MITIGATION PLAN AND
AS-BUILT BASELINE REPORT
Morgan Creek Stream Restoration Site

Haywood County, North Carolina
Cataloging Unit: 06010106
EEP Contract #: D06035-A
March 16, 2009

Submitted to:
North Carolina Department of Environment and Natural Resources
North Carolina Ecosystem Enhancement Program
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Raleigh, NC 27699-1652

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MITIGATION PLAN AND AS-BUILT BASELINE REPORT

Morgan Creek Stream Restoration Site

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EXECUTIVE SUMMARY

Restoration Systems has completed construction on degraded reaches of Morgan Creek and three of its tributaries located within Haywood County, North Carolina. The project is located within the French Broad River Basin, Cataloging Unit 06010106, specifically within the targeted local watershed 06010106020040. The primary objectives of the project were to improve local water quality, contribute to the improvement of the water quality of the overall watershed, and restore aquatic and riparian habitat. Specifically, these objectives were achieved by restoring and enhancing approximately 3,900 linear feet of stream, restoring approximately 9.8 acres of riparian buffers, and restoring and enhancing approximately 1.11 acres of wetlands.

General Site Conditions

The Morgan Creek project site is in a rural setting in the Blue Ridge hydrophysiographic ecoregion and currently used to pasture cattle with woody vegetation confined to isolated areas. The surrounding area is rural in nature, with limited residential development. The drainage area of Morgan Creek ranges from 0.47 mi^2 to 0.73 mi^2 with its tributaries ranging from 0.004 mi^2 to 0.18 mi^2. Prior to restoration, the existing channels were highly degraded due to unrestricted livestock access, channelization activities, and lack of riparian vegetation.

Restoration Approach and Implementation

The restoration design was based on a Priority Level 1 and 2 approach to restore proper channel dimension and allow for appropriate sediment transport. Restoration practices on this project were implemented with the intent of minimizing unnecessary disturbance to adjacent land and to protect mature riparian vegetation where it existed. The constructed stream profile has restored stable bed morphology including appropriate riffle-pool sequencing. Cross-vanes, J-Hook vanes, and in-stream log structures have been integrated into the channel to provide grade control, maintain stable streambanks while the riparian vegetation establishes, and provide in-stream habitat. Sod mats were harvested onsite and were used to stabilize the newly graded streambanks. Excavated materials from the constructed channel were used to backfill around in-stream structures and to build riffles with a natural substrate and function. Restoration activities have resulted in 3,711 linear feet of restored stream channel, 558 linear feet of stream enhancement, 0.6 acres of restored wetlands, and 0.46 acres of enhanced wetlands for a total of **4,083 stream mitigation units (SMU's)** and **0.83 wetland mitigation units (WMU's)**.

Native woody and herbaceous species have been used to establish at minimum a fifty-foot wide riparian buffer on each side of the restored reach. The riparian buffer consists of zones in which different woody species were planted. Live stakes of appropriate native species were used along the lower stream banks. Natural stabilization was achieved via establishment of temporary ground cover and planting of native herbs and grass seeding. Project activities have restored 9.8 acres of riparian buffer.

The ecological benefits of this restoration include a decrease in sediment entering the watershed via bank erosion; increased aquatic habitat through the construction of a stable channel and appropriate in-stream features; improved terrestrial habitat through the eradication of invasive woody species in the riparian area and the planting of a diverse, native riparian buffer, allowing

for better filtration of nutrients entering the stream via groundwater contributions; and improved management of extreme flow events.

Monitoring

Monitoring will consist of the collection and analysis of data about stream stability, riparian vegetation survivability, and ground water hydrology to assist in the evaluation of the project in meeting established restoration objectives. Specifically, the success of channel modification, erosion control, and re-vegetation parameters will be assessed using measurements of stream dimension, pattern, and profile, site photographs, and vegetation sampling. Also included in the data collection is stage data from on-site stream gages to document the frequency and magnitude of high-flow events and continuous-reading water level monitors to document ground water hydrology in the wetland restoration areas. Monitoring will be conducted annually for a minimum of five years or until success criteria are met. The first scheduled monitoring event will be conducted at the end of the first full growing season of 2009.

If remedial action is deemed necessary during the monitoring period, the area and/or source of instability will be assessed and appropriate actions will be recommended. This includes, but is not limited to bank erosion, in-stream structure failure, down-cutting of the stream channel, and excessive disease or mortality of the riparian vegetation. No issues have arisen since completion of construction which require consideration or attention.

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Figure 1. Vicinity Map
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1.0 PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

The purpose of the Morgan Creek Stream Restoration Site (Site) is to restore degraded sections of Morgan Creek and three of its tributaries located in Haywood County, North Carolina. This Plan presents information regarding the existing (pre-restoration) site and watershed conditions, the restoration approach for the project, the resulting linear footage of restored channel and acreage of restored buffer, the monitoring protocol, remedial action plan and detailed as-built drawings of the post-construction site.

1.1 General Project Description

Morgan Creek is located approximately 10 miles northeast of the City of Waynesville in rural Haywood County, North Carolina (Figure 1: Vicinity Map). The site consists of approximately 9.8 acres of floodplain, approximately 3,900 linear feet of stream designated as Morgan Creek and its tributaries, and 0.51 acres of existing wetlands (Figure 2: Project Map). The stream reaches consist of perennial and intermittent, first and second order streams that have historically been impacted by riparian and bank vegetation removal, channel straightening, unrestricted livestock access, and agricultural land-use practices. Existing land use within the site consists of forested areas and pasture land. The site is located within moderate to steep, sloping colluvial valleys and elevations range from approximately 2500 ft. to 2625 ft. (NGVD). Past land management activities have consisted of timber harvesting with subsequent land clearing for agricultural uses including cattle grazing. The land outside of the conservation easement remains in active agricultural production.

1.1.1 USGS and NCDWQ River Basin Designations

The project reach is located in the Pigeon River watershed of the French Broad River Basin (United States Geological Survey (USGS) 14-digit Hydrologic Unit 06010106020040) within North Carolina Division of Water Quality (NCDWQ) sub-basin 04-03-05. This sub-basin is primarily forested, although agriculture accounts for a significant portion of the sub-basin. Morgan Creek drains into Fines Creek at the downstream end of the Site, which in turn flows to the Pigeon River five miles farther downstream.

1.1.2 NCDWQ Surface Water Classification

Morgan Creek in the vicinity of the Site is assigned a best usage classification of C by the NCDWQ and as such there are no restrictions on watershed development or types of discharge. These waters are suitable for aquatic life propagation and survival, fishing, wildlife, secondary recreation, and agriculture. Secondary recreation includes wading, boating, and other uses not involving human body contact with water on an organized or frequent basis.

Fines Creek, from its source to the Pigeon River, as well as the portion of the Pigeon River located approximately 5 miles south of the SITE, are listed on the DWQ final 2006 303(d) list. Streams which are included in the 303(d) list do not meet water quality standards or have impaired uses. Listing of these streams likely results from non-point

agriculture and urban runoff, and potentially from industrial point source discharges. Specifically, the reason given for the listing of Fines Creek and the Pigeon River is "Impaired Biological Integrity."

1.2 Project Goals and Objectives

The primary goals of the Morgan Creek Stream Restoration Project are to:

- Restore aquatic and riparian habitat within the upper portions of the Morgan Creek watershed.
- Restore geomorphic stability to the subject stream reaches.

These goals will be accomplished through the following objectives:

- Restoration of approximately ten acres of Montane Alluvial Forest along both sides of Morgan Creek.
- Removing nonpoint sources of pollution associated with cattle raising and agricultural activities including the exclusion of livestock from Morgan Creek and adjacent floodplain and establishing a native woody riparian buffer (at least 50' wide) adjacent to streams and wetlands to treat surface runoff which may be laden with sediment and/or agricultural pollutants from the adjacent landscape.
- Reestablishing stream stability and the capacity to transport watershed flows and sediment loads by restoring a stable dimension, pattern, and profile supported by natural in-stream habitat and grade/bank stabilization structures.
- Promoting floodwater attenuation through a) reconnecting bankfull stream flows to the abandoned floodplain terrace, b) restoring secondary, entrenched tributaries thereby reducing floodwater velocities, c) restoring floodplain wetlands, thereby increasing the storage capacity for floodwaters within the Site, and d) revegetating floodplains to increase frictional resistance on floodwaters crossing the Site.
- Improving aquatic habitat by enhancing stream bed variability and the use of in-stream structures.
- Providing wildlife habitat including seepage slope wetlands.

These accomplishments will result in:

- Restoration and enhancement of 4083 Stream Mitigation Units.
- Providing 0.83 Wetland Mitigation Units.
- Protecting the Site with a perpetual conservation easement.

1.3 Project Structure

The project is illustrated in Figure 2 which depicts stream restoration and enhancement reaches for Morgan Creek and each of its tributaries. The project structure is tabulated in the corresponding Table 1 (See Appendix A).

1.4 Restoration Type and Approach

Restoration and enhancement practices implemented on this project were designed to minimize unnecessary disturbance to adjacent land and to protect mature riparian vegetation where it exists. Consideration was given to the potential functional lift provided by restoration activities in comparison to the functional lift that could be

realized through the natural process of channel evolution. Included in this consideration was an attempt to determine the disturbance and sedimentation that could occur as a result of this natural process. Where restoration was determined to be warranted, consideration was given to which reaches could best be served by maintaining as much of the existing channel pattern as possible.

The proposed reaches of Morgan Creek and its tributaries are designed as Type B4 and Type B4a streams. This channel configuration provides the most stable and natural form in the moderately sloping colluvial valleys that are found throughout the Site. Additionally, since broad alluvial valleys are not found within the Site, the lower sinuosity of the Type B4 streams will result in minimizing grading and earthwork activities. The proposed channel dimensions, patterns, and profiles are based on hydraulic relationships and morphologic dimensionless ratios of the reference reaches. The installation of rock and wood structures was utilized throughout the restored reaches of the Site. Rock and log structures were installed in runs for grade control to prevent headcut formation. Log vanes with rootwads were installed in meander bends to direct the flow away from the outside of the bend and provide toe and bank protection. Sod transplants were used extensively throughout the project to stabilize newly constructed channel banks. On-site material including sod, bed material, boulders, and logs were used to the maximum extent possible.

Proposed wetland areas are underlain by hydric soils but are non-jurisdictional due to insufficient hydrology. Channel restoration reestablished a connection between the floodplain and the channel. Overbank flooding and better utilization of nearby seepage hydrology will provide the needed hydrology to sustain these hydric soil zones as jurisdictional wetlands. Areas where jurisdictional wetlands existed have been enhanced by the planting of appropriate woody and herbaceous species. Each wetland restoration and enhancement area has been planted with species appropriate to the ecoregion and will promote the functionality of the wetlands as integral parts of the riparian corridor.

1.5 Project History, Contacts and Attribute Data

The summary of the project history, contacts, and attribute data is tabulated in Tables 2, 3, and 4 in Appendix A.

2.0 SUCCESS CRITERIA

2.1 Morphologic Parameters and Channel Stability

Success criteria context provided by NCEEP Mitigation Plan Document Guidance:

> Restored and enhanced streams should demonstrate morphologic stability to be considered successful. Stability does not equate to an absence of change, but rather to sustainable rates of change or stable patterns of variation. Restored streams often demonstrate some level of initial adjustment in the several months that follow construction and some change/variation subsequent to that is also to be expected. However, the observed change should not be unidirectional such that it

represents a robust trend. If some trend is evident, it should be very modest or indicate migration to another stable form.

2.1.1 Dimension

Cross-section measurements should indicate little change from the as-built cross-sections. If changes do occur, they will be evaluated to determine whether the adjustments are associated with settling and increased stability or whether they indicate movement towards an unstable condition. The following thresholds will be considered indicators of concern:

- Width/depth ratio increases more than 10 percent,
- Bank height ratio increases more than 25 percent.

2.1.2 Pattern and Profile

Measurements and calculated values should indicate stability with little deviation from as-built conditions and established morphological ranges for the restored stream type. Annual measurements should indicate stable bed-form features with little change from the as-built survey. The pools should maintain their depth with flatter water surface slopes, while the riffles should remain shallower and steeper. The following thresholds will be considered indicators of concern:

- Riffle slope increases more than 50 percent,
- Profile scarp formation greater than 20 percent of mean depth,
- Pool maximum depth decreases more than 20 percent,
- Pool/riffle feature shifts along the profile of more than the equivalent of one bankfull width.

2.1.3 Substrate

Calculated D_{50} and D_{84} values should indicate coarser size class distribution of bed materials in riffles and finer size class distribution in pools. Generally, it is anticipated that the bed material will coarsen over time. The following thresholds will be considered indicators of concern:

- D_{50} or D_{84} value decreases more than 30 percent,
- Percent sand increases more than 50 percent.

2.1.4 Sediment Transport

Depositional features should be consistent with a stable stream that is effectively managing its sediment load. Point bar and inner berm features, if present, should develop without excessive encroachment of the channel. Lateral and mid-channel bar features should typically not be present and if so only in isolated instances.

2.2 Vegetation

Riparian vegetation monitoring shall be conducted for a minimum of five years to ensure that success criteria are met per USACE guidelines. Accordingly, success criteria will consist of a minimum survival of 320 stems per acre by the end of the Year 3 monitoring period and a minimum of 260 stems per acre at the end of Year 5. If monitoring indicates

either that the specified survival rate is not being met or the development of detrimental conditions (i.e., invasive species, diseased vegetation), appropriate corrective actions will be developed and implemented.

2.3 Hydrology

Surface water monitored data and calculated return intervals should indicate the occurrence of a bankfull event during a minimum of two of the five monitored years. It should be noted that Tropical Storm Fay (August 2008) produced an approximate 3/4 bankfull flow event while construction was underway. The project also experienced a half-bankfull event on December 11, 2008.

Ground water hydrology success criteria for the five-year monitoring period will include a minimum regulatory criterion, comprising saturation (free water) within one foot of the soil surface for 5 percent of the growing season.

3.0 MONITORING PLAN

Monitoring protocol will follow that outlined within the EEP Site Specific Mitigation Plan and detailed in the U.S. Army Corps of Engineers (USACE) Stream Mitigation Guidelines for Monitoring Level I. Vegetation monitoring will follow the CVS-EEP Protocol for Recording Vegetation (Lee et al. 2006). Monitoring shall consist of the collection and analysis of stream stability and riparian/stream bank vegetation survivability data to support the evaluation of the project in meeting established restoration objectives. Specifically, project monitoring will include measurements of stream dimension, profile, pattern, bed materials, photo documentation, vegetation survivability sampling, and stream bankfull return interval.

3.1 Duration

Monitoring shall be conducted annually for a minimum of five years or until success criteria are met, as required in the guidelines and called for in the contract agreements. The first scheduled monitoring event will be conducted in 2009 at the end of the first full growing season following project construction and planting.

3.2 Reporting

A monitoring report will be prepared after all monitoring tasks for each annual monitoring event are completed. Each report will provide the new monitoring data and compare the new data against previous findings. Data tables, cross-sections, profiles, photographs, and other graphics will be included in the report as necessary. Each report will include a discussion of any significant deviations from the as-built survey and previous annual measurements, as well as evaluations as to whether the changes indicate a stable or unstable condition. Each annual monitoring report will be submitted by December 31st of the year during which the monitoring event was conducted.

3.3 Hydrology

Monitored stream flow data will be used to evaluate the success of restoring the intended bankfull return period. Stream gauges have been installed for monitoring flow stage within the restored reaches. Two crest gauges have been set, both within the monitored profile reach on Morgan Creek; one at the upstream end of the project, just downstream of the pipe outfall, and one at the downstream end of the project within the Morgan Creek enhancement area. Each site visit by the monitoring performer will include inspection and documentation of the highest stage for the monitoring interval. Following each inspection the crest gages will be reset and any required maintenance will be performed.

Monitored ground water hydrology will be used to evaluate the success of restored wetland areas. Continuously recording, ground water monitoring gauges were installed in accordance with specifications in *Installing Monitoring Wells/Piezometers in Wetlands* (NCWRP 1993). Monitoring gauges were set to a depth of approximately 24 inches below the soil surface. Screened portions of each gauge were surrounded by filter fabric, buried in screened well sand, and sealed with a bentonite cap to prevent siltation and surface flow infiltration during floods. Three groundwater gauges were installed in wetland restoration areas to provide representative coverage of the Site. Hydrological sampling will be performed in restoration areas during the growing season at intervals necessary to satisfy the hydrology success criteria within each physiographic landscape area (USEPA 1990).

3.4 Stream Channel Stability and Geomorphology

The purpose of monitoring is to evaluate the stability of the restored stream. Following the procedures established in the USDA Forest Service Manual (Harrelson et al 1994) and the methodologies utilized in the Rosgen stream assessment and classification system (Rosgen 1994, 1996), data collected will consist of detailed dimension and pattern measurements, a longitudinal profile(s), and bed materials sampling.

3.4.1 Dimension

Permanent cross-sections (approximately one per 20 bankfull-width lengths, evenly divided based upon riffle and pool percentages), have been established and will be used to evaluate stream dimension. Four riffle and four pool cross-sections have been located within the reaches also surveyed as part of the longitudinal profile on Morgan Creek. One riffle and one pool cross-section has been located on the North Branch monitored reach. Permanent monuments, recoverable either through field identification or use of GPS, have been set at the left and right extents of each cross-section. The cross-section surveys shall provide a detailed measurement of the stream and banks, to include points on the adjacent floodplain, at the top of bank, bankfull, at all breaks in slope, the edge of water, and thalweg. Subsequently, width-to-depth ratios, entrenchment ratios, and bank height ratios will be calculated for each cross-section.

3.4.2 Profile

Two longitudinal profiles, each covering a minimum of 20 bankfull-width lengths, have been established and surveyed. One monitored profile reach is located along Morgan

Creek measuring approximately 2900 linear feet. A second monitored profile reach measuring approximately 200 linear feet is located on North Branch. The beginning and ending points of each measured section has been permanently monumented. Average, pool, and riffle slopes, as well as pool-to-pool spacing will be calculated using data collected during the monitoring of these longitudinal profiles.

3.4.3 Pattern

Evaluations of stream pattern, based on valley/stream type, will be developed based upon measurements of sinuosity, meander width ratio, and radius of curvature (on newly constructed meanders only for first year monitoring). Calculations will be made of sinuosity, meander width ratio, radius of curvature/bankfull width ratio, and meander length/bankfull width ratio.

3.4.4 Bed Materials

Pebble counts will be conducted at each riffle cross section, as well as across the overall study reach (based upon percentage of riffles and pools) for the purpose of classification and evaluation of sediment transport. Pebble count data will be plotted by size distribution in order to assess the D50 and D84 size class.

3.5 Vegetation Monitoring

The Carolina Vegetation Survey – Ecosystem Enhancement Program (CVS-EEP) 2008 protocol for recording vegetation (Lee et. al 2008) will be used to determine the planting pattern of woody stems with respect to species, spacing, and density as well as to forecast survivability and growth of planted stems in subsequent monitoring years. Six vegetative sampling plots were established within the project easement area: five standard (10 x 10m) plots and one non-standard (5 x 20m) plot. Four plots were established in the stream restoration areas and two within the wetlands area (one in enhancement, one in restoration).

Plots were placed within the applicable planting zones to capture the heterogeneity of the designed vegetative communities. However, given that several planting zones were too narrow to accommodate the standard or non-standard plots, all vegetation plots were established within the buffer and wetland planting areas. Plot corners were permanently marked with rebar and recorded during the baseline survey. All planted stems and plot corners were marked with orange flagging tape to facilitate relocation during subsequent monitoring years. A reference photograph was taken for each plot at the origin looking diagonally across the plot to the opposite corner.

3.6 Photograph Reference Points

Photograph reference points (PRPs) have been established to assist in characterizing the site and to allow qualitative evaluation of the site conditions. The location of each photo point has been permanently marked in the field and the bearing/orientation of the photograph is indicated on the As-built plans to allow for consistent repetition. A total of seventeen (17) PRP's have been established along the restored stream. Ten (10) of these PRP's have been located upstream of the permanent monitoring cross sections. These

photographs will be taken facing downstream looking at the section, and will show as much of the banks and channel as possible. The survey tape used for cross-sectional measurements will be centered in each photograph and the water line will be located near the lower edge. An effort will be made to consistently photograph the same area in each subsequent monitoring event.

4.0 MAINTENANCE AND CONTINGENCY PLANS

Recommendations for suggested increased observation, maintenance and/or repair in problem areas will be made within the Results and Discussion sections of the annual monitoring reports, based on the data that is collected. Both the vegetation and morphology sections will include plan views and tables indicating the location of the problems areas, their severity and possible cause(s).

5.0 AS-BUILTS

The Morgan Creek site construction was completed at the beginning of January 2009 and the As-Built survey was completed on January 13, 2009. The survey located the constructed channel boundaries along with the location of in-stream structures. Additionally, all permanent monitoring markers were located during the survey. As-Built plans have been prepared with this information depicting the pre-construction location of the channel, the design alignment, and the post-construction location. A half-size set of the As-Built plans are in Appendix B of this report.

