RACEY MITIGATION SITE ON LAXON CREEK, WATAUGA COUNTY

Year 3 (2004) and 4 (2005) Monitoring Report

Prepared for the

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

Transportation Improvement Project R-0529

Period Covered, January 9, 2001 – September 27, 2005

North Carolina Wildlife Resources Commission
Division of Inland Fisheries
Watershed Enhancement Group

Raleigh

2006

The purpose of this report is to summarize 2004 and 2005 monitoring data collected from 1,160 linear feet of stream channel on Laxon Creek at the Racey stream mitigation site in Watauga County (Figure 1). Mickey and Scott (2001) described pre-construction survey methods, site conditions, and project objectives. The purpose of the project is to improve water quality, aquatic habitat, riparian area quality, and channel stability. This monitoring report is submitted as partial fulfillment of the off-site stream mitigation requirements of the North Carolina Department of Transportation (NCDOT) for the R-0529 US 421 road improvement project in Watauga County. For that project, a total of 14,814 linear feet of stream mitigation is required by the United States Army Corps of Engineers (USACE) and 7,407 linear feet of mitigation is required by the North Carolina Division of Water Quality (NCDWQ).

Monitoring

Monitoring surveys were conducted on June 3 and 7, 2004 and July 21 and September 27, 2005. The 2004 and 2005 monitoring data is compared with as-built data as reported by Mickey and Hining (2004). The 2004 and 2005 monitoring surveys included longitudinal profiles (2004 only), channel cross-section dimension measurements, pebble counts, stem counts (planted trees/live stakes), and water temperature (2005 only). A photographic chronology of the site is being maintained at three locations: stations 1+88, 7+33 and 8+40 (Appendices 1-3). Photographs are taken looking upstream. Photographs of additional sites are maintained at the Elkin Watershed Enhancement Program office.

Bankfull rain events are monitored through review of the United States Geological Survey's South Fork New River flow gage (station # 03161000) near Jefferson, North Carolina, by photographs and by personal observations of bankfull stage pins placed on site. Bankfull at the Racey site has been corresponding to approximately 1,800 cubic feet per second at the gage station. However, due to the localization of many rain events, some bankfull events could only be confirmed by visiting the site after a rain event or through contact with the landowner. Since completion of the project there have been 10 bankfull or greater events at the site (Table 1).

Longitudinal Profile

The 2004 longitudinal profile data was surveyed from stations 0+0 to 11+63 (Figure 2). There was no appreciable change in the profile between the 2001 (as-built) and 2003; however, the 2004 data reveals differences in stream bed elevation at stations 0+53 - 1+58, 8+08 - 8+52, and 9+29 - 9+80, which can be attributed to dams constructed by beavers at this site.. These dams were subsequently washed out during the flood events associated with the 2004 hurricanes. It should be noted that the 2001 and 2002 longitudinal profile surveys ended at station 9+23 because little construction activity occurred between this point and the confluence of the South Fork New River. The longitudinal profile has remained stable with no identified aggradation or degradation areas other than the changes caused by the beavers. Comparison of the 2004 data with previous years indicates that the minor changes in the longitudinal profile are the result of normal storm events and not the result of stream enhancement activities. Due to the longitudinal profile being stable following the 2004 survey, it was not surveyed in 2005.

Cross-sections

Four cross-sections were surveyed during July 2005. Cross-sectional dimensions showed some adjustment following the 2004 hurricanes when compared with the 2004 monitoring survey data (Figure 3). There have been minor adjustments in thalweg depths and minor lateral movement of the channel following the 2004 hurricanes. Most of the cross-sections exhibited minor build up of the streambanks due to deposition of soil materials (silt, sand, small gravel) during high flow storm events.

CROSS-SECTION 1+88 – run (Figure 3.1): This cross-section is located just above a root wad. There has been little change in the cross-section from 2001 thru 2005. The thalweg has deepened and the channel has widened slightly following the three September 2004 hurricanes; in spite of this the banks are stable and well vegetated.

CROSS-SECTION 2+08 – pool (Figure 3.2): This cross-section is located over the middle of a pool just below a rock weir and has shown very little change over time. The thalweg has deepened and the channel has widened slightly following the three September 2004 hurricanes; in spite of this the banks are stable and well vegetated.

