.27			-25.0	918.57	37.0	918.18
-19.0	918.80	47.5	918.38			-24.0	918.65	38.4	918.33
-17.0	918.81	48.0	918.13			-22.0	918.73	39.1	918.26
-15.0	918.81	50.2	918.02			-20.0	918.77	41.0	918.53
-13.0	918.80	50.6	918.14			-18.0	918.76	41.6	918.55
-11.0	918.77	52.6	918.36			-16.0	918.71	42.5	918.33
-9.0	918.72	53.7	918.57			-14.0	918.67	43.1	918.40
-7.0	918.71	55.0	918.57			-13.0	918.79	43.3	918.31
-5.0	918.68	56.0	918.53			-11.0	918.76	44.0	918.27
-4.0	918.51	57.5	918.41			-9.0	918.77	46.0	918.32
-2.4	917.96	59.0	918.48			-8.0	918.48	48.0	918.33
-1.4	917.61	60.7	918.73			-7.2	918.18	50.0	918.26
0.0	917.13	61.7	919.01			-6.7	918.05	51.0	918.24
1.0	916.77	63.0	919.11			-5.0	917.72	52.2	918.37
2.0	916.64	65.0	919.17			-3.0	917.62	53.0	918.58
3.0	917.11	67.0	919.24			-1.0	917.46	54.2	918.71
4.0	916.86	69.0	919.29			1.0	917.23	56.0	918.68
5.0	916.95	71.0	919.28			2.0	916.95	57.6	918.58
6.0	917.56	73.0	919.21			4.0	917.84	58.5	918.58
7.0	917.63	75.0	918.98			5.0	917.04	60.0	918.71
8.0	917.95	77.0	919.01			6.0	917.66	61.2	918.85
9.0	918.06	80.0	919.15			7.0	917.99	61.8	919.06

Table 39. (Continued) Listing of horizontal stations and elevations for cross section PR206
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1992		1993		1993		1993		1994	
29 August		1 September		1 September		1 September		19 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
63.0	919.13	-50.0	921.05	10.0	917.97	72.0	919.29	-50.0	921.05
65.0	919.17	-48.0	920.96	12.0	917.90	73.0	919.23	-48.5	920.95
67.0	919.27	-47.0	921.05	14.0	917.81	74.0	919.14	-47.0	921.03
69.0	919.29	-45.0	920.94	16.0	917.74	75.0	919.06	-45.5	920.93
71.0	919.29	-43.0	920.92	18.0	917.77	76.0	919.05	-43.3	920.91
73.0	919.22	-42.0	920.85	20.0	917.79	77.0	919.07	-41.0	920.87
75.0	918.99	-41.0	920.86	22.0	917.72	78.0	919.11	-39.5	920.99
77.0	919.01	-39.0	920.98	24.0	917.79	80.0	919.19	-37.0	921.00
79.0	919.11	-37.0	921.00	26.0	917.82	81.0	919.21	-34.8	920.89
81.0	919.20	-35.0	920.92	28.0	917.87	82.0	919.19	-34.6	920.78
83.0	919.13	-34.6	920.85	30.0	917.93	84.0	919.16	-34.6	919.71
85.0	919.08	-34.6	919.54	31.5	917.97	84.5	919.11	-33.5	919.22
86.0	919.26	-34.0	919.42	33.5	917.97	85.0	919.16	-32.3	918.99
87.0	919.69	-32.5	919.09	36.0	918.06	86.0	919.36	-30.6	918.81
87.9	919.94	-32.3	918.97	37.7	918.10	87.0	919.75	-29.0	918.88
89.0	920.65	-31.0	918.84	39.0	918.17	88.0	920.12	-27.0	918.98
89.6	921.37	-30.0	918.85	40.0	918.25	89.0	920.72	-25.0	919.03
91.0	921.41	-28.0	918.89	41.0	918.05	89.3	921.38	-23.0	919.07
94.0	921.34	-26.4	918.99	43.0	918.18	91.0	921.42	-21.5	919.14
97.0	921.29	-25.8	918.94	44.0	918.21	93.0	921.37	-20.0	918.90
100.0	921.22	-24.0	919.00	44.5	918.32	95.0	921.30	-18.5	918.78
101.0	921.26	-23.0	919.03	45.0	918.28	97.0	921.29	-16.0	918.77
		-21.0	919.10	46.0	918.35	99.0	921.24	-14.5	918.83
		-19.5	918.76	46.8	918.33	101.0	921.26	-13.6	918.77
		-18.0	918.71	48.0	918.62			-10.5	918.02
		-16.0	918.72	48.8	918.83			-8.0	917.83
		-14.0	918.70	48.8	919.01			-4.5	917.81
		-14.0	918.60	50.0	919.16			-3.0	917.53
		-13.0	918.50	51.0	919.12			0.0	916.88
		-12.0	918.47	53.0	919.10			1.0	917.00
		-11.4	918.40	55.0	919.01			2.0	917.45
		-10.0	918.06	57.0	918.91			3.0	917.29
		-8.0	917.74	58.5	918.97			4.0	917.18
		-6.0	917.73	59.6	918.92			6.0	917.85
		-4.0	917.56	60.2	919.00			7.0	918.06
		-2.0	917.46	60.7	919.14			9.0	917.99
		0.0	916.86	62.0	919.28			10.0	918.10
		1.0	916.81	63.0	919.29			11.5	917.91
		4.0	916.33	64.0	919.24			13.6	917.86
		5.0	917.27	66.0	919.25			15.7	917.80
		6.5	918.05	68.0	919.29			18.0	917.79
		8.0	918.02	70.0	919.35			19.0	917.86