6.0 REFERENCES

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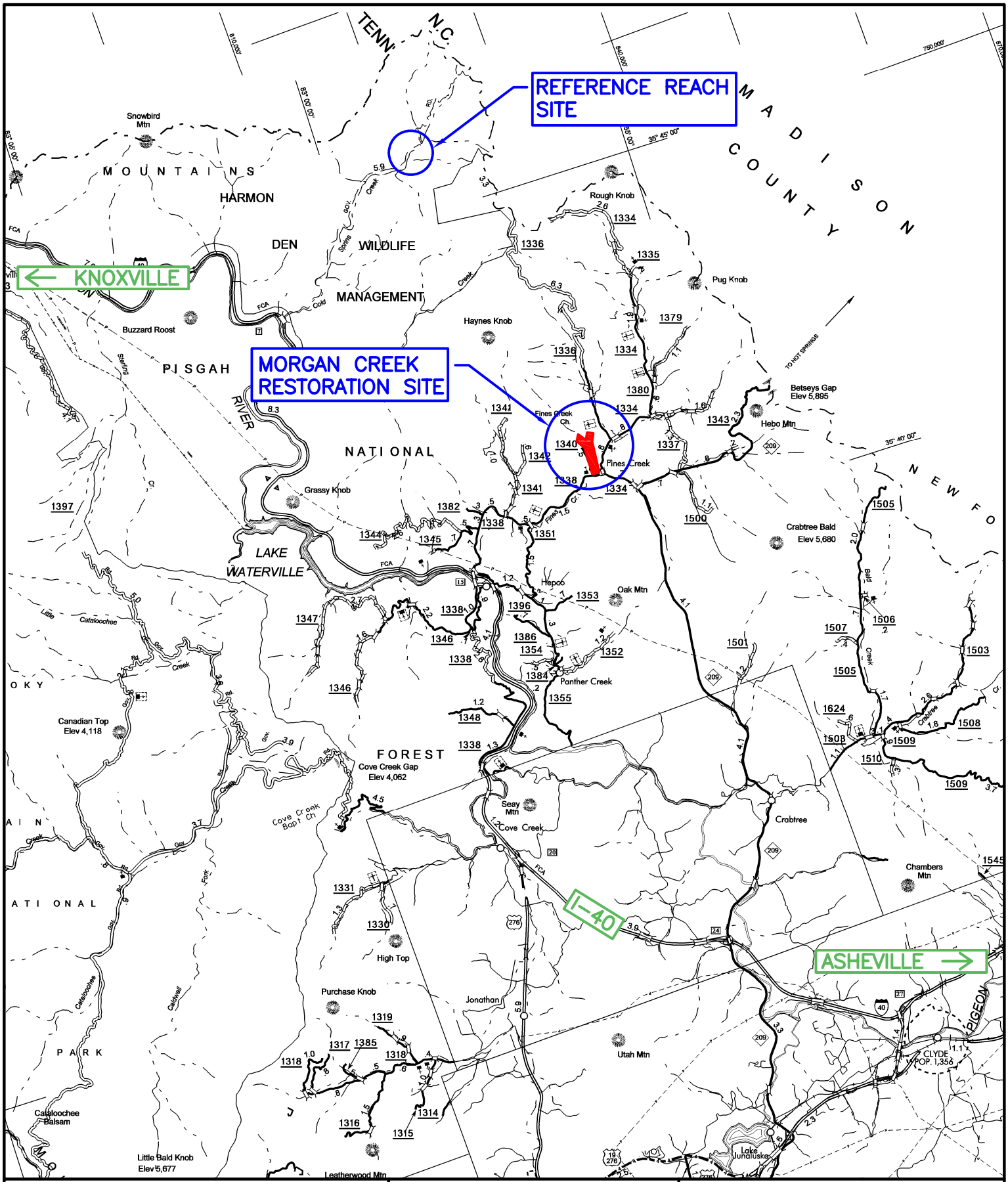
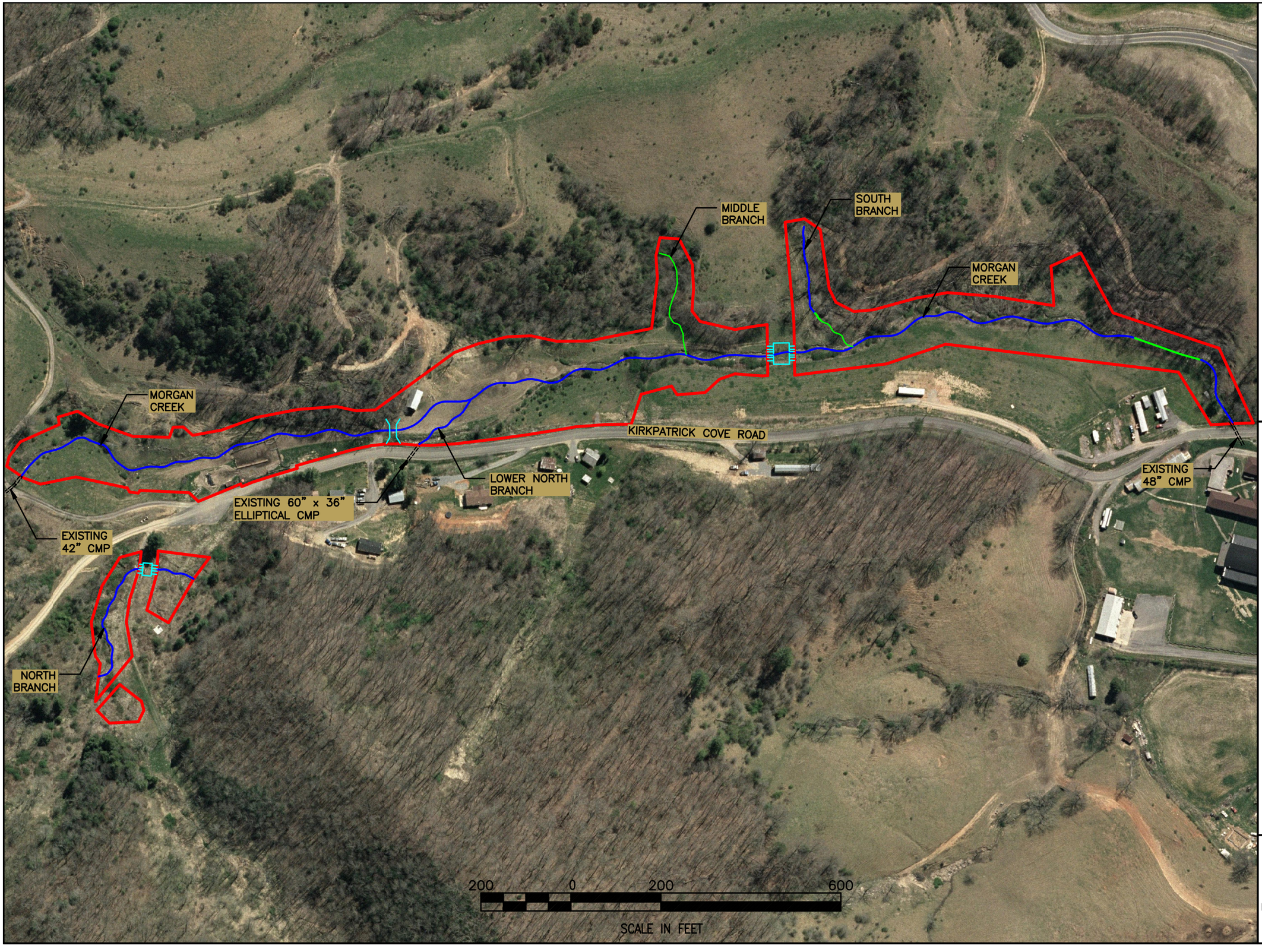
APPENDIX A

FIGURES AND TABLES


REFERENCE REACH SITE
MORGAN CREEK RESTORATION SITE
KNOXVILLE
ASHEVILLE
I-40
TENN.
N.C.
MADISON COUNTY
M O U N T A I N S
HARMON
DEN
WILDLIFE
MANAGEMENT
PISGAH
NATIONAL
FOREST
LAKE WATERVILLE
RIVER
Snowbird Mtn
Buzzard Roost
Haynes Knob
Rough Knob
Pug Knob
Betseys Gap Elev 5,895
Hebo Mtn
Fines Creek Ch.
Fines Creek
Grassy Knob
Crabtree Bald Elev 5,680
Hepco
Oak Mtn
Panther Creek
Canadian Top Elev 4,118
Cove Creek Gap Elev 4,062
Cove Creek Bapt Ch
Seay Mtn
Cove Creek
Crabtree
Chambers Mtn
High Top
Purchase Knob
Jonathan
Utah Mtn
CLYDE POP. 1,356
Cataloochee Balsam
Little Bald Knob Elev 5,677
Leatherwood Mtn
Lake Junaluska
PREPARED FOR:
PREPARED BY:
AND BY:
Ecosystem Enhancement Program
Restoration Systems, LLC
Wolf Creek Engineering
SCALE
0
1
3
MILES
SITE VICINITY MAP
MORGAN CREEK RESTORATION SITE
HAYWOOD COUNTY, NORTH CAROLINA
FIGURE 1



PREPARED FOR:

Ecosystem Enhancement Program

PREPARED BY:

Restoration Systems, LLC

AND BY:

Wolf Creek Engineering

LEGEND

- STREAM RESTORATION
- LEVEL I ENHANCEMENT
- STREAM CROSSING (FORD)
- STREAM CROSSING (PIPED)
- CONSERVATION EASEMENT

SITE MAP

MORGAN CREEK RESTORATION SITE
HAYWOOD COUNTY, NORTH CAROLINA

FIGURE 2

Table 1. Project Components
Morgan Creek Stream Restoration Site / EEP Contact #D06035-A

Restoration Reach/Area	Restoration Level	Approach	Pre-Restoration LF or AC	Post-Restoration LF or AC	Station Range/Location	Comments
Morgan Creek	R	P2	892	900	100+00 - 108+73	
Morgan Creek	R	P1	340	340	108+73 - 112+00	
Morgan Creek	R	P2	1,402	1,438	112+00 - 126+36	
Morgan Creek	E1	E1	141	141	126+36 - 127+77	
Morgan Creek	R	P2	213	212	127+77 - 129+72	
North Branch	R	R2	288	296	200+00 - 202+96	
North Branch	R	P2	63	66	203+38 - 204+02	
Lower North Branch	R	P1	2	254	500+00 - 502+46	
Middle Branch	E1	E1	148	148	300+00 - 301+48	
Middle Branch	E1	E1	154	154	301+48 - 303+02	
South Branch	R	P1	197	205	400+00 - 402+05	
South Branch	E1	E1	115	115	402+05 - 403+20	
A, C, D, E, F, G, H, I, J, K	E		0.46	0.46		
R1, R2, R3, R4, R5, R6, R7	R		0.60	0.60		

Component Summation							
Restoration Level	Stream (LF)	Riparian Wetland (Ac)		Non-Riparian (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration	3,711		0.60				
Enhancement			0.46				
Enhancement I	558						
Enhancement II							
Creation							
Preservation							
HQ Preservation							
			1.06				
Totals	**4,269**	**1.06**					**BMP Count**

	= Non-Applicable

Table 2. Project Activity and Reporting History Morgan Creek Restoration Project		
Activity or Report	**Data Collection Complete**	**Completion or Delivery**
Restoration Plan	Nov 2007	Jan 2008
Final Design - Construction Plans	N/A	Jul 2008
Construction	N/A	Jan 2009
Temporary S&E mix applied to entire project area	N/A	Dec 2008
Permanent seed mix applied to entire site	N/A	Dec 2008
Bare-root plantings for floodplain and uplands	N/A	Jan 2009
Mitigation Plan / As-Built (Year 0 Monitoring - baseline)	Jan 2009	Feb 2009
Year 1 Monitoring		
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

Table 3. Project Contact Table Morgan Creek Restoration Project		
Full Delivery Provider		
Restoration Systems, Inc Travis Hamrick	1101 Haynes St., Suite 211 Raleigh, NC 27604 919-755-9490	
Designer		
Wolf Creek Engineering, pllc S. Grant Ginn, P.E.	30 Ben Lippen School Rd., Suite 203 Asheville, NC 28806 828-505-2186	
Construction Contractor		
North State Environmental, Inc Darrell Westmoreland	2889 Lowery St. Winston-Salem, NC 27101 336-725-2010	
Project Manager		
American Wetlands Lamar Beasley	2310 Valley Carline Court Ruston, VA 20191 703-860-0045	
Planting & Seeding Contractor		
North State Environmental, Inc Stephen Joyce	2889 Lowery St. Winston-Salem, NC 27101 336-725-2010	
Monitoring Performers		
Stream Monitoring - Wolf Creek Engineering, pllc	S. Grant Ginn, P.E.	828-505-2186
Vegetation Monitoring - Equinox Environmental, Inc	Sarah Marcinko	828-253-6856

Table 4. Project Attribute Table					
Morgan Creek Restoration Project					
Project County	Haywood				
Physiographic Region	Blue Ridge				
Ecoregion	Southern Crystalline Ridges and Mountains				
Project River Basin	French Broad River Basin				
USGS HUC for Project (14 digit)	06010106020040				
NCDWQ Sub-basin for Project	04-03-05				
Within extent of EEP Watershed Plan?					
WRC Class (Warm, Cool, Cold)					
% of project easement fenced or demarcated	100% Demarcated Easement Corners				
Beaver activity observed during design phase?	None within project site				
Restoration Component Attribute Table					
	Morgan	North	Lower North	Middle	South
Drainage area (mi^2)	0.71	0.12	0.18	0.004	0.006
Stream order	Second	First	First	First	First
Restored length (feet)	2890	362.5	254	-	250
Perennial or Intermittent	Perennial	Perennial	Perennial	Intermittent	Perennial
Watershed type	Rural	Rural	Rural	Rural	Rural
Watershed LULC Distribution (e.g.)					
Residential	15%	30%	35%	0%	0%
Ag-Row Crop	0%	0%	0%	0%	0%
Ag-Livestock	35%	0%	0%	65%	55%
Forested	50%	70%	65%	35%	45%
Watershed impervious cover (%)	5	5	5	0	0
NCDWQ AU/Index number	5-32-7				
NCDWQ classification	C	C	C	C	C
303d listed?	No				
Upstream of a 303d listed segment?	Yes				
Reasons for 303d listing or stressor	non-point urban and agricultural runoff, agricultural activities				
Total acreage of easement	10.25				
Total vegetated acreage within easement	9.8				
Total planted acreage as part of the restoration	9.5				
Rosgen classification of pre-existing	C4b, G4	A4	A4	G4	F4
Rosgen classification of As-Built	B4	B4a	B4	B4a	B4a
Valley type	II	II	II	II	II
Valley slope	0.0376	0.0515	0.0365	0.118	0.1271
Valley side slope range	4% - 44%				
Valley toe slope range	4.5% - 8%				
Cowardin classification	N/A				
Trout waters designation	N/A				
Species of concern, endangered?	small whorled pagonia, Indiana and Gray bat				
Dominant soil series and characteristics	CxA	EvE, SdD, CxA	CxA	HaD2	FnE2, HaD2
Series	Cullowhee-Nikwasi	Evard-Cowee, Saunook	Cullowhee-Nikwasi	Hayesville Clay Loam	Fannin Loam
Depth (in)	0-65	0-72, 0-65	0-65	0-60	0-61
Clay %	-	-	-	-	0-35
K	mod. rapid - rapid	moderate - mod. rapid	moderately rapid	moderate	moderate
T	-	-	-	-	-

Exhibit Table 5a. - Baseline Stream Data Summary

Morgan Creek Restoration Site - Morgan Creek (3031 ft)

Parameter	Gauge	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			As-Built / Baseline					
Simension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)							15.2						23.4				13.4	15.2	15.4	13.8		15	16.5		
Floodprone Width (ft)							50				43		48	52			28	30	32	33		36	63		
Bankfull Mean Depth (ft)							0.64				1.3		1.48	1.5			0.84	0.95	0.96	0.8		0.9	1.1		
[1]Bankfull Max Depth (ft)							1.2						2.2				1.15	1.28	1.3	1.1		1.3	1.7		
Bankfull Cross-Sectional Area (ft2)							9.5						34.6				11.3	14.4	14.8	10.2		13.3	18.7		
Width/Depth Ratio							23.7						15.8					16		14.5		16.9	17.9		
Entrenchment Ratio							3.3						2.2				1.4		3	2.2		2.4	4.2		
[1]Bank Height Ratio							1.8						1.5					1				1			
d50 (mm)							58						45												
Profile																									
Riffle Length (ft)											20		28	40			14	17	21	12		19	31		
Riffle Slope (ft/ft)							0.0312				0.015		0.025	0.043			0.027	0.038	0.043	0.0245		0.0375	0.0588		
Pool Length (ft)											6		18	42			4	6	11	7		11.7	20		
Pool Max Depth (ft)							1.2						2.3				1.7	1.9	2	2.5		2.6	3		
Pool Spacing (ft)					52			485			51		87	113			26.8	45.6	77	36		51	77		
[2]Pool Volume (ft3)																									
Pattern																									
Channel Beltwidth (ft)					80			190					43				17	23	32	25		28	35		
Radius of Curvature (ft)					32			75			44		75	103			28	36	68	28		36	68		
Radius of Curvature Ratio (ft/ft)					2.1			4.9					3.2				2.08	2.36	4.28	1.87		2.4	4.53		
Meander Wavelength (ft)							200						100				69	86	120	69		86	120		
Meander Width Ratio (ft/ft)					5			13					1.8				1.1	1.5	2.1	4.6		5.73	8		
Substrate, bed and transport parameters																									
[4]Ri% / Ru% / P% / G% / S%											29		29		21	21				36	25	26		13	
[4]SC% / Sa% / G% / C% / B% / Be%					5	26	51	17	0	1	1	10	48	41	0	1									
[4]d16 / d35 / d50 / d84 / d95 / dip / disp (mm)					0.32	5.37	16.7	69	119		5.2	22	45	130	190										
Reach Shear Stress (competency) lb/ft2																	1.52	2.08	2.1						
Max part size (mm) mobilized at bankfull																		650							
Stream Power (transport capacity) W/m2																									
Additional Reach Parameters																									
Drainage Area (sq mi)							0.47						2.77												
Impervious cover estimate (%)																									
Rosgen Classification							C4b						B4					B4		B4		B4	B4a		
Bankfull Velocity (fps)							7.2											4.5							
Bankfull discharge (cfs)							68																		
Valley length (ft)																									
Channel Thalweg length (ft)																		2912				2890			
Sinuosity (ft)							1.12						1.05				1.01	1.02	1.07			1.05			
Water Surface Slope (channel) (ft/ft)							0.036						0.0238				0.027	0.038	0.043	0.0253		0.0297	0.0528		
BF slope (ft/ft)							0.037						0.024				0.028	0.038	0.043	0.0236		0.0297	0.0527		
[5]Bankfull Floodplain Area (acres)																									
[6]Proportion Overwide (%)																									
[7]Entrenchment Class (ER Range)																									
[8]Incision Class (BHR Ranch)																									
BEHI VL% / L% / M% / H% / VH% / E%																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Exhibit Table 5b. - Baseline Stream Data Summary

Morgan Creek Restoration Site - North Branch (415 ft)

Parameter	Gauge	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			As-Built / Baseline					
Simension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)							7.1						8					8.5				9.4			
Floodprone Width (ft)							14						11.6					18.5				21			
Bankfull Mean Depth (ft)							1						0.52					0.53				0.5			
[1]Bankfull Max Depth (ft)							1.5						0.77					0.72				0.9			
Bankfull Cross-Sectional Area (ft2)							6.9						4.2					4.48				5			
Width/Depth Ratio							7.1						15.4					16.1				17.7			
Entrenchment Ratio							2						1.45				1.4	2.2	3			2.23			
[1]Bank Height Ratio							1.5						1					1				1			
d50 (mm)							27						27												
Profile																									
Riffle Length (ft)																	7	9	12	4		7	12.5		
Riffle Slope (ft/ft)							0.078						0.142				0.0444	0.0482	0.0619	0.036		0.056	0.09		
Pool Length (ft)																	3	4	7	5.2		6.5	9		
Pool Max Depth (ft)							1.5						0.95					1.1				1.9			
Pool Spacing (ft)							95						68				17		26	17		22	25		
[2]Pool Volume (ft3)																									
Pattern																									
Channel Beltwidth (ft)							23						17				13	17	19	11		13	13		
Radius of Curvature (ft)					5			14					13				17		26	17		22	26		
Radius of Curvature Ratio (ft/ft)					0.7			2					1.6				2		3	1.8		2.3	2.8		
Meander Wavelength (ft)							41						29				36	41	42	36		41	42		
Meander Width Ratio (ft/ft)							3.2						2.1				1.5		3	2.8		4.4	4.5		
Substrate, bed and transport parameters																									
[4]Ri% / Ru% / P% / G% / S%																				31	29	26		14	
[4]SC% / Sa% / G% / C% / B% / Be%					5	26	51	17	0	1	1	10	48	41	0	1									
[4]d16 / d35 / d50 / d84 / d95 / dip / disp (mm)					0.32	5.37	16.7	69	119		5.2	22	45	130	190										
Reach Shear Stress (competency) lb/ft2																		1.69							
Max part size (mm) mobilized at bankfull																		500							
Stream Power (transport capacity) W/m2																									
Additional Reach Parameters																									
Drainage Area (sq mi)							0.12						0.1												
Impervious cover estimate (%)																									
Rosgen Classification							A4						B4a					B4a				B4a			
Bankfull Velocity (fps)							3.8											4.5							
Bankfull discharge (cfs)							26																		
Valley length (ft)																									
Channel Thalweg length (ft)																		368				362.5			
Sinuosity (ft)							1.05						1.07					1.02				1.06			
Water Surface Slope (channel) (ft/ft)							0.078						0.126					0.0538				0.0528			
BF slope (ft/ft)							0.051						0.135					0.051				0.0524			
[5]Bankfull Floodplain Area (acres)																									
[6]Proportion Overwide (%)																									
[7]Entrenchment Class (ER Range)																									
[8]Incision Class (BHR Ranch)																									
BEHI VL% / L% / M% / H% / VH% / E%																									
Channel Stability or Habitat Metric																									
Biological or Other																									

APPENDIX B

AS-BUILT DRAWINGS

Wolf Creek Engineering
ENGINEERING & ENVIRONMENTAL CONSULTING
30 Ben Lippen School Road Asheville, NC 28806
PHONE: (828) 505-2186 WWW.WOLFCREEKENG.COM