CROSS-SECTION 7+13 – step pool (Figure3.3): The thalweg has deepened and the channel has widened considerably, probably due to storm events and the failure of a beaver dam located above the cross-section. However, the streambanks are stable and well vegetated. While the banks are stable, the steep right bank should be visually monitored for potential bank erosion problems during the yearly conservation easement inspection.

CROSS-SECTION 8+40 – run (Figure 3.4): The thalweg has deepened to the level found in 2003. Immediately below the transect, the left bank has migrated slightly and a central bar has developed creating a separate channel along the right bank. These channel adjustments are the direct result of beaver activity during 2003 - 2004. Both banks are well vegetated and stable. If the central bar becomes larger, there is the potential risk of bank erosion developing along the right bank. This location should be monitored for potential bank erosion problems during the yearly conservation easement inspection.

Substrate

Bed material was collected from a riffle at cross-section 18+42 (Figure 4). Substrate analyses show a slight increase in most particle sizes, except for the D_{95} cumulative distribution. Since 2001 the D_{50} cumulative distribution has coarsened from medium, to course, to very coarse gravel. The increase in particle size, especially the D_{50} and D_{84} cumulative distribution, is probably a result of the channel becoming narrower. This has occurred as a result of improved bank profiles and in-stream structures following site construction, an improved riparian corridor that has narrowed the stream to improve sediment transport, and the three September 2004 hurricanes that flushed out a lot of silt and sand from the watershed (visual observations immediately following these hurricane events).

Riparian Improvements

Since construction was completed on November 3, 2000, all disturbed banks have become well vegetated (Appendices 1-3). A total of 412 stems (live stakes and rooted plants) were planted along 0.67 acres of disturbed streambanks in 2001 and 2002 (Table 2). A total of 195 stems were counted in 2005 for a 47% survival (Table 2). The density of stems in the disturbed areas planted is 291/acre (195/0.67) and is above the 260 stems/acre required for woody species planted at mitigation sites through year five (USACE 2003). It should be noted that these stem counts do not include seven black cherry *Prunus serotina,* 14 white pine *Pinus strobes*, and 18 black walnut *Juglans nigra*, planted by the landowner in 2001. These trees were not included in the 2004 and 2005 survival counts.

Temperature

Because Laxon Creek is classified by NCDWQ as trout water, the WRC wanted to determine if water temperatures would decrease as riparian vegetation began providing shade along the 1,160 ft site. Stream water temperature was recorded hourly at the upper and lower site boundaries from July 28 to September 27, 2005 (Figure 5) and compared with temperature data collected during approximately the same time period in 2001, 2002, and 2003 (Mickey and Hining 2004). The average daily water temperatures at the upper station were 17.7°C, 18.1°C, 16.5°C, and 17.5°C in 2001, 2002, 2003, and 2005, whereas at the lower station water temperatures were 17.4°C, 18.5°C, 16.5°C, and 17.5°C in 2001, 2002, 2003, and 2005. It was hoped from 2001 to 2005, as the density of the riparian vegetation improved, that the average daily water temperature would be cooler at the lower end of the project. Unfortunately, the upper and lower daily average water temperatures were nearly identical (Figure 5). This could be attributed to the study reach being too short (1,160 ft) to document any change in the temperature regime or the riparian vegetation has not matured enough to provide stream shading and cooler water temperatures.

Site Repairs

A major flood event occurred on November 19, 2003 that resulted in some minor damage to a rock cross-weir at longitudinal profile station 3+57 (Appendix 4). Damage to the structure occurred after a ford crossing was replaced by the landowner with a bridge in 2002 (construction of a bridge at this location was permitted in the conservation easement). Flood waters crested the bridge and lateral movement of flood waters were constricted by the bridge abutments. This constriction resulted in the flood waters creating an upward current under the cross-weir boulders, causing the structure to fail. Under normal flood conditions, flood waters would have flowed over the structure, holding it in place. This structure, along with some minor bank damage immediately downstream from the site, was repaired on February 25, 2004. These repairs have been the only ones required at this site since construction was completed on November 3, 2000 (Mickey and Scott 2001).

