As Built Report for the Miller et al. Mitigation Site on Meat Camp Creek, Watauga County

Prepared for the

North Carolina Department of Transportation Stream Mitigation Program

Transportation Improvement Project R-529

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This as-built plan is submitted as partial fulfillment of the off-site stream mitigation agreement between the North Carolina Department of Transportation (DOT) and North Carolina Wildlife Resources Commission (WRC) for the R-529 US 421 road improvement project in Watuaga County. Under this agreement, a total of 14,814 linear feet of stream mitigation is required by the United States Army Corps of Engineers (COE) and 7,407 linear feet of mitigation is required by the North Carolina Division of Water Quality (DWQ). The purpose of this report is to summarize those practices used for bank stabilization and habitat enhancement along 652 linear feet of Meat Camp Creek located on the Miller et al. property, Watauga County (Figure 1). Mickey and Scott (2002) described pre-construction site conditions and project objectives.

Site Improvements

Conservation Easement

In order to ensure long term protection of the site, conservation easements (CE) were signed by five separate landowners on July 23, August 2 and 28, and September 11, 2002. A total of 0.696 acre are in the CE's (Figure 2). Right-of-way access to the easement by WRC personnel is from SR 1335 (Meat Camp Road) and SR 1339 (Hopewell Church Road) at the northern end of the project. The CE's are perpetual and are held by the WRC. Copies of the CE and survey plat are attached to this report as a separate item for DWQ, COE and DOT files.

Channel Modifications

Construction was carried out through an informal contract with A&E Construction, Lansing, NC. The contractor provided a dump truck and trackhoe with hydraulic thumb. Access to the site was through a temporary construction access from SR 1335 (Meat Camp Road) and the Church of Deliverance parking lot. Work began on September 17 and was completed on September 23, 2002.

Two rock weirs, 11 rock vanes, and 1 log vane were installed to prevent stream headcutting, bank erosion, and create or maintain pool habitat (Table 1). Large footer rocks support top boulders in the weirs and vanes. Holes were dug below the weir apex to accelerate and maintain pool formation by stream water velocities. Excess streambed materials were excavated at rock weirs and rock vanes and placed upstream of the structure near the bank where natural deposition would be expected. Rock vanes were used to divert water away from eroding banks and for habitat diversity. The streambank was sloped to the top of the bank and vegetated. On disturbed banks, erosion control fabric was installed to provide temporary bank protection until vegetation could be established.

The post-construction as-built survey was completed on March 4, 2003 and included five channel cross-sections, a longitudinal profile, and pebble counts. The post-construction longitudinal profile shows how the project increased pool and deep-water habitat (Figure 3). Pool habitat was increased from 21% to 31%. The scour action of rock weirs and rock and log vanes can be observed from the as-built profile (Figure 3). These structures are creating deep-water

aquatic habitat and sorting bed material in a way that will provide gravel required for fish spawning. The five cross-sections will be used to monitor long-term channel stability (Figure 4.1 4.5). The pre-construction and post construction riffle D 50's were 45.0 mm and 46.6 mm (coarse gravel) (Figure 5). Slope at this location is 0.016 percent and sinuosity is 1.1 (Mickey and Scott, 2001). Based on entrenchment ratios (2.5 - 3.0) and width/depth ratios (21.8 - 33.8) from two riffle cross-sections (stations 3+37 and 4+74), Meat Camp Creek at this location is classified as a C4b stream type (Rosgen 1996). The goal of stabilizing the stream channel, while maintaining a C4b stream type at this location was achieved.

Riparian Improvements

During construction, sod mats salvaged from the site were used to provide instant bank stability and long-term erosion control. Sod mats had the advantage of containing an established seed mix. On sites where sod mats were not used, the area was seeded with a WRC native riparian mix and cover crop of winter wheat and rye. After seeding, an eight-foot wide straw erosion control blanket was used to cover the soil. These blankets were used to stabilize the soil surface until a vegetative cover could be achieved and to contribute to soil stability after vegetation becomes established. As the straw blankets decompose over a 2-year period, permanent vegetation should be well established.

A total of 177 live stakes and bare root nursery trees plant were planted on March 17, 2003 (Table 2). Plantings included tag alder *Alnus serrulata*, silky dogwood *Cornus amomum*, silky willow *Salix sericea*, black walnut *Juglans nigra*, and black locust *Robina pseudoacacia* . Based on DWQ planting guidelines, a total of 224 trees should have been planted on the 0.698 acre site. However, fewer plantings were required because of existing stands of mature trees along some sections of the stream (Figures 4.1 - 4.5).

One of the objectives of the project was to do a one-time treatment of multiflora rose. Multiflora rose was sprayed with roundup and/or removed by the track hoe during construction. Spot treatments of this invasive plant may be necessary at a later date.

Livestock Exclusion

In order for any stream restoration/enhancement project to be a success, livestock must be excluded from the recent construction area and riparian zone and an alternate watering source provided. This was accomplished by installation of two spring reservoirs and two gravity flow watering tanks. Mr. Derick Goddard, Cost Share Technician with the Watauga County Soil and Water Conservation District (WCSWCD), supervised construction of the livestock exclusion plan for the site (Figure 6).

Project Costs

The WRC project cost for stream enhancement work was $28,903.41 or $44.47 per linear foot of stream enhancement (Table 3). Project cost includes: administrative cost; meetings with the landowner, NCDOT and NRCS personnel; field survey work; preparation of project

conceptual design; construction and as-built plans; tree purchase and planting; erosion control materials (seed, fertilizer, fabric); construction and livestock exclusion contracts; and WRC personnel costs. Taking into account NCDOT Location and Survey and Right of Way personnel expenses ($3,500) and CE costs ($3,460), the project cost a total of $35,863.41 or $55.17 per foot (Table 3). Long term monitoring and repair costs will be added to the total as needed during the five-year monitoring period.