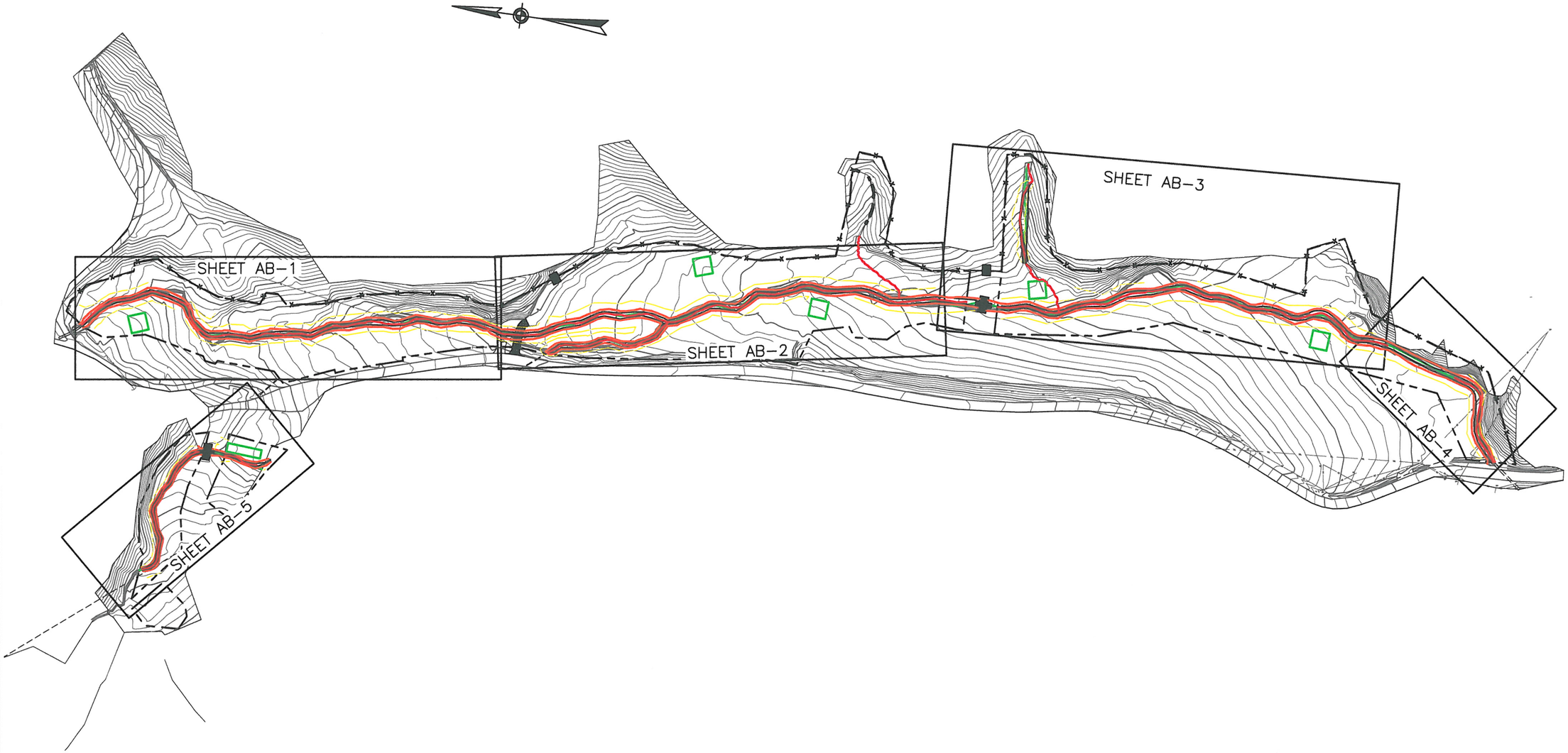
PROJECT: MORGAN CREEK RESTORATION PROJECT
OWNER: RESTORATION SYSTEMS, INC

TITLE: **AS-BUILT SHEET INDEX**

SCALE	DSGN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	cme	1026	AB-0
DATE 2/18/09	CHKD. BY SGG		

DATE	BY	REV.	DESCRIPTION

NORTH CAROLINA PROFESSIONAL SEAL 021767 ENGINEER S. GRANT GINN 2-18-09



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SCALE IN FEET

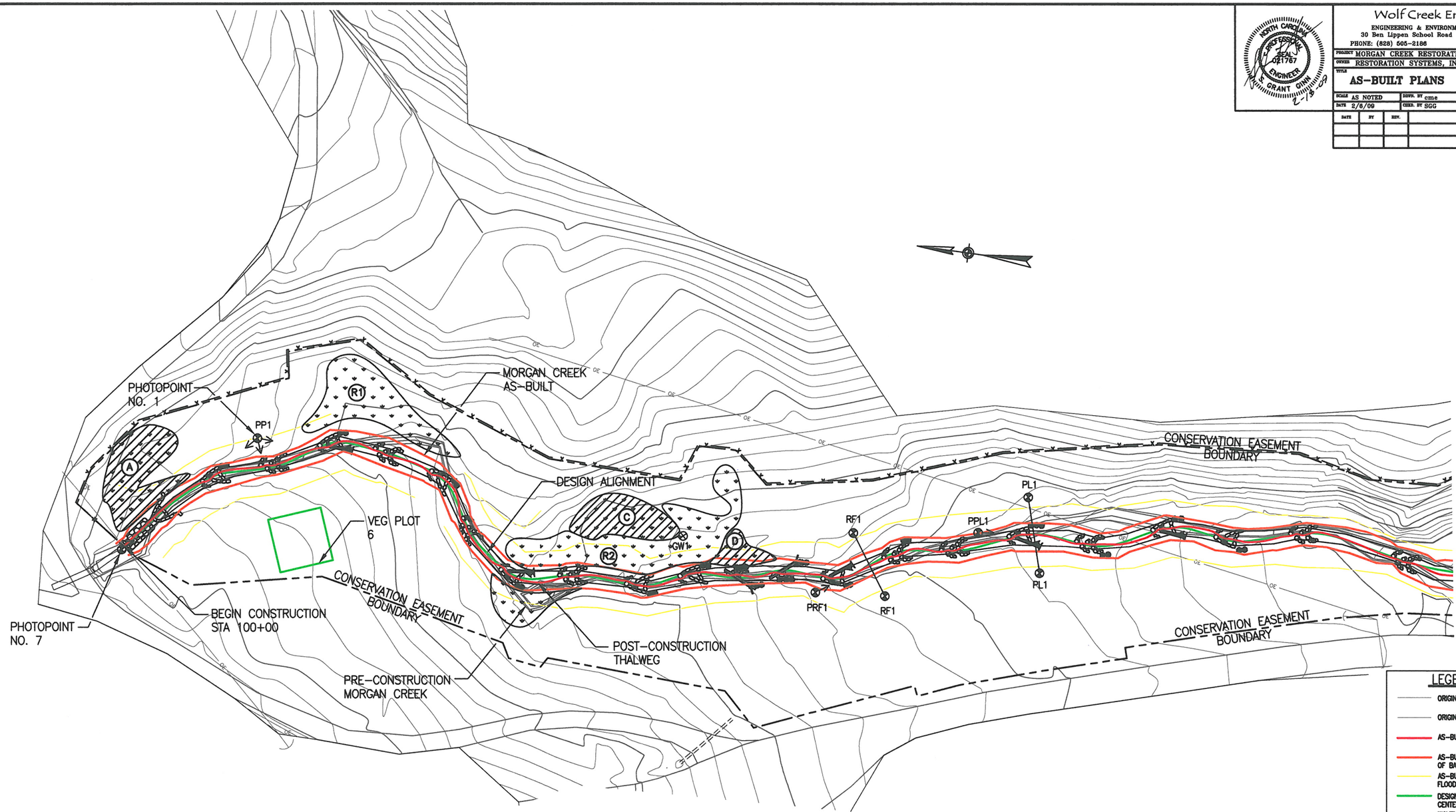
Wolf Creek Engineering
ENGINEERING & ENVIRONMENTAL CONSULTING
30 Ben Lippen School Road Asheville, NC 28806
PHONE: (828) 505-2186 WWW.WOLFCREEKENG.COM

NORTH CAROLINA PROFESSIONAL SEAL 021767 ENGINEER R. GRANT GINN 2-9-09

PROJECT: MORGAN CREEK RESTORATION PROJECT
OWNER: RESTORATION SYSTEMS, INC.
TITLE: **AS-BUILT PLANS**

SCALE	DSNR. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	cme	1026	AB-1
DATE 2/6/09	CHKD. BY SGG		

DATE	BY	REV.	DESCRIPTION



POINT NO.	POINT DESCRIPTION	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
PP1	PHOTOPOINT NO. 1	729156.17	826117.25	2605.55
PRF 1	PHOTOPOINT RIFFLE	728807.03	826071.48	2583.49
RF1 LT	RIFFLE X.S.	728789.03	826110.51	2584.68
RF1 RT	RIFFLE X.S.	728764.74	826075.17	2581.69
PPL 1	PHOTOPOINT POOL	728713.94	826121.16	2578.04
PL1 LT	POOL X.S.	728686.50	826146.71	2578.57
PL1 RT	POOL X.S.	728673.40	826102.02	2578.35
PP7	PHOTOPOINT NO. 7	728228.60	826038.00	2587.80
GW1	GROUNDWATER GAUGE 1	728691.56	826094.25	2587.50

30 0 30 90
SCALE IN FEET

LEGEND
- ORIGINAL CHANNEL
- ORIGINAL CONTOUR
- AS-BUILT THALWEG
- AS-BUILT TOP OF BANK
- AS-BUILT FLOODPLAIN
- DESIGN CHANNEL CENTERLINE
- WOVEN WIRE FENCE W/ ONE STRAND B/W
- WETLAND RESTORATION
- WETLAND ENHANCEMENT
- LOG VANE
- LOG CROSS VANE
- ROCK CROSS VANE
- BOULDER RUN
- LOG VANE RUN
- DOUBLE HOOK RUN
- IRON ROD
- GAUGE

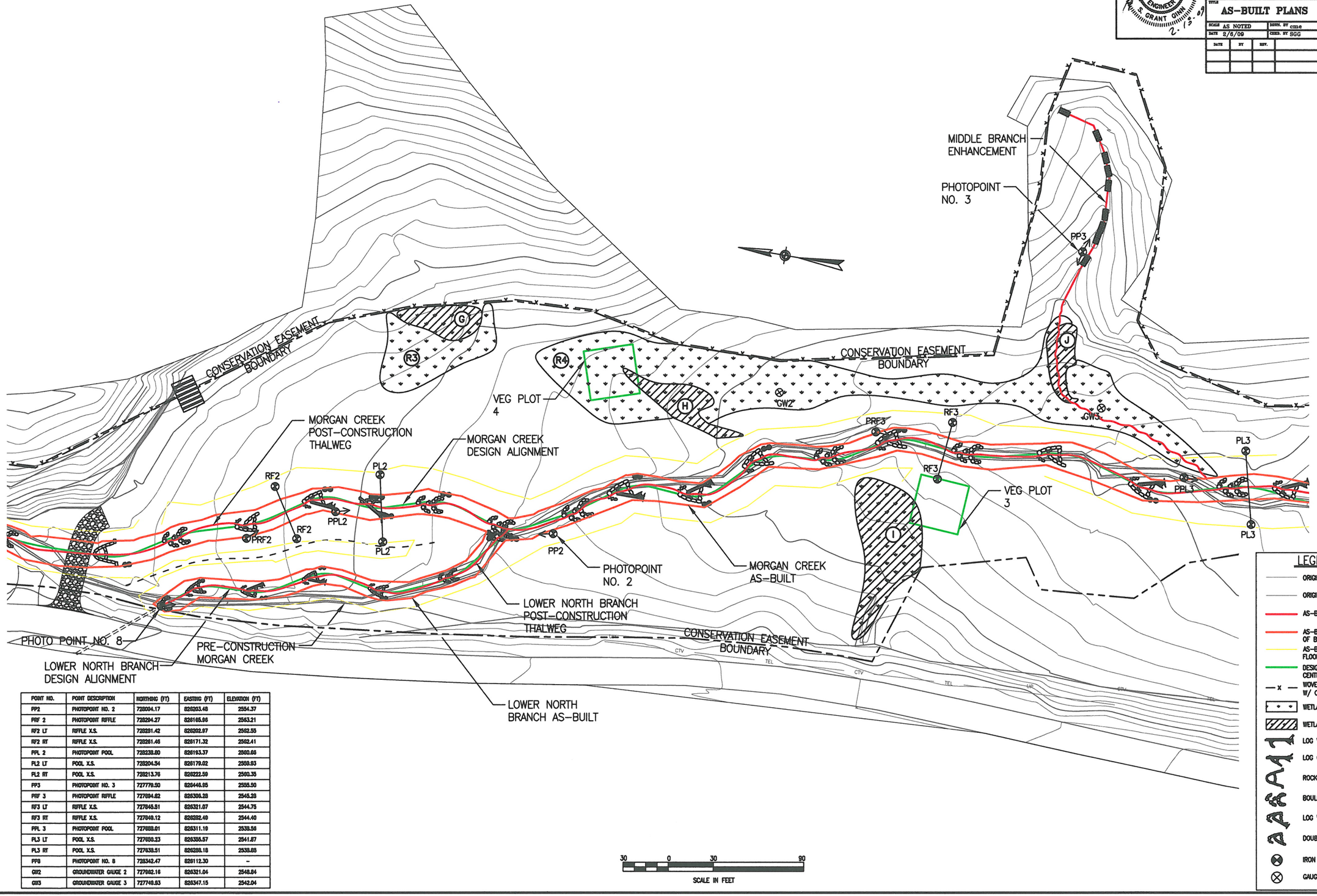
Wolf Creek Engineering
ENGINEERING & ENVIRONMENTAL CONSULTING
30 Ben Lippen School Road Asheville, NC 28806
PHONE: (828) 505-2186 WWW.WOLFCREEKENG.COM

NORTH CAROLINA PROFESSIONAL SEAL 021767 ENGINEER S. GRANT GINN 2-19-09

PROJECT: MORGAN CREEK RESTORATION PROJECT
OWNER: RESTORATION SYSTEMS, INC.
TITLE: **AS-BUILT PLANS**

SCALE	DRWN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	cme	1026	AB-2
DATE 2/6/09	CHKD. BY SGG		

DATE	BY	REV.	DESCRIPTION



POINT NO.	POINT DESCRIPTION	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
PP2	PHOTOPOINT NO. 2	728094.17	826203.48	2554.37
PRF 2	PHOTOPOINT RIFFLE	728294.27	826165.96	2563.21
RF2 LT	RIFFLE X.S.	728291.42	826202.97	2562.55
RF2 RT	RIFFLE X.S.	728261.46	826171.32	2562.41
PPL 2	PHOTOPOINT POOL	728238.80	826193.37	2560.66
PL2 LT	POOL X.S.	728204.54	826179.02	2559.93
PL2 RT	POOL X.S.	728213.76	826222.59	2560.35
PP3	PHOTOPOINT NO. 3	727779.50	826446.95	2555.50
PRF 3	PHOTOPOINT RIFFLE	727694.62	826306.28	2545.28
RF3 LT	RIFFLE X.S.	727645.51	826321.07	2544.75
RF3 RT	RIFFLE X.S.	727648.12	826282.49	2544.40
PPL 3	PHOTOPOINT POOL	727638.01	826311.19	2538.56
PL3 LT	POOL X.S.	727630.23	826356.57	2541.67
PL3 RT	POOL X.S.	727633.51	826288.16	2538.65
PP8	PHOTOPOINT NO. 8	728342.47	826112.30	–
GW2	GROUNDWATER GAUGE 2	727982.16	826321.04	2548.84
GW3	GROUNDWATER GAUGE 3	727749.93	826347.15	2542.04

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NORTH CAROLINA PROFESSIONAL SEAL 021767 ENGINEER S. GRANT GINN 2-13-09

PROJECT: MORGAN CREEK RESTORATION PROJECT
OWNER: RESTORATION SYSTEMS, INC.
TITLE: **AS-BUILT PLANS**

SCALE	DESIGN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	cme	1026	AB-3
DATE 2/6/09	CHECK. BY SGG		

DATE	BY	REV.	DESCRIPTION

SOUTH BRANCH DESIGN ALIGNMENT
PHOTOPOINT NO. 4
PRE-CONSTRUCTION SOUTH BRANCH
SOUTH BRANCH AS-BUILT
SOUTH BRANCH POST-CONSTRUCTION THALWEG
PRE-CONSTRUCTION MORGAN CREEK
CONSERVATION EASEMENT BOUNDARY
PHOTOPOINT NO. 5
VEG PLOT 2
PHOTOPOINT NO. 9
DESIGN ALIGNMENT
POST-CONSTRUCTION THALWEG
MORGAN CREEK AS-BUILT
CONSERVATION EASEMENT BOUNDARY
VEG PLOT 1

POINT NO.	POINT DESCRIPTION	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
PP4	PHOTOPOINT NO. 4	727502.10	628516.81	2552.59
PRF 4	PHOTOPOINT RIFFLE	727161.40	628411.45	2522.38
RF4 LT	RIFFLE X.S.	727138.65	628423.48	2522.86
RF4 RT	RIFFLE X.S.	727151.52	628379.28	2522.60
PPL 4	PHOTOPOINT POOL	-	-	-
PL4 LT	POOL X.S.	726942.40	628397.15	2515.67
PL4 RT	POOL X.S.	726931.51	628354.84	2515.99
PP5	PHOTOPOINT NO. 5	726837.41	628385.98	2514.40
PP9	PHOTOPOINT NO. 9	727536.85	628317.72	-

30 0 30 90
SCALE IN FEET

LEGEND
- ORIGINAL CHANNEL
- ORIGINAL CONTOUR
- AS-BUILT THALWEG
- AS-BUILT TOP OF BANK
- AS-BUILT FLOODPLAIN
- DESIGN CHANNEL CENTERLINE
- WOVEN WIRE FENCE W/ ONE STRAND B/W
- WETLAND RESTORATION
- WETLAND ENHANCEMENT
- LOG VANE
- LOG CROSS VANE
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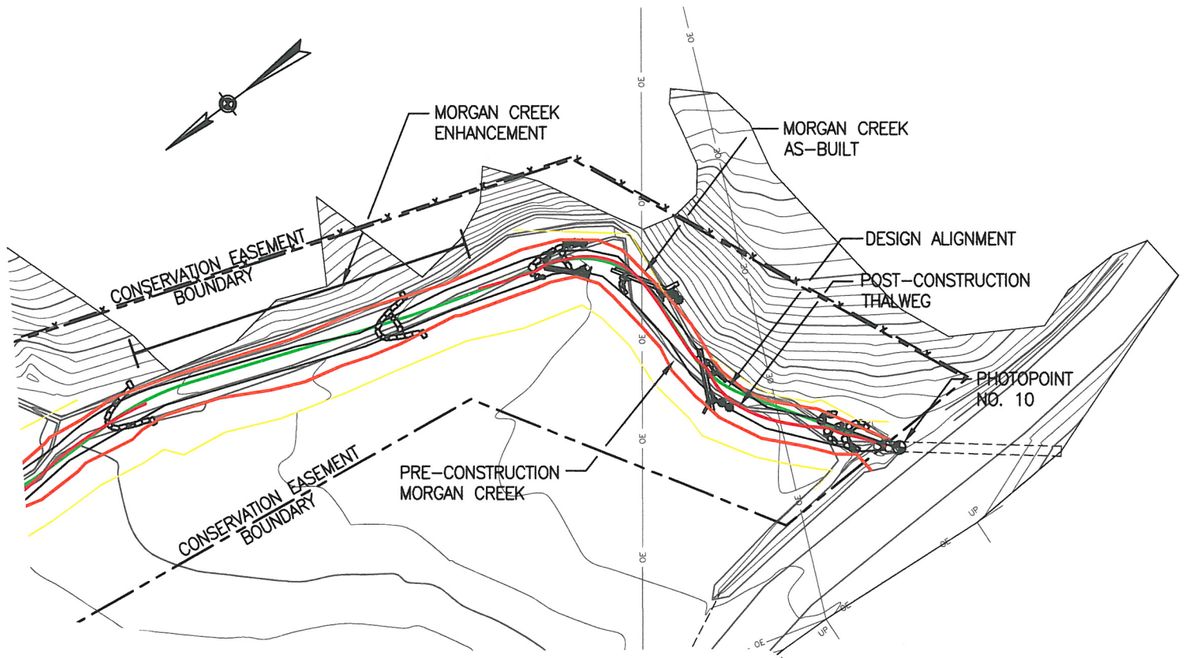
NORTH CAROLINA PROFESSIONAL SEAL 021767 ENGINEER S. GRANT GINN 2-13-09

PROJECT: MORGAN CREEK RESTORATION PROJECT
OWNER: RESTORATION SYSTEMS, INC.
TITLE: **AS-BUILT PLANS**

SCALE	DSWN. BY	PROJECT NO.	SHEET NUMBER
AS NOTED	cme	1026	AB-4
DATE 2/6/09	CHKD. BY SGG		

DATE	BY	REV.	DESCRIPTION



PP10	PHOTOPOINT NO. 10	726527.45	828153.34	-

LEGEND

- ORIGINAL CHANNEL
- ORIGINAL CONTOUR
- AS-BUILT THALWEG
- AS-BUILT TOP OF BANK
- AS-BUILT FLOODPLAIN
- DESIGN CHANNEL CENTERLINE
- WOVEN WIRE FENCE W/ ONE STRAND B/W
- WETLAND RESTORATION
- WETLAND ENHANCEMENT
- LOG VANE
- LOG CROSS VANE
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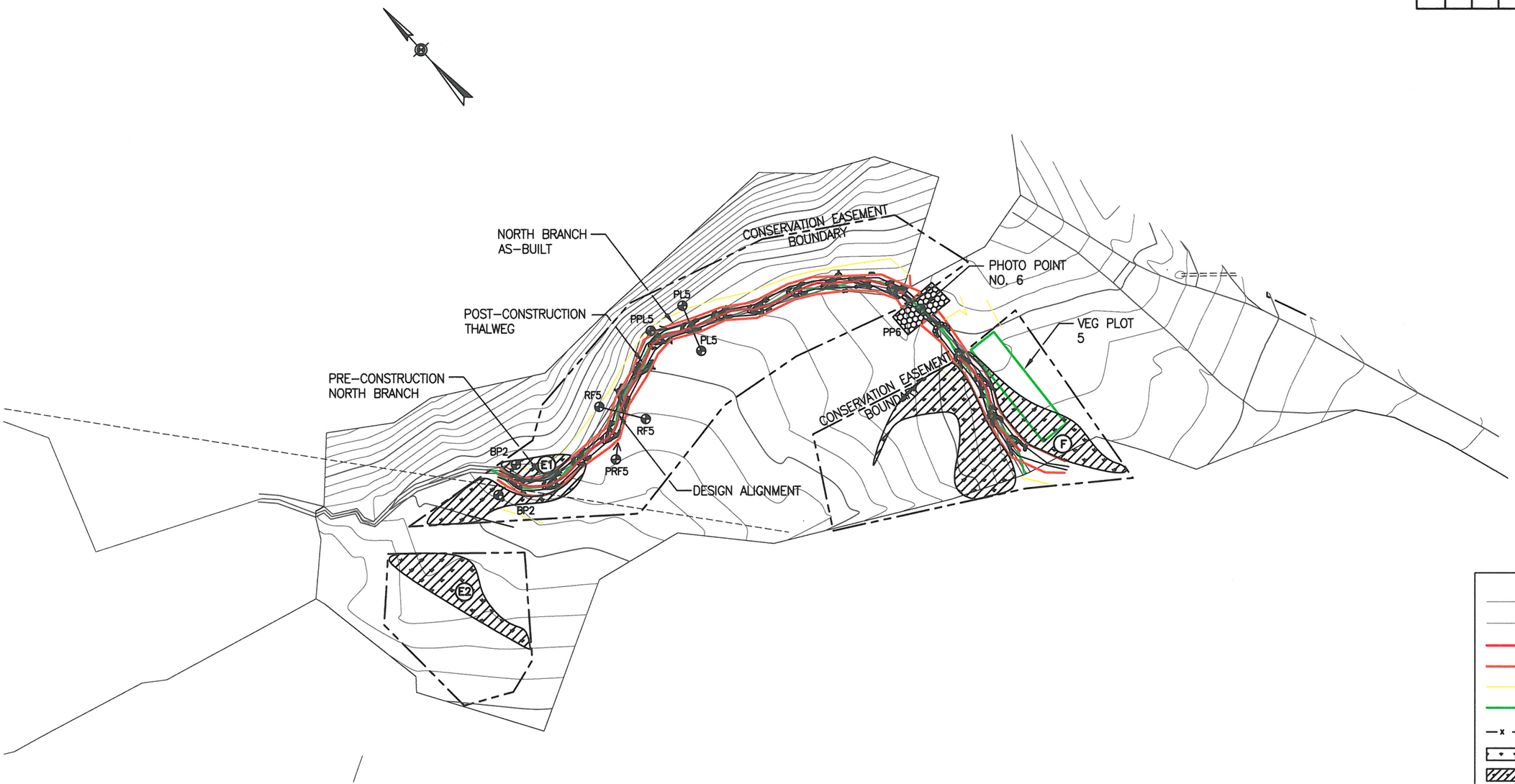
NORTH CAROLINA PROFESSIONAL SEAL 021767 ENGINEER S. GRANT GINN 2-13-09