Conclusion

It has been five years since construction at the Racey site was completed on November 3, 2000. During this period there have been 10 bankfull or greater events resulting in only minor repairs to the site on February 25, 2004. The streambank improvements and repairs have remained stable with no failures noted. In-stream structures are functioning as designed. The riparian vegetation is thriving and helping to rebuild and stabilize the streambanks. Stream temperatures should continue to be monitored for an additional three to five years to determine if the maturing riparian vegetation is having any impact.

It is our recommendation that this site be considered stabilized and released from further monitoring. Furthermore, we recommend NCDOT should be awarded 1,160 mitigation credits (1:1 ratio) for this site as approved by NCDWQ (NCDWQ letter to the NCWRC dated November 6, 2000, office files).

Acknowledgements

The Elkin Watershed Enhancement Team of J. Mickey, Jr., J. Wasseen, II and S. Hining (2004) were responsible for collection and analysis of the field data and preparation of this report. J. Borawa improved the report with his thorough review and thoughtful suggestions.

References

Mickey, J. H. and S. Scott. 2001. As-built report for the Racey mitigation site, Laxon Creek, Watauga County. North Carolina Wildlife Resources Commission, Raleigh.

Mickey, J. H. and S. Hining. 2004. Racy mitigation site on Laxon Creek, Watauga County. Period covered: July 30, 2002 – February 25, 2004. North Carolina Wildlife Resources Commission, Raleigh.

USACE (U.S. Army Corps of Engineers), Wilmington District, U. S. Environmental Protection Agency, North Carolina Wildlife Resources Commission, and the North Carolina Division of Water Quality. 2003. Stream Mitigation guidelines. Wilmington, North Carolina.

FIGURE 1.—Racey mitigation site, Laxon Creek, Watauga County, 2001-2003.

