

Cross section PR167 was established in 1977 in the upriver limb of a large meander bend of Powder River in Sections 21 and 28 of T6S, R50E (the bend described as “near Daily Ranch” by Gay *et al.*, 1998, *their* Figure 9). Resurveys were conducted during the years 1978-1980, 1982, 1984-1998, 2011, and 2014.

The large meander bend that includes section PR167 has been expanding at its crest at least since the arrival of homesteading settlers in this segment of Powder River valley more than a century ago (Martinson and Meade, 1983, sheet 2). During the great flood of 1923 (which was a larger flood than that of 1978), a house and artesian well on the left-bank terrace at the bend crest were undermined by the erosion of the bank. The bank erosion has continued (moving the left edge of the bend-crest channel at least 100 m leftward since 1923), such that the main channel of Powder River now flows to the left of the old artesian well, and the decapitated well continues to flow, at a rate of a few liters per minute, onto the point bar that has since formed on the inside of the meander bend (Meade and Moody, 2013, p. 25).

The neck of the large meander bend that includes section PR167 has become progressively narrower, at least since 1939 (the date of the earliest known aerial photographs, which were used in the cartographic compilation by Martinson and Meade, 1983, sheet 2). This narrowing is most likely due to the progressive erosion of the inner banks of the bend (such as the bank erosion recorded since 1977 at section PR167). We cannot predict whether this bend will eventually be cut off by having its neck width reduced to zero by bank erosion (a “neck” cutoff) or by the upvalley growth of gullies that proceed by headcutting their ways across the neck (a “chute” cutoff). Headcutting gullies formed the cutoff channels at PR122A and PR141A during the 1978 floods, and several such gullies have already headcut themselves part way across the neck of the meander bend that includes section PR167 (Gay *et al.*, 1998, *their* Figure 9).

During the early years of our study, cross section PR 167 closely epitomized Luna Leopold’s (1994, p. 5) generalization: “A natural channel migrates laterally by erosion of one bank, maintaining on the average a constant channel cross section by deposition on the opposite bank. In other words, there is an equilibrium between erosion and deposition. The form of the cross section is stable, meaning more or less constant, but the position of the channel is not.” This “equilibrium” between erosion and deposition was especially manifested at cross section PR167 during the 1978 flood (Meade and Moody, 2013, *their* Figure 6, second panel), when the 2-m-high right-bank Lightning terrace was eroded laterally some 26 m, displacing about 66 m³ of terrace material for each meter of channel length, while an equivalent quantity of new sediment was laid in lesser thicknesses of 0.2-0.6 m over a much wider section width (>100 m) onto the point bar, floodplain, and terrace on the left side of the channel.

Since the early 1990s, however, the shape of the cross-channel profile of section PR167 has altered significantly as the volume of new material that was deposited and accumulated on (and in) the left side of the channel, not only exceeded somewhat the volume of material eroded from the right-side cutbank, but accumulated in such a way as to narrow the width of the low-water channel of the river. The left bank of Powder River at cross section PR167, instead of being a gently-sloping surface as it was formerly, now has a levee (station 57-67), which is about 2 m above the sand bar along the left bank in 2014. The left bank is now stabilized (as of 2014) by a small but dense forest of Russian-olive trees that stand 3-4 m tall and extends from station

70 to station 10. From 1998 to 2014 under the Russian olives, no sand was deposited between stations 10 and 25 and about 0.03-0.05 m of sand was deposited between stations 25 and 57.

Gay, G.R., Gay, H.H., Gay, W.H., Martinson, H.A., Meade, R.H., and Moody, J.A., 1994, Evolution of cutoffs across meander necks in Powder River, Montana, USA: *Earth Surface Processes and Landforms*, v. 23, p. 651-662.

Leopold, L.B., 1994, A view of the river: Cambridge, Massachusetts, Harvard University Press, 298 p.

