Laura Lockard

Matthew Bennett

July 11, 2003

An Assessment of Bank Erosion Along Black Hole Creek

Throughout the summer of 2003, Lycoming college interns hiked the full 8-miles of Black Hole Creek in Montgomery, Pennsylvania. The interns assessed the creek from its emergence along PA route 15 to its confluence with the Susquehanna River. All occurrences of erosion were documented using a form identical to the one attached. The creek lies in three distinct habitats. The first third is well forested, the second third is dominated by a golf course, and the final third transverses an agricultural/residential habitat. In all, 215 disturbances were observed along Black Hole Creek and are presented in Table 1. Of these, 18 were bridges (8.37% of total disturbances) and 20 were pipes flowing into or underneath the creek bed (9.30% of total disturbances). There were 15 instances of rip rap (7.44% of total disturbances) along the banks and 2 small man-made rock dams impeding water flow (0.93% of total disturbances). There were 36 deposition bars (16.74% of total disturbances) throughout the creek bed. Three major tributaries were observed (1.40% of total disturbances) contributing approximately 50% of the total water volume of Black Hole Creek (based on comparisons of the width, depth and velocity of each). There were also 7 intermittent tributaries (3.26% of total disturbances) and 15 ephemeral tributaries (6.98% of total disturbances) observed. One dried point source was also noted (0.47% of total disturbances). There were 98 instances of erosion documented along the creek (45.58% of total disturbances), 48 of which were on the right banks (22.33% of total disturbances), while 50 were on the left banks (23.26% of total disturbances). The positions of the banks (right or left) are established while facing downstream.

The potential for bank erosion was determined by a combination of bank height, bank angle, density of roots present, and the particle size of the bank substrate. These factors are rated for High, Moderate, or Low erosion potential and are explained further in Tables 2-6.

The 98 erosion potential sites were determined based on the following analysis:

Erosion Potential based on Bank Height:

Erosion potential based on bank height is presented in Table 2. A bank up to 6 feet high was considered to have Low erosion potential. Banks 6 to 9 feet high were considered to have Moderate erosion potential, and any bank over 9 feet high had a High erosion potential. Of the 98 banks assessed for bank height, 50 were considered to have Low potential (51.02% of total banks), 28 were Moderate (28.57% of total banks), and 20 were determined to be of High erosion potential (20.41% of total banks). Of the 48 right banks, 24 were Low (50.00% of total right banks), 14 were Moderate (29.17% of total right banks), and 10 were of High erosion potential (20.83% of total right banks). Of the 50 left banks, 26 were Low (52.00% of total left banks), 14 were Moderate (28.00% of total left banks), and 10 were of High erosion potential (20.00% of total left banks).

Erosion Potential based on Bank Angle:

Erosion potential relative to bank angle is presented in Table 3. A bank with an angle up to 45 degrees is considered to have Low erosion potential. A bank from 45 to 90 degrees is considered to be of Moderate erosion potential, and an undercut bank (one over 90 degrees) is considered to have High erosion potential. Of the 98 banks assessed, 15 were of Low erosion potential based on bank angle (15.31% of total banks), 52 were of Moderate erosion potential (53.06% of total banks), and 31 were of High erosion

potential (31.63% of total banks). On the right banks, 6 of the 48 banks assessed were of Low erosion potential (12.50% of total right banks), 26 were of Moderate potential (54.17% of total right banks), and 16 were of High potential (33.33% of total right banks). On the left banks, 9 of the 50 assessed were of Low erosion potential (18.00% of total left banks), 26 were of Moderate potential (52.00% of total left banks), and 15 were of High potential (30.00% of total left banks).

Erosion Potential based on Root Density:

Erosion potential based on the root density of the bank is presented in Table 4. A bank of Low erosion potential is one at least 60% covered by vegetation. A bank of Moderate erosion potential is one with 30% to 60% vegetative cover, while a bank less than 30% covered by vegetation is of High erosion potential. There were 13 of the 98 total banks assessed that were considered to have Low erosion potential (13.27% of total banks), 16 of the total were of Moderate potential (16.33% of total banks), and 69 were of High erosion potential based on root density (70.41% of total banks). On the right banks, 7 of the 48 were of Low potential (14.58% of total right banks), 7 were of Moderate potential (14.58% of total right banks), and 34 were of High erosion potential (70.83% of total right banks). On the left banks, 6 of the 50 were of Low potential (12.00% of total left banks), 9 were of Moderate potential (18.00% of total left banks), and 35 were of High erosion potential (70.00% of total left banks).

Erosion Potential based on Particle Size:

Erosion potential based on the particle size of the bank substrate is presented in Table 5. Banks composed mainly of bedrock or boulders are considered to have Low erosion potential. Banks made up of basketball-sized rocks to pebbles are considered to have Moderate erosion potential, while banks made of sand or clay have High erosion potential. Of the 98 banks assessed, 22 were of Low erosion potential (22.45% of total banks), 25 were of Moderate erosion potential (25.51% of total banks), and 51 were of High potential based on particle size (52.04% of total banks). There were 12 of Low potential of the 48 total right banks (25.00% of total right banks), 13 with Moderate potential (27.08% of total right banks), and 23 of High erosion potential (47.92% of total right banks). There were 10 with Low potential out of the 50 left banks (20.00% of total left banks), 12 with Moderate potential (24.00% of total left banks), and 28 with High erosion potential (56.00% of total left banks).

Erosion Potential based on Length of Site as Compared to Bank Height:

Erosion potential based on the length of each site as compared to the height is presented in Table 6. The sites were classified by categories: those 0-50 feet in length, those 51-100 feet in length, those 101-250 feet in length, and those 251-500 feet long. There were no observed sites greater than 500 feet long along Black Hole Creek. Of the 98 sites, 76 were 0-50 feet long (77.55% of total banks), 11 were 51-100 feet long (11.22% of total banks), 7 were 101-250 feet long (7.14% of total banks), and 4 were 251-500 feet long (4.08% of total banks). Of the 48 right bank sites, 36 were 0-50 feet long (75.00% of total right banks), 6 were 51-100 feet long (12.50% of total right banks), 4 were 101-250 feet long (8.33% of total right banks), and 2 were 251-500 feet long (4.17% of total right banks). There were 40 left banks between 0-50 feet long (80.00% out of 50 total left banks), 5 between 51-100 feet long (10.00% of total 50 left banks), 3 between 101-250 feet long (6.00% of total 50 left banks), and 2 between 251-500 feet long (4.00% of total 50 left banks).

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