

# Evaluation of Stream Bank Erosion along the Middle and East Branch Chillisquaque Creek.

## Summary of summer 2005 internship.

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## Introduction

During the summer 2005, Lycoming College, Bucknell University, Susquehanna University, and Bloomsburg University interns, as part of the Susquehanna River Heartland Coalition for Environmental Studies (SRHCES) did a physical assessment of the Middle branch Chillisquaque Creek from Lake Chillisquaque to Route 45 and the East Branch Chillisquaque from Route 44 to the confluence with the Middle branch Chillisquaque Creek. The Middle branch Chillisquaque Creek was not assessed above Lake Chillisquaque or below Route 45 due to time constraints. East branch Chillisquaque was not assessed above Route 44 due to the residential nature of the area. The physical assessment required the interns to walk the streams and document via GPS all disturbances and potential erosion sites using an NRCS data form (See Appendix 1). **Bank erosion potential** is based on an analysis of bank height, bank angle, density of roots, and particle size. Assessments of the characteristics of each bank are in terms of erosion potential of HIGH, MODERATE, or LOW. The physical assessment summarized here is part of a larger project in cooperation with the PPL Montour Preserve CREP project to plant Riparian Buffers on over 80 acres of the watershed. To date 68 acres of buffer has been planted. SRHCES has been given access to approximately 5 acres to develop and monitor different types of buffers (See map in Figure 1). The land was prepared for a fall 2005 tree planting by sowing a mixture of grass and wildflowers in May 2005 (See attached pictures in Appendix 2).

## Summary

A total of 283 observations were noted along Chillisquaque Creek. Of these, 122 were located on the Middle branch and 161 on the East branch. These observations are summarized in Table 1. Figure 2 illustrates the make-up of the various disturbances in the Middle branch of Chillisquaque Creek. Of the observations in the Middle branch 7 were bridges, making up 5.7% of the total observations. There were 14 gravel bars or 11.5% of the total observations. Two pipes (1.6%) and three areas of rip rap (2.5%) were found. No tributaries were found on the surveyed portion of the Middle branch. However, 96 (78.7%) erosion sites were documented. Forty-five (36.9%) of the erosion sites were located on the right bank and the remaining 51 (41.8%) sites were located on the left bank. Figure 3 illustrates the make-up of the various disturbances in the East branch of Chillisquaque Creek. Of the observations in the East branch 7 were bridges, making up 4.3% of the total observations. There were 23 gravel bars or 14.3% of the total observations. Three pipes (1.9%) and five areas of rip rap (3.1%) were found. One (0.6%) tributary was found on the

surveyed portion of the East branch. However, 122 (75.8%) erosion sites were documented. Fifty-eight (36.0%) of the erosion sites were located on the right bank and the remaining 64 (39.8%) sites were located on the left bank.

### **Length of Erosion Site:**

A summary of bank erosion potential based on length of site compared to bank height can be found in Table 2. The approximate length of each erosion site, using categories of 0 to 50 feet, 51 to 100 feet, 101 to 250 feet, 251 to 500 feet, and 501 to 1000 feet, was also determined. Out of the total sites on the Middle branch 29 (30.2%) were 0 to 50 feet in length, 31 (32.3%) were 51 to 100 feet, 25 (26.0%) were 101 to 250 feet, 7 (7.3%) were 251 to 500 feet, and 4 (4.2%) were 501 to 1000 feet. Of the right bank sites, 12 (26.7) were 0 to 50 feet in length, 16 (35.6%) were 51 to 100 feet, 10 (22.2%) were 101 to 250 feet, 5 (11.1%) were 251 to 500 feet, and 2 (4.4%) was 501 to 1000+ feet. Of the left bank sites, 17 (33.3%) were 0 to 50 feet in length, 15 (29.4%) were 51 to 100 feet, 15 (29.4%) were 101 to 250 feet, 2 (3.9%) were 251 to 500 feet, and 2 (3.9%) was 501 to 1000+ feet. Out of the total sites on the East branch 62 (50.8%) were 0 to 50 feet in length, 35 (28.7%) were 51 to 100 feet, 23 (18.9%) were 101 to 250 feet, 2 (1.6%) were 251 to 500 and 0 (0%) were 501-1000+ feet. Of the right bank sites, 34 (58.6%) were 0 to 50 feet, 13 (22.4%) were 51 to 100 feet, 11 (19.0%) were 101 to 250 feet, and there were no sites in the ranges 251 to 500 feet nor in the range 501 to 1000+ feet. Of the left bank sites, 28 (43.8%) were 0 to 50 feet, 22 (34.4%) were 51 to 100 feet, 12 (18.8%) were 101-250 feet, 2 (3.1%) were 251 to 500 feet, and none in the range 501 to 1000+ feet.

