WILD MITIGATION SITE, OBIDS CREEK, ASHE COUNTY

Year 5 Monitoring and Closeout Report

Period covered: June 27, 2006 – December 31, 2007

Prepared for the

North Carolina Ecosystem Enhancement Program

North Carolina Wildlife Resources Commission
Watershed Enhancement Group
Raleigh

2008

This report summarizes the 2007 monitoring data collected along 1,819 linear feet of Obids Creek at the Wild stream mitigation site in Ashe County (Figure 1). Mickey and Scott (2002) described pre-construction survey methods, site conditions, and project objectives. Channel modifications were completed on September 23, 2002. The purpose of the project was to improve in-stream habitat and reduce bank erosion of a previously channelized stream reach impacted by cattle grazing. This monitoring report is submitted as partial fulfillment of the off-site stream mitigation requirements for the North Carolina Department of Transportation's (NCDOT) R-0529 US 421, Transportation Improvement Project in Watauga County. For that project, a total of 14,814 linear feet of stream mitigation was required by the United States Army Corps of Engineers (USACE) Section 404 permit and 7,407 linear feet of mitigation was required by the North Carolina Division of Water Quality (NCDWQ) Section 401 water quality certification.

From 2000 to 2005 all reports associated with this mitigation site were prepared for the NCDOT stream mitigation program. In 2005, responsibility for this site was transferred from NCDOT to the North Carolina Ecosystem Enhancement Program (EEP). This document was prepared using guidelines developed by the North Carolina Wildlife Resources Commission. This was done to maintain consistency with methods used in earlier reports and to facilitate the comparison of the 2007 data with previous years' data.

Monitoring

The 2007 monitoring survey data were collected on various dates throughout November. These data are compared with the as-built and previous years' monitoring data (Mickey and Scott 2003; Mickey and Wasseen 2005; NCWRC 2007). The 2007 monitoring survey included a longitudinal profile survey, channel cross-section dimension measurements, a pebble count, and woody vegetation stem counts (planted trees/live stakes). A photographic log of the site was maintained between stations 7+75 and 8+50; 8+65 and 9+60; 10+64 and 11+27; and 12+29 and 13+41 (Appendices 1-4). All photographs are taken looking down stream.

Bankfull rain events

Bankfull rain events were monitored through review of the United States Geological Survey's South Fork New River gage (gage number 03161000) near Jefferson, North Carolina, by photographs and by personal observations of bankfull stage pins placed on site. Since completion of the project there have been 22 bankfull or greater than bankfull events at the site (Table 1).

Longitudinal Profile

The 2007 longitudinal profile survey included the entire project reach and is compared to the as-built survey and the partial surveys of 2004 and 2006 (Figure 2). The 2007 survey revealed that the channel thalweg had changed little from previous surveys, the most notable exception to this occurs within the first 490 ft of stream. However, some of these changes are due to the greater number of survey points obtained in 2007 as compared with the as-built survey and not

actual changes in the channel thalweg. The lengthening of the plunge pool at station 0+25 and the decreasing pool length at station 1+30 are a reflection of the increased number of survey data points taken in 2007 (Figure 2.1).

The pool at station 3+18 deepened since the as-built and 2004 surveys were completed. The channel thalweg elevation at station 3+40, located on a rock weir decreased by a half of a foot since the as-built survey; this is the result of repairs made at this location in 2006. A plunge pool is now present below a rock weir at station 3+44; it was not present in 2004. The cross-section transect at station 3+55 showed no changes since the two previous monitoring events. However the small pool downstream of 3+55 has filled in, which is most likely a result of downstream changes in the stream channel.

From station 4+04 to 4+86 the channel thalweg differs greatly from the 2003 as-built survey (Figure 2.1). The stream channel at this location turns to the left and originally contained a single pool. As the point bar on the left bank built up over time, the stream channel migrated to the left, cutting around a maple tree and forming an island. The island split the single pool into two pools; one upstream of the island between stations 4+04 and 4+27 and one downstream of the island between stations 4+57 and 4+73. The right bank from station 4+20 to station 4+65 appeared stable. From station 4+86 to 6+00 the channel thalweg aligns closely with the 2003 as-built survey.

There have been minor channel changes between stations 7+44 and 7+62 (Figure 2.2). In previous years, a deep pool was located below a rock weir at station 7+44. Between 2004 and 2007, a tree fell across the stream at station 7+54 creating a step pool. There was no channel or bank instability associated with the addition of this tree, nor were there any significant changes in the channel between that point and station 14+00 (Figures 2.2 and 2.3).

Two riffles located between stations 14+04 and 14+79 migrated upstream 5 and 11 feet (Figure 2.3). Instability of the right bank between stations 14+30 and 14+50 could have led to the migration of the riffles. The rock vane on the right bank at station 14+39 should help minimize further bank erosion. From station 14+79 to the end of the project the channel thalweg aligns closely with the previous years' monitoring data.

Except for the first 490 feet of stream no appreciable change in the longitudinal profile occurred between 2003 and 2007. A longitudinal profile survey was not conducted in 2005 and only partial surveys were executed in 2004 and 2006. The longitudinal profile indicates the thalweg has remained stable with minimal aggradation or degradation occurring along the entire reach. These minor changes in the longitudinal profile are expected natural occurrences and do not undermine the overall success of the stream enhancement activities.

Cross-sections

Nine cross-sections were surveyed during November 2007. Changes in some cross-sections' dimensional features, following the September 8, 13, and 27, 2004 hurricanes, were still apparent when compared with the 2004 survey data (Figures 3.1-3.9). While there have been some adjustments in thalweg depths, there was no noticeable lateral movement except at cross-section

12+74. Most of the cross-sections exhibited some build up of the streambanks due to deposition of soil materials (silt, sand, and small gravel) during bankfull or greater than bankfull storm events.

CROSS-SECTION 3+55 – riffle (Figure 3.1): This cross-section is located over a deep riffle just below a crossvane. There has been little change in the cross-section from 2003 through 2007. The thalweg has decreased in depth about 0.6 ft. This cross-section has remained stable with no lateral movement (bank erosion) observed along either streambank. The left bank has increased in height due to the riparian vegetation capturing streambed materials during flood events. The 2006 repairs that were made to two boulders in the middle of the crossvane are functioning properly.

CROSS-SECTION 7+36 – pool (Figure 3.2): This cross-section transects the tail end of a long pool just upstream a crossvane. The thalweg at this location has continued to deepen since 2004. There has been some channel migration along the right bank at cross-section position 0+60 since completion of the project. However, the bank is stable and well vegetated.

CROSS-SECTION 8+19 – riffle (Figure 3.3): This cross-section traverses a riffle. The thalweg has remained stable, exhibiting only minor adjustments due to storm events. In 2007 between transect locations 0+15 and 0+17 there has been a build up of the right bank; this is a result of the repairs that were made in 2006 where holes behind the root wads were filled in. The unusual high points seen in the as-built and 2007 monitoring data, at transect location 0+19, represents a measurement taken on top of a root wad. The build up of the bank from cross-section transect location 0+30 to 0+55 is due to streambed materials being captured by riparian vegetation during flood events. This cross-section has remained stable with no lateral movement (bank erosion) observed along the streambanks.

