DRAFT

ANNUAL REPORT FOR 2003

South Fork Big Pine Creek Stream Mitigation Site
(Charles/McGinnis Site)
Madison County
WBS Element 32573.4.1
TIP No. A-10WM

Prepared By:
Office of Natural Environment & Roadside Environmental Unit
North Carolina Department of Transportation
December 2003

Summary

The following report summarizes the stream monitoring activities that have occurred during the Year 2003 at the Charles/McGinnis Site in Madison County. This site was constructed in 1999 by the North Carolina Wildlife Resources Commission (NCWRC). This report provides the monitoring results for the first formal year of monitoring (Year 2003); however, it is actually the fourth year since construction. The Charles/McGinnis Site will be monitored again in 2004. The actual timeline for formal monitoring will be decided by the Mitigation Review Team.

Based on the overall conclusions of monitoring along South Fork Big Pine Creek, the Charles/McGinnis Site has met the required monitoring protocols for the first year of monitoring. Localized areas of active bank scour and erosion exist. These areas should be assessed by the Mitigation Review Team to determine if remedial actions are warranted. These areas and all other areas will continue to be monitored during 2004.

Based on information obtained from the U.S. Geological Survey (USGS), the Charles/ McGinnis Site has met the required hydrologic monitoring protocols. Vegetative success criteria have also been met for the first year of monitoring. No biological sampling has been conducted to-date. It is unknown whether or not this sampling will be conducted as part of overall monitoring activities.

NCDOT will continue stream and vegetation monitoring at the site for 2004.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during the Year 2003 at the Charles/McGinnis Site. The site is situated along South Fork Big Pine Creek, immediately west of Big Pine Road (SR 1158) in the southwestern portion of Madison County (Figure 1). It is approximately 16 miles (25.6 kilometers) west-southwest of Mars Hill and nearly 18 miles (28.8 kilometers) northwest of Asheville. The Charles/ McGinnis Site was constructed as one of four projects to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) Project No. A-10 in Madison County.

This mitigation project covers approximately 1,100 linear feet of South Fork Big Pine Creek. It was designed and constructed in 1999 by the North Carolina Wildlife Resources Commission (NCWRC). Stream restoration involved construction of rock vanes for stabilization purposes, installing livestock management practices, and re-vegetation of the streambanks with native species. During the winter of 2000, the site was extensively planted with live stakes and bare rooted trees.

1.2 Purpose

According to the as-built report (NCWRC, 2000), the objectives at this mitigation site were to improve water quality, riparian quality and stability, and fisheries habitat associated with South Fork Big Pine Creek. The following objectives were proposed:

- Increasing the floodplain area and stabilizing the bankfull elevations along the reach;
- Installing boulder vanes, log vanes, or rootwads along the stream to reduce overall erosion and enhance/improve fish habitat;
- Installing small vortex weirs to create pool habitat in sections of long riffles;
- Sloping and vegetating the streambanks to provide more resistance to flooding; and
- Planting of native trees, shrubs, and ground cover to stabilize the banks, shade the stream, and improve wildlife cover and food.

The majority of these objectives were completed by reshaping the stream banks to a more stable cross-sectional profile. Areas of high bank stress were protected using rootwads or vanes. The riparian zone was planted with native vegetation. No vortex weirs or cross vanes however, were installed to create pool habitat.

Successful stream mitigation is demonstrated by a stable channel that does not aggrade or degrade over time. It is also demonstrated by reduced erosion rates, the permanent establishment of native vegetation, and bed features consistent with the design stream type. Vegetation survival is based on federal guidelines denoting success criteria for wetland mitigation. Results of stream monitoring conducted during the 2003 growing season at the Charles/McGinnis Site are included in this report.

Activities in 2003 reflect the first formal year of monitoring following the restoration efforts; however, it is the fourth year since construction. Included in this report are analyses on stability (primarily the longitudinal profile and cross sections), vegetative monitoring results, and site photographs.

1.3 Project History

The effort to provide stream mitigation for TIP No. A-10 began in 1996 with a Memorandum of Agreement (MOA) between the North Carolina Department of Transportation (NCDOT) with the NCWRC. The MOA was to provide 25,000 feet of mitigation for 9,990 feet of jurisdictional stream impacts. Subsequent amendments to the MOA were made to provide mitigation for additional stream impacts from TIP No. A-10. These amendments resulted in a total mitigation of over 26,000 feet.

The NCDOT worked with representatives from the NCWRC, U.S. Army Corps of Engineers, North Carolina Division of Water Quality, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, Natural Resources Conservation Service and Madison County Soil and Water Conservation District on a Mitigation Review Team. The purpose of the team was to develop criteria and policies for selecting stream reaches for mitigation.

The Charles/McGinnis Site was one of the sites selected by the Mitigation Review Team to provide compensatory mitigation for TIP No. A-10. The mitigation plan for this mitigation site was developed during 1998 and approved by the team. The NCWRC implemented the project in 1999.

August 1999	Site grading commenced
August 1999	Site Planted with Native Perennial Seed Mix
January 2000	Site Planted with Live Stakes and Bare Rooted Trees
July 2000	NCWRC Site Review to Evaluate Vegetation
June – July 2003	Stream Channel Monitoring (1 yr.)
June – July 2003	Vegetation Monitoring (1 yr.)

1.4 Debit Ledger

The entire Charles/McGinnis Site was used for TIP No. A-10 to compensate for unavoidable stream impacts related with roadway construction. This project generated 1,100 linear feet of stream credits.

2.0 STREAM ASSESSMENT

2.1 Success Criteria

The success criterion, as defined by the Mitigation Site Monitoring Protocol for the NCWRC/NCDOT Mitigation Program (2003), evaluates channel stability and improvements to fish habitat. Specifically, this evaluation includes all or a combination of the following parameters: channel stability, erosion control, seeding, woody vegetation, and overall response of fish and invertebrate populations for stream mitigation projects. This is

to be accomplished using photo reference sites, stream dimension and profile, survival of planted vegetation, and direct sampling of important populations. The chart provided below further details the criteria used to evaluate success or failure at these mitigation sites.

NCWRC/ NCDOT Mitigation Monitoring Criteria

Measurement	Success (requires no action)	Failure	Action
Photo Reference Sites			
Longitudinal Photos Lateral Photos	No significant* aggradation, degradation, or erosion	Significant* aggradation, degradation, or erosion	When significant* aggradation, degradation or erosion occurs, remedial actions will be undertaken.
Channel Stability			
Cross-Sections Longitudinal Profiles Pebble Counts	Minimal evidence of instability (down-cutting, deposition, erosion, decrease in particle size)	Significant* evidence of instability	When significant* evidence of instability occurs, remedial actions will be undertaken.
Plant Survival			
Survival Plots	≥75% coverage in Photo Plots	<75% coverage in Photo Plots	Areas of less than 75% coverage will be re-seeded and/or fertilized, live stakes and bare-rooted trees will be replanted to achieve >80% survival.
Stake Counts	≥80% survival of stakes, 4/m2	<80% survival of stakes, 4/m2	
Tree Counts	≥80% survival of bare-rooted trees	<80% survival of bare-rooted trees	
Biological Indicators (only used for projects with potential to make watershed level changes)			
Invertebrate Pop. Fish Populations	Population measures remain to same or improve	Population measures indicate a negative trend	Reasons for failure will be evaluted and remedial action plans developed and implemented.
Overall success or failure will be based on success of 3 of the 4 criteria.			

*Significance or subjective determinations of success will be determined by a majority decision of the Mitigation Review Team

Federal guidelines for stream mitigation are relatively consistent with those protocols established by the NCWRC and NCDOT. These guidelines include the following main parameters: no less than two bankfull events for the five-year monitoring period, reference photos, plant survivability analyses, channel stability analyses, and biological data if specifically required by permit conditions (USACE, 2003). This report addresses all of the above mentioned parameters for both the NCWRC/NCDOT protocols and federal guidelines aside from shading and biological data, which was not required at this site.

Natural streams are dynamic systems that are in a constant state of change. Longitudinal profile and cross section surveys will differ from year to year based on changes in the watershed. Natural channel stability is achieved by allowing the stream to develop a proper dimension, pattern, and profile such that, over time, channel features are maintained and the stream system neither aggrades nor degrades. A stable stream consistently transports its sediment load, both in size and type, associated with local deposition and scour. Channel instability occurs when the scouring process leads to degradation, or excessive sediment deposition results in aggradation (Rosgen, 1996). The following surveys were conducted in support of the monitoring assessment:

- Longitudinal Profile Survey. This survey addressed the overall slope of the reach, as well as slopes between bed features. The bed features are secondary delineative criteria describing channel configuration in terms of riffle/pools, rapids, step/pools, cascades and convergence/divergence features which are inferred from channel plan form and gradient. The surveys are compared on a yearly basis to note and/or compare aggradation, degradation, head cuts, and areas of mass wasting. The longitudinal profile is expected to change from year to year. Significant changes may require additional monitoring.
- Cross Section Surveys. These surveys addressed the following characteristics at various locations along the reach: entrenchment ratio, width/depth ratio, and dominant channel materials. The entrenchment ratio is a computed index value used to describe the degree of vertical containment. The width/depth ratio is an index value which indicates the shape of the channel cross section. The dominant channel materials refer to a selected size index value, the D50, representing the most prevalent of one of six channel material types or size categories, as determined from a channel material size distribution index.

2.2 Stream Description

2.2.1 Pre-Construction Conditions

South Fork Big Pine Creek classified as a B stream type in 1998 according to the Rosgen Classification of Natural Rivers. The channel was moderately entrenched with an unusually low width/depth ratio and sinuosity. According to the Natural Resources Conservation Service (NRCS), flood damage along the creek was addressed by channelization in the early 1980's. Vegetation consisted primarily of reed canary grass planted by the NRCS. Few pools existed (NCWRC, 1998).

2.2.2 Post Construction Conditions

Two rock vanes and one rootwad revetment were installed at the project site to control erosion of the streambanks on the outside of the meander bends. A rock/soil berm was removed and the banks were sloped accordingly. Coir logs were used to define the bankfull elevation. Three watering tanks were installed at the site for livestock management and a barbed-wire fence was erected along the left riparian zone (facing downstream).

2.2.3 Monitoring Conditions

South Fork Big Pine Creek was initially classified as a B stream type according to the Rosgen Classification of Natural Rivers. A total of five cross sections were surveyed. A comparison of channel morphology is presented in Table 1. Channel stationing is provided on Figure 2.