### **Bank Erosion Potential:**

Bank erosion potential is based on an analysis of bank height, bank angle, density of roots, and particle size. Assessments of the characteristics of each bank are in terms of erosion potential of HIGH, MODERATE, or LOW. These are summarized below:

#### **Bank Heights**

Table 3. Summarizes the bank erosion potential based on bank heights. A LOW height was determined to be between 0 to 6 feet, a MODERATE was between 6 to 9 feet, and a HIGH potential was anything greater than 9 feet. On the Middle branch 61 banks were determined to be LOW, consisting of 63.5% of the total. There were 30 banks rated MODERATE in height, consisting of 31.3% of the total. Five banks were rated HIGH, making up 5.2%. On the right banks, 28 were LOW (63.6%), 14 banks were MODERATE (31.8%), and 2 banks were HIGH (4.5%). On the left banks, 33 were LOW (63.5%), 16 were MODERATE (30.8), and 3 banks were HIGH (5.8%). On the East branch 109 banks were recorded to be LOW, consisting of 90.1% of the total. There were 10 banks rated Moderate in height (8.3%) and 2 banks rated HIGH (1.7%). On the right banks, 52 were LOW (89.7%), 4 banks were MODERATE (6.9%), and 2 banks were HIGH (3.4%). On the left banks, 57 were LOW (90.5%), 6 were MODERATE (9.5%), and 0 were HIGH (0%).

#### **Bank Angles**

A summary of bank erosion potential based on bank angles can be found in Table 4. The angle of banks was also assessed. LOW potential would be a bank with an angle of 45 degrees. MODERATE potential would be closer to 90 degrees, and HIGH potential would be

greater than 90 degrees. On the Middle branch a total of 30 banks were rated LOW (31.3%), 50 were rated MODERATE (52.1%), and 16 were rated HIGH (16.7%). Of the 45 right banks, 16 were LOW (35.6%), 18 were MODERATE (40.0%), and 11 were HIGH (24.4%). On the left banks, 14 were LOW (27.5%), 32 were MODERATE (62.7%), and 5 were HIGH (9.8%). On the East branch a total of 10 banks were rated LOW (8.1%), 10 were rated MODERATE (8.1%), and 103 were rated HIGH (83.7%). Of the right banks, 2 were HIGH (3.1%), 4 were MODERATE (6.2%), and 53 were HIGH (92.2%). Of the left banks, 8 were rated LOW (12.5%), 6 were MODERATE (9.4%), and 50 were HIGH (78.1%).

### **Root Density**

A summary of bank erosion potential based on root density can be found in Table 5. The root density of the vegetation on the banks was assessed. LOW erosion potential would be a well vegetated bank with greater than 60% cover. MODERATE would be a root depth of about 30 to 60% of the bank. HIGH potential would be sparse root coverage of less than 30%. On the Middle branch a total of 17 banks had LOW potential s (18.7%), 60 had MODERATE potential (65.9%), and 14 had HIGH potential (15.4). On the right banks, 8 had LOW potential (17.8%), 29 had MODERATE potential (64.4%), and 8 had HIGH potential (17.8%). On the left banks, 9 had LOW potential (19.6%), 31 had MODERATE potential (67.4%), and 6 had HIGH potential (13.0%). On the East branch a total of 10 banks had LOW potential s (8.3%), 79 had MODERATE potential (65.8%), and 31 had HIGH potential (25.8). On the right banks, 4 had LOW potential (7.1%), 39 had MODERATE potential (69.6%), and 13 had HIGH potential (23.2%). On the left banks, 6 had LOW potential (9.4%), 40 had MODERATE potential (62.5%), and 18 had HIGH potential (28.1%).