Table 39. (Continued) Listing of horizontal stations and elevations for cross section PR206
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1994		1994		1995		1995		1995	
19 September		19 September		1 October		1 October		1 October	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
22.6	917.92	98.0	921.26	-50.0	921.05	21.0	919.00	84.0	919.58
24.0	917.88	100.0	921.22	-48.0	920.93	23.0	919.05	85.0	919.54
26.0	917.93	101.0	921.27	-47.0	921.04	24.8	919.15	85.6	919.41
28.0	917.98	139.6	921.14	-45.0	920.95	26.0	918.73	87.0	919.71
30.0	917.98			-43.3	920.91	27.0	918.51	88.0	920.10
33.0	918.02			-41.0	920.85	28.5	918.34	89.5	921.36
36.0	918.09			-39.0	920.98	29.8	918.21	90.0	921.41
39.0	918.25			-37.0	921.00	32.0	917.98	91.0	921.41
40.5	918.25			-35.0	920.89	34.0	918.07	93.5	921.37
41.5	917.97			-34.7	920.83	36.0	918.14	96.0	921.30
42.5	918.21			-34.6	919.66	38.0	918.10	98.0	921.26
43.5	918.20			-34.0	919.48	40.0	918.04	100.0	921.23
44.3	918.37			-33.0	919.44	42.0	918.05		
46.0	918.39			-32.0	919.25	44.0	918.05		
47.0	918.57			-31.2	919.28	46.0	917.98		
48.0	918.78			-30.0	919.41	48.0	917.77		
49.2	919.14			-28.0	919.44	50.0	917.53		
51.0	919.13			-26.0	919.49	52.0	917.41		
53.0	919.14			-24.0	919.55	54.0	917.43		
55.0	919.04			-23.0	919.55	56.0	917.19		
57.0	919.00			-20.0	919.27	60.0	917.21		
59.0	918.96			-18.0	919.27	62.0	918.21		
60.0	919.07			-16.0	919.33	62.7	918.54		
61.3	919.33			-14.0	919.37	63.0	919.62		
63.0	919.29			-12.0	919.36	64.0	919.59		
65.0	919.30			-10.0	919.36	65.0	919.56		
67.0	919.33			-8.0	919.38	67.0	919.67		
70.0	919.36			-6.0	919.35	69.0	919.69		
72.3	919.33			-4.0	919.32	71.0	919.70		
74.6	919.07			-2.0	919.26	72.0	919.64		
76.0	919.08			0.0	919.14	73.0	919.56		
78.0	919.15			2.0	919.00	73.3	919.64		
80.0	919.24			4.0	919.00	73.5	919.53		
82.0	919.20			5.7	919.06	74.5	919.53		
84.0	919.17			6.3	919.14	75.0	919.35		
85.0	919.19			8.0	919.17	75.6	919.43		
86.0	919.38			10.0	919.17	76.3	919.66		
87.2	919.81			12.0	919.16	78.0	919.65		
88.8	920.75			14.0	919.20	80.0	919.68		
89.2	921.34			16.0	919.18	81.0	919.68		
92.0	921.40			18.0	919.18	82.0	919.52		
95.5	921.31			19.0	919.03	83.0	919.48		