Table 1. Abbreviated Morphological Summary (Charles/McGinnis Site)

Variable		South Fork Big Pine Creek (Combined Cross Sections #1 Thru #5)						
		Pre-Const.*	As-Built*	Year 1	Year 2	Year 3**	Year 4**	Year 5**
Drainage Area (mi²)		2.7	2.7	2.7	2.7	2.7	2.7	2.7
Bankfull Width (ft)	Mean	-	-	15.2				
Bankfull Mean Depth (ft)	Mean	-	-	1.5				
Width/Depth Ratio	Mean	-	-	8.8				
Bankfull Cross Sectional Area (ft²)	Mean	-	-	22.5				
Maximum Bankfull Depth (ft)	Mean	-	-	2.9				
Width of Floodprone Area (ft)	Mean	-	-	200				
Entrenchment Ratio	Mean	-	-	14.2				
Slope		-	-	0.03				
Particle Sizes								
D_{16} (mm)		-	-	0.5				
D_{35} (mm)		-	-	18.0				
D_{50} (mm)		-	-	50.0				
D_{84} (mm)		-	-	128.0				
D_{95} (mm)		-	-	256.0				

* According to the NCWRC, comparisons of pre-construction, as-built, and monitoring data are not valid due to intangible factors. Monitoring data for subsequent years should be used as the basis of comparison.
** Year 3 through Year 5 Formal Monitoring has not been defined and may not be required.

2.3 Results of the Stream Assessment

2.3.1 Site Data

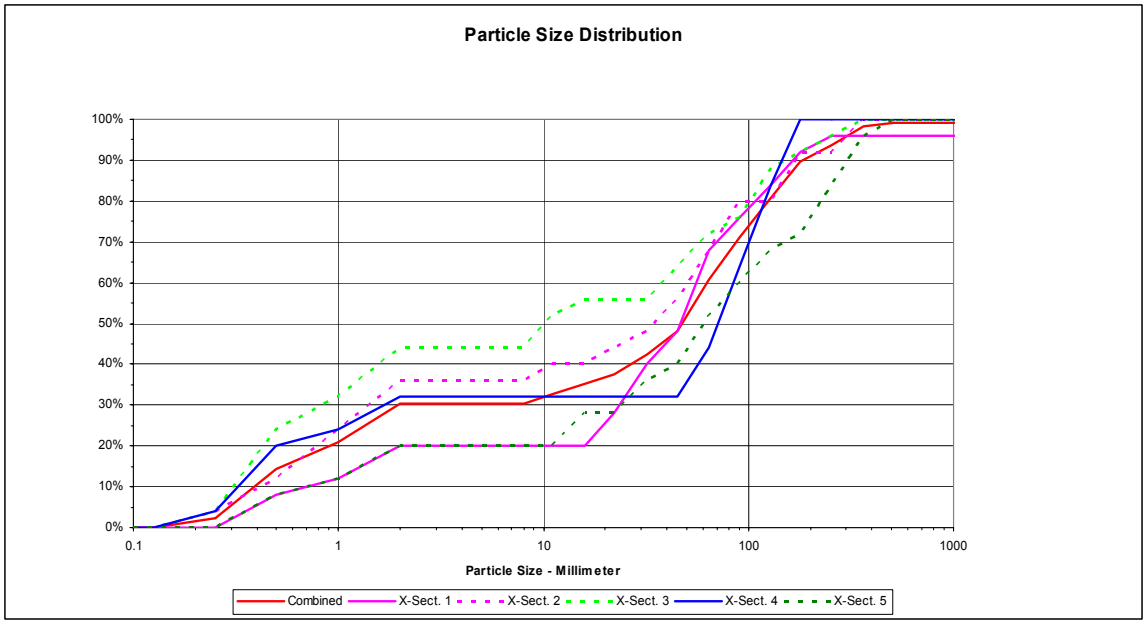
The assessment included the re-survey of five cross sections and the longitudinal profile established by the NCWRC after construction. This data is presented in the Appendix. The longitudinal profile originated along the southern boundary of the site and proceeded northward throughout the 1,100 linear-foot section of the reach. Stationing began at 0+00 and ended at 12+00. Both points were in the middle of riffle sections. Cross section locations were subsequently based on the stationing of the longitudinal profile and are listed below.

- Cross Section #1. Station 0+96, midpoint of riffle at rock vane
- Cross Section #2. Station 1+97, midpoint of run
- Cross Section #3. Station 3+31, midpoint of riffle
- Cross Section #4. Station 5+99, midpoint of riffle
- Cross Section #5. Station 7+70, midpoint of riffle

The majority of the cross sections remain intact aside from Cross Sections #4 and #5. Based on the comparison of cross section survey results with the as-built sections, Cross Sections #1, #2, #3, and #4 appear to be slightly aggrading while Cross Section #5 has degraded over one foot in elevation. Survey data will vary depending on actual location of

rod placement and alignment; however, this information should remain similar in overall appearance. The cross section comparison is presented in Appendix B. Additional comparisons will be implemented between 2003 data and future monitoring data to determine actual extents of change.

Pebble counts were taken at each cross section as a means to determine the extent of change in bed material. No existing data was available for South Fork Big Pine Creek. Based on the recent surveys the cumulative D_{50} (50 percent of the sampled population is equal to or finer than the representative particle diameter) of the reach is approximately 50 mm, ranging from 10 mm at Cross Section #3 to 70 mm at Cross Section #4. This information is presented in the chart below. Comparisons will be made between 2003 data and future monitoring data.



Several head cuts were noted during the survey of the longitudinal profile. The first was noted at Station 0+40. This head cut was causing debris to accumulate in the center of the channel which appeared to be exacerbating bank erosion along both sides of the channel. The estimated drop of the thalweg was approximately two feet. The other two head cuts were observed at Stations 4+70 and 7+63. The second head cut exhibited a vertical drop of nearly 1.5 feet while the third dropped approximately one foot. Both the second and third head cuts had resulted in minor bank scouring.

Qualitative investigations were conducted on the adjacent property downstream of the project area to assess the applicability of a source for the head cutting. One area was identified approximately 100 feet (30.5 meters) downstream of the project area. The adjoining property owner had straightened a meander bend during the spring/summer of 2003. A log crib wall was placed on the outside of the reach for bank protection. This straightening has resulted in the conversion of a pre-existing pool to a riffle thus, increasing the overall slope of the channel through this area. It is anticipated that as the stream equalizes, additional destabilization of the substrate will occur upstream through the project area.

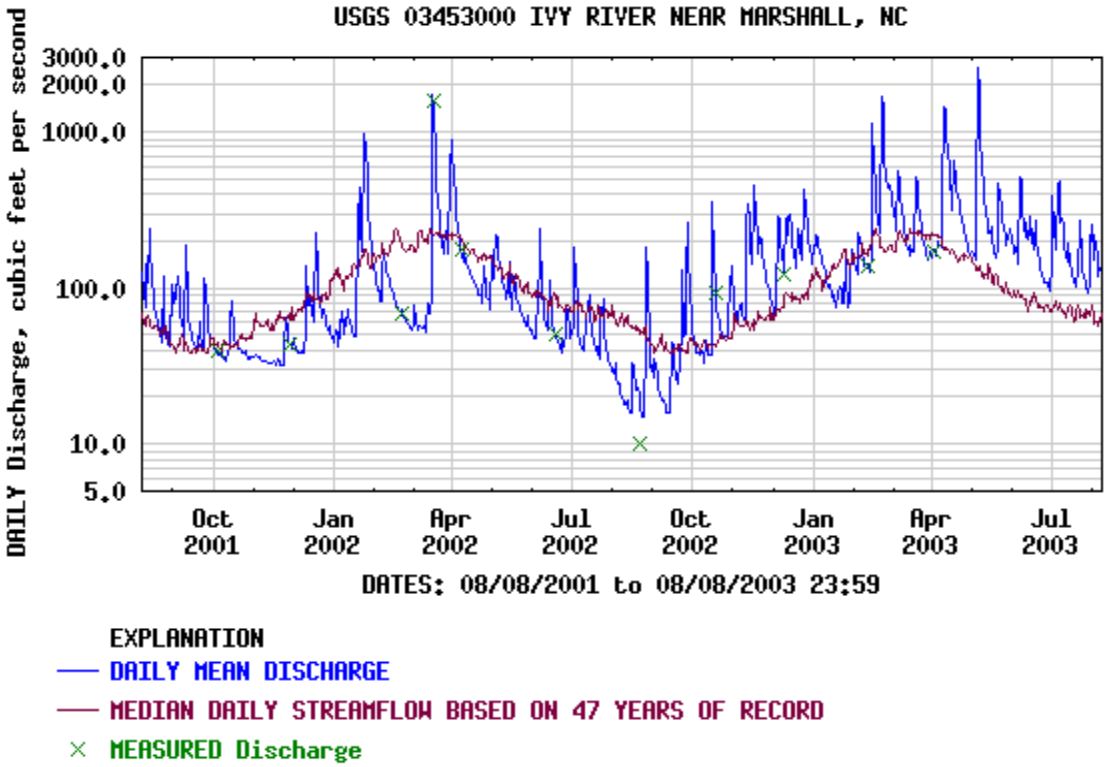
Bank stability was also assessed during the longitudinal profile survey. Several areas of active scouring and/or sloughing were observed. Descriptions relating to these areas are as follows:

- Station 0+96 at Cross Section #1. The existing coir log along the left streambank (facing downstream) has been undermined and may fail. This area should be assessed during the next monitoring period to determine remedial actions.
- Stations 2+21 through 2+54. A center bar was observed through this section of the reach. The thalweg currently follows the left channel; however, the right channel also funnels water during normal and high flows. This area should be assessed during the next monitoring period to determine remedial actions.
- Stations 5+33 through 5+63. The right streambank is undermined and actively sloughing.
- Stations 5+33 through 6+50. The left streambank is severely undercut and may fail prior to the next monitoring period.
- Station 5+99 at Cross Section #4. Active erosion is present along outside of meander bend. This meander bend experienced erosional problems during the summer of 2003. NCDOT maintenance crews were forced to repair the outside of this bend due to severe erosion along the roadway embankment. As a result, one rootwad was removed and not replaced.
- Stations 7+67 through 8+00. Active erosion was noted at and around the pipe outlet entering from the right side.
- Stations 9+00 through 10+00. The right streambank is actively eroding.

2.3.2 Climatic Data

Monitoring requirements state that at least two bankfull events must be documented through the five-year monitoring period. No surface water gages exist on Big Pine Creek or its tributaries. A review of known U.S. Geological Survey (USGS) surface water gages identified two gages within 12 miles of the mitigation site: one along the French Broad River approximately one mile downstream of Marshall and one along the Ivy River at the US 25/70 crossing between Marshall and Weaverville, immediately northwest of the Madison and Buncombe County boundary.