CROSS-SECTION 9+16 – run (Figure 3.4): This cross-section transects a run downstream of a crossvane containing root wads along the right bank. However, it could also be considered a fast pool. The 2007 monitoring survey indicates no major changes in the thalweg of the cross-section when compared with the previous years' surveys. However, as bank vegetation continued to increase in density, bank height has increased as streambed materials were captured by the riparian vegetation during flood events. This cross-section has remained stable with no lateral movement (bank erosion) of the stream channel.

CROSS-SECTION 10+88 – pool (Figure 3.5): This cross-section transects a stable pool immediately downstream of the upper ford and a crossvane with root wads installed along the left bank. There has been little change in this cross-section since construction.

CROSS-SECTION 12+31 – riffle (Figure 3.6): This cross-section transects a riffle. The only changes at this site have been a 1 ft deepening of the thalweg along the left bank, and formation of an inner berm along the right bank. Both banks are stable and well vegetated.

CROSS-SECTION 12+74– pool (Figure 3.7): This cross-section transects a pool below a crossvane with root wads installed along the left bank. In 2006 a boulder was repositioned along the right bank and cobble placed in front of the boulder to alleviate pressure on the bank.

Previously this boulder caused the right bank to be cut away and resulted in an increase in channel depth between the boulder and the right bank. The thalweg has moved to the center of the channel as a result of repairs made in 2006. Cross-section transect location 0+18 identifies a hole behind the root wads, whereas the high point at position 0+19 is on top of the root wads. Both banks are stable and well vegetated.

CROSS-SECTION 13+80 – 14+29 pool/riffle complex (Figure 3.8): This cross-section goes through an S-curve meander pattern, making it part cross-section, part longitudinal profile. This allowed for the monitoring of two distinct pools that were created with root wads and bank re-shaping. The holes behind the root wads at cross-section transect location 0+19 and 0+23 were filled in 2006. The thalweg at transect location 0+34 to 0+40 has evolved from a run to a pool feature. The stream bed is below that found in 2003. The riffle between transect location 0+54 and 0+60 has lengthened compared to the 2006 survey, although the riffle crest height is still below that found in 2003, 2004, and 2005. This site is stable and well vegetated.

CROSS-SECTION 16+52 – pool (Figure 3.9): This cross-section is located downstream of the lower ford and a crossvane. The cross-section has remained stable and the thalweg has deepened approximately 0.8 ft since construction. The point at transect location 0+31 can only be explained as a rock or some other material present at the water's edge. There have been some minor adjustments to the bankfull and floodplain areas due to the capture of streambed materials during flood events.

Substrate

Bed material was collected from a riffle at cross-section 8+19 (Figure 4). Substrate analyses indicate all particle size classes have shown minor fluctuations throughout the five years of monitoring. The biggest fluctuation occurred in the D_{16} and D_{35} particle sizes of 2004. Currently, all particle sizes are greater than or equal to that found in 2003, except for the D16 size class. The increase in particle size, especially the D_{50} and D_{84}, is probably a result of the elimination of cattle having access to streambanks. Visual observations confirmed that the stream substrate contained less silt and sand.

Riparian Improvements

A total of 716 bare root trees and live stakes were planted in the 2.6 acre conservation easement area during the winter of 2003 (Table 2). Of the 2.6 acre conservation easement, only five areas totaling 1 acre were disturbed during construction. The majority of the 716 plants were planted in these construction areas. Total stem counts (trees and live stakes) were made in the five vegetation plots. No effort was made to distinguish between planted stems and naturally regenerated stems. The 2007 vegetation survey revealed 338 stems (338 stems per acre) present at the five sites. Although this is 47% of the original number planted, the density of counted stems present in 2007 exceeded the mitigation success criteria of 260 stems per acre required for woody species through monitoring year five (USACE 2003). Of the 11 tree and shrub species planted, those having greater than 50% survival in 2007 were elderberry *Sambucus canadensis* (60%), black locust *Robinia pseudoacacia* (57%), and tag alder *Alnus serrulata* (100%). The total number of tag alder in 2007 is greater than the number of tag alder planted in 2003. This is

due to the high number of naturally regenerated stems and being unable to distinguish between them and the planted stems.

Three species of native plants, hawthorne *Crataegus spp.* (1 stem), ninebark *Physocarpus opulifolius* (102 stems), and black cherry *Prunus serotina* (11 stems), were found to be naturally recolonizing the site.

It should be noted that multiflora rose *Rosa multiflora* is present at the Wild mitigation site. According to Miller (2004) it is a nonnative invasive shrub. The plant is aggressively competing with the native riparian flora along the streambanks at the Wild site. It has spread from the conservation easement and is impacting adjacent fields. A one time herbicide treatment of multiflora rose will occur in the spring of 2008 in order to meet a previous agreement with the landowners. Additional treatments will be necessary to control the exotic invasive species. It also must be noted that a North Carolina threatened plant species, Gray's lily *Lilium grayi*, was found inside the fenced conservation easement area.

Livestock Exclusion

The livestock management program developed for this project included the installation of two stream-crossings, three watering tanks, and fencing to exclude livestock from the riparian zone. These agricultural best management practices, installed as a part of the restoration management plan, are functioning properly.

Repairs

During the 2006 monitoring survey, four sites needing minor repairs were identified (NCWRC 2007). A small excavator with a hydraulic thumb was used to make the repairs on June 16, 2006. Two large boulders were repositioned in the middle of the cross-vane at station 3+55. The shifting of the boulders could be attributed to the upstream landowner removing all of the vegetation from the banks of the unnamed tributary to Obids Creek in 2005, which increased the stream's velocity coming into this cross-section and redistributed the aforementioned boulders. At station 8+50 two boulders on the left bank were repositioned to make a mini-rock vane. The damage at cross-section 12+74 was caused by flooding associated with 2004 hurricanes. That repair involved repositioning a large boulder on the right bank, backfilling the void with cobble and filling a scour hole behind the root wads. The fourth repair area was located at station 13+80 and required filling voids behind the root wads.

Summary

Since completion of the as-built report (Mickey and Scott 2003) Obids Creek at the Wild mitigation site has remained stable as seen in the photographic log (Appendices 1-4). There have been no major bank failures or serious structural failures, except at cross-section 12+74. All necessary repair work was completed in 2006, and the repairs have alleviated those areas of instability. The longitudinal profile and cross-section data, through five years of monitoring, have revealed that the stream channel and banks are essentially stable. Those areas identified as potential problem sites were not due to stream enhancement activities, but natural storm events

or upstream landowner activities. Substrate composition sizes have fluctuated through the five years of monitoring. Most of the particle sizes are greater than as-built conditions; this is due in part to the cattle being removed from the riparian zone. The substrate data substantiated visual observations that the stream substrate contained less silt and sand. The riparian vegetation is thriving and helping to re-build and stabilize the streambanks. There have been 22 bankfull events, through the five years of monitoring. The stream channel and banks are stable and in-stream structures are functioning as designed.

Recommendations

1. That this site be considered stabilized and released from further monitoring.
2. Award 1,819 mitigation credits to EEP for this site as approved by the USACE and NCDWQ Note: A subsequent letter from NCDWQ referencing the original certification (Number 97-0616 dated August 21, 2001) approved this site at a 3:1 mitigation credit ratio. This apparent inconsistency needs to be resolved.
3. Implement a multiflora rose control plan to prevent the species from displacing native plants within the easement area before they have matured. Treat multiflora rose with herbicide in the late summer of 2008 and the early spring of 2009.