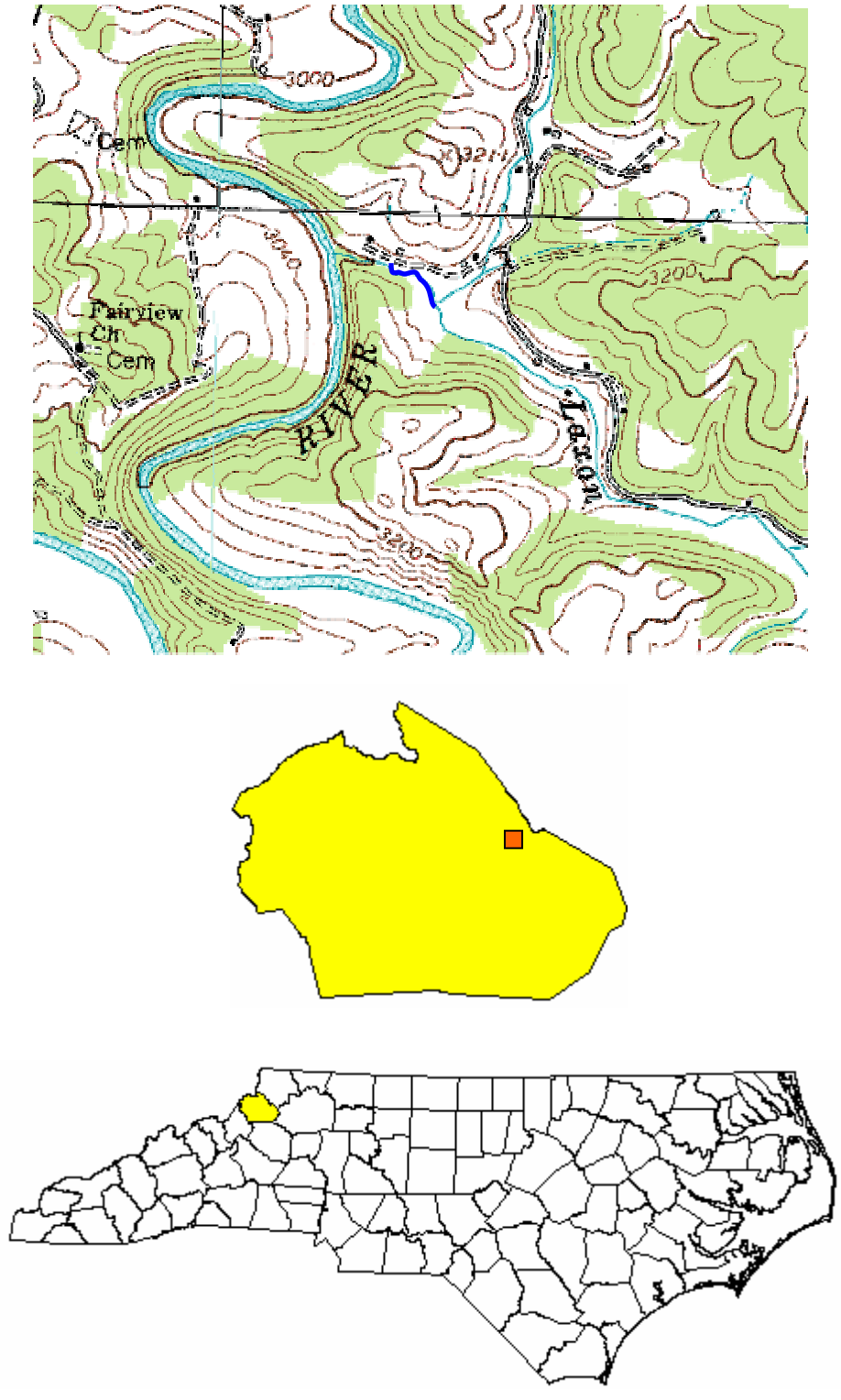


FIGURE 2.—Longitudinal profile comparisons for 2001-2004, Racey mitigation site, Laxon Creek, Watauga County. It should be noted that the 2001 and 2002 longitudinal profile surveys ended at station 9+23 because little construction activity occurred between this point and the confluence of the South Fork New River.