The Ivy River gage was utilized for this report since it is the smaller of the two gages (158 square-mile drainage area as compared to the 1,332 square-mile drainage area associated with the French Broad) and more accurately reflects hydrology and precipitation in the area. The Ivy River gage is situated in USGS Hydrologic Unit 06010105. Datum of the gage is 1,700.41 feet above sea level NGVD29. Based on the drainage area associated with the gage, the correlated bankfull discharge according to the NC Rural Mountain Regional Curves (USACE, 2003) is between 450 and 500 cubic feet per second (cfs). A review of peak flows was conducted for the period between August 2001 and August 2003. According to the graph, there were 14 bankfull events occurring during this period, with seven of the events happening in 2003. Approximately five of these events over the two year period exceeded 1,000 cfs, well above the bankfull discharge. The USGS graph depicting these peak flows is presented below.



2.4 Conclusions

Remedial actions may be necessary throughout several areas of this project dependent upon decisions made by the Mitigation Review Team. Due to the stream's close proximity to Big Pine Road and non-restricted channel access, channel work can be done from this side of the stream. Recommendations are presented below regarding remedial action(s):

1. The existing debris jam and resulting headcut at Station 0+40 could be corrected by the construction of two cross vanes acting as drop structures through this area. These cross vanes would provide grade control as well as assist with the overall stability of the adjacent streambanks.
2. The center bar at Station 2+21 could be removed by widening the left channel and constructing a cross vane to center the thalweg.
3. The eroding banks between Stations 5+33 and 6+50 could be re-graded and stabilized by constructing several cross vanes through this area. The cross vanes will also help with grade control.
4. Several rock vanes may be needed in the vicinity of Cross Section #4 to help stabilize the outside of the meander bend.
5. Cross Section #5 appears to be degrading. Placement of cross vanes through this section (from Stations 7+67 to 8+00) would help with grade control issues. It will also assist with stabilizing the adjacent stream banks.

The remaining areas of concern will be monitored for the next several years to determine the actual extent of change.

Additional substrate destabilization occurring from the noted downstream source will be monitored to determine the overall effect on the project. Pending the outcome of this assessment, the NCDOT may request the downstream landowner to remedy the problem.

Based on information obtained from the USGS, the Charles/McGinnis Site has met the required monitoring protocols. If the Mitigation Review Team determines that supplemental work is needed, this work should be conducted during the winter of 2003/2004 to insure that the overall goals of this project are maintained.

3.0 VEGETATION

3.1 Success Criteria

The NCDOT will monitor the South Fork Big Pine Creek Site for five years or until success criteria is met. A 320 stems per acre survival criterion for planted seedlings will be used to determine success for the first three years. The required survival criterion will decrease by 10 percent per year after the third year of vegetation monitoring (i.e., for an expected 290 stems per acre for year 4, and 260 stems per acre for year 5). The number of plants of one species will not exceed 20 percent of the total number of plants of all species planted.

3.2 Description of Species

According to the As-Built Report for the Charles/McGinnis Mitigation Site, South Fork Pine Creek, Madison County (2000), the following species were planted along the streambanks:

Live Stakes (*installed during winter of 1999/2000*)

Black willow (*Salix nigra*)
Silky willow (*Salix sericea*)
Silky dogwood (*Cornus amomum*)

Bare Rooted Trees (*installed during early winter 2000*)

Black willow (*Salix nigra*)
Red-osier dogwood (*Cornus stonoifera*)
Willow oak (*Quercus phellos*)
River birch (*Betula nigra*)
Black walnut (*Juglans nigra*)
Persimmon (*Diospyros virginiana*)
Green ash (*Fraxinus pennsylvanica*)
Red maple (*Acer rubrum*)

Permanent Seeding Mix

Sensitive fern (*Onoclea sensibilis*)
Joe pye weed (*Eupatorium fistulosa*)
Swamp milkweed (*Asclepias incarnata*)
Eastern gamagrass (*Tripascum dactyloides*)
Creeping spikerush (*Eleocharis palustris*)
Green bulrush (*Scirpus atrovirens*)
Hop sedge (*Carex lupilina*)
Rice cut grass (*Leersia oryzoides*)
Soft rush (*Juncus effusus*)
Softstem bulrush (*Scirpus validus*)
Deertongue (*Panicum clandestinum*)
Button bush (*Cephalanthus occidentalis*)
Elderberry (*Sambucus canadensis*)
Red chokeberry (*Aronia arbutifolia*)
Silky dogwood (*Cornus amomum*)
Winterberry (*Ilex verticillata*)
Blackgum (*Nyssa sylvatica*)
Green ash (*Fraxinus pennsylvanica*)
Red maple (*Acer rubrum*)
Pin oak (*Quercus palustris*)

Three square spikerush (*Scirpus americanus*)
Virginia wild rye (*Elymus virginicus*)
Woolgrass (*Scirpus cyperinus*)
Black cherry (*Prunus serotina*)
Silver maple (*Acer saccharium*)

3.3 Plot Descriptions

Several vegetation plots were installed during and immediately after construction. Since these plots were not staked and information regarding species was not available, six new plots were randomly established along the left streambank and floodplain within the project area. No plots were established on the right streambank due to the narrow buffer and on-going right-of-way maintenance associated with Big Pine Road. These six plots included two large 1,000 square-foot areas near Stations 3+00 and 4+00. The remaining four plots were one-meter square plots (12.1 square feet). Stakes were placed at all four edges of the 1,000 square-foot plots and at the two opposing edges of the 12.1 square-foot plots. These stakes were flagged and labeled for future identification. Vegetation (trees) within the two 1,000 square-foot plots were flagged, tagged and numbered. The vegetation associated with the 12.1 square-foot plots were only flagged. Due to the narrow riparian area and ease of access, the locations of these plots were not surveyed.

Tree Plot A is situated along the section upstream from the existing culvert. It is on the left streambank (facing downstream) and is oriented in a north-south direction. Black willow, silky willow, silky dogwood, and river birch account for the woody species in the plot. Section 3.4 provide numerical counts for species found within Tree Plots A and B, as well as the four small plots.

Tree Plot B is located on the left streambank immediately downstream of the culvert. It is also oriented in a north-south direction. Dominant woody vegetation includes black willow, silky willow, silky dogwood, and green ash.

3.4 Results of Vegetation Monitoring

Vegetation Monitoring Statistics, by Tree Plot

Plot No. (Type)	Black Willow	Silky Willow	Silky Dogwood	Red-osier Dogwood	Willow Oak	River Birch	Black Walnut	Persimmon	Green Ash	Red Maple	Total 2003 (Year 1)	Total 2004 (Year 2)	Total 2005 (Year 3)	Total 2006 (Year 4)	Total 2007 (Year 5)	Total (at planting)	Density (Trees/Acre)
Plot A (100'x10')	6	1	96			1					104					104	4,530
Plot B (100'x10')	26	17	50						1		94					94	4,094
											AVERAGE DENSITY						**4,312**

Vegetation Monitoring Statistics, by Vegetation Plot																	
Plot No. (Type)	**Black Willow**	**Silky Willow**	**Silky Dogwood**	**Red-osier Dogwood**	**Willow Oak**	**River Birch**	**Black Walnut**	**Persimmon**	**Green Ash**	**Red Maple**	**Total 2003 (Year 1)**	**Total 2004 (Year 2)**	**Total 2005 (Year 3)**	**Total 2006 (Year 4)**	**Total 2007 (Year 5)**	**Total (at planting)**	**Density (Trees/Acre)**
Plot 1 (1 meter grid)		1									1					1	3,600
Plot 2 (1 meter grid)			2								2					2	7,200
Plot 3 (1 meter grid)			2								2					2	7,200
Plot 4 (1 meter grid)		1									1					1	3,600
											AVERAGE DENSITY						**5,400**

Site Notes:

Vegetation plots were established during the first year of monitoring. Several plots were installed during construction; however, these plots could not be located. Canary grass (*Phalaris* sp.) dominates the herbaceous stratum at the site. This species is considered invasive; however, it provides excellent ground cover and rooting stability during the growing season. Specific notes regarding each plot is presented below.

Tree Plot A. One volunteer American elm (*Ulmus americana*) was observed in the plot. Herbaceous species included canary grass, blackberry (*Rubus* sp.), clover (*Trifolium* sp.), goldenrod (*Solidago* sp.), and ragweed (*Ambrosia* sp.).

Tree Plot B. Two volunteers were noted; cherrybark oak (*Quercus pagoda*) and forsythia (*Forsythia* sp.). Herbaceous species included canary grass, blackberry, clover, goldenrod, and ragweed.

Plot 1. Morning glory (*Ipomoea* sp.) and fescue (*Festuca* sp.) were observed in and immediately adjacent to the vegetation plot. In addition, two silky dogwoods, four elderberries (*Sambucus canadensis*), and one silky willow were noted within five feet of the vegetation plot.

Plot 2. Morning glory, fescue, and clematis (*Clematis* sp.) were observed in and immediately adjacent to the vegetation plot. In addition, seven silky dogwoods were noted within five feet of the vegetation plot.

Plot 3. Canary grass and clover (*Trifolium* sp.) were observed in and immediately adjacent to the vegetation plot. In addition, one silky willow and six silky dogwoods were noted within five feet of the vegetation plot.

Plot 4. Canary grass, fescue, morning glory, and goldenrod (*Solidago* sp.) were observed in and immediately adjacent to the plot. In addition, six silky dogwoods and three silky willows were noted within five feet of the vegetation plot.

3.5 Conclusions

The 2003 vegetation monitoring of the site represents an average density of more than 4,000 trees per acre, well above the minimum required by the success criteria.

4.0 BIOLOGICAL INDICATORS

Personnel with the Tennessee Valley Authority (TVA) were to conduct biological sampling along South Fork Big Pine Creek. It is unknown at this time whether or not the sampling has been conducted at the mitigation site. If this information becomes available, it will be inserted into the report at a later time.

5.0 OVERALL CONCLUSIONS

Based on the overall conclusions of monitoring along South Fork Big Pine Creek, the Charles/McGinnis Site has met the required monitoring protocols for the first formal year of monitoring. Localized areas of active bank scour and erosion exist. These areas should be assessed by the Mitigation Review Team to determine if remedial actions are warranted. These areas and all other areas will continue to be monitored during 2004.

Based on information obtained from the USGS, the Charles/McGinnis Site has met the required hydrologic monitoring protocols. Vegetative success criteria has also been met for the first year of monitoring. No biological sampling has been conducted to-date. It is unknown whether or not this sampling will be conducted as part of overall monitoring activities.

NCDOT will continue stream and vegetation monitoring at the site for 2004.