PROJECT: MORGAN CREEK RESTORATION PROJECT
OWNER: RESTORATION SYSTEMS, INC.
TITLE: **AS-BUILT PLANS**

SCALE	DESIGN BY	PROJECT NO.	SHEET NUMBER
AS NOTED	cme	1026	AB-5
DATE 2/6/09	CHKD. BY SGG		

DATE	BY	REV.	DESCRIPTION



POINT NO.	POINT DESCRIPTION	NORTHING (FT)	EASTING (FT)	ELEVATION (FT)
BP2 LT	BEGIN PROFILE	729047.60	825608.04	2616.10
BP2 RT	BEGIN PROFILE	729041.62	825589.22	2617.00
PRF 5	PHOTOPOINT RIFFLE	729011.82	825651.74	2614.40
RF5 LT	RIFFLE X.S.	729030.97	825684.74	2612.59
RF5 RT	RIFFLE X.S.	729017.39	825679.44	2613.46
PPL 5	PHOTOPOINT POOL	729052.16	825714.81	2609.26
PL5 LT	POOL X.S.	729050.69	825737.44	2609.77
PL5 RT	POOL X.S.	729024.76	825728.27	2610.39
PP6	PHOTOPOINT NO. 6	728956.37	825636.00	-

30 0 30 90
SCALE IN FEET

LEGEND
- ORIGINAL CHANNEL
- ORIGINAL CONTOUR
- AS-BUILT THALWEG
- AS-BUILT TOP OF BANK
- AS-BUILT FLOODPLAIN
- DESIGN CHANNEL CENTERLINE
- WOVEN WIRE FENCE W/ ONE STRAND B/W
- WETLAND RESTORATION
- WETLAND ENHANCEMENT
- LOG VANE
- LOG CROSS VANE
- ROCK CROSS VANE
- BOULDER RUN
- LOG VANE RUN
- DOUBLE HOOK RUN
- IRON ROD
- GAUGE

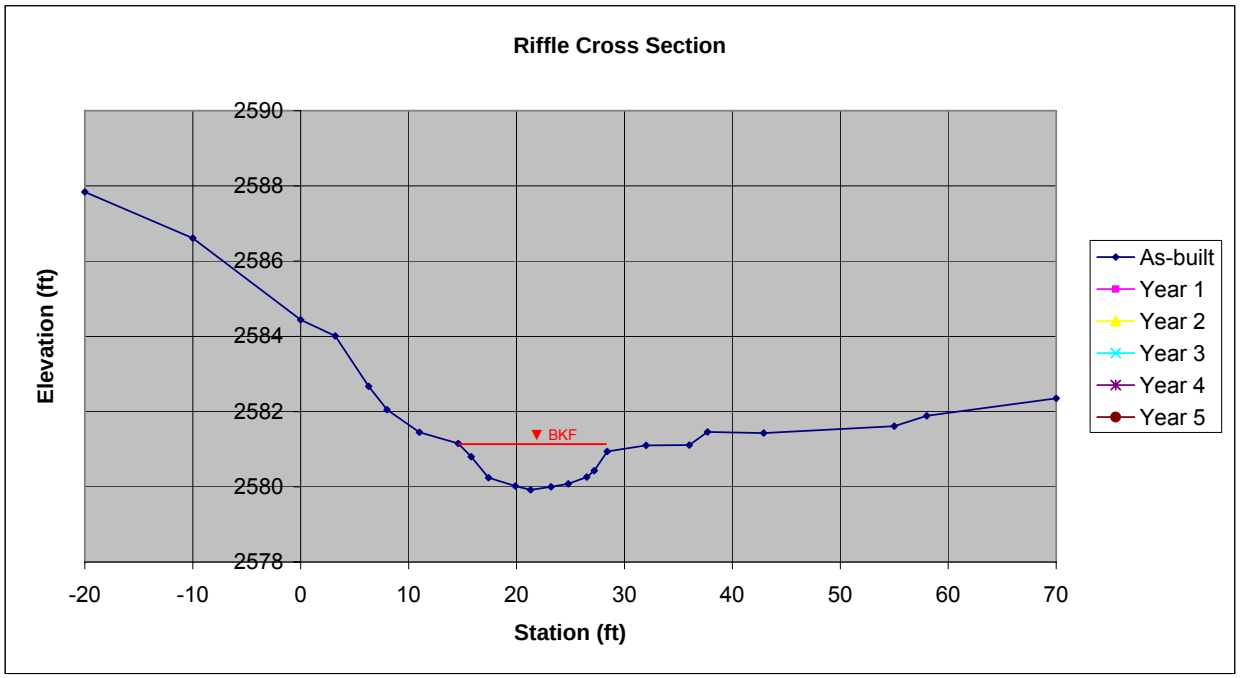
APPENDIX C

BASELINE MONITORING DATA

Morgan Creek Stream Restoration Site
Haywood County, NC
Riffle Cross Section RF1
Reach 1 - Morgan Creek - Sta 15+21.4

Year 0

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	1/8/09	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0
Area	12.2	Area	0.0	Area	0.0	Area	0.0	Area	0.0	Area	0.0
Bkf W	13.8	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10
Dmean	0.9	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0
Dmax	1.2	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0
W/d	15.6	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0

Morgan Creek Stream Restoration Site
Haywood County, NC
Riffle Cross Section RF1
Reach 1 - Morgan Creek - Sta 15+21.4

As-Built

Station	FS/BS	Elev.	Desc.
BM	5.53	2584.66	RF1 IR Lt
HI		2590.19	
-20	2.35	2587.84	
-10	3.58	2586.61	
0	5.75	2584.44	GRND
3.2	6.18	2584.01	
6.3	7.52	2582.67	
8	8.14	2582.05	
11	8.74	2581.45	
14.6	9.04	2581.15	BKF LT
15.8	9.39	2580.80	
17.4	9.95	2580.24	EOW LT
19.9	10.17	2580.02	
21.3	10.27	2579.92	
23.2	10.19	2580.00	
24.8	10.11	2580.08	
26.5	9.93	2580.26	EOW RT
27.2	9.76	2580.43	
28.4	9.25	2580.94	BKF RT
32	9.09	2581.10	
36	9.08	2581.11	
37.7	8.73	2581.46	
42.9	8.76	2581.43	GRND
55	8.58	2581.61	
58	8.30	2581.89	
70	7.84	2582.35	

Year 1

Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 2

Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 3

Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 4

Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

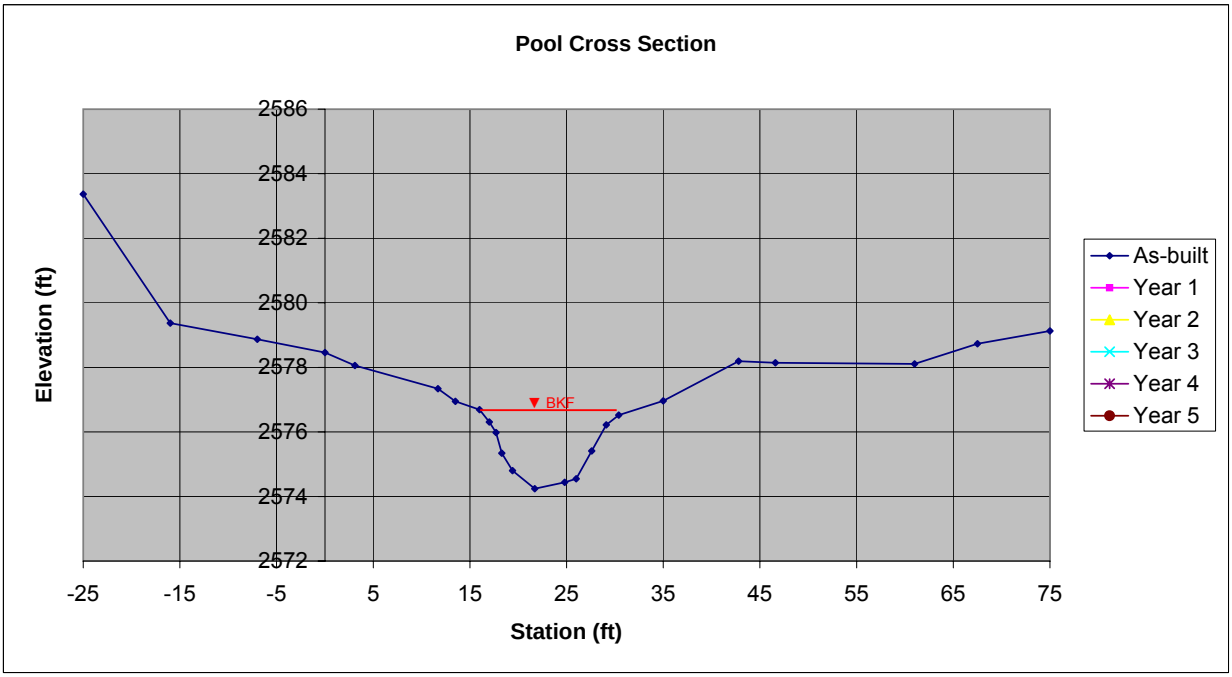
Year 5

Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Morgan Creek Stream Restoration Site
Haywood County, NC
Pool Cross Section PL1
Reach 1 - Morgan Creek - Sta 16+28.6

Year 0

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	1/8/09	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0
Area	22.5	Area	0.0	Area	0.0	Area	0.0	Area	0.0	Area	0.0
Bkf W	14.4	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10
Dmean	1.6	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0
Dmax	2.5	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0
W/d	9.2	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0

Morgan Creek Stream Restoration Site
Haywood County, NC
Pool Cross Section PL1
Reach 1 - Morgan Creek - Sta 16+28.6

As-Built			
Station	FS/BS	Elev.	Desc.
BM	5.53	2584.66	RF1 IR Rt
HI		2590.19	
-25	6.82	2583.37	
-16	10.82	2579.37	
-7	11.32	2578.87	
0	11.73	2578.46	GRND
3.1	12.13	2578.06	
11.7	12.85	2577.34	
13.5	13.24	2576.95	
16	13.50	2576.69	BKF LT
17	13.88	2576.31	
17.7	14.21	2575.98	
18.3	14.85	2575.34	EOW
19.4	15.39	2574.80	
21.7	15.95	2574.24	
24.8	15.75	2574.44	
26	15.64	2574.55	
27.6	14.78	2575.41	EOW
29.1	13.97	2576.22	
30.4	13.67	2576.52	BKF RT
35	13.23	2576.96	
42.8	12.00	2578.19	
46.6	12.05	2578.14	GRND
61	12.08	2578.11	
67.5	11.46	2578.73	
75	11.06	2579.13	

Year 1			
Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 2			
Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 3			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

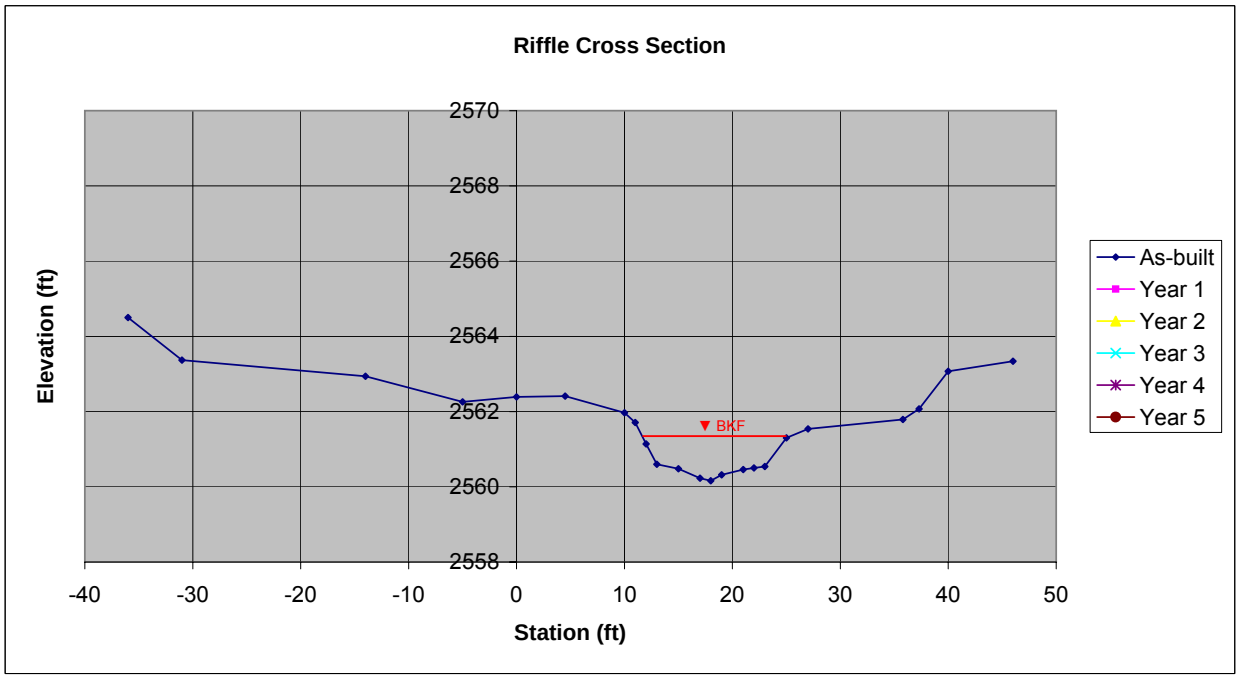
Year 4			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 5			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Morgan Creek Stream Restoration Site
Haywood County, NC
Riffle Cross Section RF2
Reach 1 - Morgan Creek - Sta 20+74.6

Year 0

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	1/8/09	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0
Area	10.2	Area	0.0	Area	0.0	Area	0.0	Area	0.0	Area	0.0
Bkf W	13.5	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10
Dmean	0.8	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0
Dmax	1.1	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0
W/d	17.9	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0

Morgan Creek Stream Restoration Site
Haywood County, NC
Riffle Cross Section RF2
Reach 1 - Morgan Creek - Sta 20+74.6

As-Built

Station	FS/BS	Elev.	Desc.
BM	7.72	2562.55	RF2 IR Lt
HI		2570.27	
-36	5.77	2564.50	
-31	6.90	2563.37	
-14	7.33	2562.94	
-5	8.01	2562.26	
0	7.88	2562.39	GRND
4.5	7.86	2562.41	
10	8.30	2561.97	BKF LT
11	8.56	2561.71	
12	9.13	2561.14	
13	9.67	2560.60	
15	9.79	2560.48	EOW LT
17	10.04	2560.23	
18	10.11	2560.16	
19	9.95	2560.32	
21	9.81	2560.46	EOW RT
22	9.77	2560.50	
23	9.73	2560.54	
25	8.97	2561.30	BKF RT
27	8.73	2561.54	
35.8	8.48	2561.79	
37.3	8.20	2562.07	GRND
40	7.20	2563.07	
46	6.93	2563.34	

Year 1

Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 2

Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 3

Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 4

Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

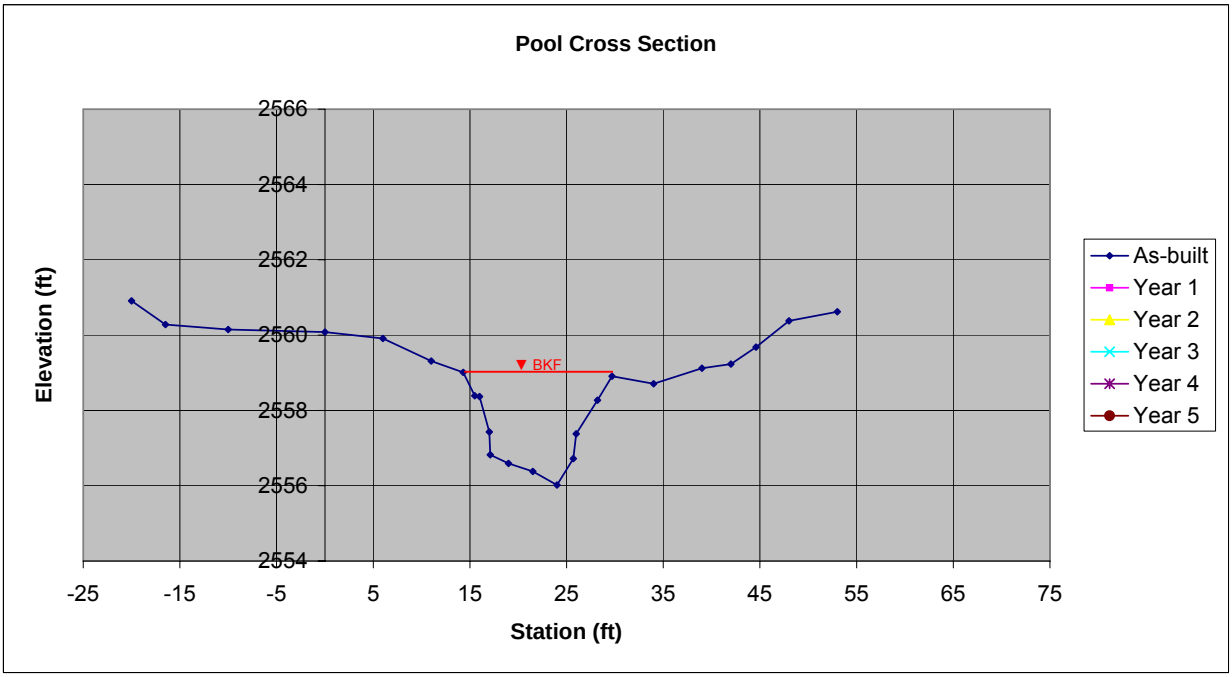
Year 5

Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Morgan Creek Stream Restoration Site
Haywood County, NC
Pool Cross Section PL2
Reach 1 - Morgan Creek - Sta 21+44

Year 0

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	1/8/09	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0
Area	28.0	Area	0.0	Area	0.0	Area	0.0	Area	0.0	Area	0.0
Bkf W	15.4	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10
Dmean	1.8	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0
Dmax	3.0	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0
W/d	8.5	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0

Morgan Creek Stream Restoration Site
Haywood County, NC
Pool Cross Section PL2
Reach 1 - Morgan Creek - Sta 21+44

As-Built			
Station	FS/BS	Elev.	Desc.
BM	7.72	2562.55	RF2 IR Lt
HI		2570.27	
-20	9.36	2560.91	
-16.5	9.99	2560.28	
-10	10.12	2560.15	
0	10.19	2560.08	GRND
6	10.36	2559.91	
11	10.96	2559.31	
14.3	11.26	2559.01	BKF LT
15.5	11.88	2558.39	
16	11.90	2558.37	
17	12.84	2557.43	EOW
17.1	13.45	2556.82	
19	13.68	2556.59	
21.5	13.89	2556.38	
24	14.25	2556.02	
25.7	13.55	2556.72	
26	12.89	2557.38	EOW
28.2	12.00	2558.27	
29.7	11.36	2558.91	BKF RT
34	11.56	2558.71	
39	11.15	2559.12	
42	11.04	2559.23	
44.6	10.59	2559.68	GRND
48	9.89	2560.38	
53	9.65	2560.62	

Year 1			
Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 2			
Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 3			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