Acknowledgements

M. Fowlkes, J. Wasseen, II and Todd Ewing of the NCWRC watershed enhancement group collected and analyzed the field data; J. Wasseen, II prepared this report. M. Fowlkes and J. Borawa improved the report with their thorough review and thoughtful suggestions.

References

Mickey, J. H. and S. Scott. 2002. Stream stabilization and enhancement plan, Wild site, Obids Creek, Ashe County. North Carolina Wildlife Resources Commission, Raleigh, North Carolina.

Mickey, J. H. and S. Scott. 2003. As-built report for the Wild mitigation site, Obids Creek, Ashe County. North Carolina Wildlife Resources Commission, Raleigh, North Carolina.

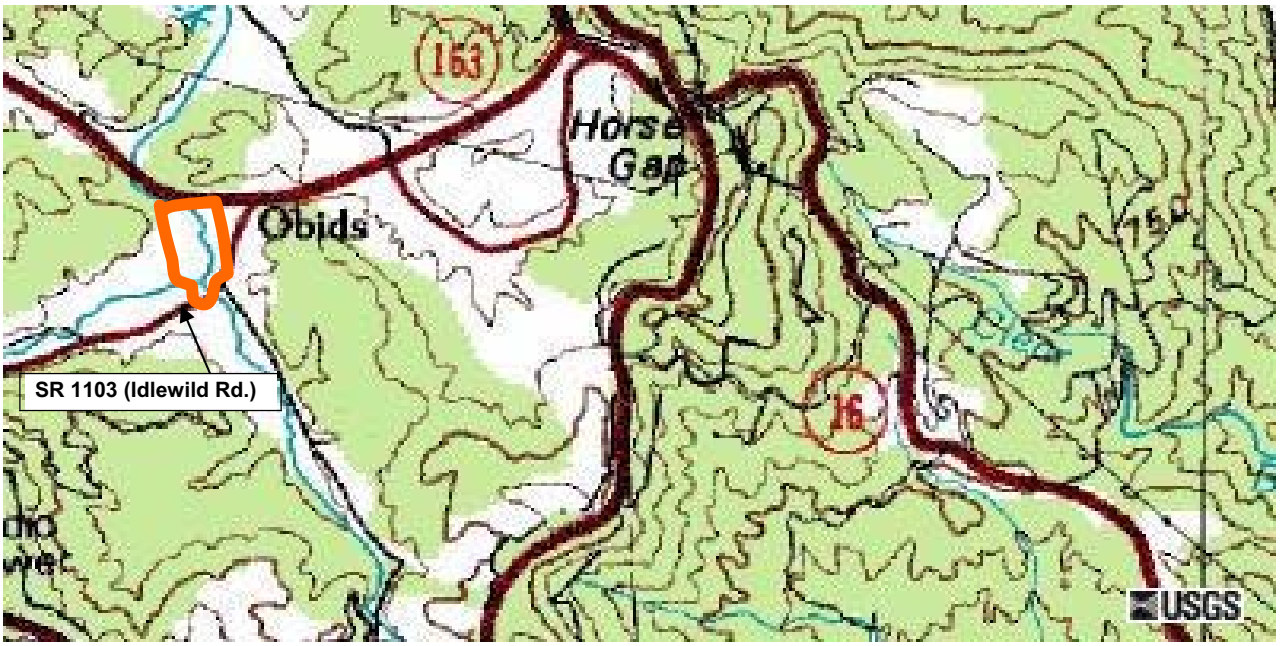
Mickey, J. H. and J. A. Wasseen. 2005. 2004 - 2005 monitoring report for the Wild mitigation site on Obids Creek, Ashe County. North Carolina Wildlife Resources Commission, Raleigh, North Carolina.

Miller, J. H. 2004. Nonnative invasive plants of southern forests a field guide for identification and control. Southern Research Station, Asheville, North Carolina

NCWRC (North Carolina Wildlife Resources Commission). 2007. Wild mitigation site, Obids Creek, Ashe County, year 3 monitoring report, period covered: June 30, 2005 – June 27, 2006. Raleigh.

USACE (US 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.—Location of the Wild stream mitigation site, Obids Creek, Ashe County, North Carolina.



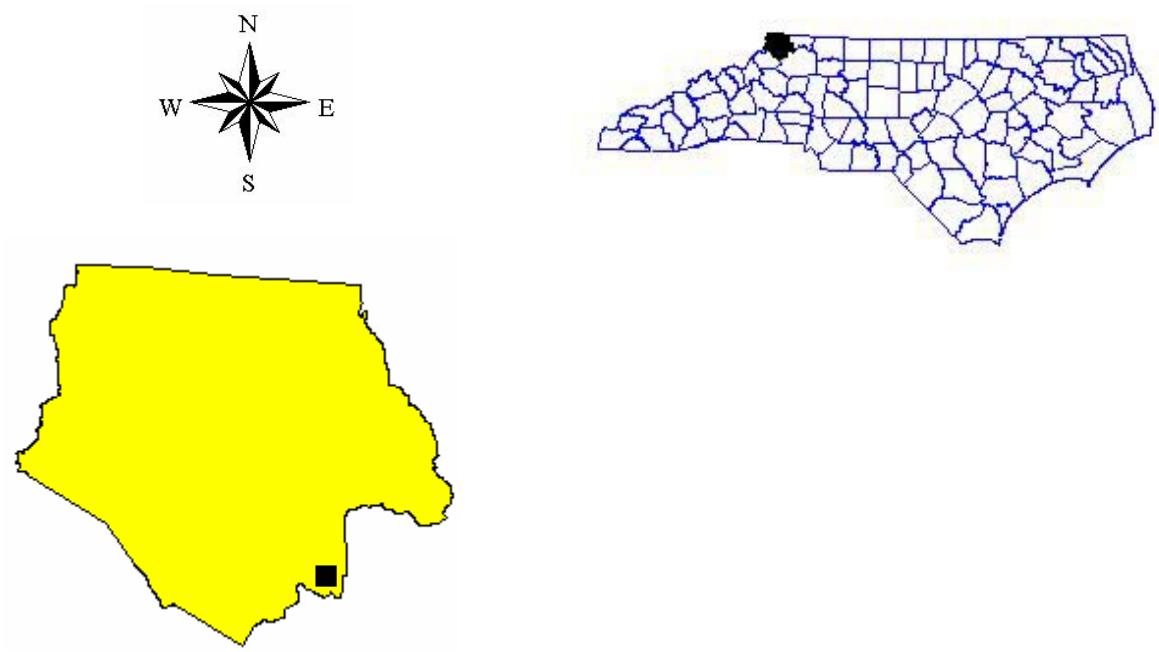


FIGURE 2.—Longitudinal profile comparisons, Wild site, Obids Creek, Ashe County, 2003-2007.