6.0 REFERENCES

North Carolina Wildlife Resources Commission (NCWRC), 2000. As-built Report for the Charles/McGinnis Mitigation Site, South Fork Big Pine Creek, Madison County.

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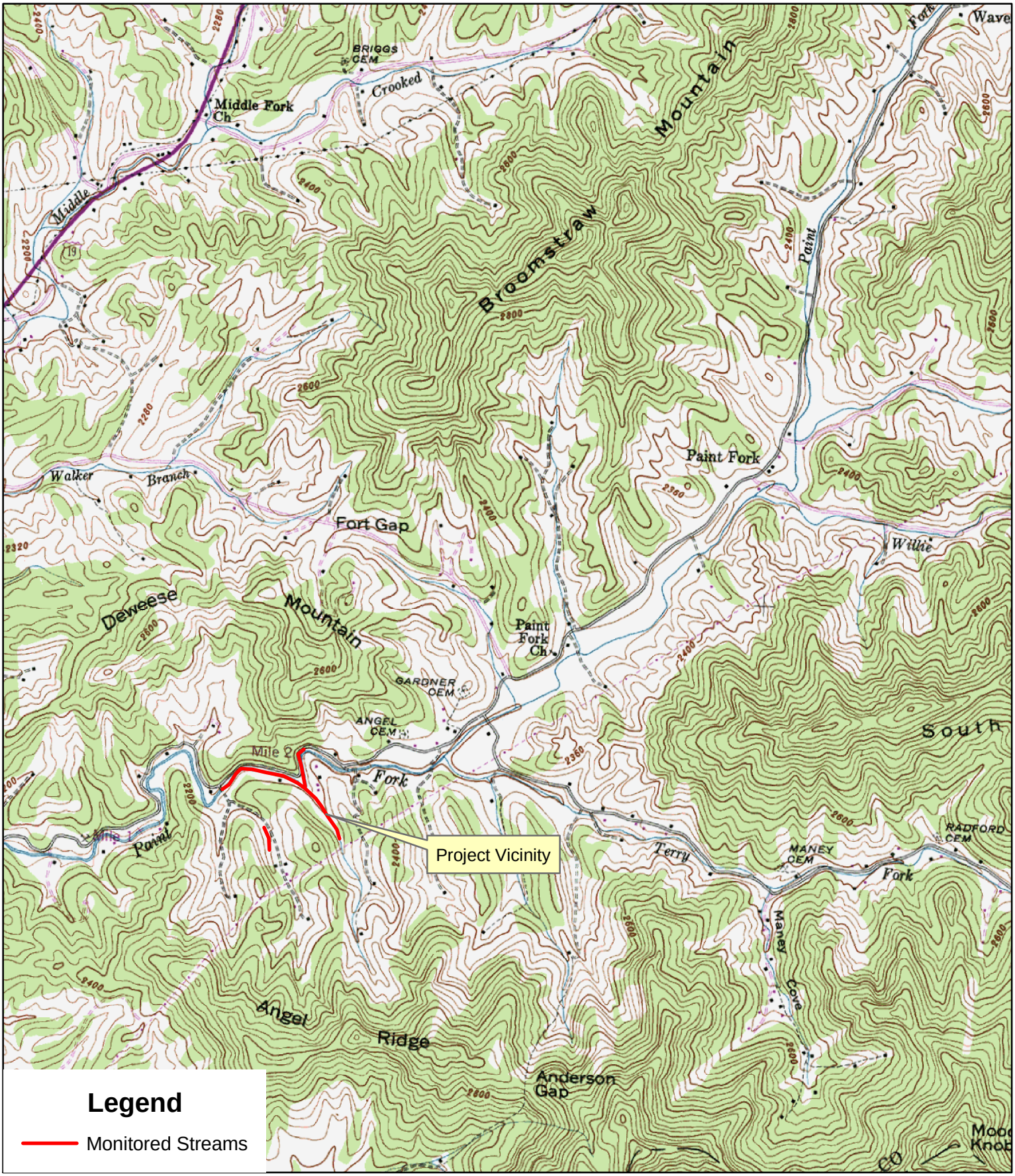


MULKEY ENGINEERS & CONSULTANTS

Feet: 0, 1,000, 2,000, 3,000, 4,000
Meters: 0, 200, 400, 600, 800, 1,000

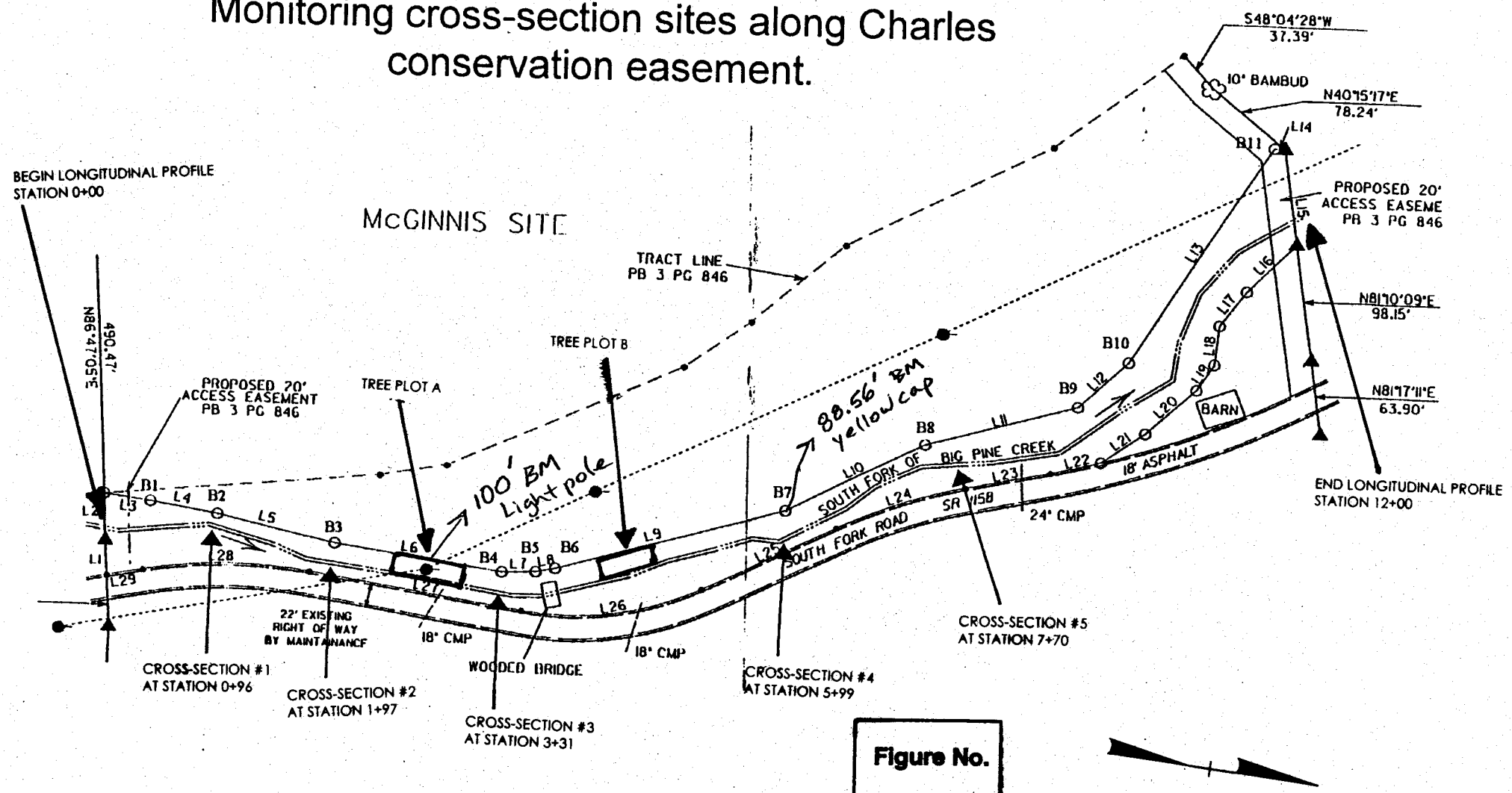
1:24,000
USGS 7.5-Minute Topographic Quadrangle: Barnardsville, NC

Figure No.
1

Prepared For:

PROJECT VICINITY
Brigmon Stream Mitigation Site
Paint Fork Creek
Madison County, North Carolina

Monitoring cross-section sites along Charles conservation easement.



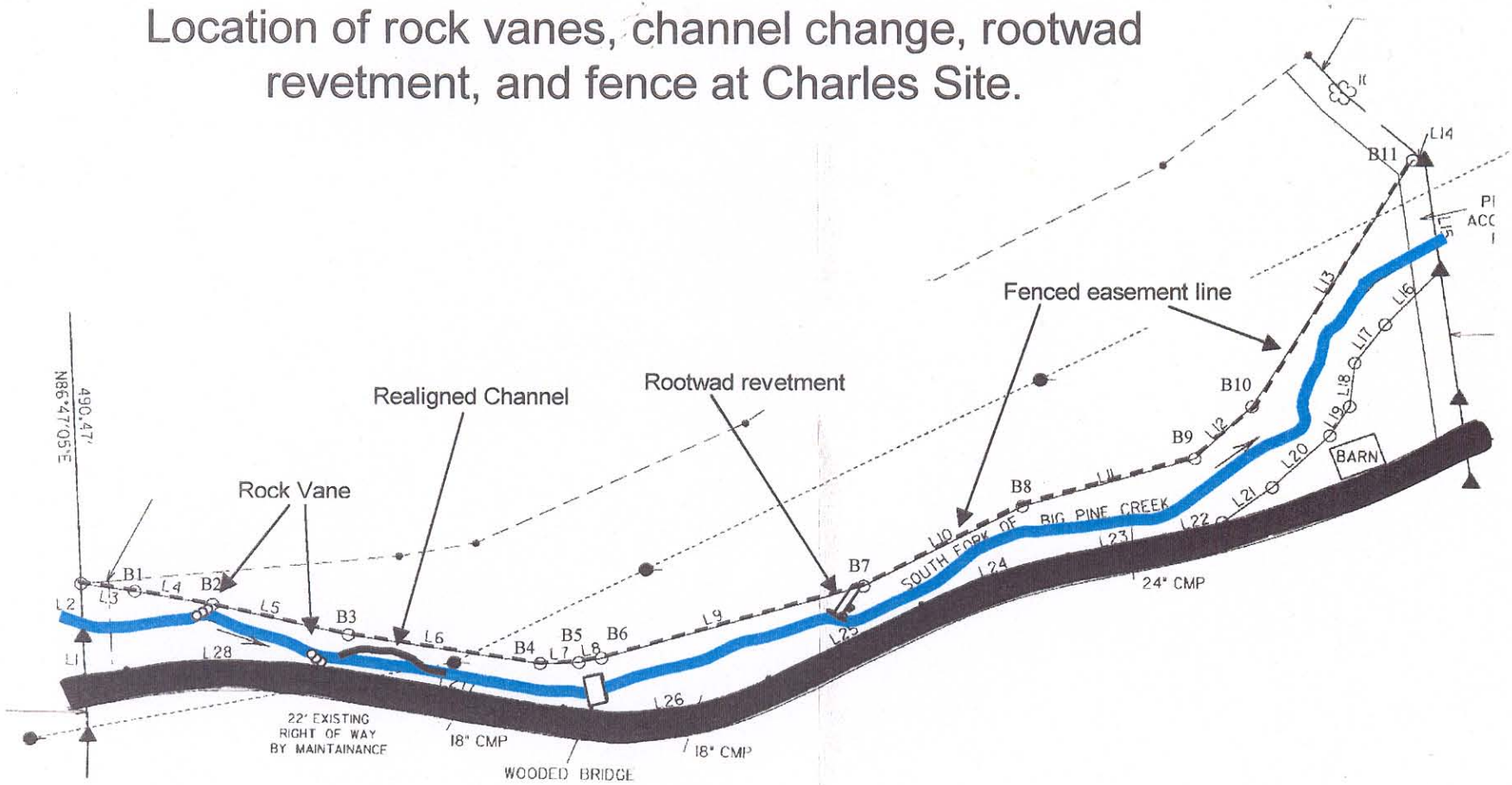
SOUTH FORK BIG PINE CREEK – CHARLES/MCGINNIS SITE