Summary

Using natural stream design techniques, stream dimension and profile was improved at this site. Water quality will be improved through reduced sedimentation from eroding banks and exclusion of livestock from the riparian zone. In-stream habitat for fish and aquatic invertebrates has been increased with the installation of rock weirs, rock and log vanes, and root wads. Both aquatic and terrestrial species will benefit with the return of a functioning riparian corridor. Stream aesthetics have also been improved.

References

Mickey, J. H. and S. Scott. 2002. Stream restoration plan, Miller site, Meat Camp Creek, Watuaga County. North Carolina Wildlife Resources Commission, Raleigh.

Rosgen, D. L. 1996. Applied river morphology. Printed Media Companies, Minneapolis, Minnesota.

FIGURE 1.-Miller et al mitigation site on Meat Camp Creek, South Fork New River drainage, Watauga County, March 2003.

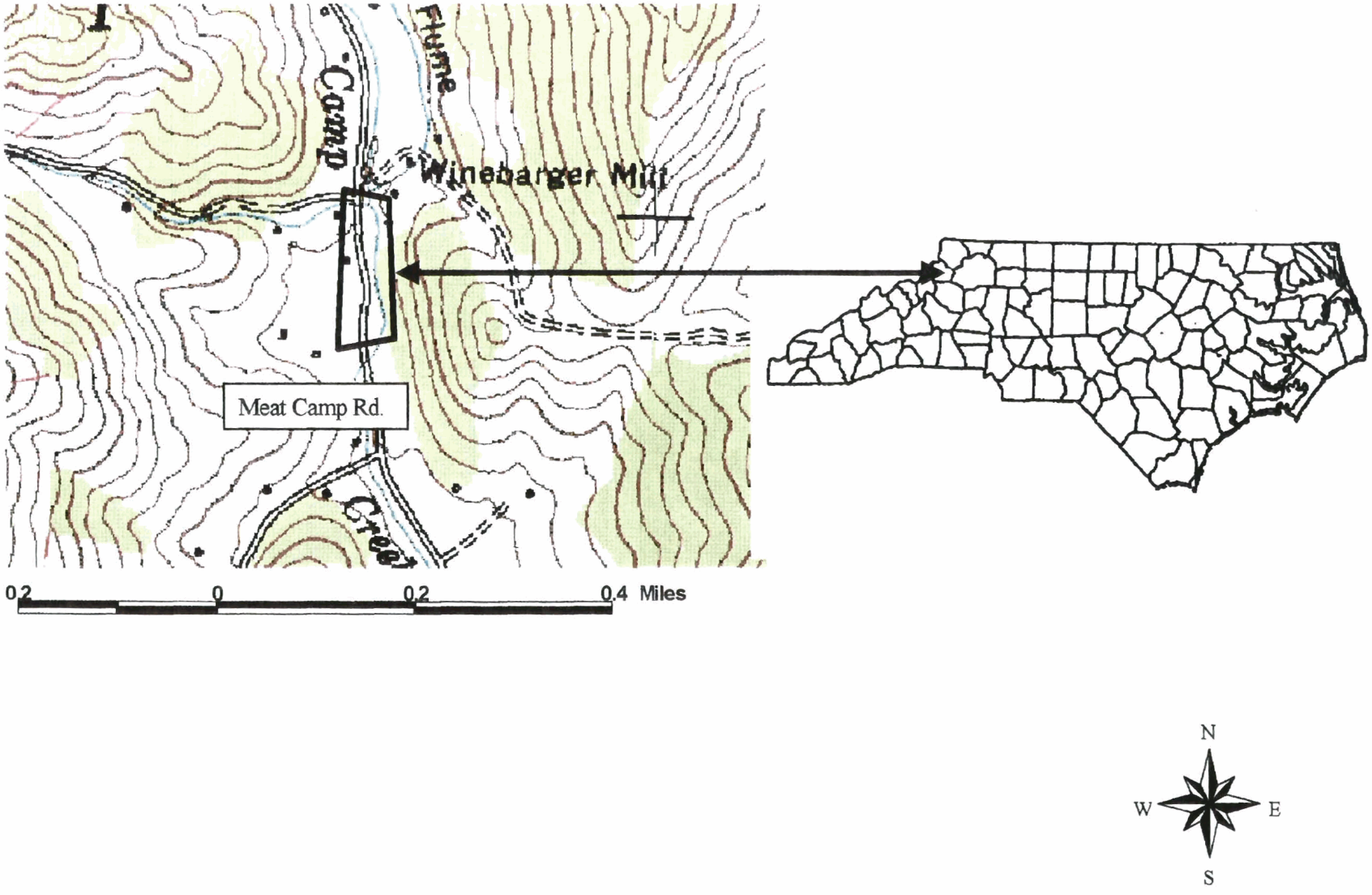


FIGURE 2.-Easements along the Meat Camp Creek mitigation site, Watauga County. 2002.