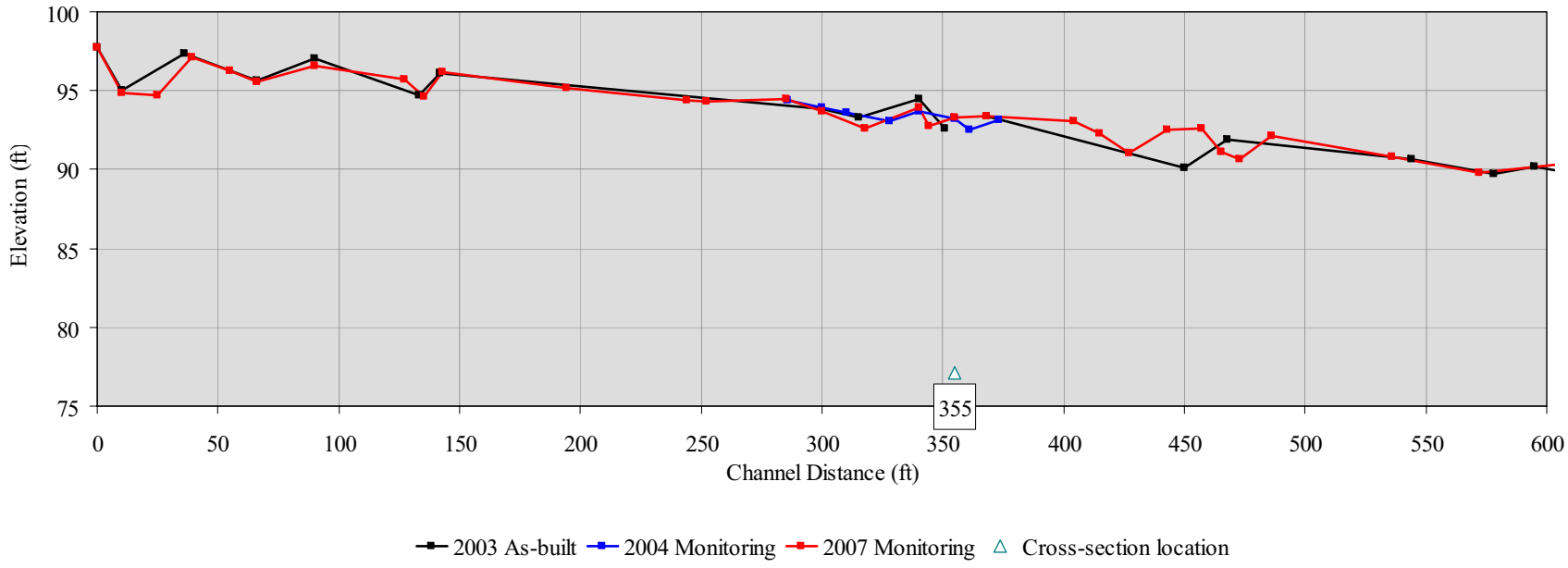


FIGURE 2.1.—Longitudinal profile between station 0+00 and station 6+00.

FIGURE 2.—Continued.

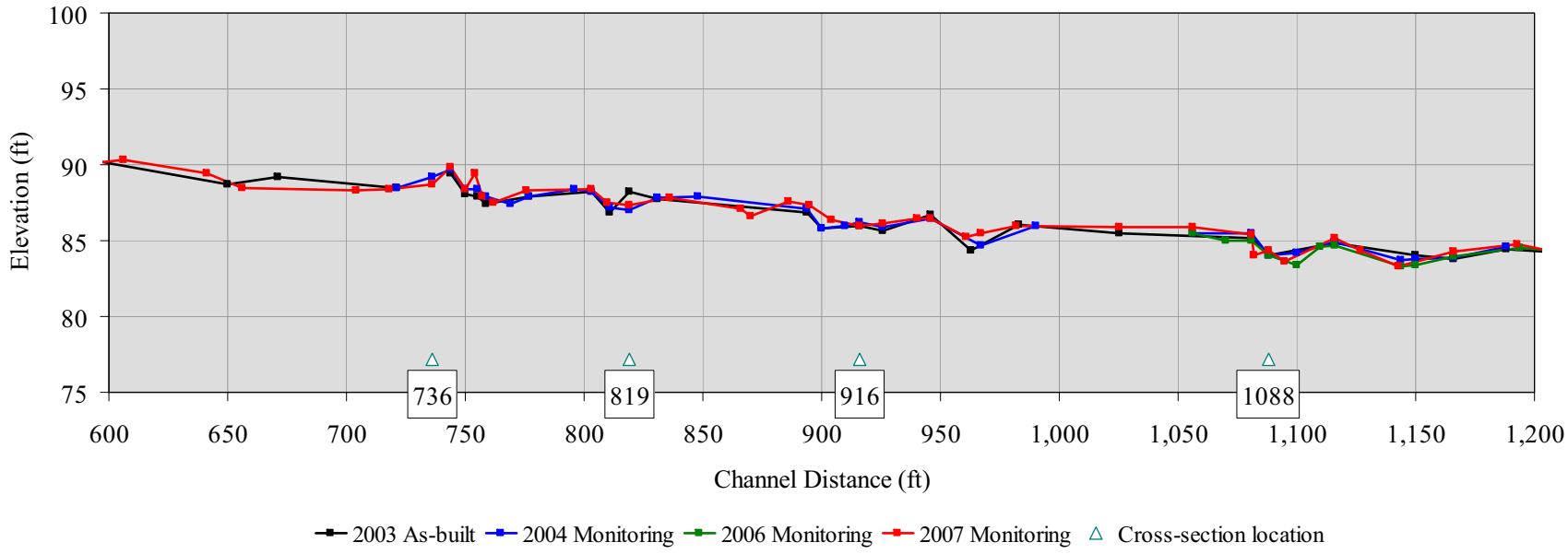


FIGURE 2.2.—Longitudinal profile between station 6+00 and station 12+00.

FIGURE 2.—Continued.

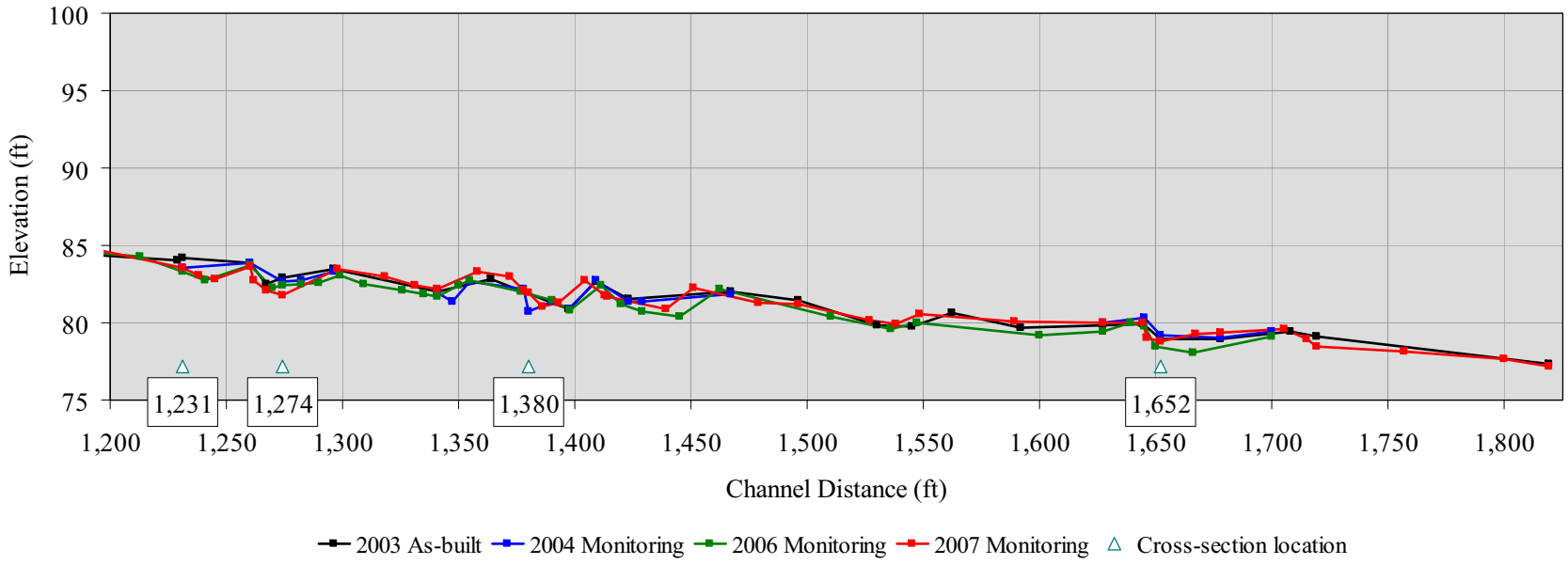


FIGURE 2.3.—Longitudinal profile between station 12+00 and station 18+20.