Figure No.

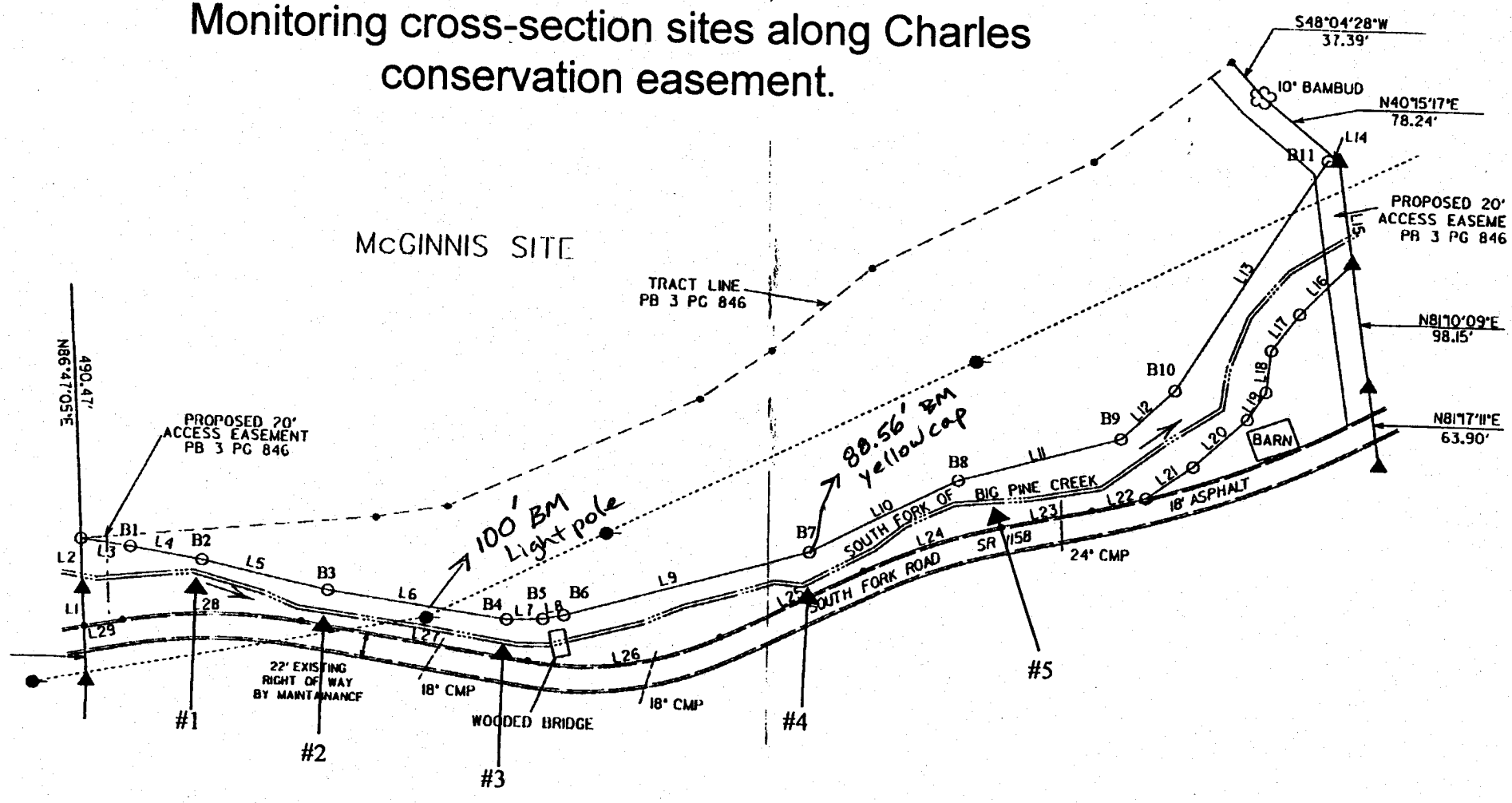
2

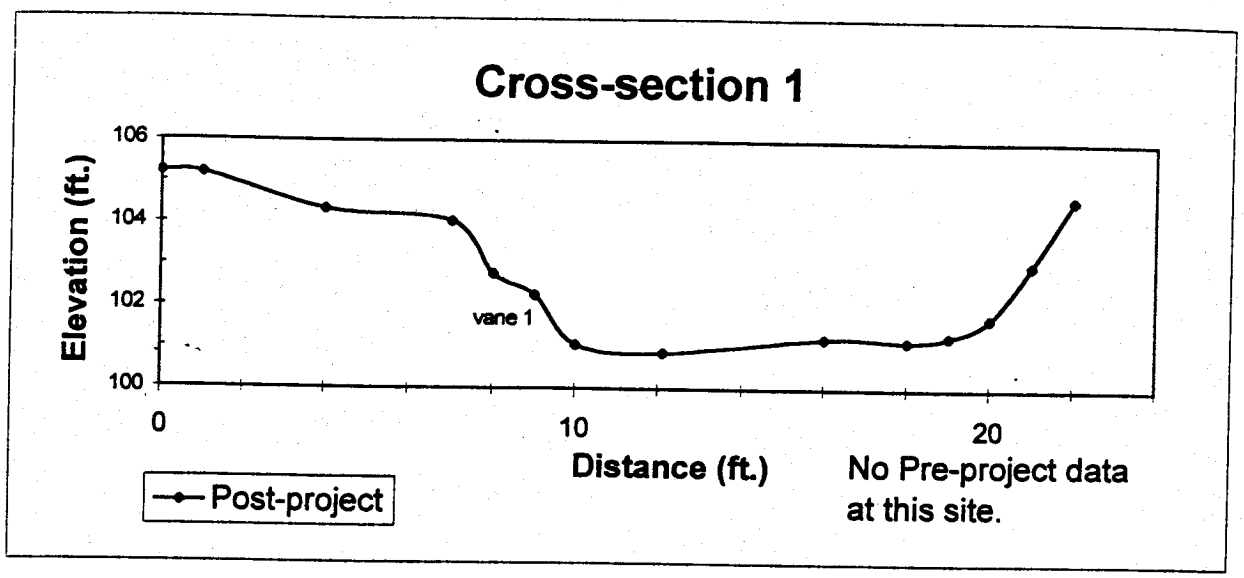
APPENDIX A
AS-BUILT DATA

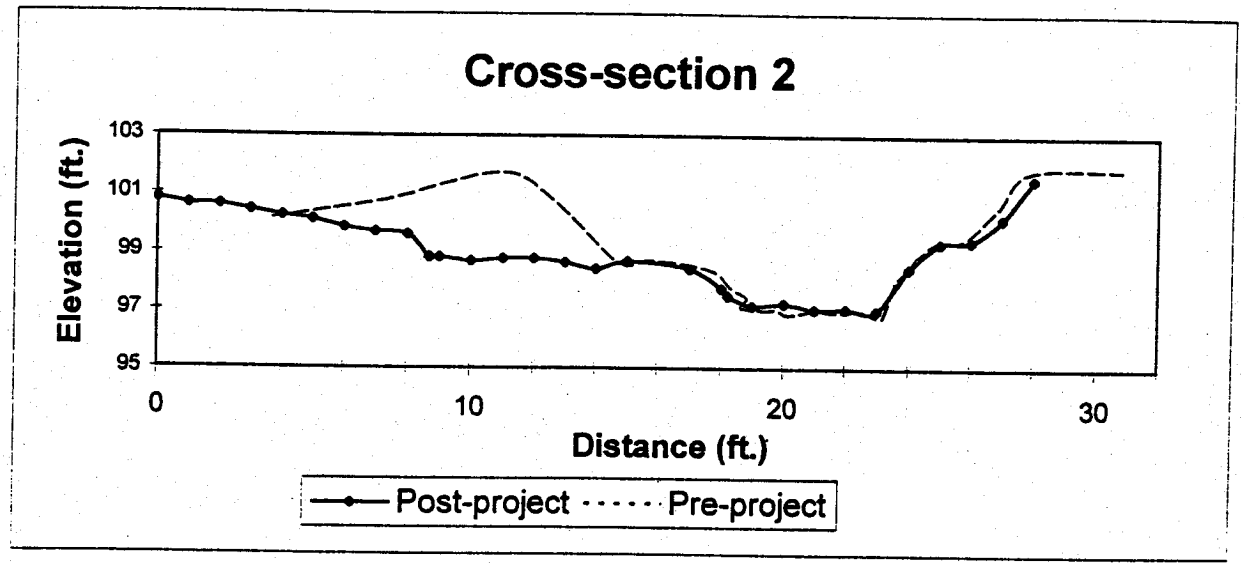
Location of rock vanes, channel change, rootwad revetment, and fence at Charles Site.