Table 39. (Continued) Listing of horizontal stations and elevations for cross section PR206
 [Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1996		1996		1996		1997		1997	
16 October		16 October		16 October		24 September		24 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
-50.0	921.04	18.0	919.01	87.2	919.78	-50.0	921.05	26.7	918.76
-48.0	920.94	20.0	918.98	88.0	920.09	-48.0	920.95	26.8	918.65
-46.5	921.01	22.0	918.90	89.0	920.83	-47.0	921.04	28.5	918.49
-43.3	920.92	24.0	918.73	89.4	921.35	-45.0	920.96	31.0	918.47
-41.0	920.84	25.6	918.63	91.0	921.42	-43.3	920.91	33.2	918.36
-40.0	920.98	26.0	918.48	94.0	921.35	-41.0	920.82	34.5	918.22
-38.0	920.97	27.5	918.22	97.0	921.30	-39.0	920.97	37.5	918.13
-36.0	920.94	30.0	918.13	100.0	921.22	-37.0	921.00	39.0	918.04
-34.7	920.73	32.0	918.16			-35.0	920.79	40.0	918.08
-34.7	919.96	34.0	918.14			-35.0	920.08	43.0	918.04
-34.5	919.71	36.0	918.13			-33.8	919.50	46.0	918.10
-33.9	919.50	38.0	918.15			-32.0	919.26	49.0	918.11
-32.6	919.32	40.0	918.18			-30.0	919.44	50.5	918.10
-31.0	919.34	42.0	918.16			-27.0	919.51	52.5	917.81
-30.0	919.41	43.1	918.13			-25.0	919.59	54.0	917.78
-28.0	919.49	44.0	918.06			-23.0	919.59	56.0	917.73
-26.0	919.53	45.3	918.06			-21.5	919.43	58.0	917.80
-24.0	919.58	46.0	917.83			-20.0	919.26	60.0	917.86
-23.0	919.57	48.0	917.74			-17.0	919.34	62.0	917.80
-21.5	919.45	50.0	917.79			-14.0	919.42	64.0	917.58
-20.4	919.23	52.0	917.76			-11.0	919.42	66.0	917.38
-19.0	919.25	54.0	917.71			-8.5	919.35	68.0	917.50
-17.0	919.32	56.0	917.67			-6.0	919.12	70.0	917.45
-15.0	919.38	58.0	917.64			-4.5	919.16	72.0	917.56
-13.0	919.39	60.0	917.23			-2.8	919.10	73.7	918.15
-11.0	919.40	62.0	917.24			-1.5	919.18	74.3	918.55
-9.0	919.32	64.0	917.44			-0.5	919.33	74.6	919.22
-7.0	919.17	66.0	917.87			0.5	919.36	75.6	919.77
-5.5	919.15	66.8	918.14			3.0	919.34	76.5	919.92
-4.0	919.27	67.0	918.50			5.0	919.38	78.0	919.94
-2.0	919.10	67.7	919.76			7.0	919.24	79.6	919.91
0.0	919.19	69.0	919.78			8.5	919.22	80.5	920.20
2.0	919.13	71.0	919.75			9.7	919.08	81.5	919.85
4.0	919.15	73.0	919.68			10.3	918.84	82.5	920.19
6.0	919.15	75.0	919.57			11.8	918.81	84.5	919.86
8.0	919.15	76.0	919.77			14.0	918.89	86.0	919.65
10.0	919.14	78.0	919.73			15.5	918.94	87.0	919.86
11.2	919.19	79.5	919.71			18.0	919.00	88.0	920.19
13.0	919.33	80.0	919.82			21.0	919.08	89.0	920.83
14.0	919.38	82.0	919.70			22.6	919.12	89.5	921.36
15.0	919.38	84.0	919.66			24.0	918.98	90.5	921.41
16.0	919.13	85.8	919.51			25.2	918.81	92.4	921.40

Table 39. (Continued) Listing of horizontal stations and elevations for cross section PR206

[Sta., station, distance in meters from a reference pin on the left bank; Elev., elevation, in meters above sea level]