FIGURE 3.—Cross-section comparisons, Wild mitigation site, Obids Creek, Ashe County, North Carolina, 2003-2007. All views are looking downstream. The flood prone area (fpa) and bankfull (bkf) elevations are depicted with red and blue horizontal lines.

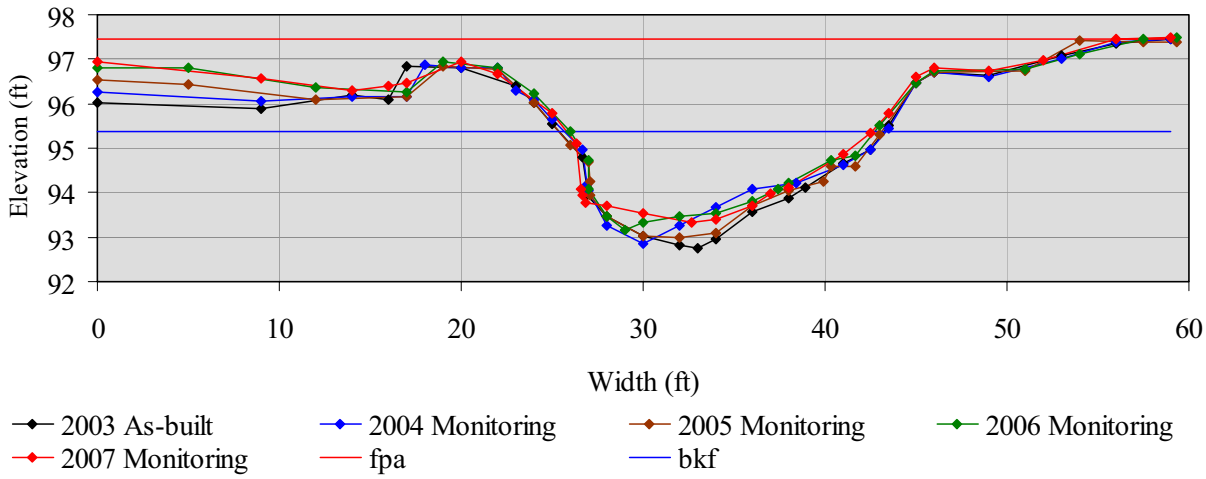


FIGURE 3.1.—Cross-section station 3+55, riffle.

FIGURE 3.—Continued.

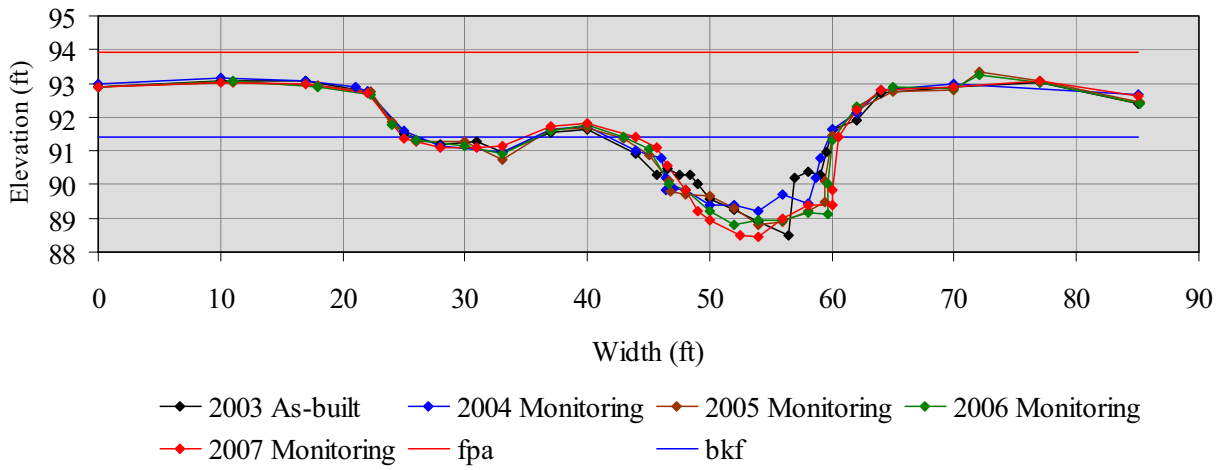


FIGURE 3.2.—Cross-section station 7+36, pool.

FIGURE 3.—Continued.

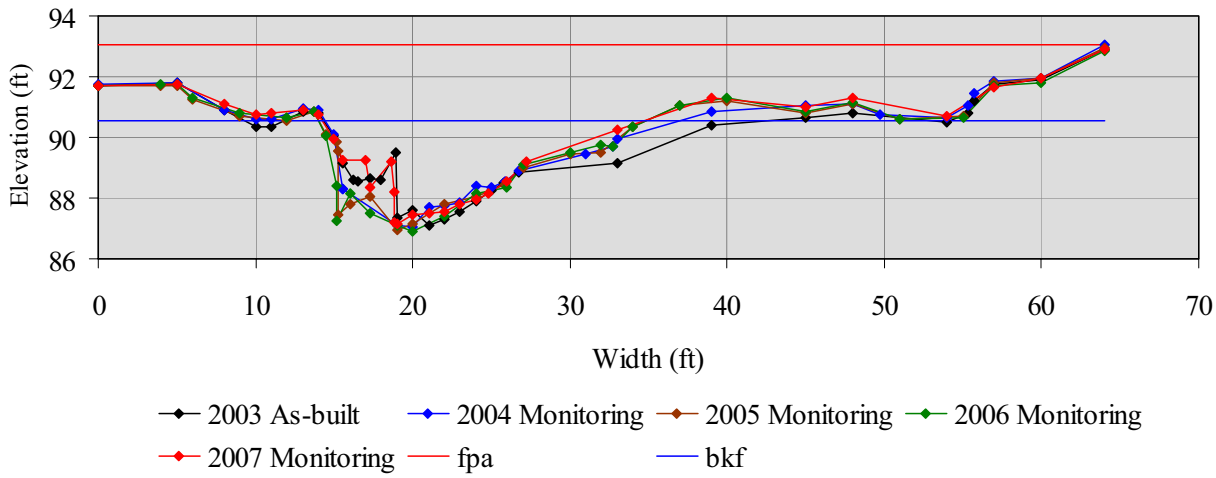


FIGURE 3.3.—Cross-section station 8+19, riffle.

FIGURE 3.—Continued.

