

# THE PERFORMANCE OF TWO HORIZONTAL LIMESTONE BEDS FOR THE REMOVAL OF MANGANESE<sup>1</sup>

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**Abstract.** Horizontal limestone beds (HLBs), which are kept open to the atmosphere, are being constructed for the passive removal of manganese from mine drainage. Two of these beds, located in the bituminous coal fields of Pennsylvania, have been monitored for over two years. Each of the HLBs is the last unit operation within a larger passive treatment system consisting of ponds, reducing and alkalinity producing systems, and wetlands. The bed at the DeSale I site was constructed in the spring of 2000 and contained 1450 tonnes of AASHTO #1 limestone (35 m x 20 m x 1.4 m deep). Water, flowing an average of 136 L/min into the HLB, had a pH of 6.9 and contained 6.5 mg/L dissolved oxygen, 35 mg/L net alkalinity (as CaCO<sub>3</sub>), < 1 mg/L Fe and Al, and 54 mg/L Mn. After passage through the HLB, the water had a pH 6.9 and contained 1.8 mg/L DO, 65 mg/L net alkalinity, <1 mg/L Fe and Al, and 45 mg/L Mn. The HLB at DeSale II was constructed in the summer of 2000 and contained 2630 tonnes of AASHTO #1 limestone (52 m x 24 m x 1.4 m deep). Water, flowing an average of 201 L/min into the HLB, had a pH of 7.0 and contained 7.9 mg/L dissolved oxygen, 80 mg/L net alkalinity (as CaCO<sub>3</sub>), < 1 mg/L Fe and Al, and 34 mg/L Mn. After passage through the HLB the water had a pH of 7.1 and contained 2.6 mg/L DO, 105 mg/L net alkalinity, <1 mg/L Fe and Al, and 31 mg/L Mn. Neither HLB significantly altered pH and only slightly decreased concentrations of Mn (3 – 9 mg/L or 9 – 17%). The HLBs increased alkalinity (25-30 mg/L) and consumed approximately 5 mg/L of dissolved oxygen.

Additional Key Words: acid mine drainage, wetlands, anoxic limestone drains, reducing and alkalinity producing systems, limestone dissolution, pyrolusite.

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