

Section PR113 was first monumented and surveyed in 1975. It was resurveyed annually during the 4 consecutive years 1977-1980, resurveyed in 1982, resurveyed annually during the 19 consecutive years 1984-2002, and, after a 9-year hiatus, resurveyed in 2012.

Cross section PR113 is located 1.5 km downvalley and 2.5 km downchannel from the narrows at the proposed Moorhead damsite. At the cross-section location, the valley is sufficiently wide to allow the river channel to make a nearly orthogonal 1.5-km-long cross-valley excursion from the valley's left-side bedrock wall to the right-side bedrock wall. Section PR113 was placed near the midpoint of this 1.5-km-long segment, about 0.4 km upchannel of the Moorhead bridge. The right bank of Powder River at this section is formed by the lower floodplain surface developed after the 1978 flood (Moody et al., 1999) and the left bank is the Lightning terrace (Moody and Meade, 2008).

In section PR113, the flood of 1978 caused substantial changes, which we were able to record by comparing our survey data for 1977 and 1978. The principal change was a complete shift in the lateral arrangement of the section from cutbank-on-the-right-side-and-point-bar-on-the-left to its opposite, cutbank-on-the-left-side-and-pointbar-on-the-right. The thalweg of the river channel here shifted, during two weeks of flood flows in May 1978, about 44 meters leftward. Our surveys indicated that the flood waters had removed most of the pre-flood pointbar from the left bank, and had deposited a large new pointbar, 0.5-1.5 m in thickness, across a lateral distance of about 40 m on the right bank. Data showing the effects of the 1978 flood on section PR113 have been portrayed and discussed by Meade and Moody (2013, see especially their Figures 14 and 17).

The leftward shift continued during the decades following the 1978 flood. The channel thalweg shifted leftward another 56 m in the 17 years between 1978 and 1995. The left-side cutbank was eroded back 54 m during the same period; more than half of this bank recession (a total of 32 m) took place during only four of the 17 years (1987, 1991, 1993, 1995). By 1995, the right-bank pointbar had grown leftward about 40 m and upward by an average of about one meter, with most of the growth happening during the three years, 1987, 1993, and 1995.

After 1995, the rate of change in section PR113 was substantially reduced. The left-side cutbank shifted leftward only another 7 m (with no appreciable lateral shift in channel thalweg) in the 17-year period 1996-2012. Only a few decimeters of new sand (no more than 0.6 m at most stations) were deposited during the period atop most of the right side pointbar and floodplain. We speculate that this slowdown marked the restabilization, by about 1995, of the configuration of the segment of Powder River represented by section PR113, after nearly two decades (1978-1995) of active adjustment to the disruptive changes wrought by the 1978 flood. This apparently stable configuration shows in the 1995 cross section: a 40-m-wide main channel, adjoined to the right by a 40-m-wide pointbar, which is adjoined to the farther right by a 40-to-50-m-wide floodplain. The total post-1995 history so far shows no more change in the 17 year period 1996-2012 than the change that took place in the single year of either 1993 or 1995.

Vegetation has become well established on the right-side point bar. By 2012, cottonwood trees 8-10 m high were growing in the parts of the cross section (*e.g.*, near cross-channel station 45) that had been the unvegetated bottom of the active channel in 1977 and

which had subsequently received repeated deposits of (mostly) sand whose aggregate thickness has totaled, by now (2014), as much as two meters.

Meade, R.H., and Moody, J.A., 2013, Erosional and depositional changes wrought by the flood of 1978 in the channels of Powder River, southeastern Montana: *U.S. Geological Survey Scientific Investigations Report* 2013-5035.

Moody, J.A., and Meade, R.H., 2008, Terrace aggradation during the 1978 flood on Powder River, Montana, USA: *Geomorphology*, v. 99, p. 387-403.

Moody, J.A., Pizzuto, J.E., and Meade, R.H., 1999, Ontogeny of a flood plain: *Geological Society of America Bulletin*, v. 111, p. 291-303.



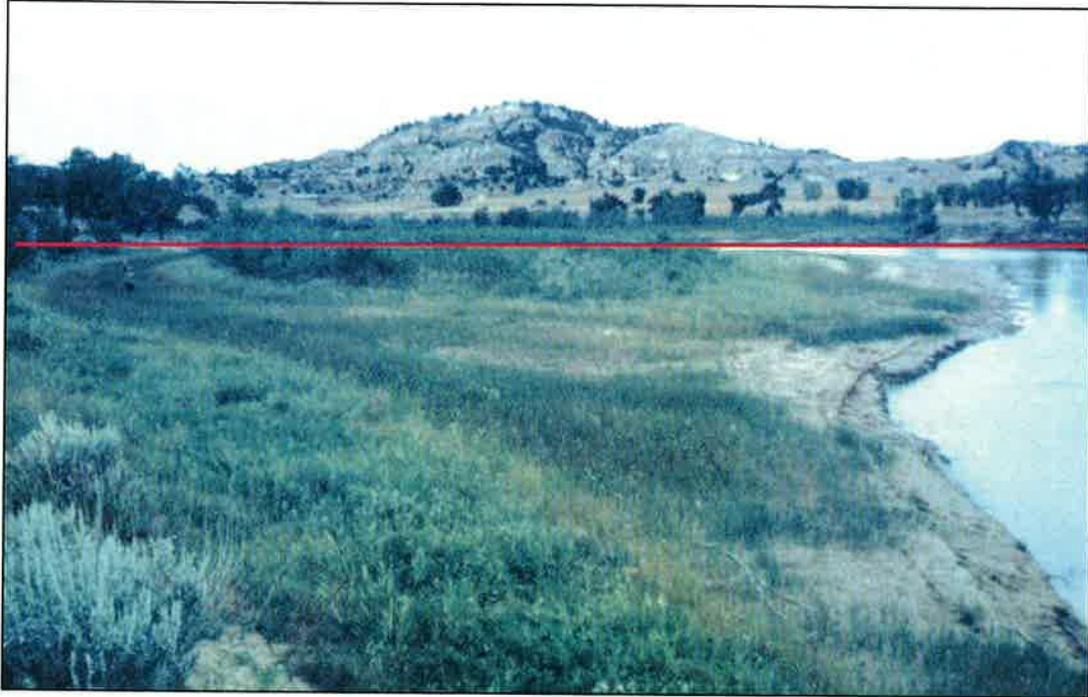
PR113. **Top.** 22 September 1989. Aerial view upriver of Powder River at the Moorhead Bridge. The approximate location of cross-section PR113 is shown by red line.



PR113. 20 July 1977. **Top.** View downriver. Person (~1.6 m tall) in red circle is on the section. **Bottom.** View upriver. Person in red circle is on the section.



PR113. 19 September 1978. **Top.** View downriver. Person (~1.9 m tall) in red circle is on the section. **Bottom.** View upriver. Red line indicates the approximate line of section.



PR113. **Top.** 25 August 1992. View upriver. **Bottom.** 25 August 1993. View upriver. Red line indicates approximate line of section.



PR113. 10 May 1993.  
View upriver. White  
vertical survey rod is  
on section. Discharge  
is  $82 \text{ m}^3 \text{ s}^{-1}$

PR113. 10 June 1993.  
View upriver. White  
vertical survey rod is  
on section. Discharge  
is  $93 \text{ m}^3 \text{ s}^{-1}$



PR113. 19 June 1993.  
View upriver. Discharge  
is  $176 \text{ m}^3 \text{ s}^{-1}$ .