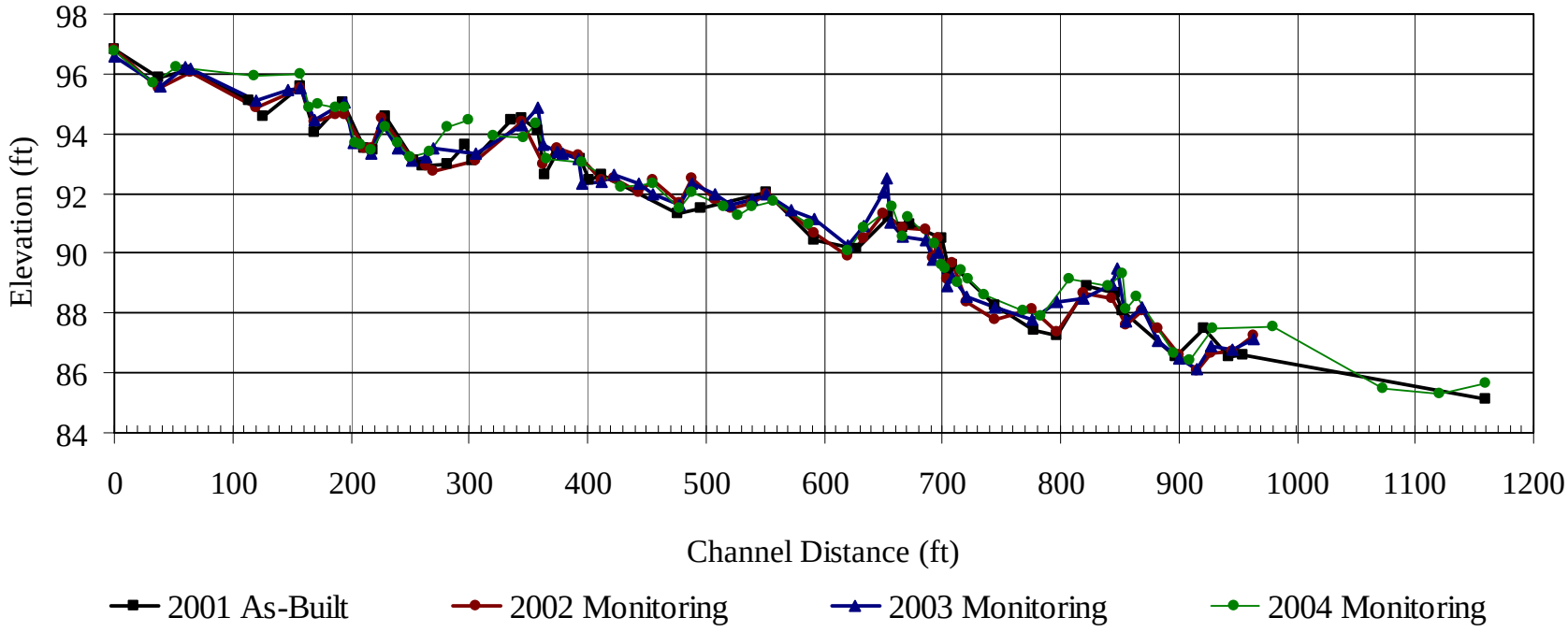


FIGURE 3.—Four cross-sectional dimension comparisons, Racey mitigation site, Laxon Creek, Watauga County 2001-2005.

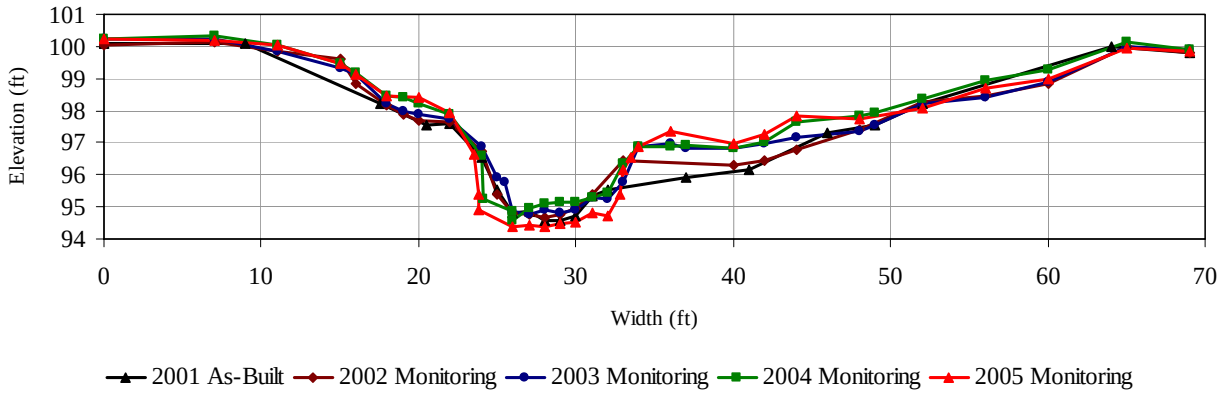


FIGURE 3.1. Cross-section 1+88, run.

FIGURE 3.—Continued.

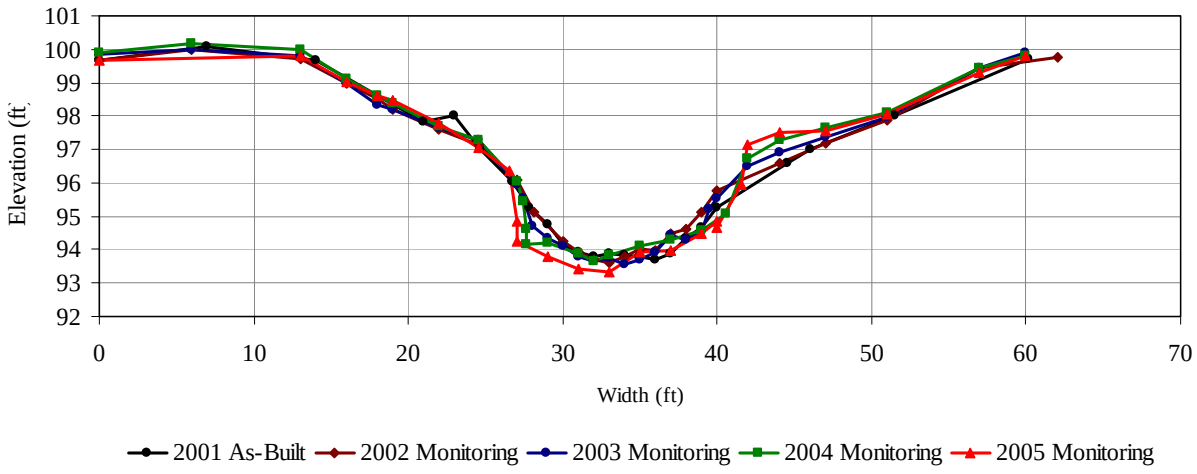


FIGURE 3.2. Cross-section 2+08, pool.