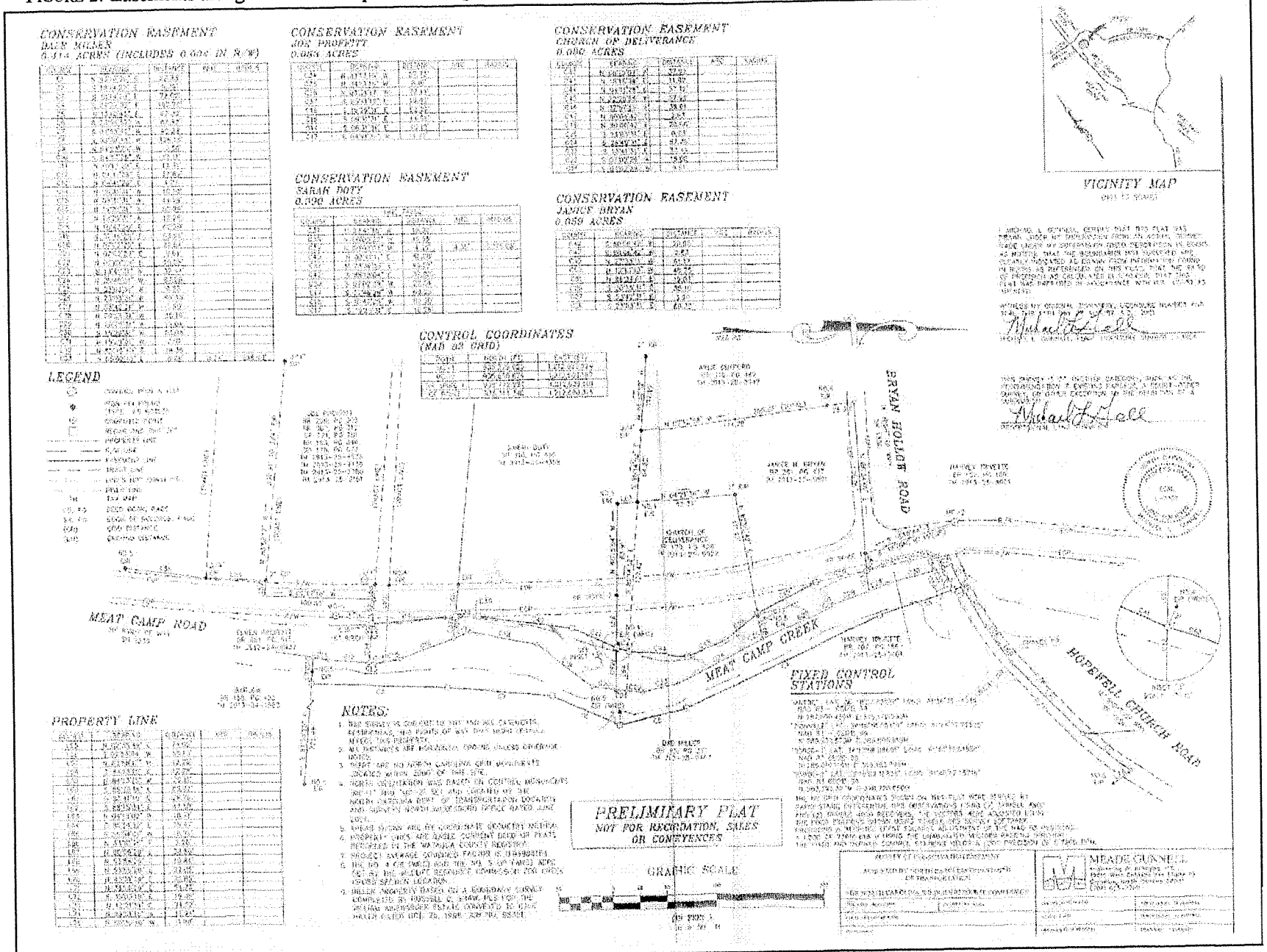


FIGURE 3.-Pre-construction and as-built longitudinal profile comparisons at the Miller et al. mitigation site on Meat Camp Creek, Watauga County, March 2003.