### **Particle Size**

A summary of bank erosion potential based on particle size can be found in Table 6. Particle sizes were also assessed with a LOW erosion potential being a bank made up mostly of bedrock and boulders, a MODERATE erosion potential being a bank of fist-sized rocks, and a HIGH potential being a bank made up of sand or clay. On the Middle branch a total of 0 banks had LOW or MODERATE potentials. Ninety-four had HIGH potential banks (100%). On the right banks, 0 banks had a LOW or MODERATE potential. Forty-five banks had a HIGH potential (100%). On the left banks, 0 banks had a LOW or MODERATE potential. Forty-nine banks had a HIGH potential (100%). On the East branch a total of 0 banks had LOW potentials. Thirty-one banks had MODERATE potential (25.6%) and 90 banks had HIGH potential (74.4%). On the right banks 0 had LOW potential (0%), 12 had MODERATE potentials (21.1%), and 45 banks had HIGH potential (78.9%). On the left banks, 0 banks had a LOW potential, 19 of the banks had MODERATE potential (29.7%), and 45 banks had a HIGH potential (70.3%).

### **Sediment Sampling:**

Data collection of sediment levels present at the sampling sites is ongoing. Baseline and one storm-event samples have been collected at five of the sampling sites and the data is in the process of being analyzed for suspended solids. Samples will be collected from future storm-events using a depth-integrating suspended sediment sampler and an event sampler. The depth-integrating suspended sediment sampler (See attached picture in Appendix 3) collects water during low to moderately high flow when it is safe enough for a person to be in the

stream. The event sampler (See attached picture in Appendix 3) collects water during the height of a storm-event; when it is not safe for a person to be in the stream. Two event samplers were placed on Chillisquaque Creek: one at sampling site #2 near parking area 6 and one near the USGS gauging station at Route 54 (Lat 41'03'42," Long 76'40'50").

**Avian Surveys:**

Surveys of bird species are being done at five of the sampling sites and near the CREP plantings every two weeks from July to December. Of the potential 229 bird species that have previously been documented on the Montour Preserve (Birds of the Montour Preserve), to date 33 have been recorded by either visual or auditory identification, during sample point counts in July and August 2005 (See Appendix 4 for list).

Table 1. Summary of Disturbances along Chillisquaque Creek

<b>Middle Branch</b>		
<b>Structure</b>	<b>Amount</b>	<b>Percentage</b>
Bridges	7	5.7%
Gravel bars	14	11.5%
Pipes	2	1.6%
Rip Rap	3	2.5%
Tributaries	0	0.0%
Total Erosion Sites	96	78.7%
Right Banks	45	36.9%
Left Banks	51	41.8%
<b>East Branch</b>		
<b>Structure</b>	<b>Amount</b>	<b>Percentage</b>
Bridges	7	4.3%
Gravel bars	23	14.3%
Pipes	3	1.9%
Rip Rap	5	3.1%
Tributaries	1	0.6%
Total Erosion Sites	122	75.8%
Right Banks	58	36.0%
Left Banks	64	39.8%

Table 2. Summary of Bank Erosion Potential based on Length of Site as compared to Bank Height along Chillisquaque Creek

<b>Middle Branch</b>					
<b>Total Banks</b>					
<b>Length in feet</b>	<b>0-50</b>	<b>51-100</b>	<b>101-250</b>	<b>251-500</b>	<b>501-1000+</b>
Low Bank Height	22	17	12	5	4
Moderate Bank Height	5	11	13	1	0
High Bank Height	2	3	0	1	0

Total	29	31	25	7	4
Percent out of 96	30.2%	32.3%	26.0%	7.3%	4.2%

**Right Banks**

<b>Length in feet</b>	0-50	51-100	101-250	251-500	501-1000+
Low Bank Height	8	9	5	3	2
Moderate Bank Height	3	7	5	1	0
High Bank Height	1	0	0	1	0
Total	12	16	10	5	2
Percent out of 45	26.7%	35.6%	22.2%	11.1%	4.4%