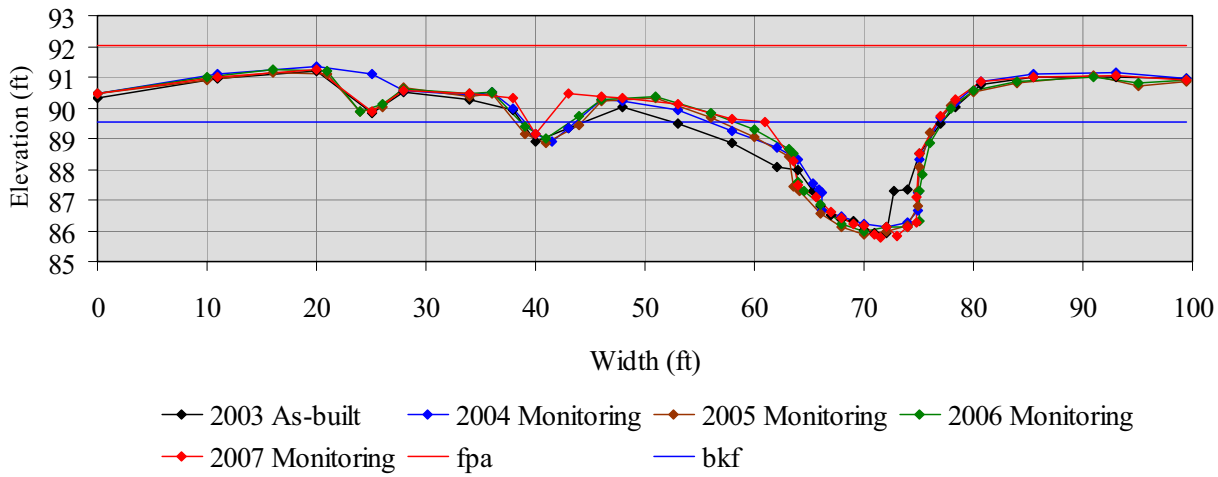


FIGURE 3.4.—Cross-section station 9+16, run.

FIGURE 3.—Continued.

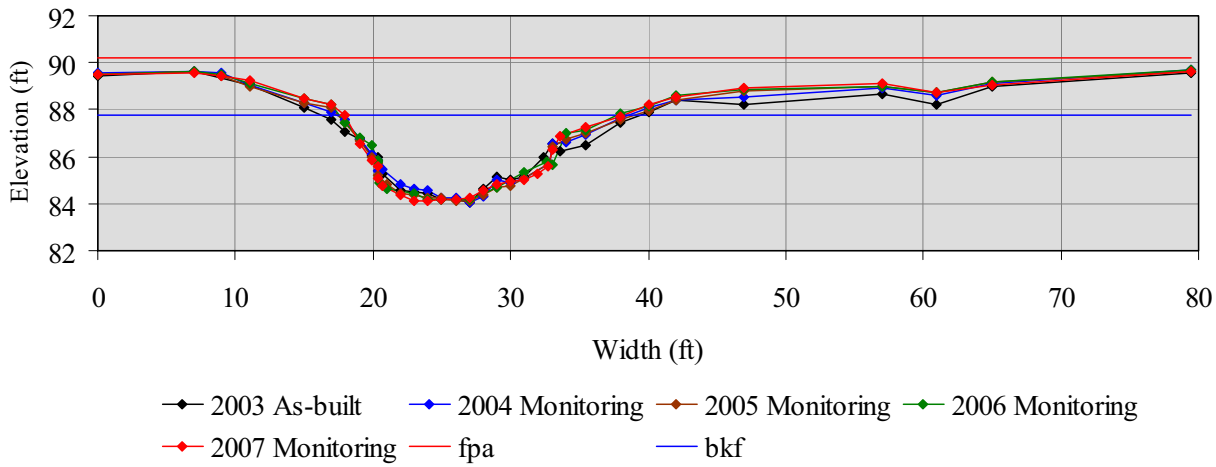


FIGURE 3.5.—Cross-section station 10+88, pool.

FIGURE 3.—Continued.

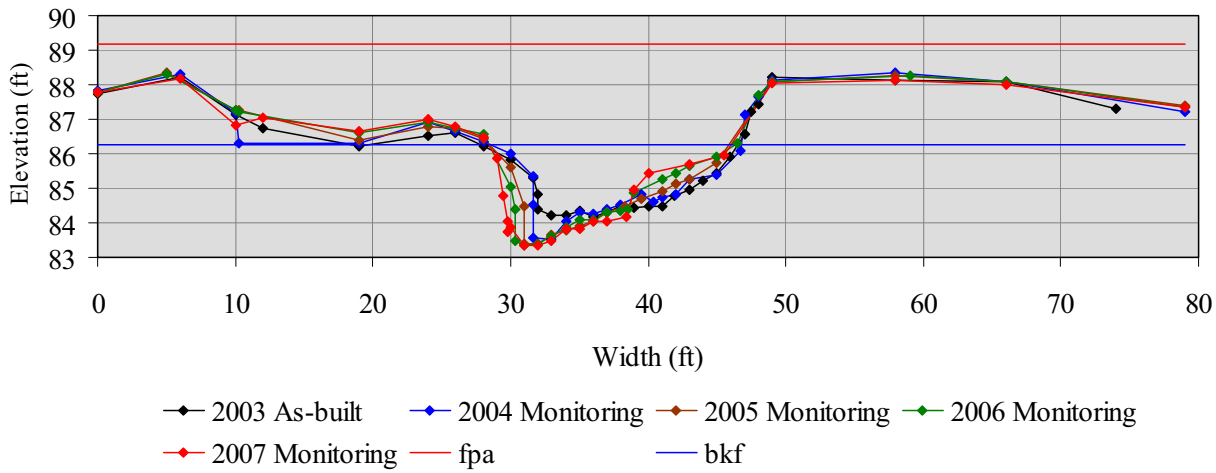


FIGURE 3.6.—Cross-section station 12+31, riffle.

FIGURE 3.—Continued.

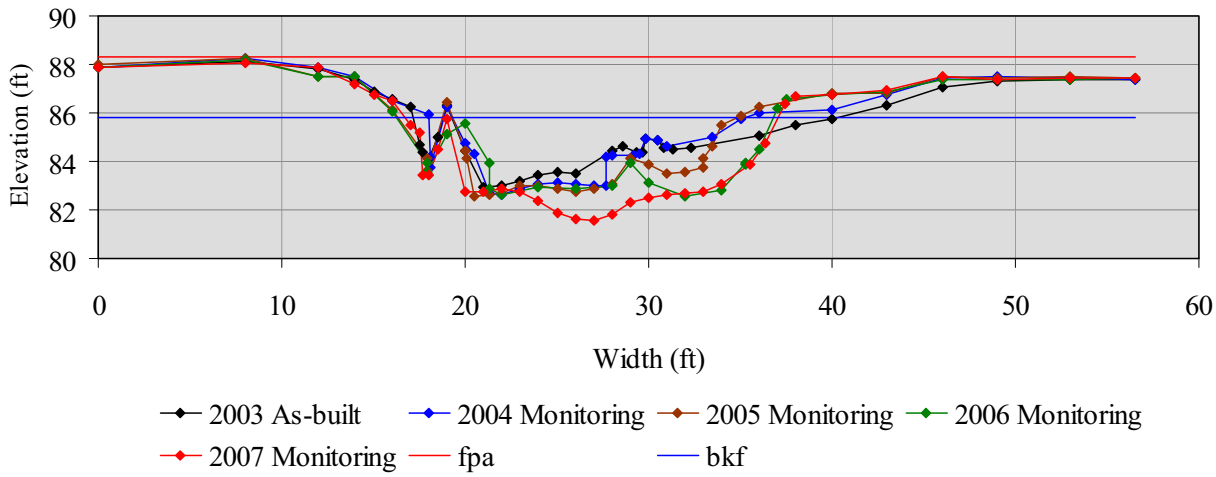


FIGURE 3.7.—Cross-section station 12+74, pool.