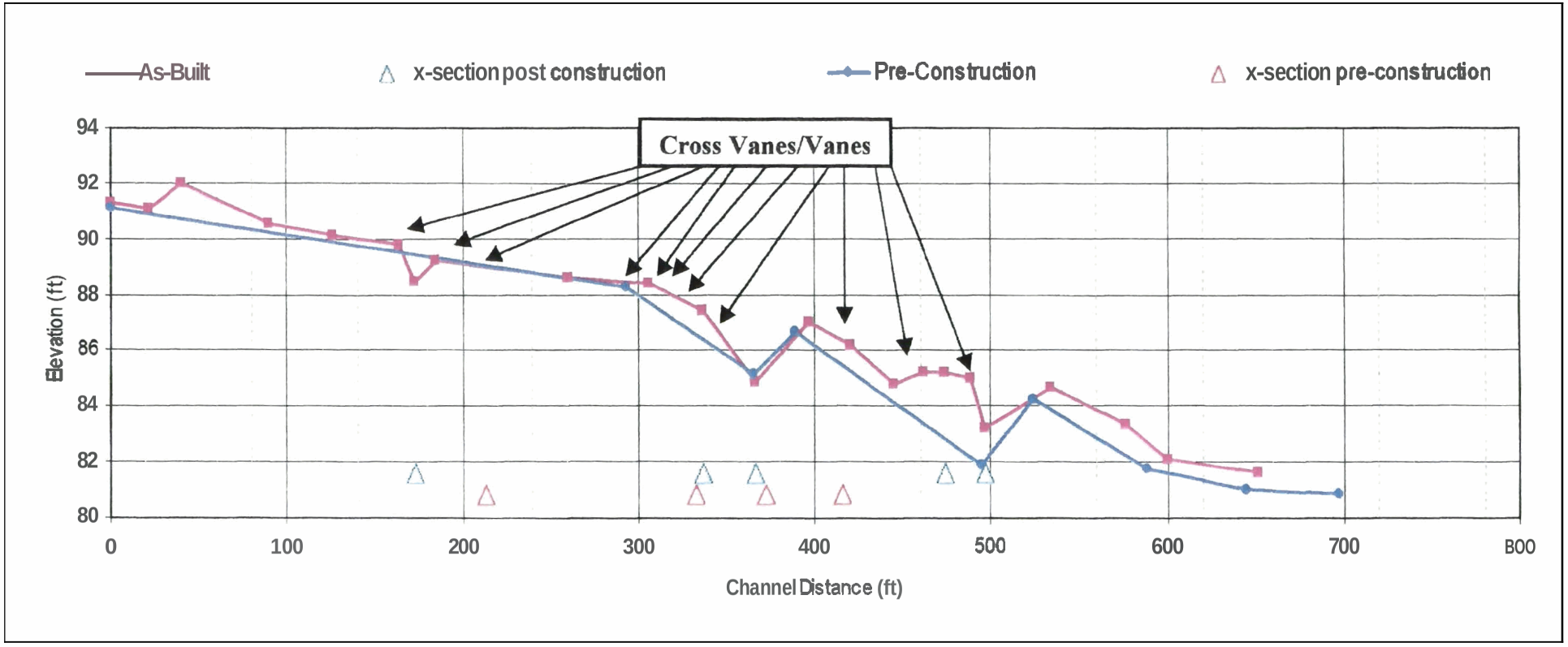


FIGURE 4.-Five cross-sections at the Miller et al. Meat Camp Creek mitigation site, Watauga County. March 2003. Figures 4.1, 4.3, 4.4 and 4.5 were surveyed from left to right bank looking downstream; pictures were taken looking upstream. Picture for figures 4.2 is lined up correctly with the cross-section survey.

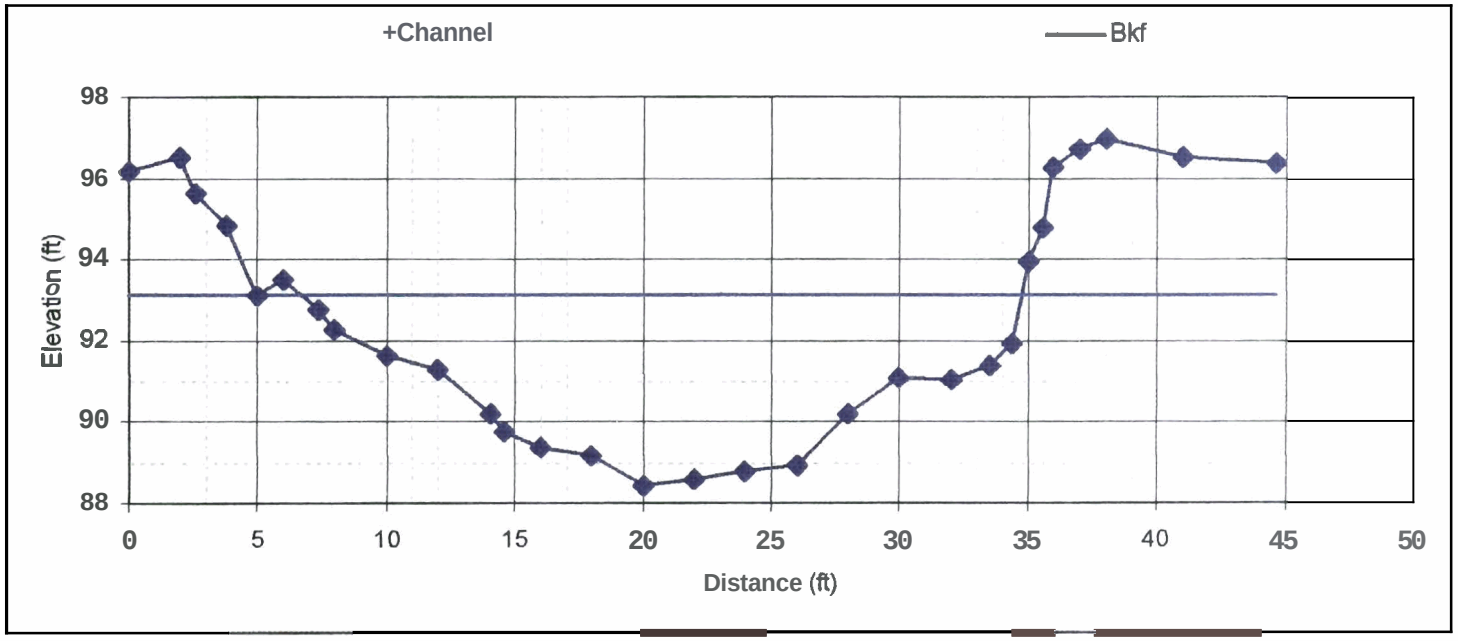


FIGURE 4.1.-Cross-sectionat station 1+73, pool at rock weir.

FIGURE 4.-Continued.