1997		1998		1998	
24 September		29 September		29 September	
Sta.	Elev.	Sta.	Elev.	Sta.	Elev.
95.0	921.32	-50.0	921.05	29.0	918.69
98.0	921.27	-47.5	921.03	31.0	918.66
100.0	921.23	-45.5	920.92	33.0	918.61
		-43.3	920.91	35.0	918.45
		-41.0	920.84	37.0	918.39
		-39.0	920.97	38.5	918.32
		-37.0	921.00	40.3	918.21
		-35.0	920.75	43.0	918.02
		-35.3	920.04	46.0	917.93
		-33.4	919.49	49.0	917.79
		-31.9	919.30	52.0	917.68
		-29.0	919.46	55.0	917.69
		-26.0	919.54	58.0	917.55
		-22.0	919.53	60.0	917.76
		-20.0	919.28	62.0	917.42
		-18.0	919.26	65.0	917.28
		-16.0	919.33	68.0	917.23
		-14.0	919.42	70.0	917.40
		-12.0	919.55	72.0	917.57
		-10.0	919.42	73.5	917.70
		-8.5	919.43	75.5	918.22
		-7.0	919.23	76.0	918.36
		-6.0	919.13	76.3	919.86
		-4.0	919.18	79.0	919.95
		-2.0	919.14	80.5	920.12
		0.0	919.33	81.6	919.79
		2.0	919.35	82.6	920.18
		4.0	919.36	84.0	919.81
		6.0	919.29	86.0	919.61
		8.0	919.29	87.8	920.07
		9.0	919.22	88.8	920.57
		10.0	918.98	89.2	921.31
		11.0	918.87	91.0	921.42
		13.0	918.88	94.6	921.31
		15.0	918.90	97.0	921.29
		17.0	918.98	100.0	921.22
		19.0	919.04	139.6	921.12
		21.0	919.12		
		23.0	919.14		
		24.0	919.04		
		25.0	918.81		
		27.0	918.77		

Appendix. Sand--Silt and Clay analysis of suspended-sediment samples collected at Moorhead and Broadus, Montana, on the Powder River

[Data source is annual publications (U.S. Geological Survey, 1975-97); concentrations of the size fractions of silt and clay and of sand were calculated from the published total concentration and the published value of the percentage of each size fraction; m³/s, cubic meter per second; mg/L, milligram per liter]

Date	Station	Discharge (m ³ /s)	Stage	Concentration (mg/L)			Percent of total	
				Silt and Clay	Sand	Total	Silt and Clay	Sand
Ice break-up floods								
3-07-91	Moorhead	13.8	Rising	660	440	1,100	60	40
3-19-97	Moorhead	43.8	Rising	2,397	153	2,550	94	6
3-19-97	Moorhead	44.0	Rising	2,202	358	2,560	86	14
3-19-97	Moorhead	45.3	Rising	2,079	231	2,310	90	10
3-19-97	Moorhead	45.7	Rising	2,411	329	2,740	88	12
3-19-97	Moorhead	45.9	Rising	2,990	370	3,360	89	11
3-19-97	Moorhead	62.0	Rising	2,282	198	2,480	92	8
3-19-97	Moorhead	63.7	Rising	2,385	265	2,650	90	10
3-19-97	Moorhead	65.4	Rising	3,296	984	4,280	77	23
3-19-97	Moorhead	67.1	Rising	3,058	862	3,920	78	22
3-19-97	Moorhead	68.8	Rising	2,698	592	3,290	82	18
3-19-97	Moorhead	74.5	Rising	3,848	962	4,810	80	20
3-19-97	Moorhead	90.1	Rising	3,012	1,058	4,070	74	26
3-19-97	Moorhead	110	Rising	3,168	1,172	4,340	73	27
3-01-83	Broadus	32.3	Maximum	4,910	100	5,010	98	2
3-10-88	Broadus	28.3	Maximum	4,704	2,016	6,720	70	30
3-08-90	Broadus	26.8	Maximum	6,552	1,848	8,400	78	22
3-24-84	Moorhead	25.5	Maximum	6,248	772	7,020	89	11
3-19-97	Moorhead	129	Maximum	3,155	1,485	4,640	68	32
3-19-76	Broadus	40.8	Falling	5,181	4,239	9,420	55	45
3-14-78	Broadus	96.9	Falling	4,130	2,870	7,000	59	41
3-23-78	Broadus	83.0	Falling	5,387	2,653	8,040	67	33
3-26-79	Broadus	17.7	Falling	2,502	248	2,750	91	9
3-21-84	Broadus	28.6	Falling	9,975	525	10,500	95	5
3-10-87	Broadus	64.3	Falling	21,840	4,160	26,000	84	16
3-18-75	Moorhead	31.2	Falling	4,448	2,612	7,060	63	37
3-15-78	Moorhead	46.2	Falling	3,827	333	4,160	92	8
3-23-78	Moorhead	51.5	Falling	2,866	2,984	5,850	49	51
3-01-83	Moorhead	24.0	Falling	7,251	989	8,240	88	12
3-24-87	Moorhead	14.2	Falling	2,214	1,246	3,460	64	36
3-10-88	Moorhead	21.5	Falling	2,000	740	2,740	73	27
3-09-90	Moorhead	17.6	Falling	2,744	56	2,800	98	2
3-25-93	Moorhead	27.6	Falling	8,070	1,100	9,170	88	12
3-10-94	Moorhead	16.1	Falling	1,373	387	1,760	78	22
3-19-97	Moorhead	45.8	Falling	2,664	296	2,960	90	10
3-19-97	Moorhead	45.7	Falling	2,355	205	2,560	92	8
3-19-97	Moorhead	45.3	Falling	2,166	114	2,280	95	5