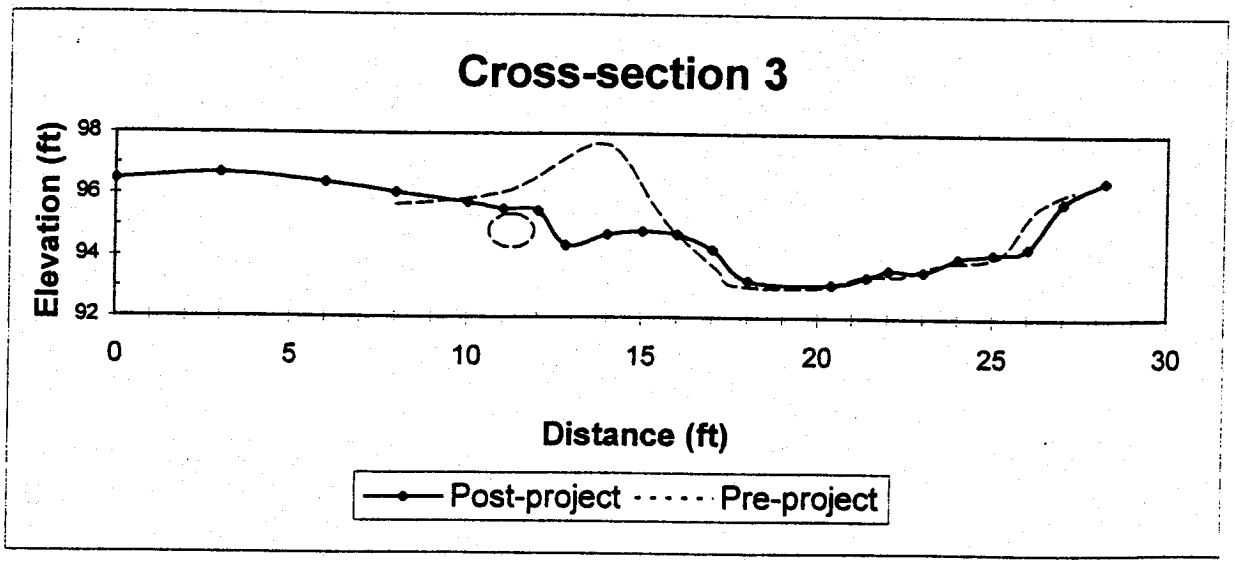


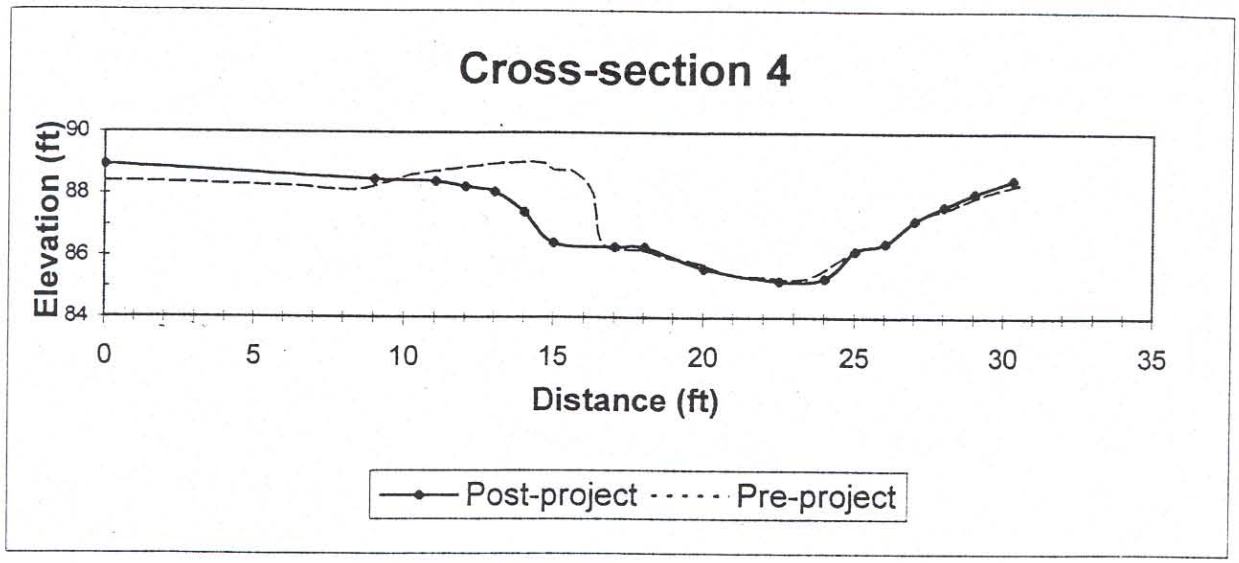
Monitoring cross-section sites along Charles conservation easement.

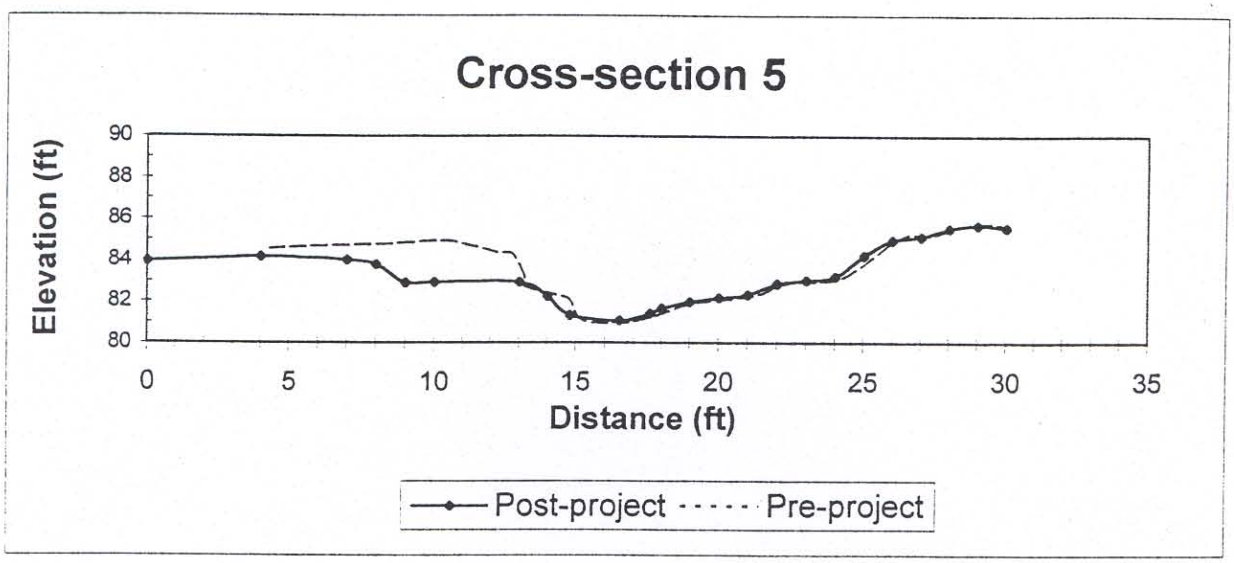



Cross-section 1
Elevation (ft.)
106
104
102
100
vane 1
0
10
20
Distance (ft.)
Post-project
No Pre-project data at this site.


Cross-section 2
Elevation (ft.)
103
101
99
97
95
0
10
20
30
Distance (ft.)
Post-project
Pre-project

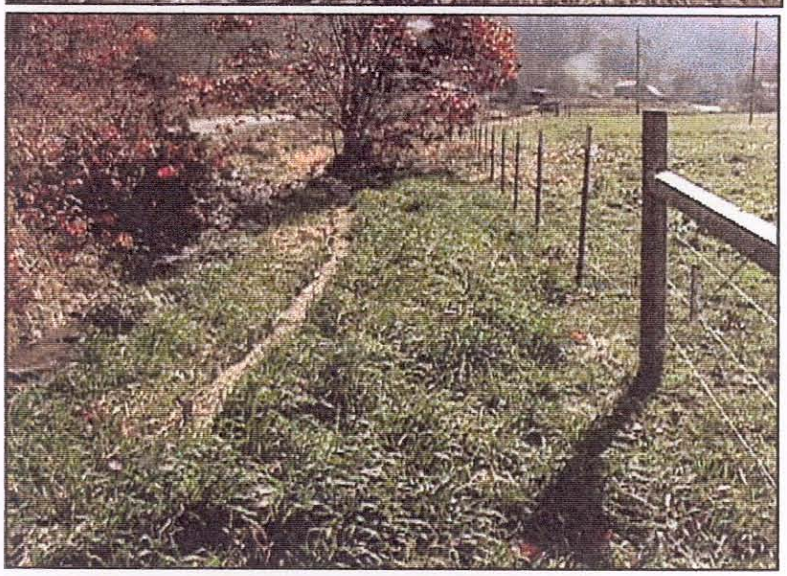

Cross-section 3
Elevation (ft)
98
96
94
92
0
5
10
15
20
25
30
Distance (ft)
Post-project
Pre-project


Cross-section 4
Elevation (ft)
90
88
86
84
0
5
10
15
20
25
30
35
Distance (ft)
Post-project
Pre-project


Cross-section 5
Elevation (ft)
90
88
86
84
82
80
0
5
10
15
20
25
30
35
Distance (ft)
Post-project
Pre-project

Looking upstream from power pole, showing sloping, erosion controls, vegetation and fencing. Top photo shows reach before construction, middle photo shows constructed channel and lower photo shows the same site 10 months after construction.

Looking upstream from the wooden bridge, top photo showing preconstruction condition of the channel. Middle photo shows channel after construction and lower photo shows the same channel 10 months after construction.