**Left Banks**

<b>Length in feet</b>	0-50	51-100	101-250	251-500	501-1000+
Low Bank Height	14	8	7	2	2
Moderate Bank Height	2	4	8	0	0
High Bank Height	1	3	0	0	0
Total	17	15	15	2	2
Percent out of 51	33.3%	29.4%	29.4%	3.9%	3.9%

**East Branch**

**Total Banks**

<b>Length in feet</b>	0-50	51-100	101-250	251-500	501-1000+
Low Bank Height	58	29	18	1	0
Moderate Bank Height	4	5	4	1	0
High Bank Height	0	1	1	0	0
Total	62	35	23	2	0
Percent out of 122	50.8%	28.7%	18.9%	1.6%	0.0%

**Right Banks**

<b>Length in feet</b>	0-50	51-100	101-250	251-500	501-1000+
Low Bank Height	32	10	8	0	0
Moderate Bank Height	2	2	2	0	0
High Bank Height	0	1	1	0	0
Total	34	13	11	0	0
Percent out of 58	58.6%	22.4%	19.0%	0.0%	0.0%

**Left Banks**

<b>Length in feet</b>	0-50	51-100	101-250	251-500	501-1000+
Low Bank Height	26	19	10	1	0
Moderate Bank Height	2	3	2	1	0
High Bank Height	0	0	0	0	0
Total	28	22	12	2	0
Percent out of 64	43.8%	34.4%	18.8%	3.1%	0.0%

Table 3. Summary of Bank Erosion Potential based on Bank Heights along Chillisquaue Creek

**Middle Branch**

**Total Banks**

Erosion Potential	Number	Percent
Low	61	63.5%
Moderate	30	31.3%
High	5	5.2%
Total	96	

**Right Banks**

<b>Erosion Potential</b>	Number	Percent
Low	28	63.6%
Moderate	14	31.8%
High	2	4.5%
Total	44	

**Left Banks**

<b>Erosion Potential</b>	Number	Percent
Low	33	63.5%
Moderate	16	30.8%
High	3	5.8%
Total	52	

**East Branch**

**Total Banks**

<b>Erosion Potential</b>	Number	Percent
Low	109	90.1%
Moderate	10	8.3%
High	2	1.7%
Total	121	

**Right Banks**

<b>Erosion Potential</b>	Number	Percent
Low	52	89.7%
Moderate	4	6.9%
High	2	3.4%
Total	58	

**Left Banks**

<b>Erosion Potential</b>	Number	Percent
Low	57	90.5%
Moderate	6	9.5%
High	0	0.0%
Total	63	

Table 4. Summary of Bank Erosion Potential based on Bank Angles along Chillisquaque Creek

Middle Branch Total Banks Erosion Potential	Number	Percent
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Low	30	31.3%
Moderate	50	52.1%
High	16	16.7%
Total	96	
<b>Right Banks</b>		
<b>Erosion Potential</b>	<b>Number</b>	<b>Percent</b>
Low	16	35.6%
Moderate	18	40.0%
High	11	24.4%
Total	45	
<b>Left Banks</b>		
<b>Erosion Potential</b>	<b>Number</b>	<b>Percent</b>
Low	14	27.5%
Moderate	32	62.7%
High	5	9.8%
Total	51	
<b>East Branch</b>		
<b>Total Banks</b>		
<b>Erosion Potential</b>	<b>Number</b>	<b>Percent</b>
Low	10	8.1%
Moderate	10	8.1%
High	103	83.7%
Total	123	
<b>Right Banks</b>		
<b>Erosion Potential</b>	<b>Number</b>	<b>Percent</b>
Low	2	3.1%
Moderate	4	6.2%
High	53	92.2%
Total	59	
<b>Left Banks</b>		
<b>Erosion Potential</b>	<b>Number</b>	<b>Percent</b>
Low	8	12.5%
Moderate	6	9.4%
High	50	78.1%
Total	64	