FIGURE 3.—Continued.

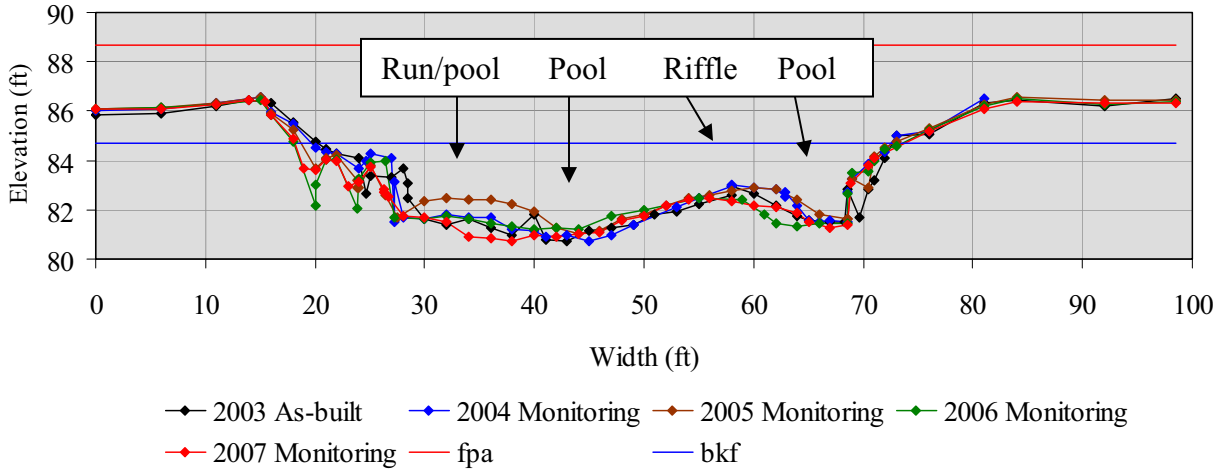


FIGURE 3.8.—Cross-section station 13+80-14+29. This cross-section incorporates two different restoration sites into one. The cross-section was taken at an S-curve that encompasses a run/pool, pool, riffle, and a second small pool sequence.

FIGURE 3.—Continued.

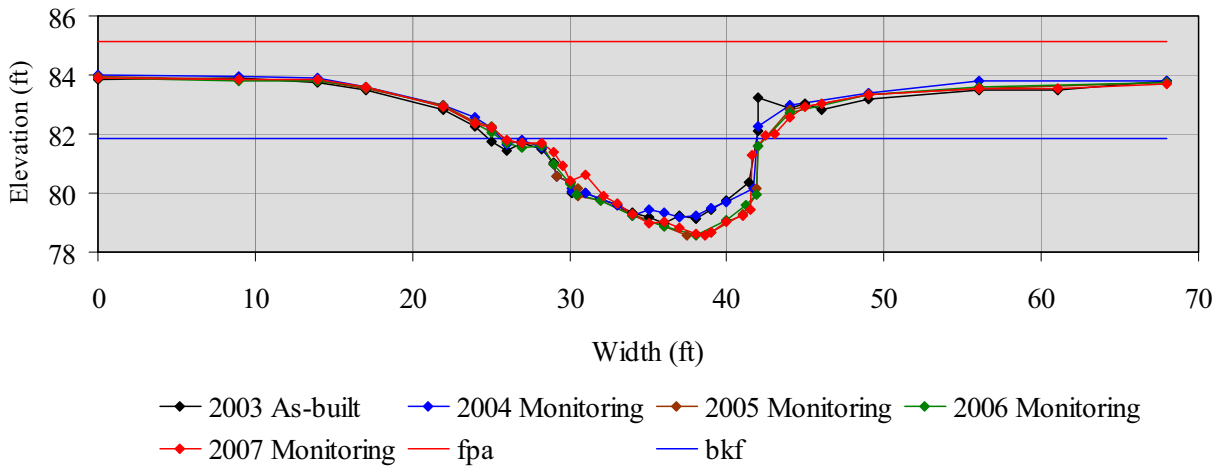
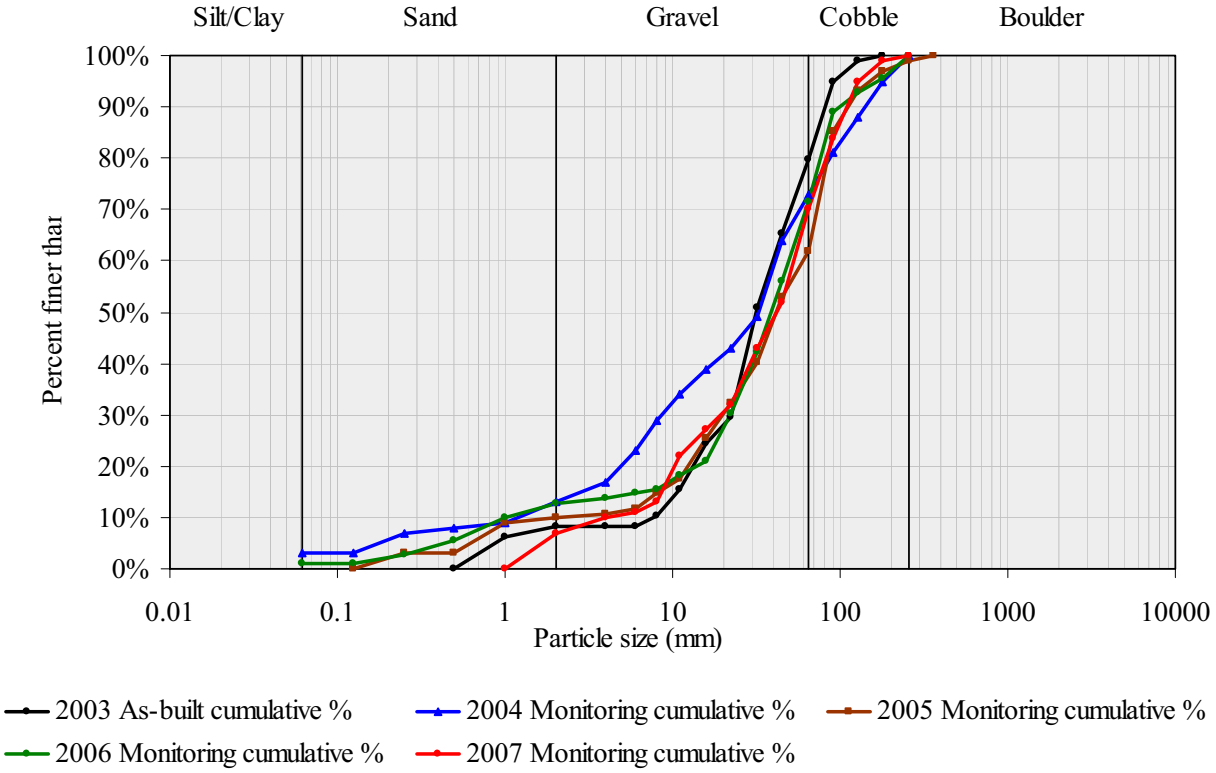


FIGURE 3.9.—Cross-section station 16+52, pool.