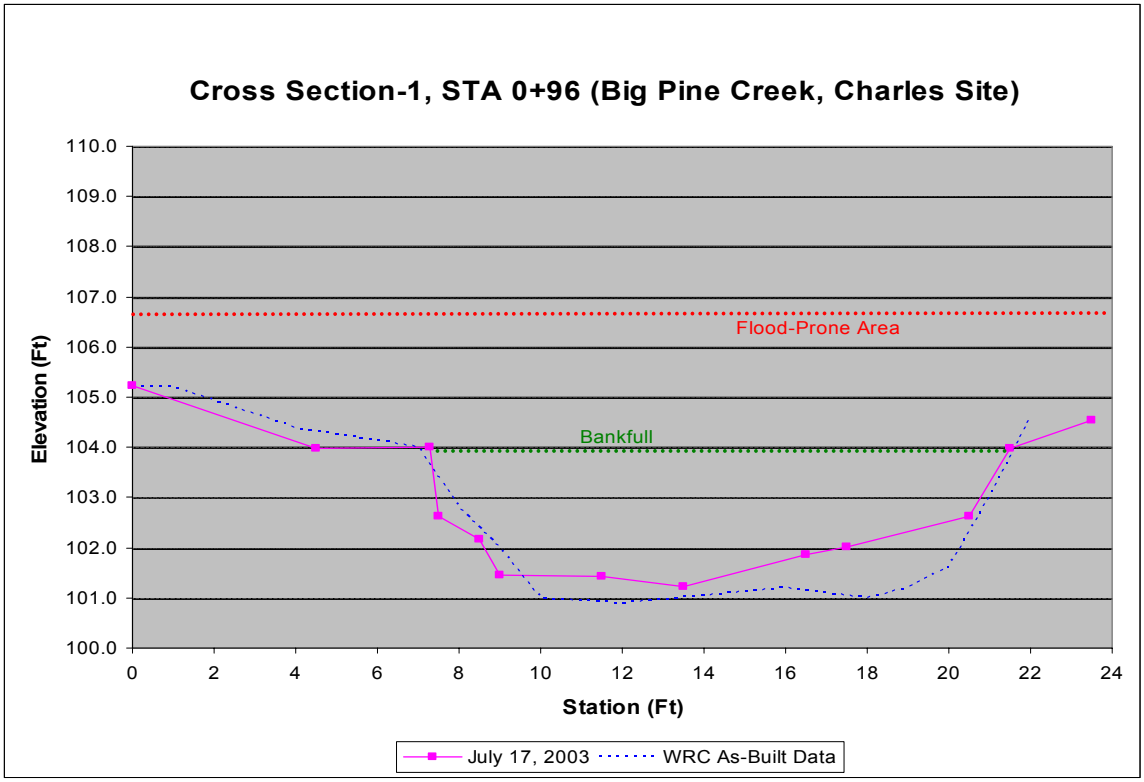


Looking upstream from point F7 in the top two photos and from point F9 in the bottom photo showing fencing an growth of ground cover. Bottom photo shows the same general reach after 10 months.

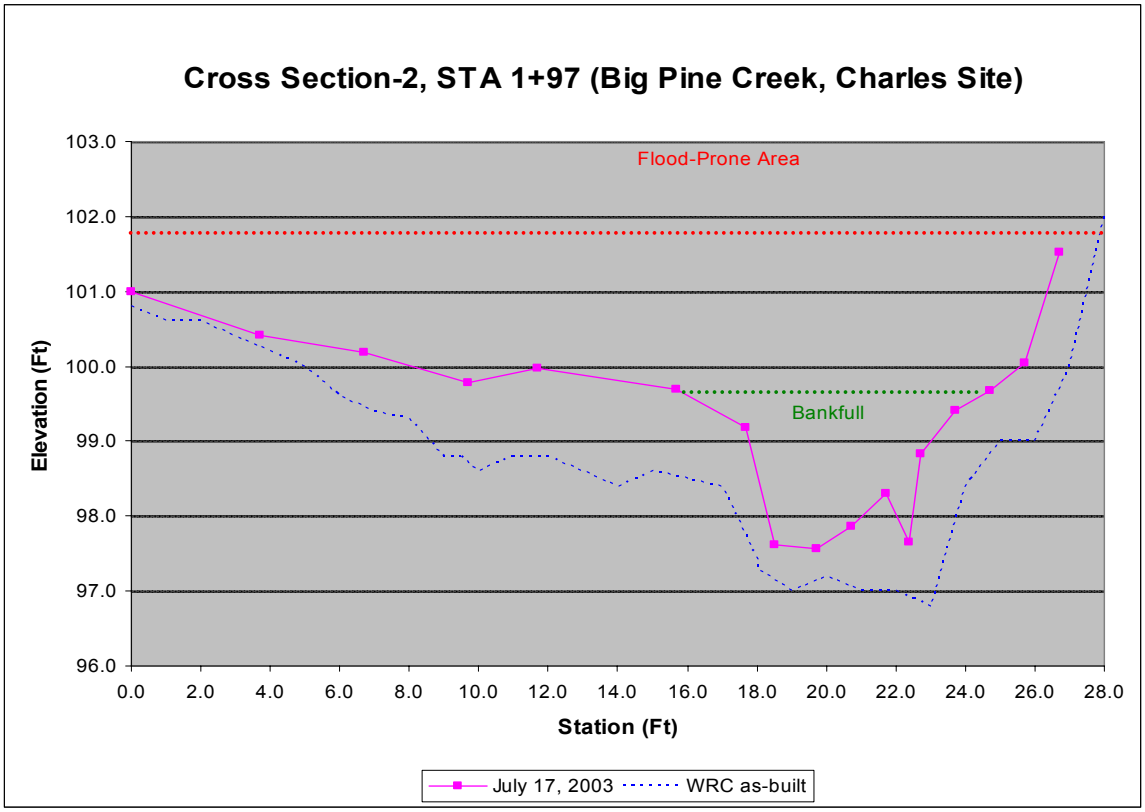
Four photos showing ground cover within the easement area. The two photos on the left are survival plots showing good vegetative cover through the erosion control blanket. Top right photo shows the diversity of grasses seeded and growing below the coir log. The lower right photo shows a live stake that has sprouted and is growing vigorously.

APPENDIX B

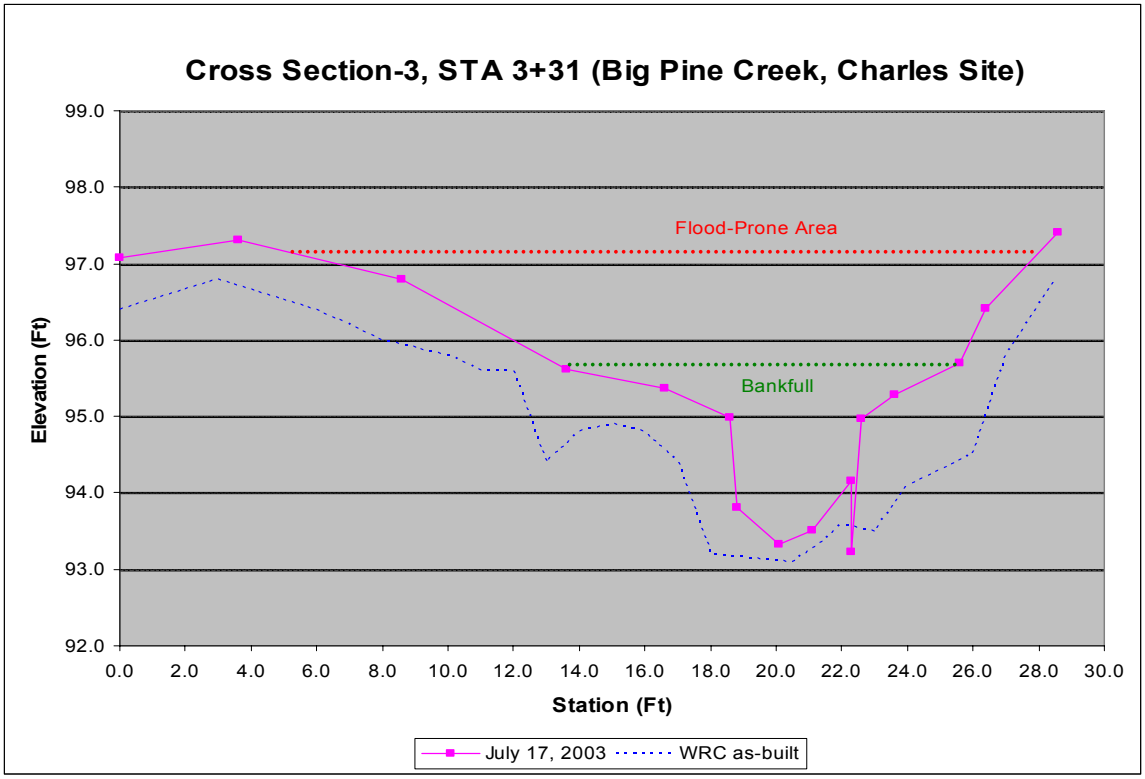
CROSS SECTIONS AND THE LONGITUDINAL PROFILE COMPARISON


Cross Section-1, STA 0+96 (Big Pine Creek, Charles Site)
Elevation (Ft)
110.0
109.0
108.0
107.0
106.0
105.0
104.0
103.0
102.0
101.0
100.0
0
2
4
6
8
10
12
14
16
18
20
22
24
Station (Ft)
Flood-Prone Area
Bankfull
July 17, 2003
WRC As-Built Data

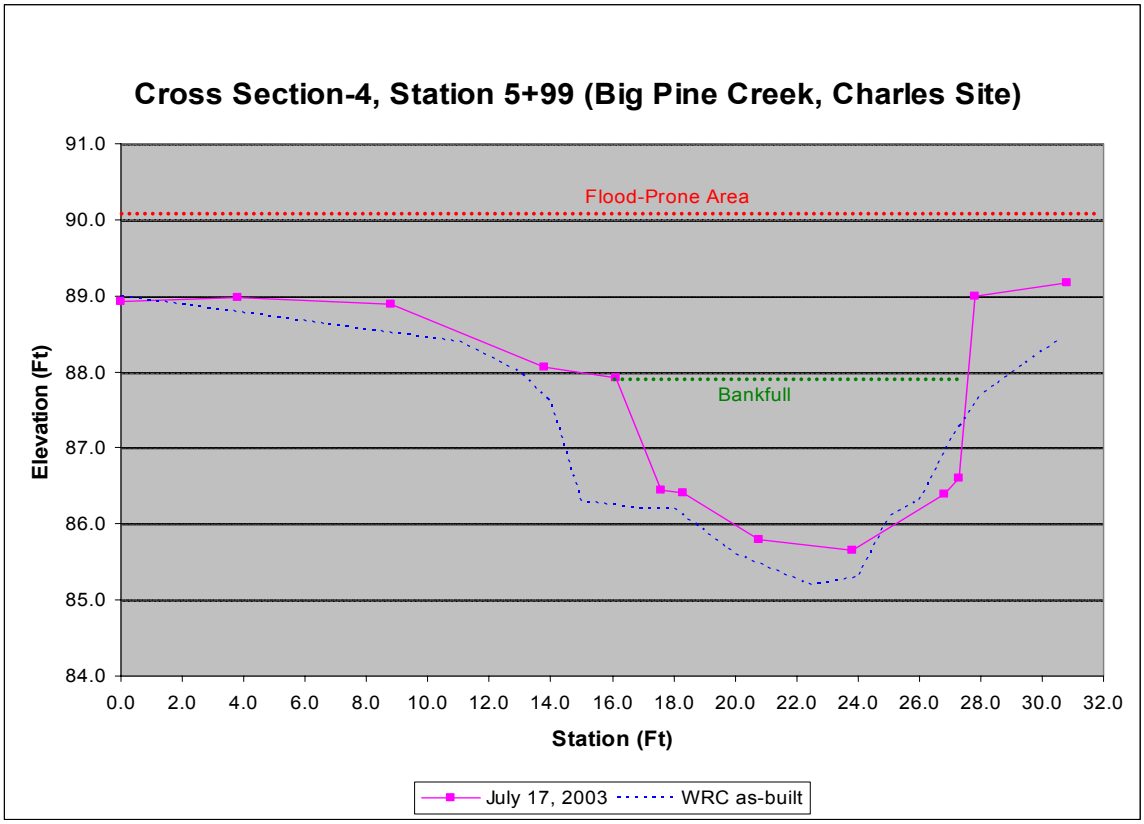
Cross Section #1 at Station 0+96


Cross Section-2, STA 1+97 (Big Pine Creek, Charles Site)
Flood-Prone Area
Bankfull
Elevation (Ft)
Station (Ft)
103.0
102.0
101.0
100.0
99.0
98.0
97.0
96.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
22.0
24.0
26.0
28.0
July 17, 2003
WRC as-built