FIGURE 3.—Continued.

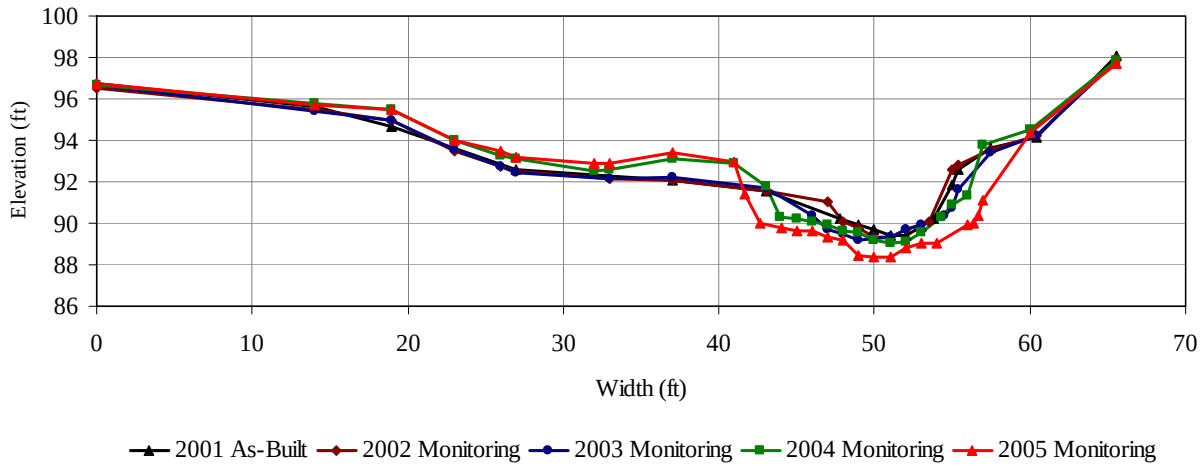


FIGURE 3.3. Cross-section 7+13, step pool.

FIGURE 3.—Continued.