Appendix. Sand--Silt and Clay analysis of suspended-sediment samples collected at Moorhead and Broadus, Montana, on the Powder River

Date	Station	Discharge (m ³ /s)	Stage	Concentration (mg/L)			Percent of total	
				Silt and Clay	Sand	Total	Silt and Clay	Sand
3-19-97	Moorhead	45.0	Falling	2,242	118	2,360	95	5
3-19-97	Moorhead	90.0	Falling	5,180	9,620	14,800	35	65
3-19-97	Moorhead	86.9	Falling	4,828	9,372	14,200	34	66
3-19-97	Moorhead	84.5	Falling	4,836	7,564	12,400	39	61
3-19-97	Moorhead	82.0	Falling	4,914	6,786	11,700	42	58
3-19-97	Moorhead	79.6	Falling	4,788	7,812	12,600	38	62
3-19-97	Moorhead	76.3	Falling	5,130	6,270	11,400	45	55
3-19-97	Moorhead	76.3	Falling	5,920	8,880	14,800	40	60
3-19-97	Moorhead	69.7	Falling	6,204	7,896	14,100	44	56
3-19-97	Moorhead	63.1	Falling	7,680	11,520	19,200	40	60
3-19-97	Moorhead	60.0	Falling	6,960	10,440	17,400	40	60
3-19-97	Moorhead	44.4	Falling	6,776	8,624	15,400	44	56
3-20-97	Moorhead	43.3	Falling	4,133	787	4,920	84	16
3-21-97	Moorhead	28.3	Falling	3,223	857	4,080	79	21
Snowmelt floods								
5-17-77	Broadus	62.0	Rising	23,751	3,549	27,300	87	13
5-18-78	Broadus	178	Rising	15,826	3,474	19,300	82	18
6-07-83	Broadus	40.8	Rising	4,070	170	4,240	96	4
6-04-86	Broadus	28.3	Rising	6,502	1,058	7,560	86	14
5-19-88	Broadus	50.7	Rising	5,962	2,318	8,280	72	28
6-24-92	Broadus	31.4	Rising	6,295	1,025	7,320	86	14
5-25-76	Moorhead	52.7	Rising	4,595	2,065	6,660	69	31
5-19-81	Moorhead	8.9	Rising	1,110	350	1,460	76	24
5-20-81	Moorhead	33.1	Rising	18,232	2,968	21,200	86	14
6-07-83	Moorhead	48.7	Rising	5,561	1,059	6,620	84	16
5-02-84	Moorhead	25.0	Rising	3,628	1,342	4,970	73	27
6-09-86	Moorhead	123	Rising	20,020	1,980	22,000	91	9
6-14-96	Moorhead	51.8	Rising	698	1,242	1,940	36	64
5-26-76	Broadus	74.5	Maximum	6,873	1,827	8,700	79	21
6-27-82	Broadus	96.9	Maximum	20,726	3,374	24,100	86	14
5-30-91	Broadus	64.3	Maximum	4,257	2,193	6,450	66	34
6-18-92	Broadus	73.1	Maximum	18,360	3,240	21,600	85	15
5-21-75	Moorhead	58.1	Maximum	7,986	4,114	12,100	66	34
5-17-77	Moorhead	134	Maximum	29,340	3,260	32,600	90	10
5-25-81	Moorhead	56.9	Maximum	9,216	3,584	12,800	72	28
5-22-85	Moorhead	15.4	Maximum	11,564	236	11,800	98	2
6-05-86	Moorhead	58.1	Maximum	17,019	1,281	18,300	93	7