Table 5. Summary of Bank Erosion Potential based on Root Density along Chillisquaque Creek

Middle Branch		
Total Banks		
<b>Erosion Potential</b>	<b>Number</b>	<b>Percent</b>
Low	17	18.7%

Moderate	60	65.9%
High	14	15.4%
Total	91	
<b>Right Banks</b>		
<b>Erosion Potential</b>	<b>Number</b>	<b>Percent</b>
Low	8	17.8%
Moderate	29	64.4%
High	8	17.8%
Total	45	
<b>Left Banks</b>		
<b>Erosion Potential</b>	<b>Number</b>	<b>Percent</b>
Low	9	19.6%
Moderate	31	67.4%
High	6	13.0%
Total	46	
<b>East Branch</b>		
<b>Total Banks</b>		
<b>Erosion Potential</b>	<b>Number</b>	<b>Percent</b>
Low	10	8.3%
Moderate	79	65.8%
High	31	25.8%
Total	120	
<b>Right Banks</b>		
<b>Erosion Potential</b>	<b>Number</b>	<b>Percent</b>
Low	4	7.1%
Moderate	39	69.6%
High	13	23.2%
Total	56	
<b>Left Banks</b>		
<b>Erosion Potential</b>	<b>Number</b>	<b>Percent</b>
Low	6	9.4%
Moderate	40	62.5%
High	18	28.1%
Total	64	

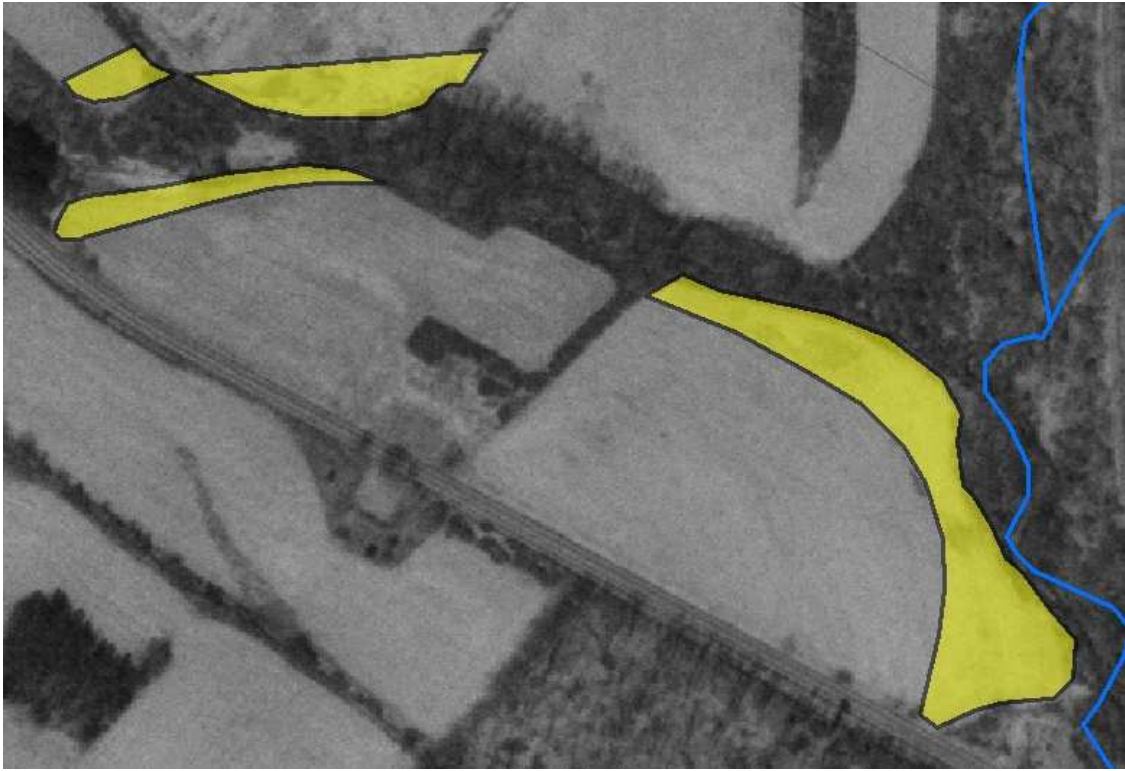
Table 6. Summary of Bank Erosion Potential based on Particle Size along Chillisquaque Creek