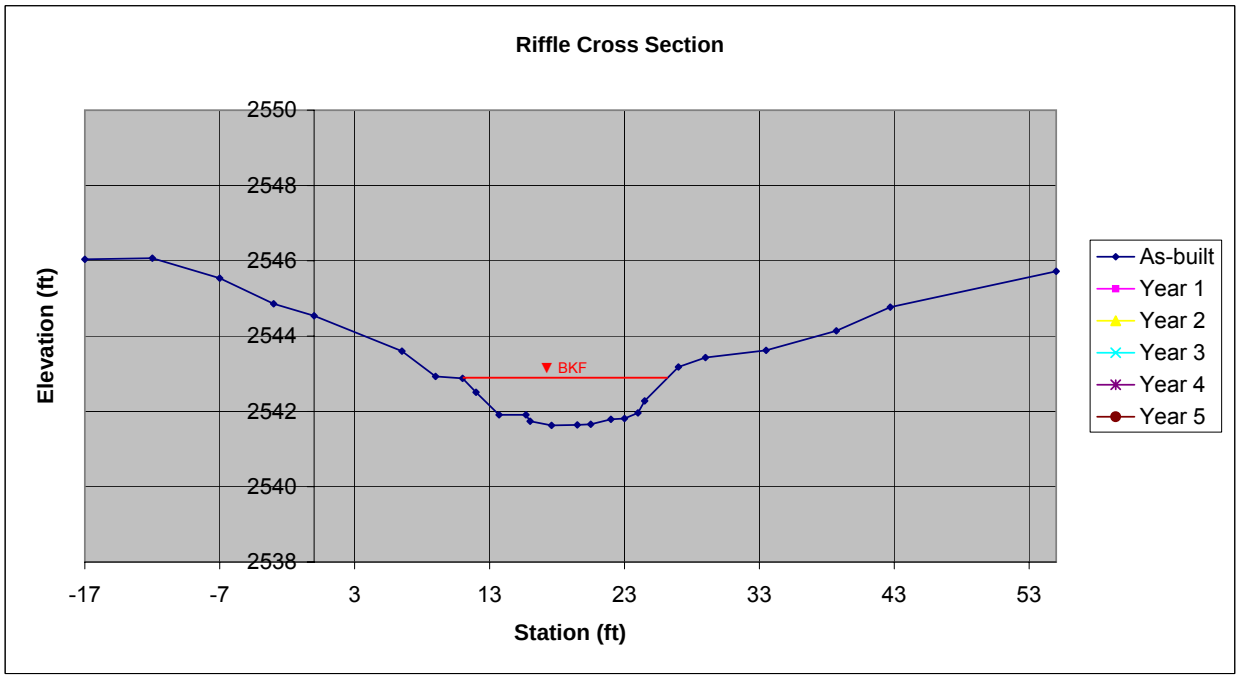
Year 4			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 5			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Morgan Creek Stream Restoration Site
Haywood County, NC
Riffle Cross Section RF3
Reach 1 - Morgan Creek - Sta 25+60.4

Year 0

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	1/8/09	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0
Area	13.3	Area	0.0	Area	0.0	Area	0.0	Area	0.0	Area	0.0
Bkf W	15	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10
Dmean	0.9	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0
Dmax	1.3	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0
W/d	16.9	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0

Morgan Creek Stream Restoration Site
Haywood County, NC
Riffle Cross Section RF3
Reach 1 - Morgan Creek - Sta 25+60.4

As-Built			
Station	FS/BS	Elev.	Desc.
BM	6.04	2544.75	RF3 IR Lt
HI		2550.79	
-17	4.75	2546.04	
-12	4.72	2546.07	
-7	5.25	2545.54	
-3	5.93	2544.86	
0	6.25	2544.54	GRND
6.5	7.19	2543.60	
9	7.86	2542.93	
11	7.91	2542.88	BKF LT
12	8.28	2542.51	
13.7	8.88	2541.91	
15.7	8.88	2541.91	EOW LT
16	9.05	2541.74	
17.6	9.16	2541.63	
19.5	9.15	2541.64	
20.5	9.13	2541.66	
22	9.00	2541.79	
23	8.98	2541.81	EOW RT
24	8.83	2541.96	
24.5	8.51	2542.28	
27	7.61	2543.18	BKF RT
29	7.36	2543.43	
33.5	7.17	2543.62	
38.7	6.65	2544.14	GRND
42.7	6.02	2544.77	
55	5.07	2545.72	

Year 1			
Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 2			
Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 3			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

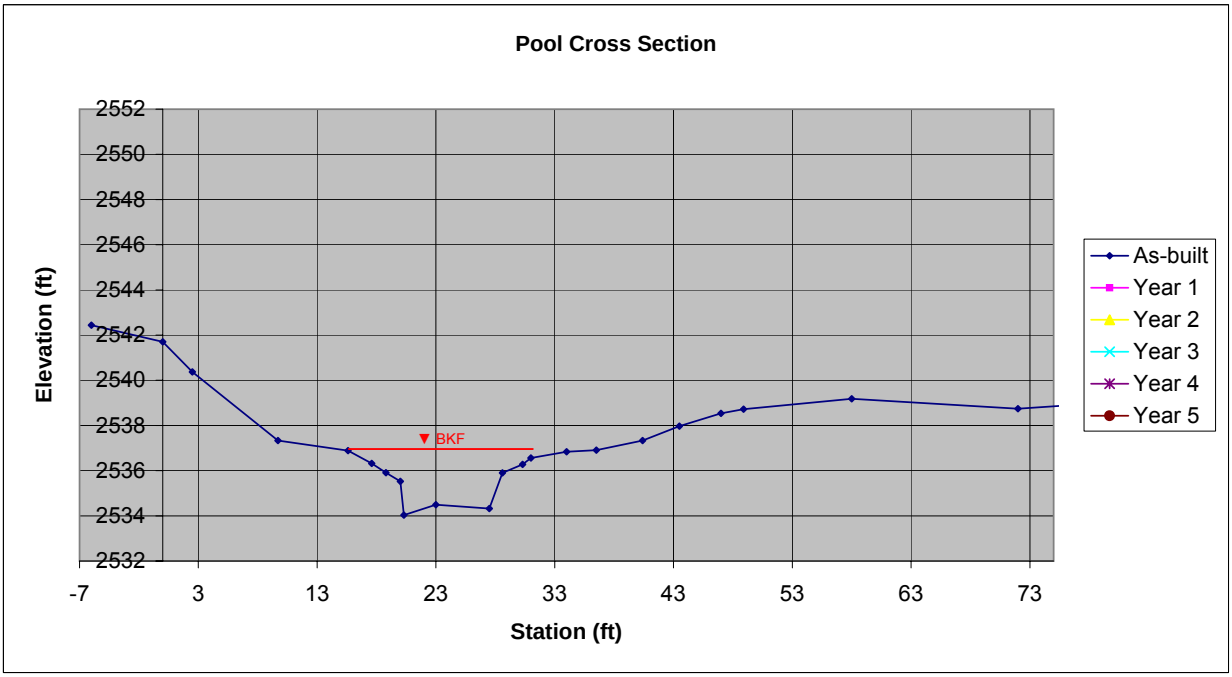
Year 4			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 5			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Morgan Creek Stream Restoration Site
Haywood County, NC
Pool Cross Section PL3
Reach 1 - Morgan Creek - Sta 27+79.7

Year 0

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	1/8/09	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0
Area	25.5	Area	0.0	Area	0.0	Area	0.0	Area	0.0	Area	0.0
Bkf W	15.4	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10
Dmean	1.7	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0
Dmax	2.9	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0
W/d	9.3	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0

Morgan Creek Stream Restoration Site
Haywood County, NC
Pool Cross Section PL3
Reach 1 - Morgan Creek - Sta 27+79.7

As-Built			
Station	FS/BS	Elev.	Desc.
BM	4.30	2541.87	PL3 IR Lt
		2546.17	
-6	3.73	2542.44	
0	4.47	2541.70	GRND
2.5	5.80	2540.37	
9.7	8.84	2537.33	
15.6	9.28	2536.89	BKF LT
17.6	9.85	2536.32	
18.8	10.26	2535.91	EOW
20	10.64	2535.53	
20.3	12.14	2534.03	
23	11.68	2534.49	
27.5	11.85	2534.32	
28.6	10.27	2535.90	EOW
30.3	9.89	2536.28	BKF RT
31	9.61	2536.56	
34	9.33	2536.84	
36.5	9.26	2536.91	
40.4	8.84	2537.33	
43.5	8.20	2537.97	
47	7.63	2538.54	
48.9	7.45	2538.72	GRND
58	6.99	2539.18	
72	7.43	2538.74	
86	6.93	2539.24	

Year 1			
Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 2			
Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 3			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

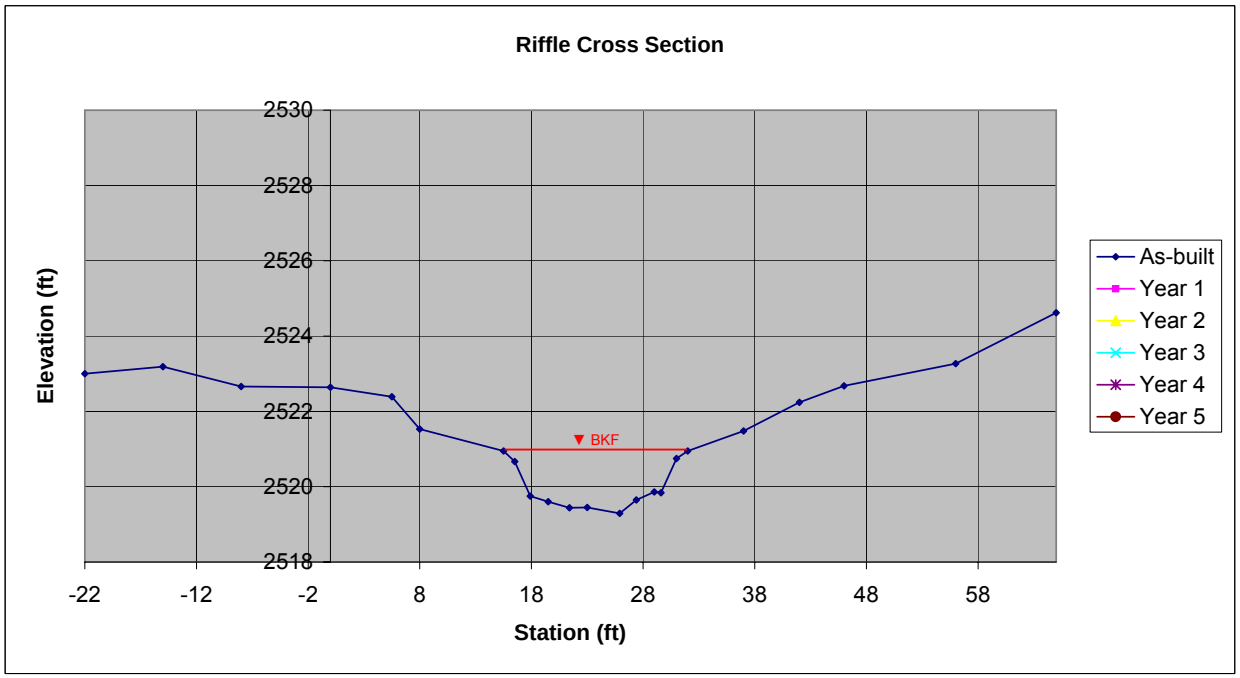
Year 4			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 5			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Morgan Creek Stream Restoration Site
Haywood County, NC
Riffle Cross Section RF4
Reach 4 - Morgan Creek - Sta 33+24.4

Year 0

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	1/8/09	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0
Area	18.7	Area	0.0	Area	0.0	Area	0.0	Area	0.0	Area	0.0
Bkf W	16.5	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10
Dmean	1.1	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0
Dmax	1.7	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0
W/d	14.5	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0

Morgan Creek Stream Restoration Site
Haywood County, NC
Riffle Cross Section RF4
Reach 4 - Morgan Creek - Sta 33+24.4

As-Built

Station	FS/BS	Elev.	Desc.
BM	6.32	2522.86	RF4 IR Lt
HI		2529.18	
-22	6.18	2523.00	
-15	5.99	2523.19	
-8	6.52	2522.66	
0	6.54	2522.64	GRND
5.5	6.79	2522.39	
8	7.65	2521.53	
15.5	8.23	2520.95	BKF LT
16.5	8.51	2520.67	
17.9	9.43	2519.75	EOW LT
19.5	9.58	2519.60	
21.4	9.74	2519.44	
23	9.73	2519.45	
25.9	9.89	2519.29	
27.4	9.53	2519.65	EOW RT
29	9.32	2519.86	
29.6	9.34	2519.84	
31	8.43	2520.75	
32	8.23	2520.95	BKF RT
37	7.70	2521.48	
42	6.94	2522.24	
46	6.50	2522.68	GRND
56	5.91	2523.27	
65	4.56	2524.62	

Year 1

Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 2

Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 3

Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 4

Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

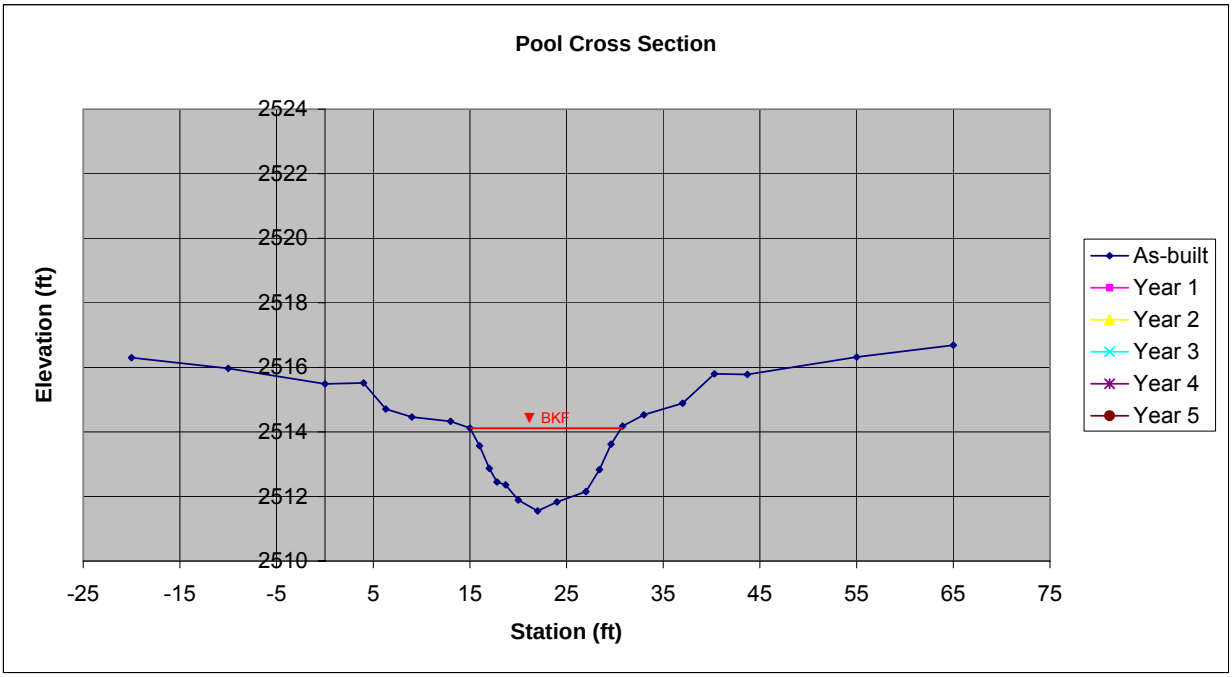
Year 5

Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Morgan Creek Stream Restoration Site
Haywood County, NC
Pool Cross Section PL4
Reach 1 - Morgan Creek - Sta 35+46

Year 0

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	1/8/09	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0
Area	26.1	Area	0.0	Area	0.0	Area	0.0	Area	0.0	Area	0.0
Bkf W	15.8	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10
Dmean	1.7	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0
Dmax	2.6	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0
W/d	9.5	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0

Morgan Creek Stream Restoration Site
Haywood County, NC
Pool Cross Section PL4
Reach 1 - Morgan Creek - Sta 35+46

As-Built			
Station	FS/BS	Elev.	Desc.
BM	6.05	2515.67	PL4 IR Lt
HI		2521.72	
-20	5.42	2516.30	
-10	5.75	2515.97	
0	6.23	2515.49	GRND
4	6.20	2515.52	
6.3	7.01	2514.71	
9	7.26	2514.46	
13	7.39	2514.33	
15	7.60	2514.12	BKF LT
16	8.15	2513.57	
17	8.85	2512.87	EOW
17.8	9.27	2512.45	
18.7	9.36	2512.36	
20	9.83	2511.89	
22	10.17	2511.55	
24	9.89	2511.83	
27	9.57	2512.15	
28.4	8.89	2512.83	EOW
29.6	8.10	2513.62	
30.8	7.54	2514.18	BKF RT
33	7.19	2514.53	
37	6.83	2514.89	
40.3	5.92	2515.80	
43.7	5.94	2515.78	GRND
55	5.40	2516.32	
65	5.03	2516.69	

Year 1			
Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

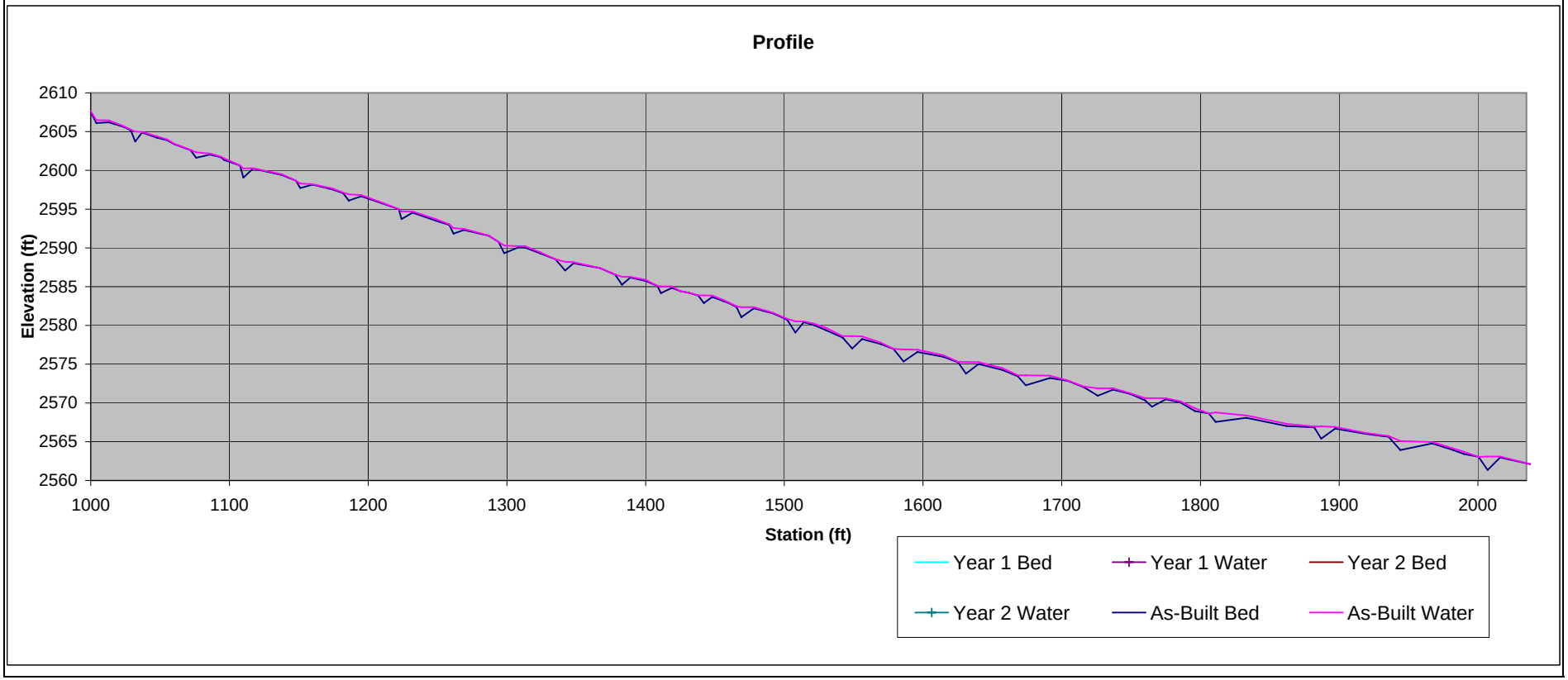
Year 2			
Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 3			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

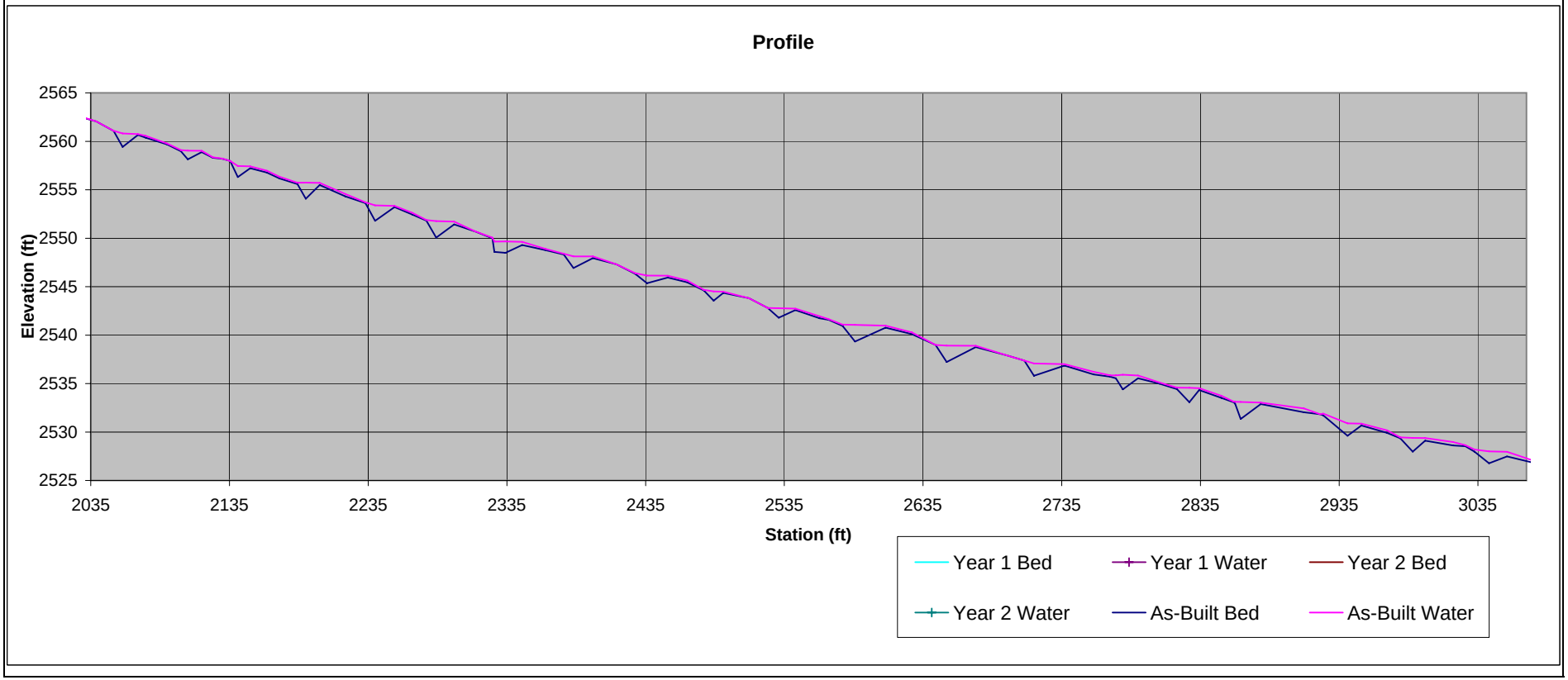
Year 4			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 5			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