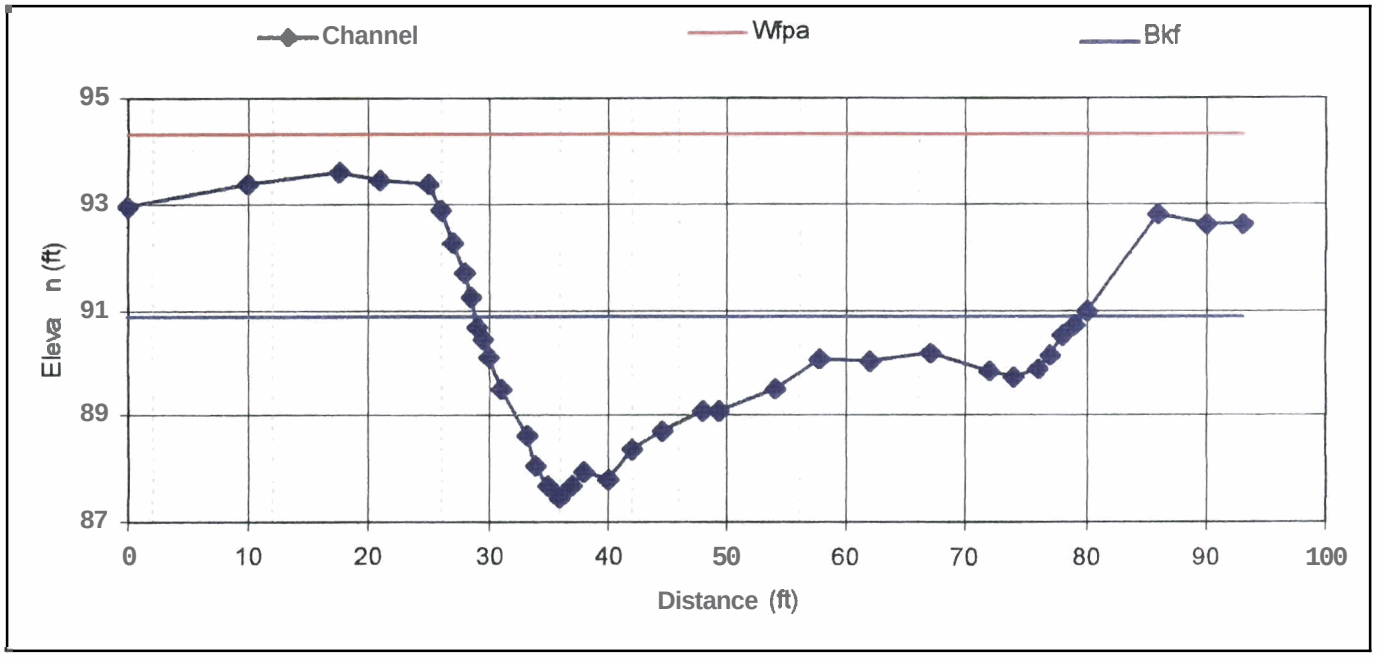


FIGURE 4.2.-Cross-section at station 3+37, riffle.

FIGURE 4.-Continued.

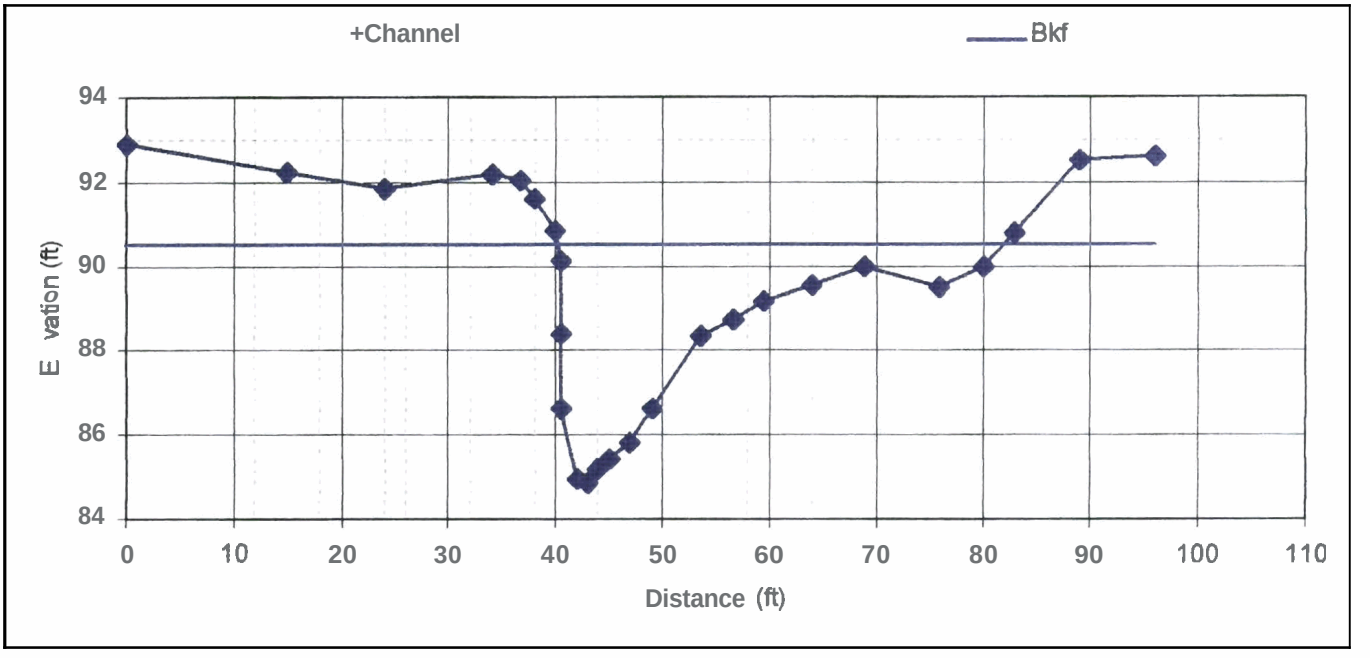


FIGURE 4.3.-Cross-section at station 3+66, pool.

FIGURE 4.-Continued.