Middle Branch		
Total Banks		
<b>Erosion Potential</b>	<b>Number</b>	<b>Percent</b>
Low	0	0
Moderate	0	0

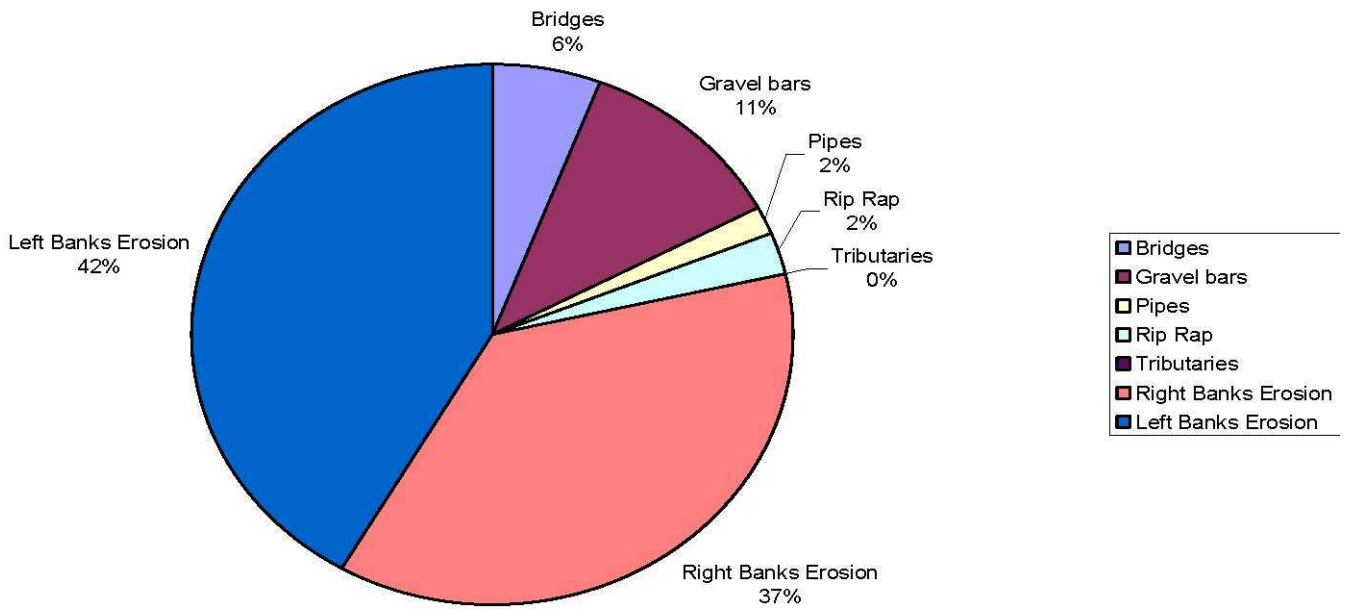


High	94	100%
Total	94	
<b>Right Banks</b>		
<b>Erosion Potential</b>	Number	Percent
Low	0	0
Moderate	0	0
High	45	100%
Total	45	
<b>Left Banks</b>		
<b>Erosion Potential</b>	Number	Percent
Low	0	0
Moderate	0	0
High	49	100%
Total	49	
<b>East Branch</b>		
<b>Total Banks</b>		
<b>Erosion Potential</b>	Number	Percent
Low	0	0
Moderate	31	25.6%
High	90	74.4%
Total	121	
<b>Right Banks</b>		
<b>Erosion Potential</b>	Number	Percent
Low	0	0
Moderate	12	21.1%
High	45	78.9%
Total	57	
<b>Left Banks</b>		
<b>Erosion Potential</b>	Number	Percent
Low	0	0
Moderate	19	29.7%
High	45	70.3%
Total	64	