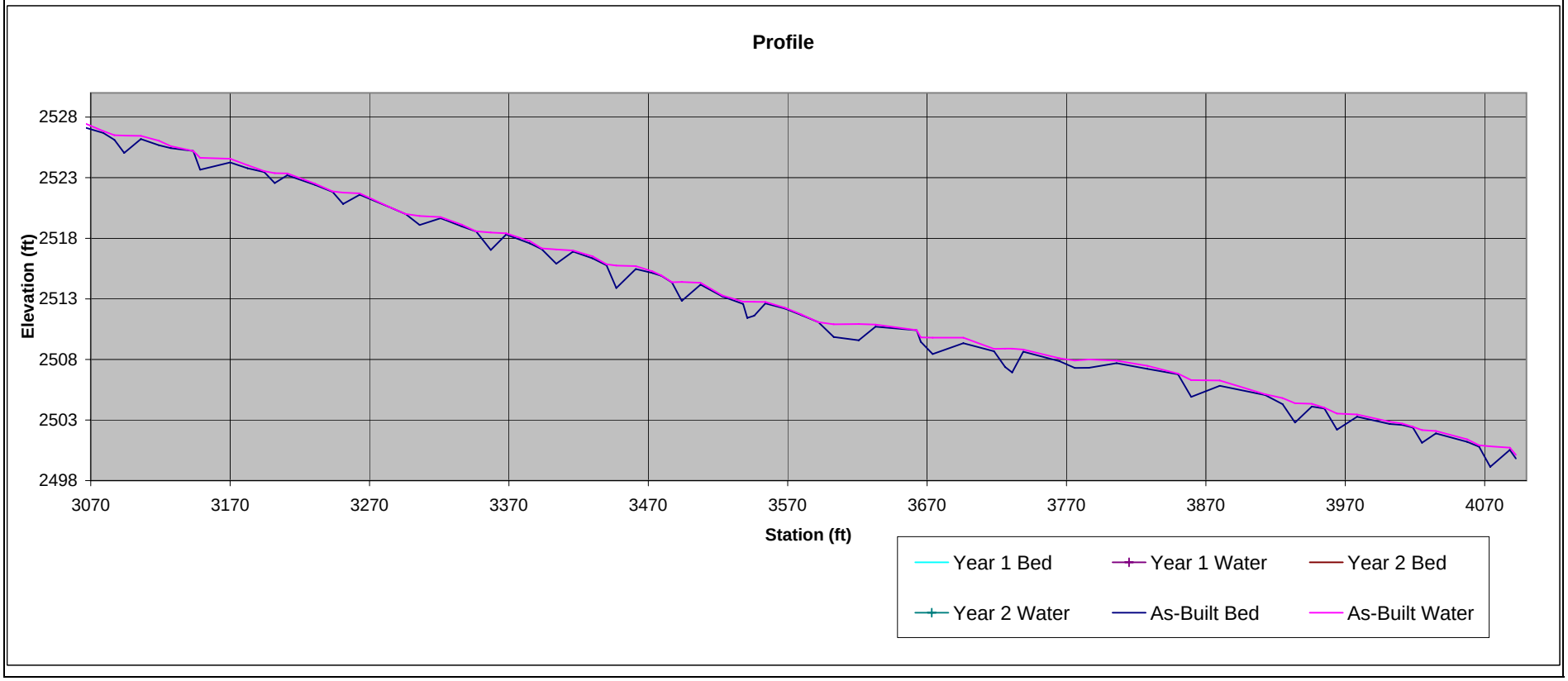
Morgan Creek Stream Restoration Site
Haywood County, NC
Profile Reach 1 - Morgan Creek



Morgan Creek Stream Restoration Site
Haywood County, NC
Profile Reach 1 - Morgan Creek



Morgan Creek Stream Restoration Site
Haywood County, NC
Profile Reach 1 - Morgan Creek



Morgan Creek Stream Restoration Site
Haywood County, NC
Profile Reach 1 - Morgan Creek

As-Built

HI	Station	Bed FS	Bed Elev.	Water Depth	Water Elev.	Bankfull FS	Bankfull Elev.	Description
2610.20	1000	2.65	2607.55	0.10	2607.65			
2610.20	1004	4.08	2606.12	0.35	2606.47			
2610.20	1013	4	2606.20	0.25	2606.45	2.85	2607.35	
2610.20	1024	4.6	2605.60	0.08	2605.68			
2610.20	1029	5.08	2605.12	0.12	2605.24			
2610.20	1032	6.47	2603.73	1.28	2605.01			
2610.20	1037	5.32	2604.88	0.09	2604.97			
2610.20	1048	5.99	2604.21	0.16	2604.37	5.01	2605.19	
2610.20	1055	6.3	2603.90	0.09	2603.99			
2610.20	1060	6.8	2603.40	0.05	2603.45			
2610.20	1072	7.6	2602.60	0.05	2602.65			
2610.20	1076	8.57	2601.63	0.70	2602.33			
2610.20	1086	8.17	2602.03	0.15	2602.18	7.20	2603.00	
2610.20	1094	8.53	2601.67	0.10	2601.77			
2610.20	1096	8.84	2601.36	0.20	2601.56			
2610.20	1107.5	9.57	2600.63	0.02	2600.65			
2610.20	1110	11.13	2599.07	1.18	2600.25			
2610.20	1117	9.97	2600.23	0.05	2600.28	8.97	2601.23	
2610.20	1138	10.8	2599.40	0.09	2599.49			
2610.20	1148	11.54	2598.66	0.01	2598.67			
2610.20	1151	12.47	2597.73	0.58	2598.31			
2610.20	1160	12.04	2598.16	0.06	2598.22			
2610.20	1174	12.65	2597.55	0.12	2597.67	11.68	2598.52	
2610.20	1182	13.15	2597.05	0.09	2597.14			
2610.20	1186	14.1	2596.10	0.80	2596.90			
2610.20	1195	13.54	2596.66	0.16	2596.82	12.50	2597.70	
2610.20	1211.5	14.54	2595.66	0.09	2595.75			
2610.20	1222	15.21	2594.99	0.02	2595.01			
2610.20	1224	16.49	2593.71	0.99	2594.70			
2610.20	1232	15.65	2594.55	0.15	2594.70	14.65	2595.55	
2610.20	1249	16.7	2593.50	0.20	2593.70			
2610.20	1258.5	17.23	2592.97	0.08	2593.05			
2597.16	1261.5	5.33	2591.83	0.73	2592.56			
2597.16	1269	4.84	2592.32	0.13	2592.45	3.65	2593.51	
2597.16	1287	5.6	2591.56	0.04	2591.60			
2597.16	1294	6.4	2590.76	0.01	2590.77			
2597.16	1298	7.85	2589.31	1.00	2590.31			
2597.16	1309	7.05	2590.11	0.10	2590.21			
2597.16	1313	7.12	2590.04	0.20	2590.24	6.04	2591.12	
2597.16	1324	7.87	2589.29	0.14	2589.43			
2597.16	1335	8.63	2588.53	0.01	2588.54			
2597.16	1342	10.08	2587.08	1.12	2588.20			
2597.16	1348	9.15	2588.01	0.15	2588.16	7.94	2589.22	
2597.16	1367	9.75	2587.41	0.02	2587.43			
2597.16	1378	10.61	2586.55	0.04	2586.59			
2597.16	1383	11.9	2585.26	1.02	2586.28			
2597.16	1389	10.98	2586.18	0.09	2586.27	9.90	2587.26	
2597.16	1400	11.42	2585.74	0.15	2585.89			
2597.16	1408.5	12.05	2585.11	0.00	2585.11			
2597.16	1411	12.99	2584.17	0.86	2585.03			
2597.16	1419	12.32	2584.84	0.19	2585.03	11.22	2585.94	
2597.16	1425	12.74	2584.42	0.00	2584.42			
2597.16	1431.5	12.97	2584.19	0.01	2584.20			
2597.16	1438	13.32	2583.84	0.06	2583.90			
2597.16	1442	14.28	2582.88	1.00	2583.88			
2597.16	1448	13.49	2583.67	0.18	2583.85	12.53	2584.63	
2597.16	1456	14.02	2583.14	0.16	2583.30			
2597.16	1460.5	14.32	2582.84	0.07	2582.91			
2597.16	1465.5	14.79	2582.37	0.11	2582.48			
2597.16	1469	16.1	2581.06	1.30	2582.36			
2597.16	1478	14.95	2582.21	0.15	2582.36	13.82	2583.34	
2597.16	1492	15.62	2581.54	0.08	2581.62			
2597.16	1502	16.4	2580.76	0.10	2580.86			
2585.29	1508	6.2	2579.09	1.45	2580.54			
2585.29	1514	4.88	2580.41	0.11	2580.52			
2585.29	1521.4	5.25	2580.04	0.18	2580.22	4.08	2581.21	
2585.29	1530	5.9	2579.39	0.30	2579.69			

Morgan Creek Stream Restoration Site
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As-Built

HI	Station	Bed FS	Bed Elev.	Water Depth	Water Elev.	Bankfull FS	Bankfull Elev.	Description
2585.29	1542	6.86	2578.43	0.20	2578.63			
2585.29	1549	8.27	2577.02	1.60	2578.62			
2585.29	1556	7.04	2578.25	0.34	2578.59	5.71	2579.58	
2585.29	1569.5	7.69	2577.60	0.19	2577.79			
2585.29	1578.7	8.32	2576.97	0.01	2576.98			
2585.29	1586	9.94	2575.35	1.55	2576.90			
2585.29	1596	8.72	2576.57	0.30	2576.87	7.68	2577.61	
2585.29	1614.5	9.33	2575.96	0.20	2576.16			
2585.29	1625.3	10.07	2575.22	0.08	2575.30			
2585.29	1631	11.51	2573.78	1.50	2575.28			
2585.29	1640	10.27	2575.02	0.24	2575.26	8.89	2576.40	
2585.29	1657.2	11.04	2574.25	0.25	2574.50			
2585.29	1668.3	11.85	2573.44	0.13	2573.57			
2585.29	1674	13.02	2572.27	1.28	2573.55			
2585.29	1691.5	12.08	2573.21	0.31	2573.52	10.78	2574.51	
2585.29	1704.5	12.45	2572.84	0.06	2572.90			
2585.29	1716	13.26	2572.03	0.08	2572.11			
2585.29	1726	14.36	2570.93	0.96	2571.89			
2585.29	1737	13.57	2571.72	0.17	2571.89	12.72	2572.57	
2585.29	1749	14.10	2571.19	0.09	2571.28			
2585.29	1760	14.96	2570.33	0.29	2570.62			
2585.29	1765	15.77	2569.52	1.10	2570.62			
2585.29	1775	14.82	2570.47	0.13	2570.60	13.81	2571.48	
2585.29	1785.5	15.23	2570.06	0.15	2570.21			
2585.29	1796	16.33	2568.96	0.35	2569.31			
2585.29	1806	16.64	2568.65	0.02	2568.67			
2585.29	1811	17.73	2567.56	1.20	2568.76			
2585.29	1833	17.20	2568.09	0.30	2568.39	16.23	2569.06	
2585.29	1862	18.27	2567.02	0.29	2567.31			
2569.70	1882	2.84	2566.86	0.09	2566.95			
2569.70	1887	4.31	2565.39	1.58	2566.97			
2569.70	1897	3.02	2566.68	0.22	2566.90	1.77	2567.93	
2569.70	1919	3.68	2566.02	0.12	2566.14			
2569.70	1932.5	4.01	2565.69	0.10	2565.79			
2569.70	1935.5	4.04	2565.66	0.08	2565.74			
2569.70	1944	5.77	2563.93	1.15	2565.08			
2569.70	1967	4.93	2564.77	0.20	2564.97	3.88	2565.82	
2569.70	1982	5.76	2563.94	0.21	2564.15			
2569.70	1990	6.29	2563.41	0.29	2563.70			
2569.70	2000.5	6.65	2563.05	0.01	2563.06			
2564.65	2007	3.31	2561.34	1.75	2563.09			
2564.65	2016	1.68	2562.97	0.11	2563.08			
2564.65	2039	2.60	2562.05	0.01	2562.06			
2564.65	2051.5	3.58	2561.07	0.01	2561.08			
2564.65	2058	5.23	2559.42	1.39	2560.81			
2564.65	2069	3.99	2560.66	0.08	2560.74	2.85	2561.80	
2564.65	2074.6	4.28	2560.37	0.19	2560.56			
2564.65	2090	4.97	2559.68	0.10	2559.78			
2564.65	2100	5.68	2558.97	0.12	2559.09			
2564.65	2105	6.51	2558.14	0.90	2559.04			
2564.65	2115	5.76	2558.89	0.13	2559.02	4.65	2560.00	
2564.65	2123	6.35	2558.30	0.06	2558.36			
2564.65	2130	6.46	2558.19	0.03	2558.22			
2564.65	2135.5	6.68	2557.97	0.01	2557.98			
2564.65	2141	8.34	2556.31	1.15	2557.46			
2564.65	2150	7.42	2557.23	0.19	2557.42	6.08	2558.57	
2564.65	2162	7.87	2556.78	0.19	2556.97			
2564.65	2171	8.48	2556.17	0.18	2556.35			
2564.65	2184	9.06	2555.59	0.13	2555.72			
2564.65	2190	10.58	2554.07	1.66	2555.73			
2564.65	2200	9.16	2555.49	0.22	2555.71	8.18	2556.47	
2564.65	2218.5	10.33	2554.32	0.25	2554.57			
2564.65	2233	11.03	2553.62	0.09	2553.71			
2564.65	2240	12.86	2551.79	1.60	2553.39			
2564.65	2254	11.44	2553.21	0.12	2553.33	10.30	2554.35	
2564.65	2267	12.22	2552.43	0.18	2552.61			
2564.65	2277	12.84	2551.81	0.07	2551.88			

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As-Built

HI	Station	Bed FS	Bed Elev.	Water Depth	Water Elev.	Bankfull FS	Bankfull Elev.	Description
2564.65	2284	14.59	2550.06	1.70	2551.76			
2564.65	2297	13.23	2551.42	0.29	2551.71	12.00	2552.65	
2564.65	2312	13.95	2550.70	0.02	2550.72			
2564.65	2324.5	14.65	2550.00	0.06	2550.06			
2564.65	2326	16.06	2548.59	1.06	2549.65			
2564.65	2334	16.16	2548.49	1.18	2549.67			
2564.65	2346	15.35	2549.30	0.32	2549.62	13.94	2550.71	
2564.65	2363	15.88	2548.77	0.12	2548.89			
2564.65	2376	16.33	2548.32	0.08	2548.40			
2564.65	2383	17.72	2546.93	1.20	2548.13			
2551.48	2397	3.54	2547.94	0.18	2548.12	2.28	2549.20	
2551.48	2414	4.18	2547.30	0.00	2547.30			
2551.48	2427.5	5.15	2546.33	0.06	2546.39			
2551.48	2436	6.12	2545.36	0.78	2546.14			
2551.48	2451	5.54	2545.94	0.19	2546.13	4.19	2547.29	
2551.48	2465	6.03	2545.45	0.18	2545.63			
2551.48	2477	6.87	2544.61	0.06	2544.67			
2551.48	2484	7.92	2543.56	0.95	2544.51			
2551.48	2491	7.12	2544.36	0.12	2544.48	5.90	2545.58	
2551.48	2509.5	7.67	2543.81	0.00	2543.81			
2551.48	2523	8.68	2542.80	0.00	2542.80			
2551.48	2531	9.68	2541.80	0.97	2542.77			
2551.48	2543	8.89	2542.59	0.14	2542.73	7.64	2543.84	
2551.48	2560.4	9.74	2541.74	0.20	2541.94			
2551.48	2567	9.90	2541.58	0.06	2541.64			
2551.48	2577	10.53	2540.95	0.13	2541.08			
2551.48	2586	12.14	2539.34	1.72	2541.06			
2551.48	2608	10.71	2540.77	0.21	2540.98	9.53	2541.95	
2551.48	2627	11.38	2540.10	0.18	2540.28			
2551.48	2644	12.49	2538.99	0.00	2538.99			
2551.48	2652	14.26	2537.22	1.69	2538.91			
2551.48	2673	12.71	2538.77	0.13	2538.90	11.63	2539.85	
2551.48	2695.5	13.58	2537.90	0.00	2537.90			
2539.21	2708	1.84	2537.37	0.00	2537.37			
2539.21	2715	3.40	2535.81	1.26	2537.07			
2539.21	2737	2.36	2536.85	0.16	2537.01	0.90	2538.31	
2539.21	2758	3.27	2535.94	0.27	2536.21			
2539.21	2770	3.50	2535.71	0.13	2535.84			
2539.21	2774	3.66	2535.55	0.30	2535.85			
2539.21	2779	4.81	2534.40	1.51	2535.91			
2539.21	2790	3.67	2535.54	0.29	2535.83	2.34	2536.87	
2539.21	2805.5	4.22	2534.99	0.12	2535.11			
2539.21	2818	4.78	2534.43	0.15	2534.58			
2539.21	2827	6.14	2533.07	1.50	2534.57			
2539.21	2834	4.88	2534.33	0.19	2534.52	3.68	2535.53	
2539.21	2850	5.69	2533.52	0.23	2533.75			
2539.21	2859	6.15	2533.06	0.07	2533.13			
2539.21	2860	6.28	2532.93	0.19	2533.12			
2539.21	2864	7.86	2531.35	1.76	2533.11			
2539.21	2878.5	6.32	2532.89	0.15	2533.04			
2539.21	2909.5	7.17	2532.04	0.39	2532.43			
2539.21	2921.3	7.37	2531.84	0.00	2531.84			
2539.21	2923.5	7.48	2531.73	0.17	2531.90			
2539.21	2941	9.60	2529.61	1.28	2530.89			
2539.21	2951	8.54	2530.67	0.19	2530.86	7.29	2531.92	
2539.21	2969.5	9.30	2529.91	0.26	2530.17			
2539.21	2979	9.86	2529.35	0.10	2529.45			
2539.21	2988	11.24	2527.97	1.42	2529.39			
2539.21	2997	10.10	2529.11	0.27	2529.38	8.92	2530.29	
2539.21	3017	10.59	2528.62	0.35	2528.97			
2539.21	3026	10.68	2528.53	0.11	2528.64			
2539.21	3032.5	11.23	2527.98	0.21	2528.19			
2539.21	3043	12.44	2526.77	1.23	2528.00			
2539.21	3056	11.73	2527.48	0.48	2527.96	10.28	2528.93	
2539.21	3079	12.52	2526.69	0.16	2526.85			
2539.21	3087	13.08	2526.13	0.38	2526.51			
2539.21	3094	14.16	2525.05	1.43	2526.48			

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As-Built

HI	Station	Bed FS	Bed Elev.	Water Depth	Water Elev.	Bankfull FS	Bankfull Elev.	Description
2539.21	3106	13.02	2526.19	0.26	2526.45	11.67	2527.54	
2539.21	3119	13.53	2525.68	0.37	2526.05			
2539.21	3127.5	13.77	2525.44	0.16	2525.60			
2539.21	3143.5	14.00	2525.21	0.00	2525.21			
2539.21	3148.5	15.55	2523.66	0.98	2524.64			
2539.21	3170	14.95	2524.26	0.31	2524.57	13.64	2525.57	
2539.21	3182.5	15.43	2523.78	0.25	2524.03			
2539.21	3194.5	15.75	2523.46	0.08	2523.54			
2526.51	3202	3.95	2522.56	0.81	2523.37			
2526.51	3211	3.31	2523.20	0.15	2523.35	1.92	2524.59	
2526.51	3231	4.11	2522.40	0.10	2522.50			
2526.51	3243.5	4.69	2521.82	0.05	2521.87			
2526.51	3251	5.68	2520.83	0.94	2521.77			
2526.51	3263	4.91	2521.60	0.10	2521.70	3.79	2522.72	
2526.51	3284.5	5.95	2520.56	0.01	2520.57			
2526.51	3296	6.52	2519.99	0.01	2520.00			
2526.51	3306	7.41	2519.10	0.74	2519.84			
2526.51	3321	6.86	2519.65	0.10	2519.75	5.39	2521.12	
2526.51	3324.4	7.00	2519.51	0.10	2519.61			
2526.51	3336	7.52	2518.99	0.14	2519.13			
2526.51	3346.5	7.95	2518.56	0.01	2518.57			
2526.51	3357	9.48	2517.03	1.45	2518.48			
2526.51	3368	8.20	2518.31	0.10	2518.41	6.87	2519.64	
2526.51	3385	8.93	2517.58	0.18	2517.76			
2526.51	3393.5	9.41	2517.10	0.06	2517.16			
2526.51	3404	10.61	2515.90	1.18	2517.08			
2526.51	3416	9.61	2516.90	0.09	2516.99	8.51	2518.00	
2526.51	3430	10.16	2516.35	0.16	2516.51			
2526.51	3440	10.74	2515.77	0.09	2515.86			
2526.51	3447	12.62	2513.89	1.86	2515.75			
2526.51	3461	11.05	2515.46	0.24	2515.70	9.74	2516.77	
2526.51	3473	11.38	2515.13	0.14	2515.27			
2526.51	3479.5	11.61	2514.90	0.03	2514.93			
2526.51	3487	12.16	2514.35	0.02	2514.37			
2526.51	3494	13.68	2512.83	1.56	2514.39			
2526.51	3507.5	12.33	2514.18	0.15	2514.33	11.48	2515.03	
2526.51	3523	13.31	2513.20	0.08	2513.28			
2526.51	3538	13.93	2512.58	0.19	2512.77			
2526.51	3541	15.09	2511.42	1.35	2512.77			
2526.51	3546	14.90	2511.61	1.15	2512.76			
2526.51	3554	13.88	2512.63	0.12	2512.75	12.67	2513.84	
2526.51	3568	14.31	2512.20	0.06	2512.26			
2526.51	3580	14.86	2511.65	0.06	2511.71			
2526.51	3592	15.43	2511.08	0.00	2511.08			
2526.51	3603	16.66	2509.85	1.05	2510.90			
2526.51	3621	16.93	2509.58	1.34	2510.92			
2526.51	3633	15.81	2510.70	0.18	2510.88	14.66	2511.85	
2526.51	3662.5	16.10	2510.41	0.01	2510.42			
2514.3	3665.5	4.84	2509.46	0.36	2509.82			
2514.3	3674	5.86	2508.44	1.36	2509.80			
2514.3	3696	4.96	2509.34	0.46	2509.80	3.47	2510.83	
2514.3	3718	5.63	2508.67	0.20	2508.87			
2514.3	3726	6.92	2507.38	1.51	2508.89			
2514.3	3731	7.37	2506.93	1.96	2508.89			
2514.3	3739	5.66	2508.64	0.18	2508.82	4.29	2510.01	
2514.3	3765	6.45	2507.85	0.25	2508.10			
2514.3	3776	7.00	2507.30	0.61	2507.91			
2514.3	3786	6.99	2507.31	0.69	2508.00			
2514.3	3806	6.61	2507.69	0.21	2507.90	5.63	2508.67	
2514.3	3828	7.08	2507.22	0.25	2507.47	5.61	2508.69	
2514.3	3850	7.53	2506.77	0.06	2506.83			
2514.3	3859.5	9.39	2504.91	1.38	2506.29			
2514.3	3880	8.47	2505.83	0.43	2506.26	7.10	2507.20	
2514.3	3912.5	9.24	2505.06	0.07	2505.13			
2514.3	3925	9.99	2504.31	0.50	2504.81			
2514.3	3934	11.51	2502.79	1.60	2504.39			
2514.3	3946	10.19	2504.11	0.23	2504.34	8.95	2505.35	