FIGURE 4.—Pebble count data comparisons, Wild site, Obids Creek, Ashe County, 2003-2007.



Size Class	Particle size (mm) in year sampled				
Index	2003 As-built	2004	2005	2006	2007
D_{16}	11	3	9	8	9
D_{35}	24	12	25	26	24
D_{50}	31	33	42	39	42
D_{84}	71	100	88	82	90
D_{95}	91	180	150	170	130

TABLE 1.—Monitoring of inner berm and bankfull events at the Wild mitigation site based on data from the United States Geological Survey South Fork New River gage (gage number. 03161000) near Jefferson, Ashe County, North Carolina and from visual observations.

Date	Gage height (ft)	Flows (ft^3/s)	Comments
2/27/02			Bankfull event (photo log)
2/22-23/03	5.0	2,250	Bankfull event
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)
7/15/05	[a]	[a]	Bankfull event
10/7/05	4.0	1,410	Inner berm event (tropical storm)
11/29/05	6.5	4,130	Bankfull event
1/18/06	5.2	2,460	Bankfull event
2/5/06	4.4	1,690	Inner berm event
4/22/06	4.3	1,610	Inner berm event
6/25/06	6.8	4,470	Bankfull event
6/27/06	5.7	3,130	Bankfull event
9/1/06	4.8	2,090	Bankfull event
11/8/06	4.9	2,160	Bankfull event
11/16/06	5.3	2,670	Bankfull event
11/17/06	5.0	2,310	Bankfull event
12/23/06	4.6	1,860	Bankfull event
1/1/07	5.6	2,980	Bankfull event

[a]Landowner observations not correlated to gage data.

TABLE 2.—Vegetation monitoring data for the Wild mitigation site, Obids Creek, Ashe County, North Carolina, August 22, 2007.

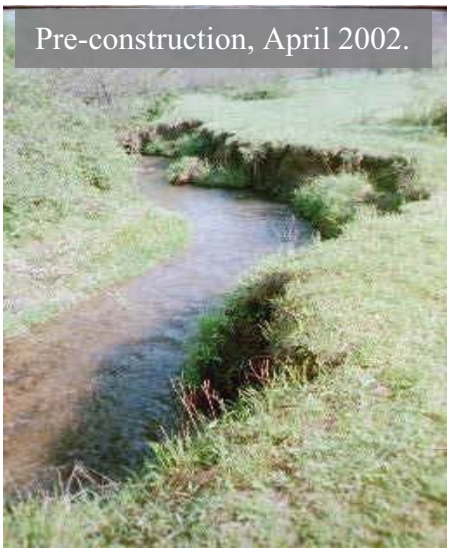
Plant type		Number planted						Number counted on August 22, 2007.						Percent change
Scientific name	Common name	Area 1[a]	Area 2[b]	Area 3[c]	Area 4[d]	Area 5[e]	Total	Area 1	Area 2	Area 3	Area 4	Area 5	Total	in numbers[f]
Live stakes														
Cornus amomum	Silky dogwood	60	55	53	50	15	233	4	10	2	11	17	44	-81%
Salix nigra	Black willow				10		10							-100%
Salix sericea	Silky willow				130	70	200				32	2	34	-83%
Sambucus canadensis	Elderberry				20	15	35	1	1	4		15	21	-40%
Bare-root nursery stock														
Alnus serrulata	Tag alder	11	11	11	11	11	55	25	21	45	66	43	200	100%
Celtis laevigata	Sugarberry	2	3	3	15	7	30							-100%
Diospyros virginiana	Persimmon	2	3	3	15	7	30				2		2	-93%
Juglans nigra	Black walnut	2	3	3	18	7	33		1		4	1	6	-82%
Quercus alba	White oak	2	3	3	10	7	25							-100%
Quercus rubra	Red oak	2	3	3	10	7	25			2	3	3	8	-68%
Robinia pseudoacacia	Black locust	2	3	3	25	7	40	1	2	1	14	5	23	-43%
Totals		83	84	82	314	153	716	31	35	54	132	86	338	
Volunteers														
Crataegus spp.	Hawthorne							1					1	
Physocarpus opulifolius	Nine bark							1	7	13	47	34	102	
Prunus serotina	Black cherry							1			6	4	11	
Totals								3	7	13	53	38	114	

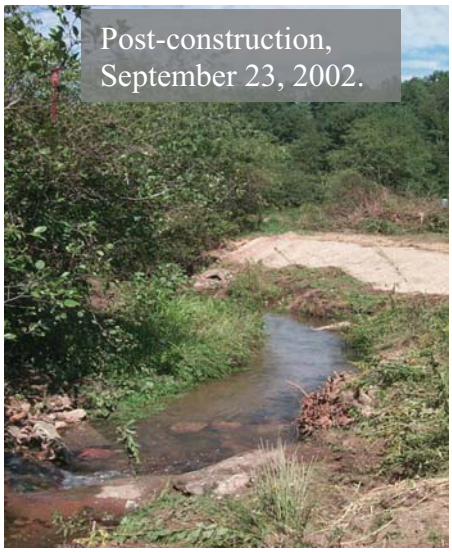
[a]Area 1. Station 7+39 area, right bank.
[b]Area 2. Station 8+19 area left bank
[c]Area 3. Station 9+00 downstream to upper ford, right bank.
[d]Area 4. Upper ford to lower property line, left bank
[e]Area 5. Upper ford to lower property line, right bank
[f]Calculated using 2007 total stem count and number planted.

Appendix 1: Photo log of the Wild mitigation site looking downstream from station 7+75 to 8+50, Obids Creek, Ashe County, April 2002 – November 2007.

Appendix 1: Continued

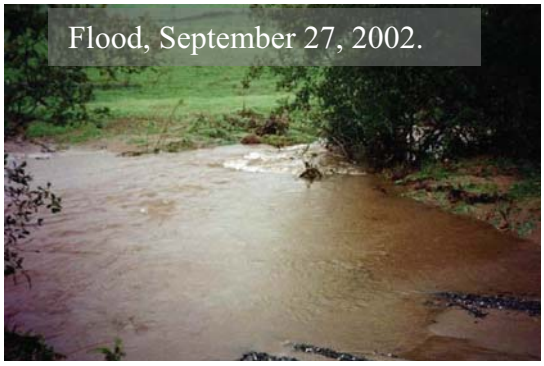
Appendix 2: Photo log of the Wild mitigation site looking downstream from station 8+65 to 9+60, Obids Creek, Ashe County, April 2002 – November 2007.





Appendix 2: Continued.

Appendix 3: Looking downstream to the upper ford from station 10+64 to 11+27, Wild mitigation site, Obids Creek, Ashe County, April 2002 – November 2007.



Appendix 3: Continued.

Appendix 4: Looking downstream from station 12+29 to 13+41, Wild mitigation site, Obids Creek, Ashe County, April 2002 – November 2007.

Appendix 4: Continued.