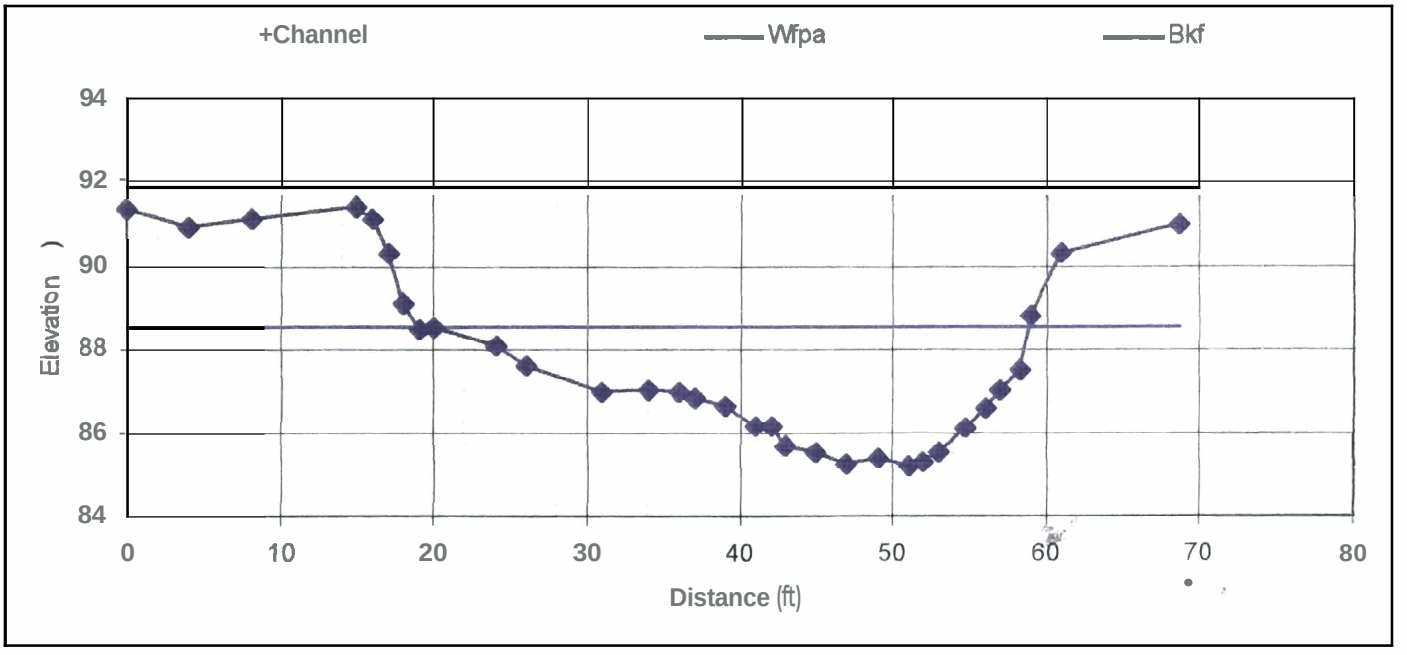


FIGURE 4.4.-Cross-sectionat station 4+74, riffle.

FIGURE 4.-Continued.