Morgan Creek Stream Restoration Site
Haywood County, NC
Profile Reach 1 - Morgan Creek

As-Built

HI	Station	Bed FS	Bed Elev.	Water Depth	Water Elev.	Bankfull FS	Bankfull Elev.	Description
2514.3	3955	10.35	2503.95	0.06	2504.01			
2514.3	3964	12.10	2502.20	1.33	2503.53			
2514.3	3978.5	11.03	2503.27	0.19	2503.46	9.49	2504.81	
2514.3	4002	11.63	2502.67	0.19	2502.86			
2514.3	4011	11.70	2502.60	0.10	2502.70			
2514.3	4018.5	11.92	2502.38	0.06	2502.44			
2514.3	4025	13.18	2501.12	1.05	2502.17			
2514.3	4035	12.40	2501.90	0.19	2502.09	11.04	2503.26	
2514.3	4057.5	13.10	2501.20	0.21	2501.41			
2514.3	4066	13.51	2500.79	0.12	2500.91			
2514.3	4074	15.17	2499.13	1.70	2500.83			
2514.3	4088	13.77	2500.53	0.19	2500.72			
2514.3	4092.4	14.48	2499.82	0.30	2500.12			

Pebble Count Weighted by Channel Feature

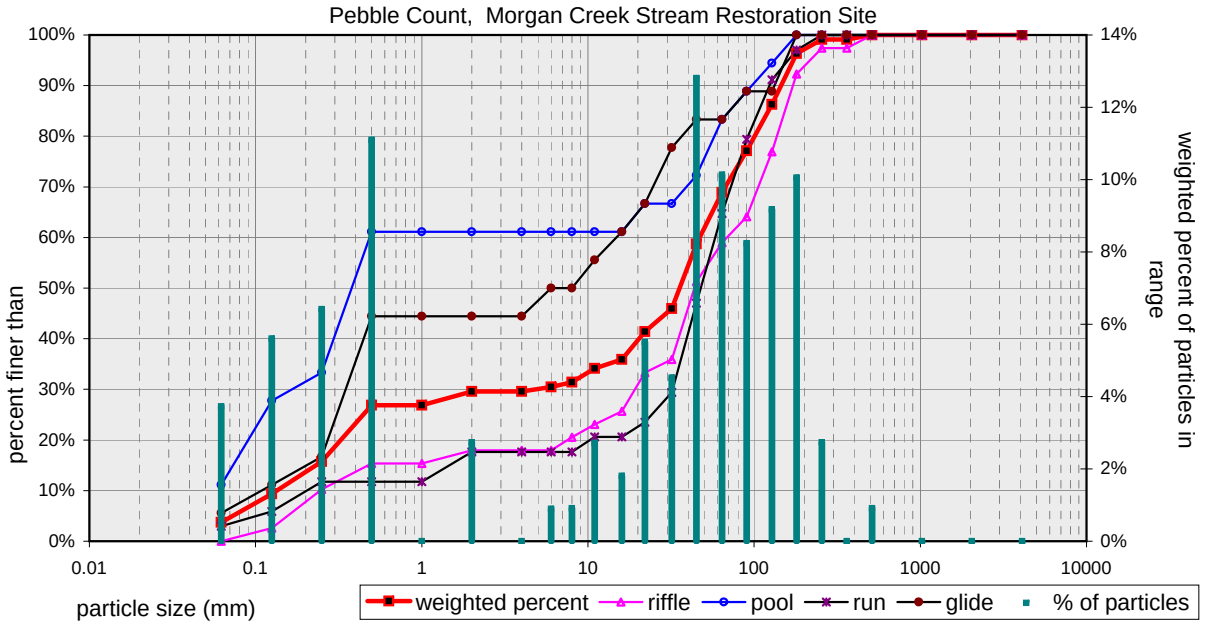
Percent Riffle:	**34**	Percent Run:	**34**
Percent Pool:	**17**	Percent Glide:	**15**

Pebble Count,

Material	Size Range (mm)		weighted	
silt/clay	0	0.062	3.5	#
very fine sand	0.062	0.13	5.2	#
fine sand	0.13	0.25	6.0	#
medium sand	0.25	0.5	10.3	#
coarse sand	0.5	1	0.0	#
very coarse sand	1	2	2.6	#
very fine gravel	2	4	0.0	#
fine gravel	4	6	0.8	#
fine gravel	6	8	0.9	#
medium gravel	8	11	2.5	#
medium gravel	11	16	1.7	#
coarse gravel	16	22	5.1	#
coarse gravel	22	32	4.2	#
very coarse gravel	32	45	11.9	#
very coarse gravel	45	64	9.4	#
small cobble	64	90	7.7	#
medium cobble	90	128	8.5	#
large cobble	128	180	9.4	#
very large cobble	180	256	2.6	#
small boulder	256	362	0.0	#
small boulder	362	512	0.9	#
medium boulder	512	1024	0.0	#
large boulder	1024	2048	0.0	#
very large boulder	2048	4096	0.0	#
weighted particle count:			93.2	

bedrock		6.8
clay hardpan		0.0
detritus/wood		0.0
artificial		0.0
weighted total count:		100

Morgan Creek Stream Restoration Site
Haywood County, NC
Morgan Creek: Reach 1
Note: **Reach Data Beginning at Sta14+78** 4%



based on sediment particles only	size percent less than (mm) D16	D35	D50	D65	D84	D95	particle size distribution gradation	geo mean	std dev
	0.254	13.23	35.6	56	117	172	71.8	5.5	21.5

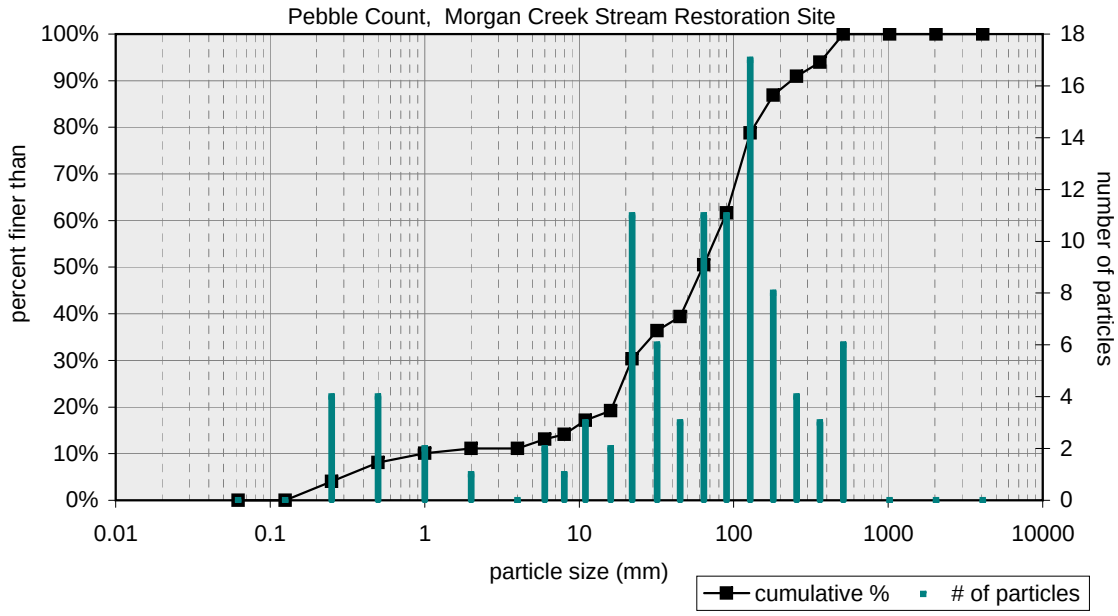
based on total count	percent by substrate type silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	3%	24%	37%	28%	1%	7%	0%	0%	0%

Pebble Count of Channel Reach

Material	Size Range (mm)		Count	
silt/clay	0	0.062	**0**	##
very fine sand	0.062	0.13	**0**	##
fine sand	0.13	0.25	**4**	##
medium sand	0.25	0.5	**4**	##
coarse sand	0.5	1	**2**	##
very coarse sand	1	2	**1**	##
very fine gravel	2	4	**0**	##
fine gravel	4	6	**2**	##
fine gravel	6	8	**1**	##
medium gravel	8	11	**3**	##
medium gravel	11	16	**2**	##
coarse gravel	16	22	**11**	##
coarse gravel	22	32	**6**	##
very coarse gravel	32	45	**3**	##
very coarse gravel	45	64	**11**	##
small cobble	64	90	**11**	##
medium cobble	90	128	**17**	##
large cobble	128	180	**8**	##
very large cobble	180	256	**4**	##
small boulder	256	362	**3**	##
small boulder	362	512	**6**	##
medium boulder	512	1024	**0**	##
large boulder	1024	2048	**0**	##
very large boulder	2048	4096	**0**	##
		total particle count:	99	

bedrock		**1**
clay hardpan		
detritus/wood		
artificial		
	total count:	100

Pebble Count,
Morgan Creek Stream Restoration Site
Haywood County, NC
Morgan Creek: Reach 1
Note: **Riffle Sta 15+21.4**



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	9.726	29.41	63.0	96	159	385	4.5	39.4	4.0

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	11%	39%	40%	9%	1%	0%	0%	0%

Pebble Count Weighted by Channel Feature

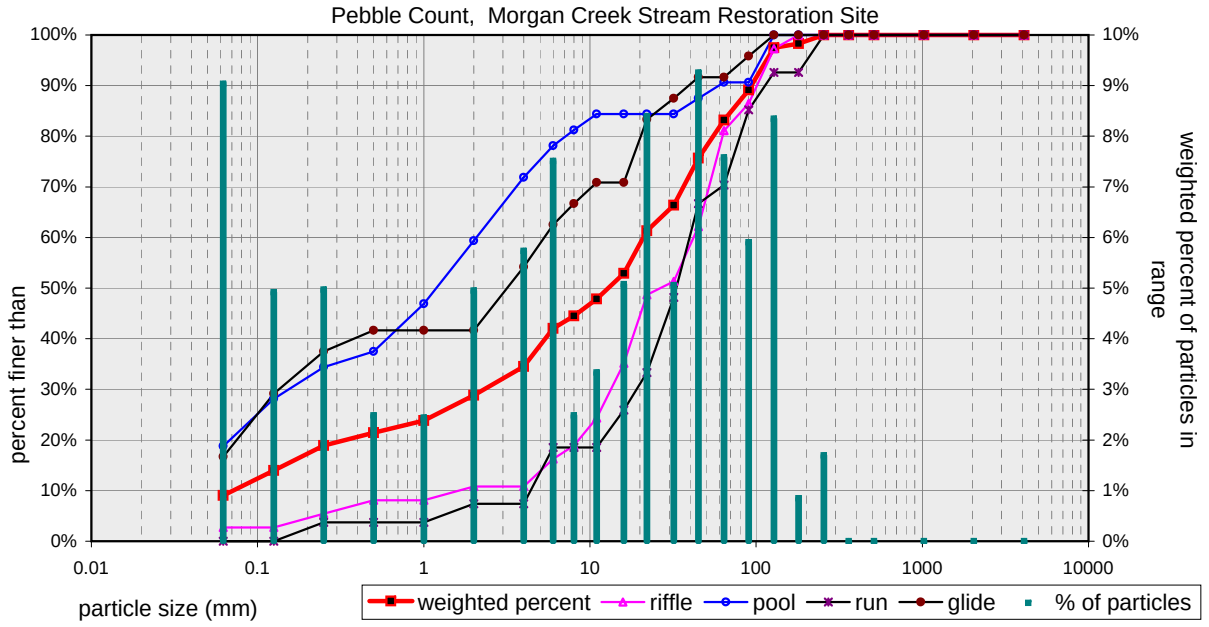
Percent Riffle:	**30**	Percent Run:	**26**
Percent Pool:	**25**	Percent Glide:	**19**

Pebble Count,

Morgan Creek Stream Restoration Site
Haywood County, NC
Morgan Creek: Reach 1
Note: **Reach Data Beginning at Sta 24+91** 9%

Material	Size Range (mm)		weighted	
silt/clay	0	0.062	8.7	#
very fine sand	0.062	0.13	4.7	#
fine sand	0.13	0.25	4.8	#
medium sand	0.25	0.5	2.4	#
coarse sand	0.5	1	2.3	#
very coarse sand	1	2	4.7	#
very fine gravel	2	4	5.5	#
fine gravel	4	6	7.2	#
fine gravel	6	8	2.4	#
medium gravel	8	11	3.2	#
medium gravel	11	16	4.9	#
coarse gravel	16	22	8.1	#
coarse gravel	22	32	4.9	#
very coarse gravel	32	45	8.9	#
very coarse gravel	45	64	7.3	#
small cobble	64	90	5.7	#
medium cobble	90	128	8.0	#
large cobble	128	180	0.8	#
very large cobble	180	256	1.6	#
small boulder	256	362	0.0	#
small boulder	362	512	0.0	#
medium boulder	512	1024	0.0	#
large boulder	1024	2048	0.0	#
very large boulder	2048	4096	0.0	#
weighted particle count:			95.9	

bedrock		4.1
clay hardpan		0.0
detritus/wood		0.0
artificial		0.0
weighted total count:		100



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.166	4.10	12.9	29	67	115	41.3	3.3	20.1

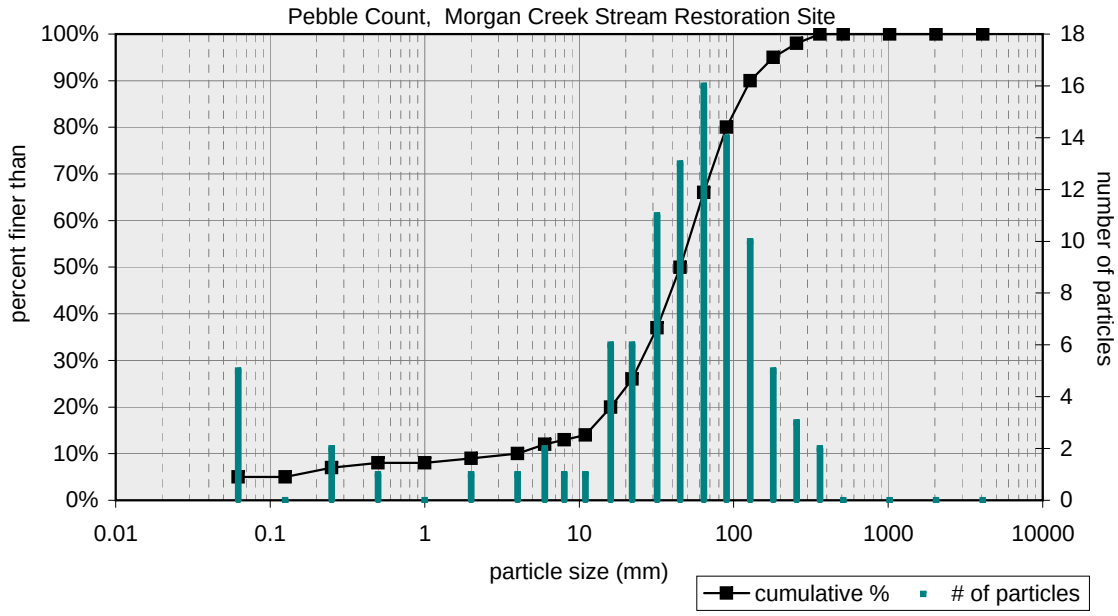
based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	9%	19%	52%	16%	0%	4%	0%	0%	0%

Pebble Count of Channel Reach

Material	Size Range (mm)		Count	
silt/clay	0	0.062	**5**	##
very fine sand	0.062	0.13	**0**	##
fine sand	0.13	0.25	**2**	##
medium sand	0.25	0.5	**1**	##
coarse sand	0.5	1	**0**	##
very coarse sand	1	2	**1**	##
very fine gravel	2	4	**1**	##
fine gravel	4	6	**2**	##
fine gravel	6	8	**1**	##
medium gravel	8	11	**1**	##
medium gravel	11	16	**6**	##
coarse gravel	16	22	**6**	##
coarse gravel	22	32	**11**	##
very coarse gravel	32	45	**13**	##
very coarse gravel	45	64	**16**	##
small cobble	64	90	**14**	##
medium cobble	90	128	**10**	##
large cobble	128	180	**5**	##
very large cobble	180	256	**3**	##
small boulder	256	362	**2**	##
small boulder	362	512	**0**	##
medium boulder	512	1024	**0**	##
large boulder	1024	2048	**0**	##
very large boulder	2048	4096	**0**	##
		total particle count:	100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100

Pebble Count,
Morgan Creek Stream Restoration Site
Haywood County, NC
Morgan Creek: Reach 1
Note: **Riffle Sta 25+60.4**



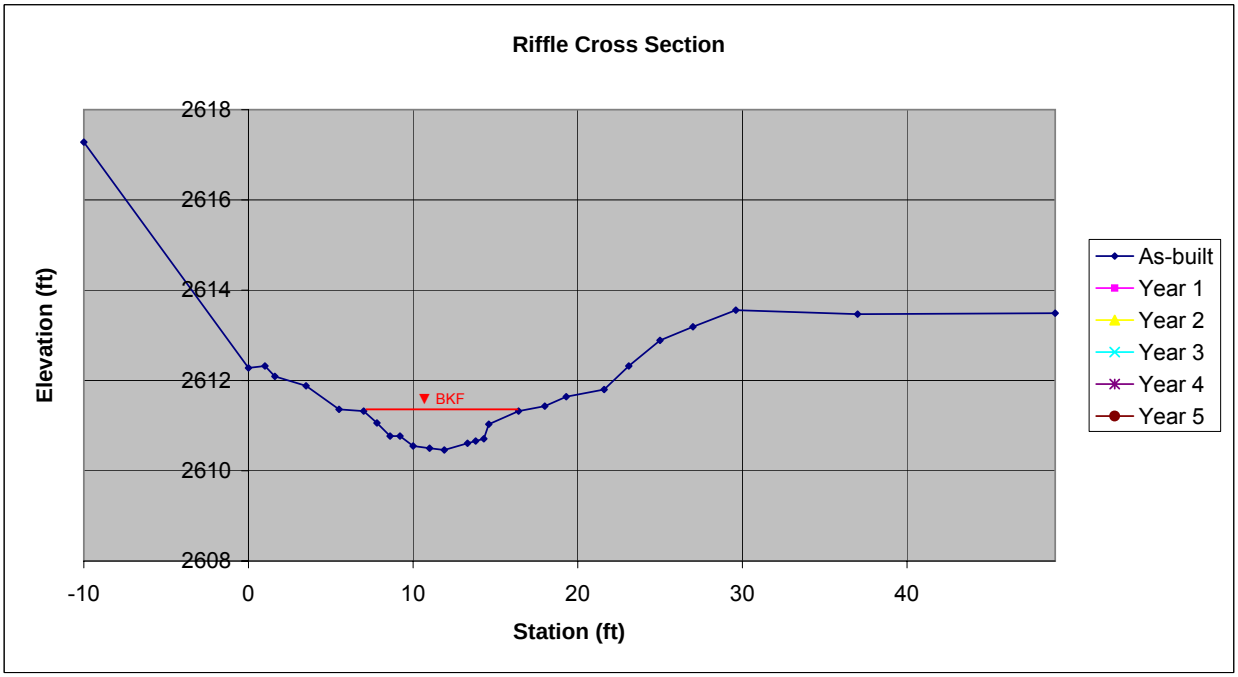
based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	12.463	29.89	45.0	63	104	180	3.0	35.9	2.9

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	5%	4%	57%	32%	2%	0%	0%	0%	0%

Morgan Creek Stream Restoration Site
Haywood County, NC
Riffle Cross Section RF5
Reach 2 - North Branch - Sta 10+85.4

Year 0

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	1/8/09	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0
Area	5.0	Area	0.0	Area	0.0	Area	0.0	Area	0.0	Area	0.0
Bkf W	9.4	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10
Dmean	0.5	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0
Dmax	0.9	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0
W/d	17.7	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0

Morgan Creek Stream Restoration Site
Haywood County, NC
Riffle Cross Section RF5
Reach 2 - North Branch - Sta 10+85.4