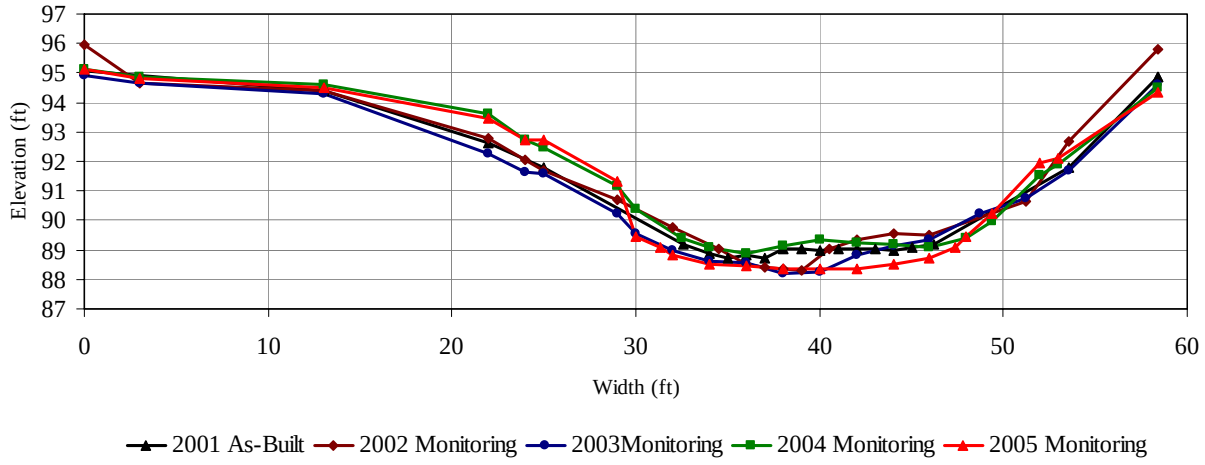
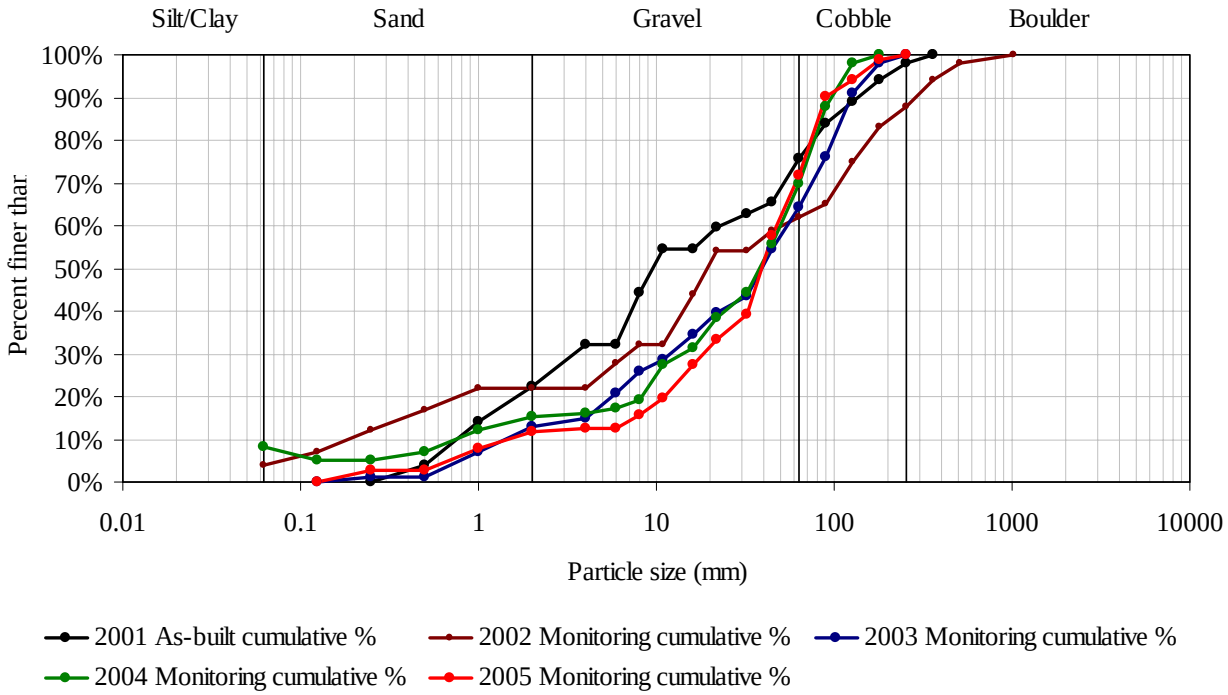


FIGURE 3.4. Cross-section 8+40, run.

FIGURE 4.—Pebble count data comparisons, Racey mitigation site, Laxon Creek, Watauga County, 2001-2005.



	Particle size (mm) in year sampled				
	2001	2002	2003	2004	2005
D 16	1.2	0.4	4.3	3.6	8.2
D 35	6.4	12.0	16.0	19.0	24.0
D 50	9.5	19.0	39.0	38.0	39.0
D 84	91.0	190.0	110.0	84.0	80.0
D 95	200.0	390.0	160.0	120.0	140.0

FIGURE 5.—Comparisons of daily average water temperatures at the upper and lower boundaries of the Racey mitigation site, Laxon Creek, Watauga County, July 28 – September 27, 2005.