Appendix. Sand--Silt and Clay analysis of suspended-sediment samples collected at Moorhead and Broadus, Montana, on the Powder River

Date	Station	Discharge (m ³ /s)	Stage	Concentration (mg/L)			Percent of total	
				Silt and Clay	Sand	Total	Silt and Clay	Sand
5-19-88	Moorhead	49.3	Maximum	3,584	2,596	6,180	58	42
5-29-91	Moorhead	66.8	Maximum	3,928	2,512	6,440	61	39
6-17-92	Moorhead	88.4	Maximum	18,792	2,808	21,600	87	13
5-08-93	Moorhead	142	Maximum	45,936	6,264	52,200	88	12
5-11-95	Moorhead	185	Maximum	34,196	7,004	41,200	83	17
5-22-78	Broadus	252	Falling	20,340	2,260	22,600	90	10
6-05-78	Broadus	98.8	Falling	3,427	1,613	5,040	68	32
6-04-81	Broadus	33.1	Falling	4,410	1,470	5,880	75	25
5-01-87	Broadus	40.2	Falling	10,750	1,750	12,500	86	14
6-11-87	Broadus	71.9	Falling	29,754	4,446	34,200	87	13
6-05-90	Broadus	28.1	Falling	2,471	1,009	3,480	71	29
5-23-91	Broadus	96.9	Falling	5,773	2,717	8,490	68	32
6-02-92	Broadus	0.68	Falling	58	8	66	88	12
6-21-95	Broadus	110	Falling	2,668	2,272	4,940	54	46
5-13-81	Moorhead	4.4	Falling	1,703	17	1,720	99	1
6-02-81	Moorhead	40.8	Falling	4,913	1,638	6,550	75	25
6-27-84	Moorhead	44.5	Falling	985	365	1,350	73	27
6-25-87	Moorhead	12.0	Falling	1,486	444	1,930	77	23
6-05-90	Moorhead	25.2	Falling	2,230	1,200	3,430	65	35
5-22-91	Moorhead	103	Falling	5,369	2,301	7,670	70	30
6-21-95	Moorhead	101	Falling	1,778	1,642	3,420	52	48
6-06-79	Moorhead	12.3	Minimum	1,112	228	1,340	83	17
5-14-87	Moorhead	9.1	Minimum	1,096	164	1,260	87	13
6-03-92	Moorhead	1.2	Minimum	20	30	50	41	59
6-03-93	Moorhead	43.9	Minimum	2,499	1,531	4,030	62	38
				Flash floods				
6-19-75	Moorhead	274	Peak	43,736	5,964	49,700	88	12
9-25-86	Moorhead	25.7	Peak	6,899	941	7,840	88	12
7-29-92	Moorhead	23.3	Peak	6,252	618	6,870	91	9
7-09-94	Moorhead	73.9	Peak	40,222	3,978	44,200	91	9
7-31-79	Broadus	22.6	Falling	22,310	690	23,000	97	3
8-24-82	Broadus	20.8	Falling	24,552	248	24,800	99	1
8-29-82	Broadus	6.6	Falling	18,500	0	18,500	100	0
9-23-82	Broadus	22.7	Falling	12,816	1,584	14,400	89	11
8-23-90	Broadus	25.1	Falling	12,512	1,088	13,600	92	8
8-24-76	Moorhead	1.2	Falling	232	2	234	99	1
7-31-79	Moorhead	13.8	Falling	24,056	744	24,800	97	3

Appendix. Sand--Silt and Clay analysis of suspended-sediment samples collected at Moorhead and Broadus, Montana, on the Powder River

Date	Station	Discharge (m ³ /s)	Stage	Concentration (mg/L)			Percent of total	
				Silt and Clay	Sand	Total	Silt and Clay	Sand
8-04-81	Moorhead	5.1	Falling	5,550	0	5,550	100	0
7-21-87	Moorhead	10.3	Falling	2,190	190	2,380	92	8
9-26-89	Moorhead	6.1	Falling	25,641	259	25,900	99	1
8-22-90	Moorhead	26.9	Falling	10,904	696	11,600	94	6
7-10-94	Moorhead	36.5	Falling	39,330	2,070	41,400	95	5
7-28-94	Moorhead	1.4	Falling	122	8	130	94	6