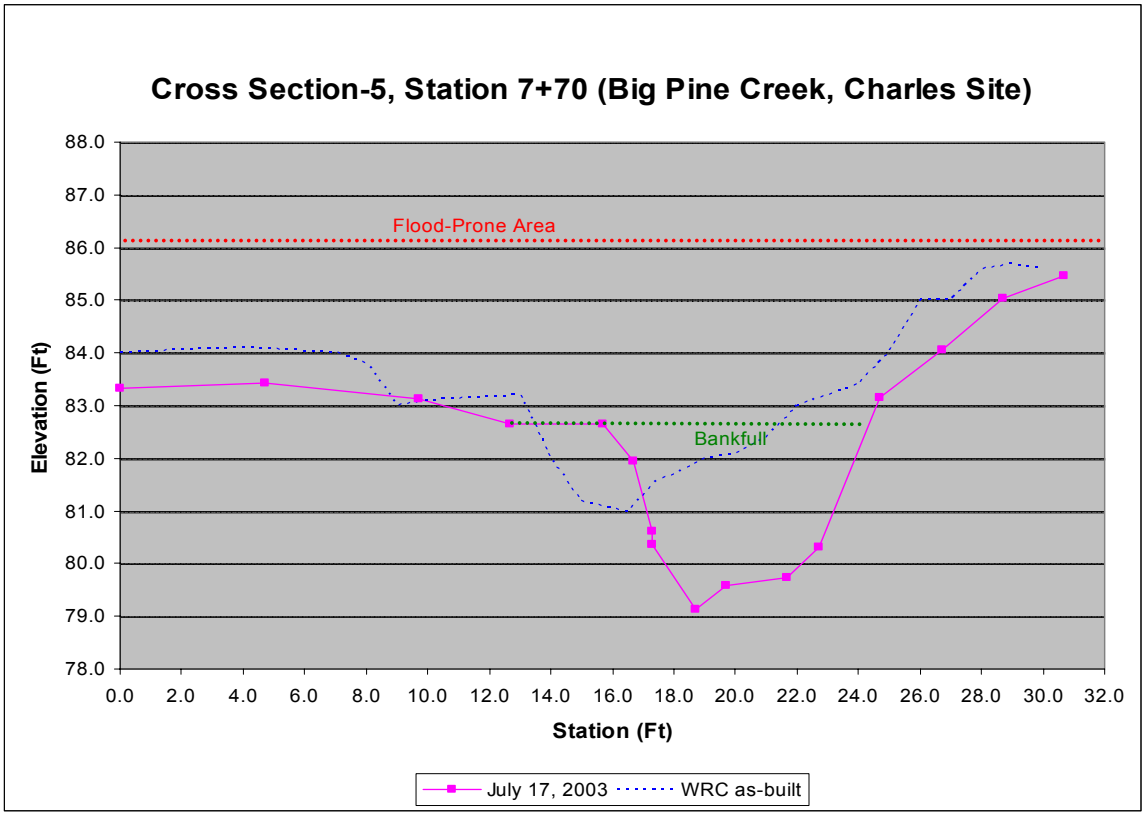
Cross Section #2 at Station 1+97


Cross Section-3, STA 3+31 (Big Pine Creek, Charles Site)
Elevation (Ft)
99.0
98.0
97.0
96.0
95.0
94.0
93.0
92.0
Flood-Prone Area
Bankfull
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
22.0
24.0
26.0
28.0
30.0
Station (Ft)
July 17, 2003
WRC as-built

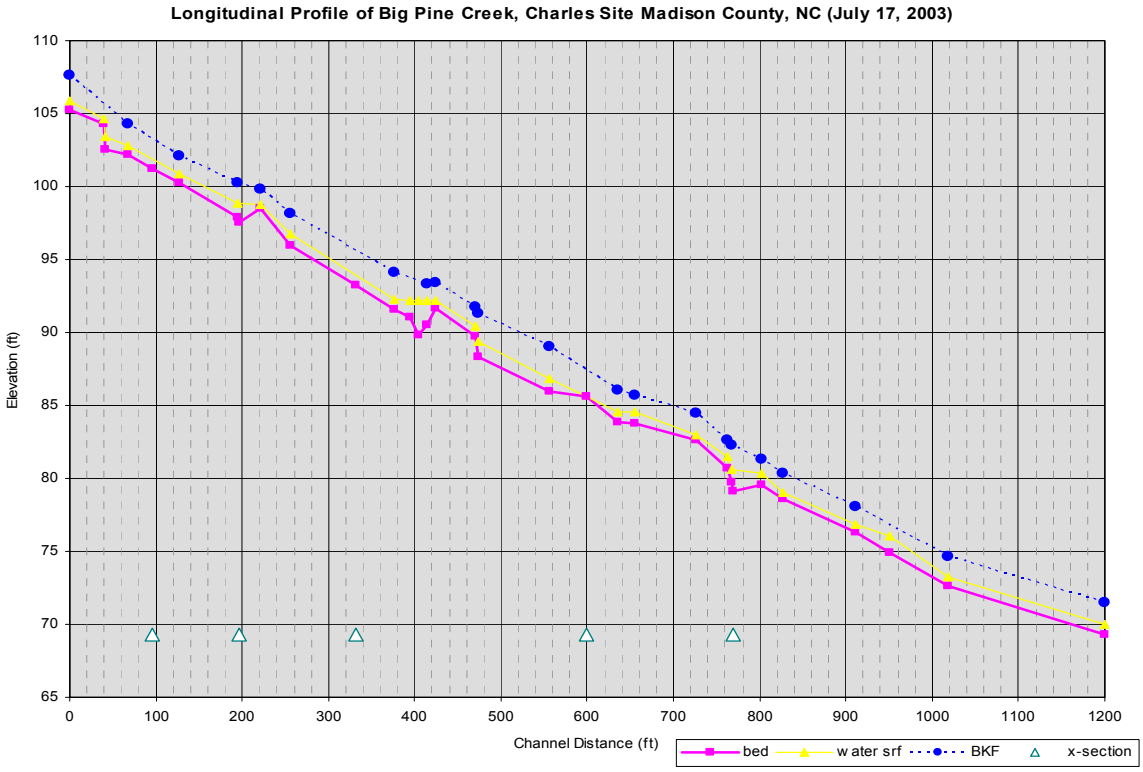
Cross Section #3 at Station 3+31


Cross Section-4, Station 5+99 (Big Pine Creek, Charles Site)
Flood-Prone Area
Bankfull
Elevation (Ft)
91.0
90.0
89.0
88.0
87.0
86.0
85.0
84.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
22.0
24.0
26.0
28.0
30.0
32.0
Station (Ft)
July 17, 2003
WRC as-built

Cross Section #4 at Station 5+99


Cross Section-5, Station 7+70 (Big Pine Creek, Charles Site)
Flood-Prone Area
Bankfull
Elevation (Ft)
Station (Ft)
88.0
87.0
86.0
85.0
84.0
83.0
82.0
81.0
80.0
79.0
78.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
22.0
24.0
26.0
28.0
30.0
32.0
July 17, 2003
WRC as-built

Cross Section #5 at Station 7+70


Longitudinal Profile of Big Pine Creek, Charles Site Madison County, NC (July 17, 2003)
Elevation (ft)
110
105
100
95
90
85
80
75
70
65
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
Channel Distance (ft)
bed
w ater srf
BKF
x-section

APPENDIX C

SITE PHOTOGRAPHS

Vegetation Plot Photographs

Tree Plot A near Station 2+70

Tree Plot B near Station 4+50

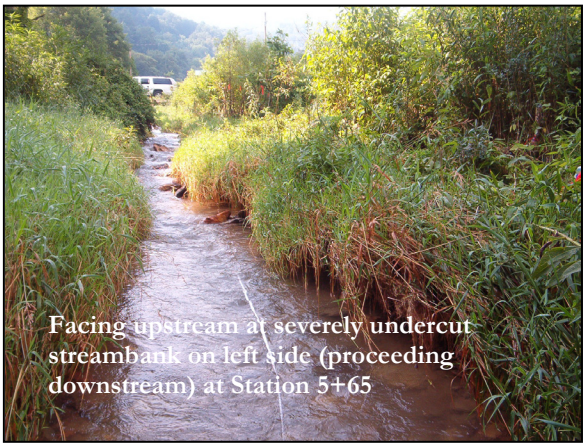
Vegetation Plot #1 near Station 0+96

Vegetation Plot #2 within Tree Plot A

Vegetation Plot #3 within Tree Plot B

Vegetation Plot #4 near Station 7+00

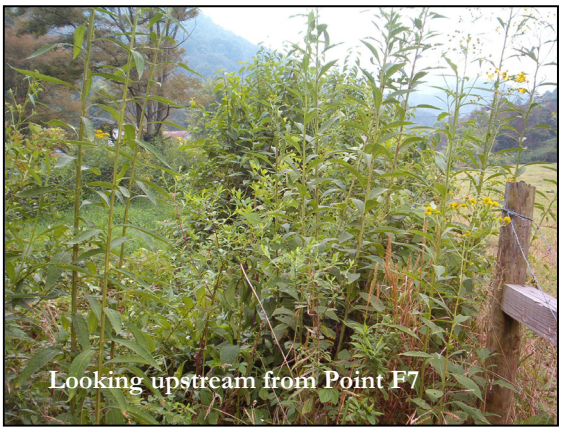
South Fork Big Pine Creek



Facing upstream at
pipe outlet near
Station 7+70

Facing downstream
from pipe outlet

Active bank erosion along right side of
stream near Station 9+40

Channel straightening immediately
downstream of project area

As-Built Comparisons