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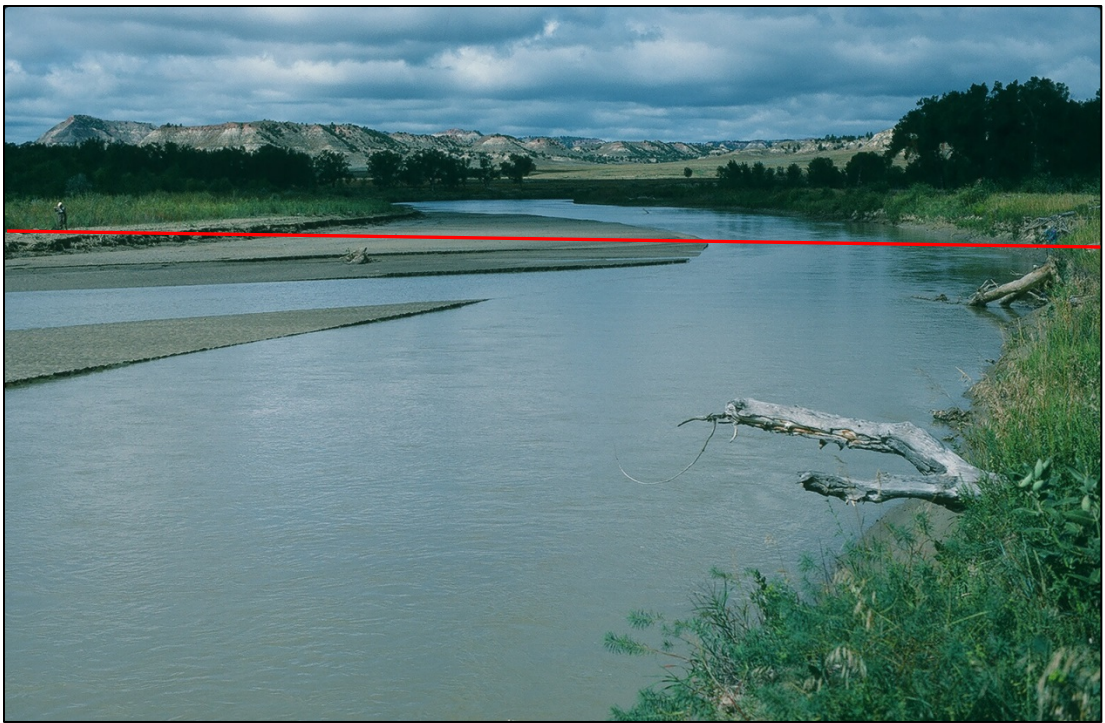
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PR167. **Top.** 13 July 1977. View upriver along the right bank. E. Meade (~1.6 m tall) is standing on the line of section. **Bottom.** 25 May 1978. View upriver of bend near John Daily's Ranch during the Flood of 1978. Approximate line of section is shown by the red line.



PR167. **Top.** 21 October 1979. View downriver. Left bank has seedlings of Russian olives brought in the Flood of 1978. Approximate location of the section is indicated by the red line. **Bottom.** 4 September 1991. View downriver from section. J. Moody (~1.9 m tall) is standing approximately on the line of section.



PR167. **Top.** 2 September 1993. View downriver. J. Pizzuto (~1.8 m tall) is on the line of section near station 60. **Bottom.** 2 September 1993. View downriver of new sand on point bar on left bank. J. Pizzuto is on the line of section near station 57. Red line indicates approximate location of section



PR167. **Top.** 16 July 2014. View downriver from the right bank. Red line indicates the approximate line of section. **Bottom.** 16 July 2014. View upriver from the right bank. Red line indicates the approximate line of section.



PR167. **Top.** 16 July 2014. Cross-channel view of the right bank. A metal pole with orange flagging is on the line of section. Red line indicates approximate location of section. **Bottom.** 16 July 2014. Cross-channel view of the left bank. Left-bank flood plain has a 60-m-wide thicket (from station 10 to station 70 that is approximately at the edge of the left bank) of 3-to-4-m-tall Russian olives, which have been trimmed along the line of section forming a narrow tunnel through the trees. Red line indicates approximate location of section.