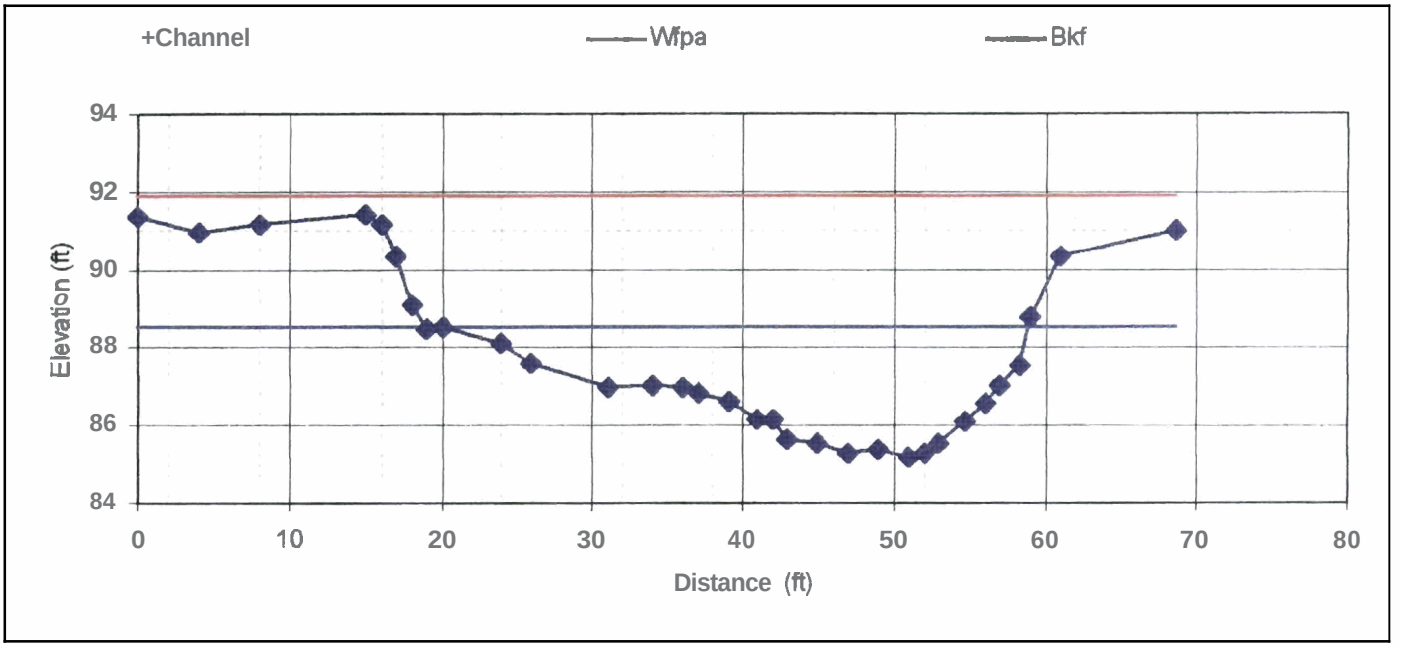
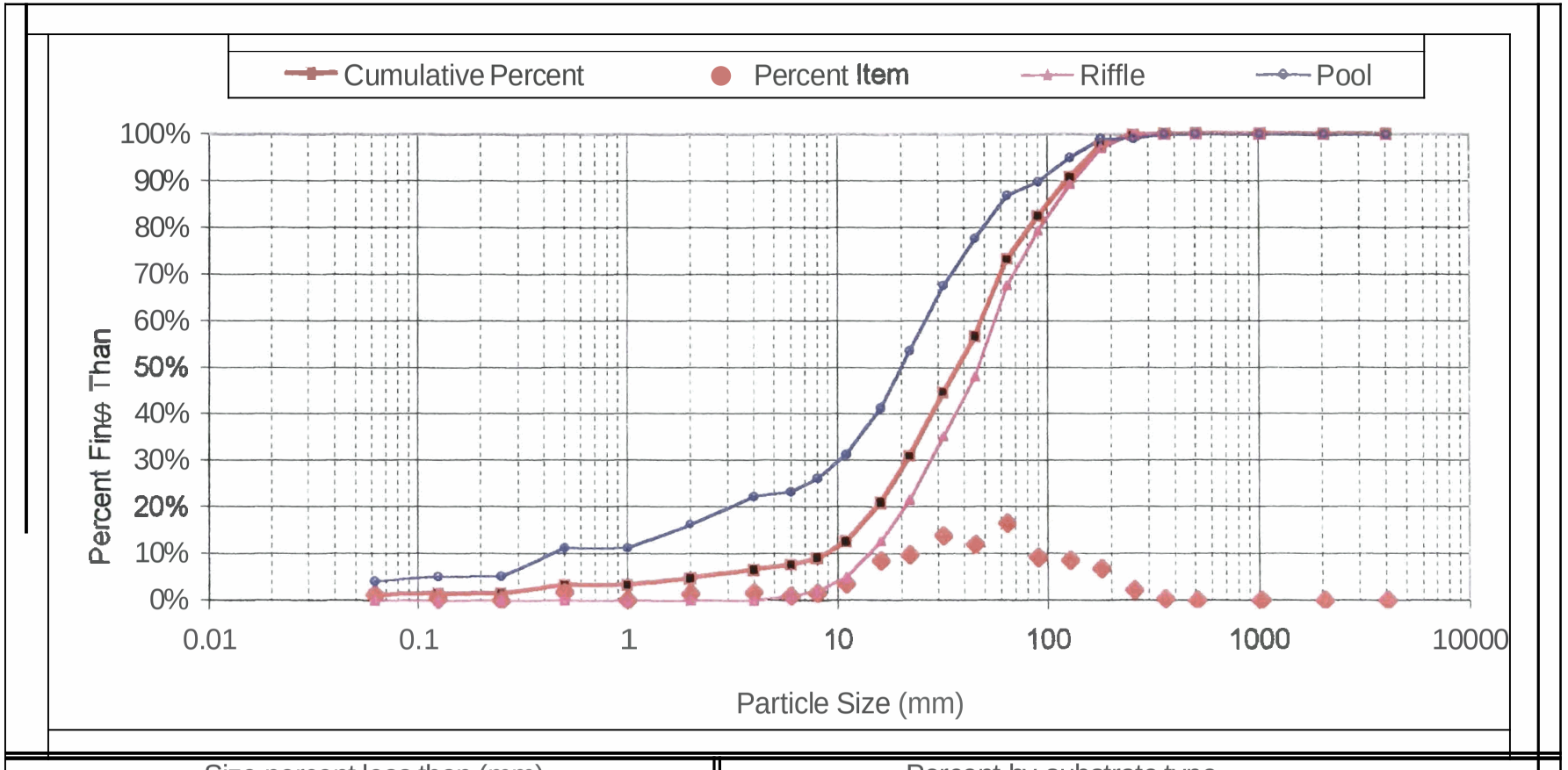


FIGURE 4.5.-Cross-section at station 4+97, pool.

FIGURE 5.-Pebble count summary at the Miller et al. Meat Camp Creek mitigation site, Watauga County, March 2003.



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
12.801	24.62	37.2	96	158	1%	4%	69%	26%	0%	0%

FIGURE 6.-Livestock exclusion plan for the Miller property mitigation site along Meat Camp Creek, Watauga County. July, 2000.