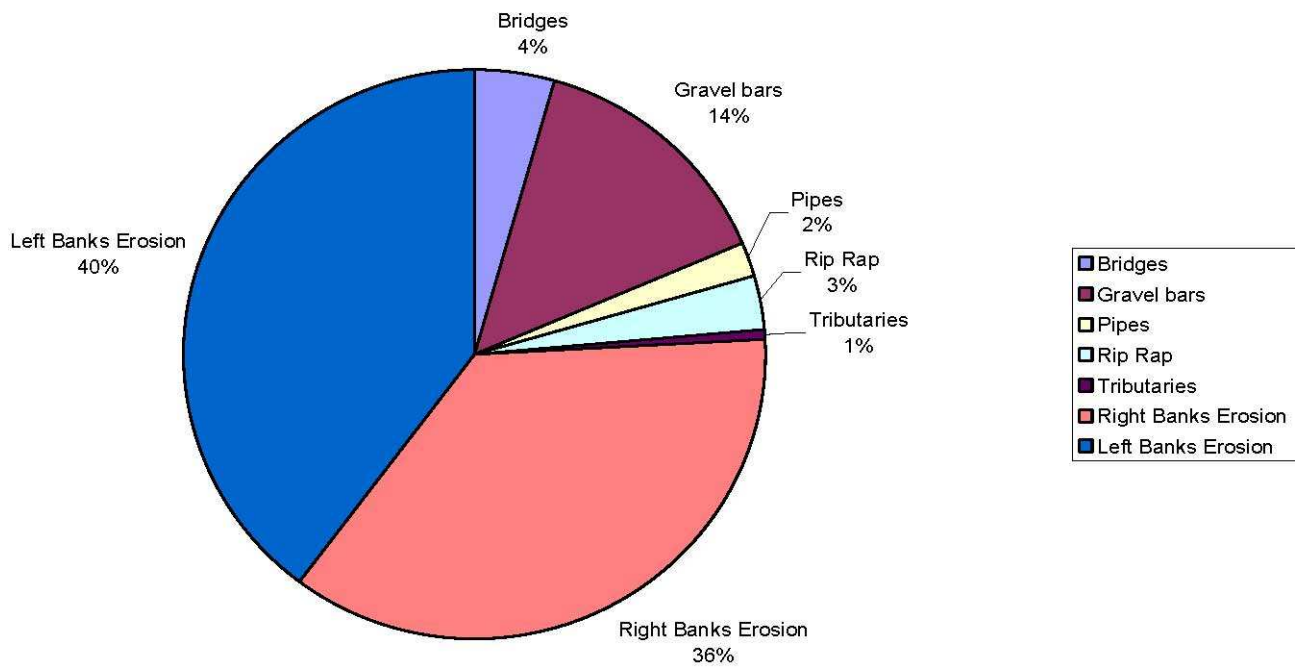
**Figure 1.**  
**CREP planting sites**



**Figure 2. Middle Branch Chillisquaque Creek Disturbances**



**Figure 3. East Branch Chillisquaque Creek Disturbances**



## Appendix 2.

### CREP seed planting-2005





### **Appendix 3.**

**Depth-integrating suspended sediment sampler.**



**Event Sampler**



## Appendix 4.

### Species

Acadian Flycatcher	Ovenbird
American Crow	Red-bellied Woodpecker
American Goldfinch	Red-eyed Vireo
American Robin	Red-tailed Hawk
Baltimore Oriole	Red-winged Blackbird
Belted Kingfisher	Song Sparrow
Black-capped Chickadee	Tree Swallow
Blue Jay	Tufted Titmouse
Blue-gray Gnatcatcher	White-breasted Nuthatch
Canada Goose	Wood Thrush
Common Grackle	
Common Yellowthroat	
Downy Woodpecker	
Eastern Towhee	
Eastern Wood-Pewee	
Field Sparrow	
Gray Catbird	
Great Blue Heron	
House Wren	
Indigo Bunting	
Mourning Dove	
Northern Cardinal	

Northern Mockingbird