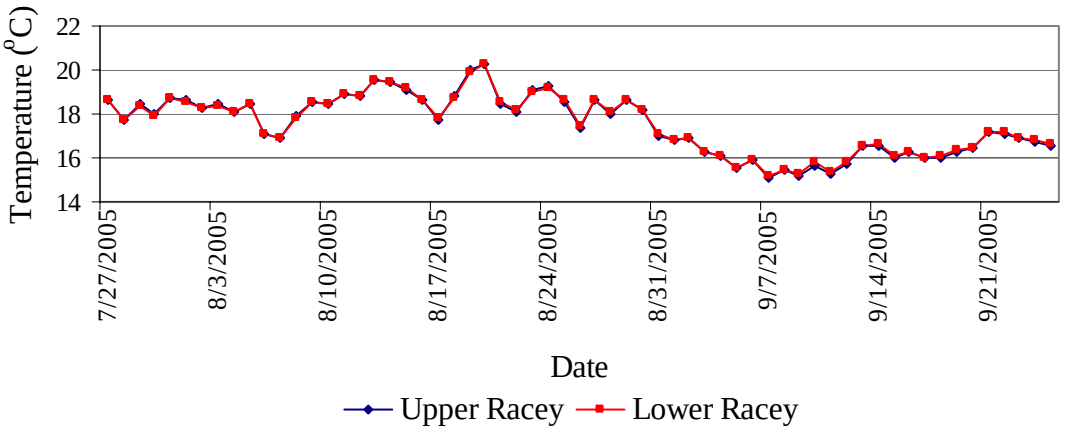


TABLE 1.—Monitoring of inner berm and bankfull events at Racey mitigation site based on data from the United States Geological Survey South Fork New River gage (No. 03161000) near Jefferson, Ashe County, North Carolina and from visual observations.

Date	Gage height (ft)	Flows (cfs)	Comments
2/22-23/03	5.0	2,250	Gage quit working
3/16/03	4.4	1,725	Inner berm event
4/10/03	5.4	2,819	Bankfull event
4/18/03	5.6	3,200	Bankfull event
6/7/03	4.1	1,820	Inner berm event
6/17/03	4.7	2,000	Bankfull event
8/9/03	4.2	1,450	Inner berm event
8/10/03	4.1	1,400	Inner berm event
11/19/03[a]	5.4	1,880	Bankfull event
2/7/04	4.8	2,080	Bankfull event
9/2/04	11.7	14,700	Bankfull event (hurricane)
9/13/04	8.6	7,550	Bankfull event (hurricane)
9/28/04	6.3	3,820	Bankfull event (hurricane)
7/8/05	4.6	2,000	Bankfull event (tropical storm)

[a]This event produced rainfall in excess of six inches at the Racey site which resulted in major, local flooding (Appendix 4).

TABLE 2.—Vegetation monitoring data for the Racey mitigation site, Laxon Creek, Watauga County, 2001-2005.

		Number planted		Survival count			
Scientific name	Common name	2001	2002	2002[a]	2003[a]	2004[b]	2005[c]
Cornus amomum	Silky dogwood	157				29	59
Salix nigra	Black willow	13				2	3
Salix sericea	Silky willow	30				31	45[d]
Alnus serrulata	Tag Alder		45			30	37
Diospyros virginiana	Persimmon	25	7			1	1
Fraxinus americana	White ashe	25				2	1
Juglans nigra	Black walnut		5			2	3
Pinus strobes	White pine	20				5	6
Prunus serotina	Black cherry	50				15	18
Quercus rubra	Northern red oak	25				6	4
Robinia pseudoacacia	Black locust		10			10	18[d]
Total		345	67			133	195
Percent survival						32	47

[a]No count conducted, planted vegetation to small to locate in dense vegetation growth.

[b]Count made on February 24, 2004.

[c]Count made on June 23, 2005.

[d]Counts were actually higher than number of stems planted due to natural regeneration.

APPENDIX 1: Photographic log of the Racey mitigation site looking upstream at cross-section 1+88, Laxon Creek, Watauga County, October 2000-July 2005.

October 30, 2000 before construction.

November 3, 2000 after construction.

May 29, 2001.

July 9, 2002.

August 14, 2003.

June 30, 2004.

APPENDIX 1.—Continued.

July 21, 2005.

APPENDIX 2.—Photographic log of the Racey mitigation site looking upstream at cross-section 7+13, Watauga County, October 2000-July 2005.

October 30, 2000 before construction.

November 3, 2000 after construction.

June 1, 2001.

July 9, 2002.

May 14, 2003.

June 7, 2004.

APPENDIX 2.—Continued.

July 21, 2005.

APPENDIX 3: Photographic log of the Racey mitigation site looking upstream at cross-section 8+40, Watauga County, October 2000-July 2005.

October 30, 2000 before construction.

November 2, 2000 after construction.

May 29, 2001.

July 30, 2002.

July 14, 2003.

June 7, 2004.

APPENDIX 3.—Continued.

July 21, 2005.

APPENDIX 4. Overview photograph showing the location of the bridge at longitudinal profile station 3+57 during the November 19, 2003 flood event on Laxon Creek, Watauga County. The rock cross-weir at this location was damaged during the flood and had to be repaired. Photograph courtesy of Dr. Jana Carp.