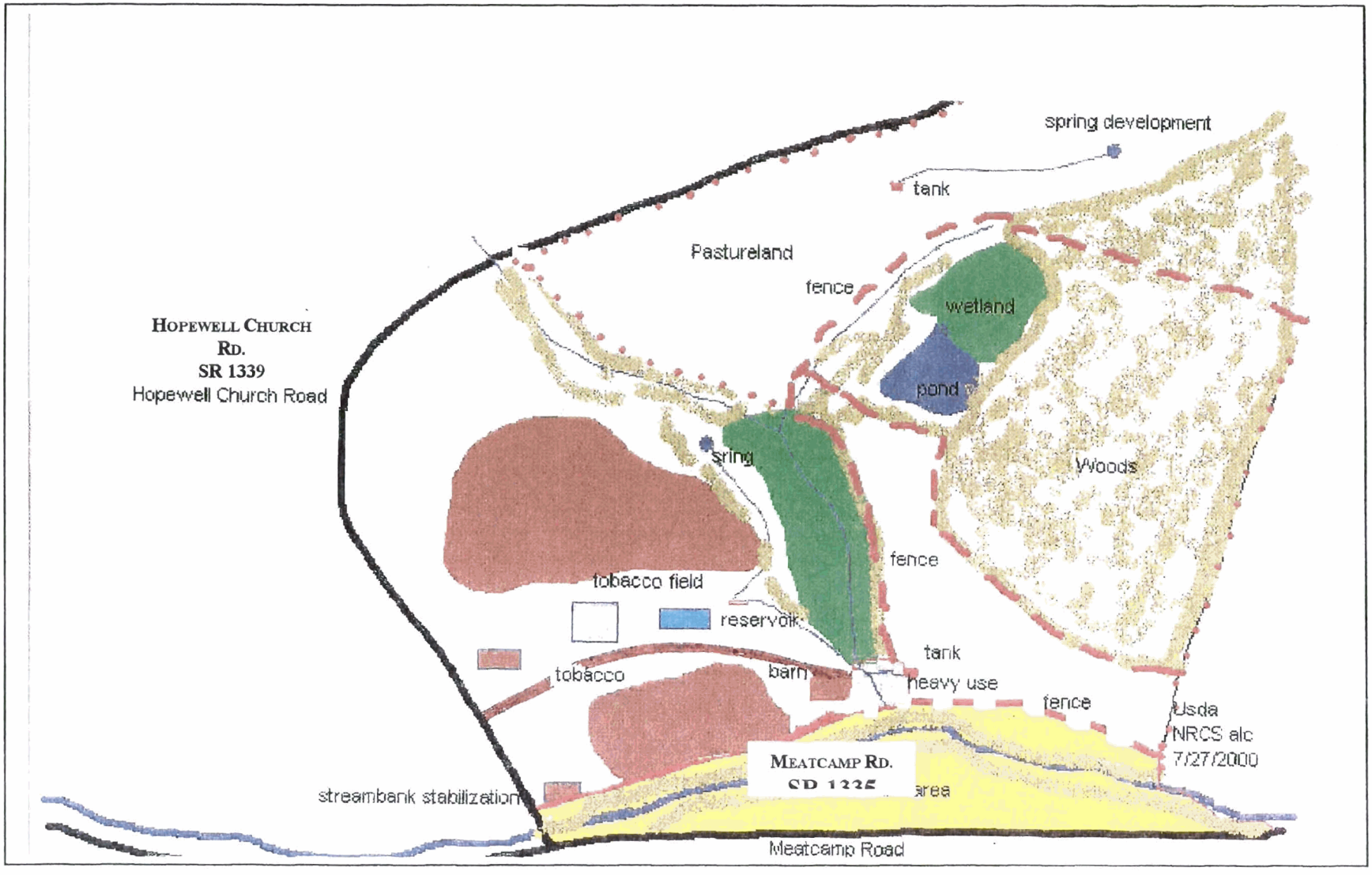


TABLE 1.-Type and location of in-stream structures for the Miller et al. mitigation site on Meat Camp Creek, Watauga County, 2002.

Structure type	Longitudinal profile station number
Rock weir	1+64
Rock vane	1+89 RB[1]
Rock vane	2+10 RB
Rock vane	2+28 RB
Rock vane	2+89 LB[2]
Rock vane	3+06 LB
Rock vane	3+30 LB
Rock vane	3+51 LB
Log vane	3+97 LB
Rock vane	4+15 RB
Rock vane	4+38 RB
Rock vane	4+57 RB
Rock vane	4+70 RB
Rock weir	4+89

[1] RB - right bank
[2] LB - left bank

TABLE 2.-Plantings at the Miller et al. mitigation site along Meat Camp Creek, Watuaga County, March 12, 2003.

Species	Scientific Name	Number planted
Silky willow	*Salix sericea*	136
Black locust	*Robina pseudoacaci*	26
Black walnut	*Juglans nigra*	5
Tag alder	*Alnus serrulata*	10
TOTAL		177

TABLE 3.- Summary project costs for the Miller et al. stream mitigation site along Meat Camp Creek as of December 31, 2003, Watuaga County.

WRC Administration		
hours	$	24.96
mileage	$	15.54
WRC Pre-Planning		
hours	$	3,447.87
mileage	$	335.96
WRC Construction		
hours	$	1,801.88
mileage	$	379.62
WRC As-Built		
hours	$	775.23
mileage	$	144.30
WRC Tree Planting		
hours	$	200.03
mileage	$	39.96
WRC Monitoring		
hours	$	-
mileage	$	-
Construction Contract	$	1,766.00
Construction Materials	$	129.70
Livestock Exclusion Contract	$	16,447.37
NRCS Administrative Cost	$	379.59
Tree Purchase	$	32.00
Livestake Purchase	$	-
WRC Overall 421 Project Administration		
hours	$	1,794.99
mileage	$	140.67
project equipment / office expenses / supplies	$	1,047.74
WRC Total Project Cost as of 12/03	$	28,903.41
WRC Cost per foot (650ft)	$	44.47
DOT Easement Payment	$	3,460.00
DOT Location and Survey	$	3,500.00
Overall Project Cost	$	35,863.41
Overall Cost per foot	$	55.17