As-Built			
Station	FS/BS	Elev.	Desc.
BM	7.55	2612.59	RF5 IR Lt
HI		2620.14	
-10	2.86	2617.28	
0	7.86	2612.28	GRND
1	7.82	2612.32	
1.6	8.05	2612.09	
3.5	8.26	2611.88	
5.5	8.78	2611.36	
7	8.82	2611.32	BKF LT
7.8	9.08	2611.06	
8.6	9.37	2610.77	
9.2	9.37	2610.77	
10	9.59	2610.55	EOW LT
11	9.64	2610.50	
11.9	9.68	2610.46	
13.3	9.53	2610.61	
13.8	9.48	2610.66	EOW RT
14.3	9.43	2610.71	
14.6	9.11	2611.03	
16.4	8.82	2611.32	BKF RT
18	8.71	2611.43	
19.3	8.50	2611.64	
21.6	8.34	2611.80	
23.1	7.82	2612.32	
25	7.25	2612.89	
27	6.95	2613.19	GRND
29.6	6.58	2613.56	
37	6.67	2613.47	
49	6.65	2613.49	

Year 1			
Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 2			
Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 3			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

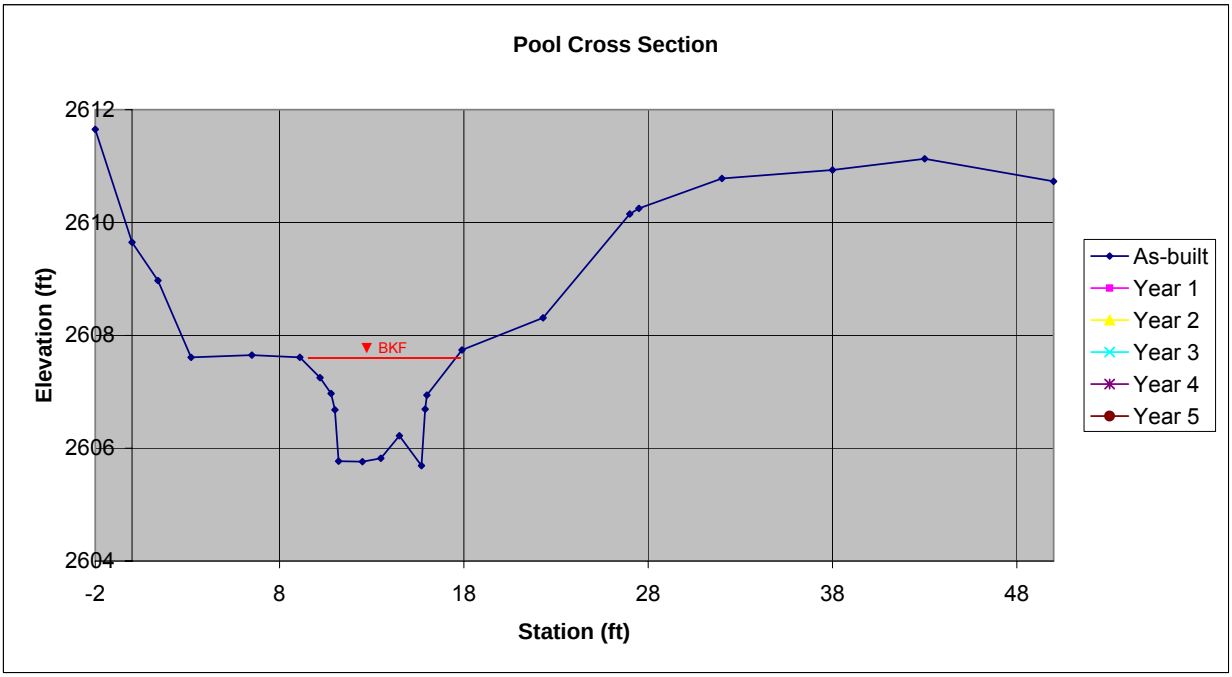
Year 4			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 5			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Morgan Creek Stream Restoration Site
Haywood County, NC
Pool Cross Section PL5
Reach 2 -North Branch - Sta 11+54.5

Year 0

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	1/8/09	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0	Date	0/0/0
Area	9.6	Area	0.0	Area	0.0	Area	0.0	Area	0.0	Area	0.0
Bkf W	8.8	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10	Bkf W	10
Dmean	1.1	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0	Dmean	0.0
Dmax	1.9	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0	Dmax	0.0
W/d	8.1	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0	W/d	0.0

Morgan Creek Stream Restoration Site
Haywood County, NC
Pool Cross Section PL5
Reach 2 -North Branch - Sta 11+54.5

As-Built			
Station	FS/BS	Elev.	Desc.
BM	7.55	2612.59	RF5 IR Lt
HI		2620.14	
-2	8.49	2611.65	
0	10.49	2609.65	GRND
1.4	11.17	2608.97	
3.2	12.53	2607.61	
6.5	12.49	2607.65	
9.1	12.53	2607.61	BKF LT
10.2	12.89	2607.25	
10.8	13.17	2606.97	
11	13.46	2606.68	EOW
11.2	14.37	2605.77	
12.5	14.38	2605.76	
13.5	14.32	2605.82	
14.5	13.92	2606.22	
15.7	14.45	2605.69	
15.9	13.45	2606.69	EOW
16	13.20	2606.94	
17.9	12.40	2607.74	BKF RT
22.3	11.83	2608.31	
27	9.99	2610.15	
27.5	9.89	2610.25	GRND
32	9.36	2610.78	
38	9.21	2610.93	
43	9.01	2611.13	
50	9.41	2610.73	

Year 1			
Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

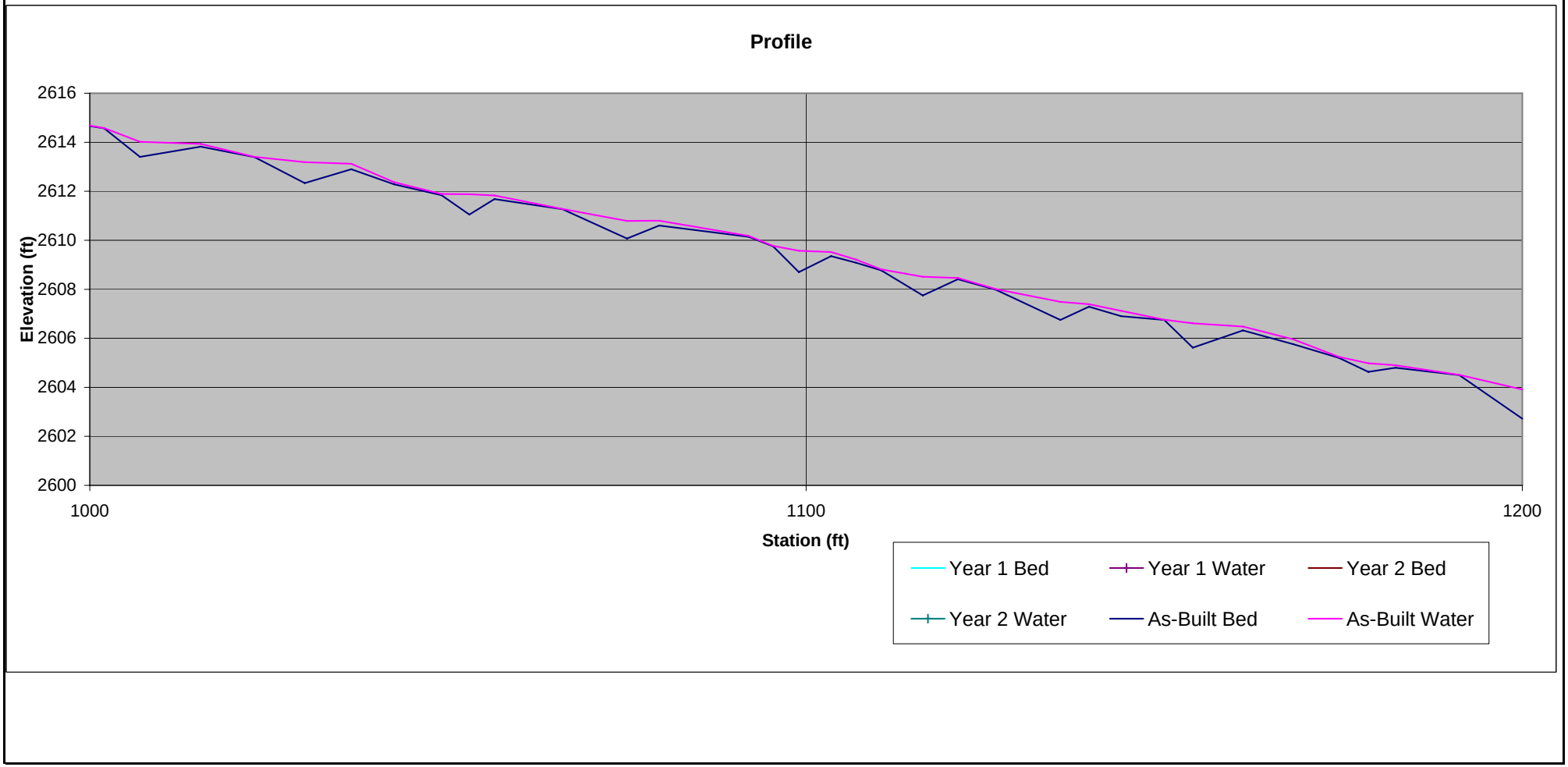
Year 2			
Station	FS/BS	Elev.	Desc.
BM			IR Lt
HI		0.00	

Year 3			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 4			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 5			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Morgan Creek Stream Restoration Site
Haywood County, NC
Profile Reach 2 - North Branch



Morgan Creek Stream Restoration Site
Haywood County, NC
Profile Reach 2 - North Branch

As-Built

HI	Station	Bed FS	Bed Elev.	Water Depth	Water Elev.	Bankfull FS	Bankfull Elev.	Description
2618.48	1000	3.82	2614.66	0.02	2614.68			
2618.48	1002	3.91	2614.57	0.01	2614.58			
2618.48	1007	5.08	2613.40	0.62	2614.02			
2618.48	1015.5	4.66	2613.82	0.11	2613.93	3.86	2614.62	
2618.48	1023	5.09	2613.39	0.01	2613.40			
2618.48	1030	6.15	2612.33	0.86	2613.19			
2618.48	1036.5	5.58	2612.90	0.22	2613.12	4.71	2613.77	
2618.48	1042.5	6.2	2612.28	0.09	2612.37			
2618.48	1049.1	6.64	2611.84	0.05	2611.89			
2618.48	1053	7.43	2611.05	0.83	2611.88			
2618.48	1056.5	6.8	2611.68	0.15	2611.83	5.69	2612.79	
2618.48	1066	7.21	2611.27	0.01	2611.28			
2618.48	1075	8.41	2610.07	0.72	2610.79			
2618.48	1079.5	7.88	2610.60	0.20	2610.80	6.86	2611.62	
2618.48	1092	8.34	2610.14	0.04	2610.18			
2618.48	1095.4	8.73	2609.75	0.02	2609.77			
2618.48	1099	9.78	2608.70	0.87	2609.57			
2618.48	1103.5	9.13	2609.35	0.17	2609.52	8.32	2610.16	
2618.48	1107	9.4	2609.08	0.13	2609.21			
2618.48	1110.5	9.71	2608.77	0.04	2608.81			
2618.48	1116.3	10.73	2607.75	0.76	2608.51			
2618.48	1121.2	10.07	2608.41	0.05	2608.46	9.24	2609.24	
2618.48	1126.5	10.5	2607.98	0.03	2608.01			
2618.48	1135.5	11.73	2606.75	0.74	2607.49			
2618.48	1139.5	11.19	2607.29	0.10	2607.39			
2618.48	1144	11.58	2606.90	0.22	2607.12			
2618.48	1150	11.73	2606.75	0.01	2606.76			
2618.48	1154	12.86	2605.62	0.99	2606.61			
2618.48	1161	12.16	2606.32	0.16	2606.48	11.24	2607.24	
2618.48	1168	12.72	2605.76	0.20	2605.96			
2618.48	1174.4	13.28	2605.20	0.04	2605.24			
2618.48	1178.5	13.85	2604.63	0.35	2604.98			
2618.48	1182.3	13.68	2604.80	0.10	2604.90	12.62	2605.86	
2618.48	1191.2	13.98	2604.50	0.01	2604.51			
2618.48	1200	15.76	2602.72	1.19	2603.91			

Pebble Count Weighted by Channel Feature

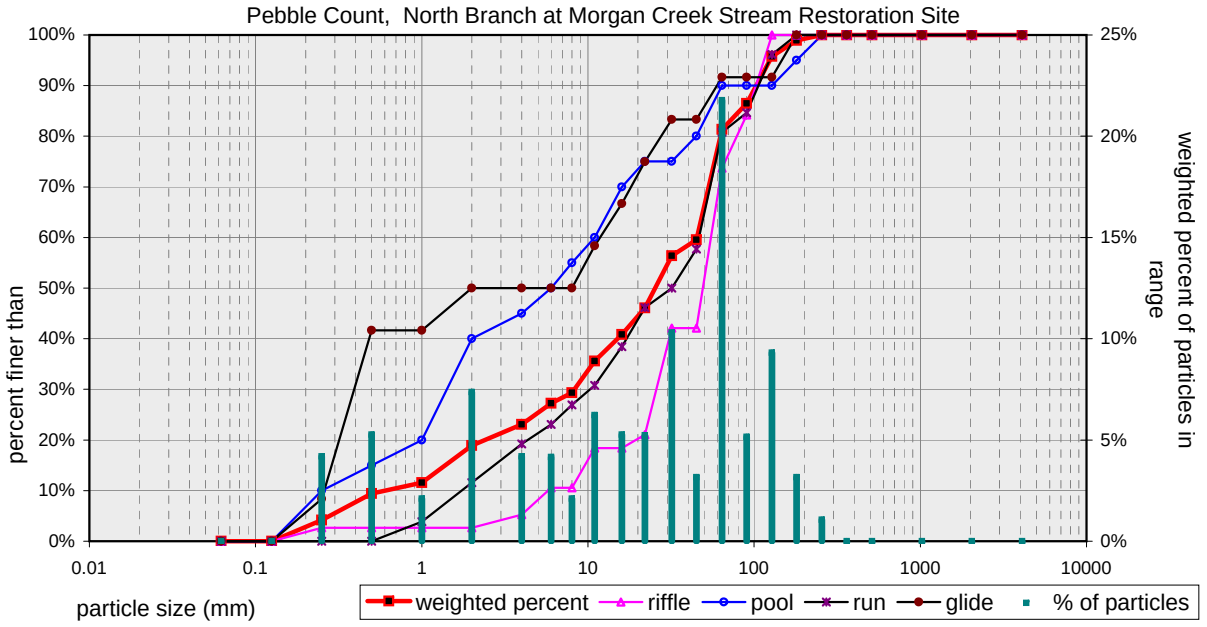
Percent Riffle:	**39**	Percent Run:	**28**
Percent Pool:	**21**	Percent Glide:	**12**

Pebble Count,

North Branch at Morgan Creek Stream Restoration Site
Haywood County, NC
North Branch: Reach 2
Note: **North Branch Beignning at Sta 10+56** 0%

Material	Size Range (mm)		weighted	
silt/clay	0	0.062	0.0	#
very fine sand	0.062	0.13	0.0	#
fine sand	0.13	0.25	4.0	#
medium sand	0.25	0.5	5.0	#
coarse sand	0.5	1	2.0	#
very coarse sand	1	2	7.0	#
very fine gravel	2	4	4.0	#
fine gravel	4	6	4.0	#
fine gravel	6	8	2.0	#
medium gravel	8	11	5.9	#
medium gravel	11	16	5.0	#
coarse gravel	16	22	5.0	#
coarse gravel	22	32	9.8	#
very coarse gravel	32	45	3.0	#
very coarse gravel	45	64	20.7	#
small cobble	64	90	4.9	#
medium cobble	90	128	8.9	#
large cobble	128	180	3.0	#
very large cobble	180	256	1.0	#
small boulder	256	362	0.0	#
small boulder	362	512	0.0	#
medium boulder	512	1024	0.0	#
large boulder	1024	2048	0.0	#
very large boulder	2048	4096	0.0	#
weighted particle count:			95.1	

bedrock		5.0
clay hardpan		0.0
detritus/wood		0.0
artificial		0.0
weighted total count:		100



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	1.521	10.68	25.4	49	76	124	9.8	10.8	7.1

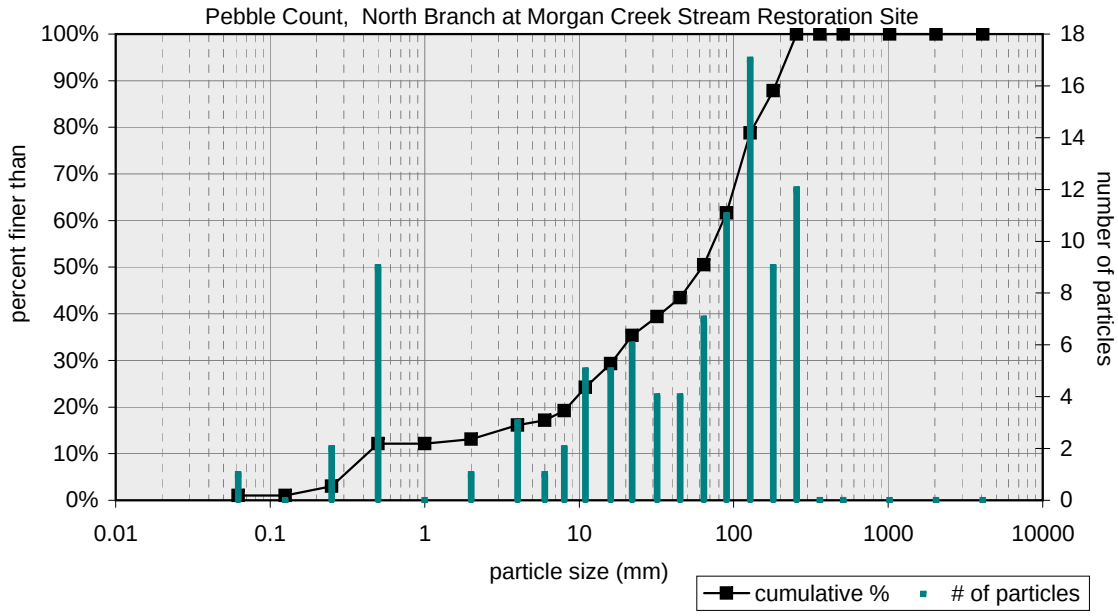
based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	18%	59%	18%	0%	5%	0%	0%	0%

Pebble Count of Channel Reach

Material	Size Range (mm)		Count	
silt/clay	0	0.062	**1**	##
very fine sand	0.062	0.13	**0**	##
fine sand	0.13	0.25	**2**	##
medium sand	0.25	0.5	**9**	##
coarse sand	0.5	1	**0**	##
very coarse sand	1	2	**1**	##
very fine gravel	2	4	**3**	##
fine gravel	4	6	**1**	##
fine gravel	6	8	**2**	##
medium gravel	8	11	**5**	##
medium gravel	11	16	**5**	##
coarse gravel	16	22	**6**	##
coarse gravel	22	32	**4**	##
very coarse gravel	32	45	**4**	##
very coarse gravel	45	64	**7**	##
small cobble	64	90	**11**	##
medium cobble	90	128	**17**	##
large cobble	128	180	**9**	##
very large cobble	180	256	**12**	##
small boulder	256	362	**0**	##
small boulder	362	512	**0**	##
medium boulder	512	1024	**0**	##
large boulder	1024	2048	**0**	##
very large boulder	2048	4096	**0**	##
	total particle count:		99	

bedrock		**1**
clay hardpan		
detritus/wood		
artificial		
	total count:	100

Pebble Count,
North Branch at Morgan Creek Stream Restoration Site
Haywood County, NC
North Branch: Reach 2
Note: **Riffle Sta 10+85**



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	3.855	21.60	62.4	96	156	221	9.3	24.5	6.4

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	1%	12%	37%	49%	0%	1%	0%	0%	0%

PHOTO POINTS

Photo Point 1

Morgan Creek facing upstream Photo No. 1

Photo Point 1

Morgan Creek perpendicular to stream Photo No. 2

Photo Point 1

Morgan Creek facing downstream Photo No. 3

Photo Point 2

Morgan Cr. / Lower North Br. confluence facing upstream Photo No. 4

Photo Point 3

Middle Branch facing upstream Photo No. 5

Photo Point 3

Middle Branch facing downstream Photo No. 6

Photo Point 4

South Branch facing upstream Photo No. 7

Photo Point 4

South Branch facing downstream Photo No. 8

Photo Point 5

Morgan Creek facing upstream Photo No. 9

Photo Point 6

North Branch from piped crossing, facing upstream Photo No. 10

Photo Point 6

North Branch from piped crossing, facing downstream Photo No. 11

Photo Point 7

Morgan Creek from U/S pipe outfall, facing downstream Photo No. 12

Photo Point 8

Lower North Branch from pipe outfall, facing downstream Photo No. 13

Photo Point 9

Piped crossing at easement break, facing upstream Photo No. 14

Photo Point 9

Piped crossing at easement break, facing downstream Photo No. 15

Photo Point 7

Morgan Creek from D/S pipe inlet, facing upstream Photo No. 16

VEGETATION SURVEY

Description of Species and Monitoring Protocol

Six vegetation monitoring plots were established and baseline data collection for the Morgan Creek Stream and Wetland Restoration Project occurred on January 22, 2009.

The project site was planted with species characteristic of a Montane Alluvial Forest natural community (Schafale and Weakley, 1990). The reference community is located within a mesic hardwood forest cove less than five miles to the northwest of the Morgan Creek site in Harmon Den. Planting occurred from January 5 – January 9, 2009. Nineteen species were documented in the baseline monitoring and are listed in Table 1. However, due to the seasonal timing of baseline vegetation monitoring and the condition of several planted stems, not every stem was identified and it is possible that some stems were misidentified. Taxonomic nomenclature follows Weakley (2008).

Table 1: Species planted at the Morgan Creek Stream and Wetland Restoration Site

BARE ROOT PLANTINGS		
Botanical Name	**Common Name**	**Total Stems Planted**
Acer saccharum	Sugar Maple	425
Amelanchier laevis	Smooth Serviceberry	425
Aronia arbutifolia	Chokeberry	125
Betula nigra	River Birch	100
Carpinus caroliniana	Ironwood	525
Cornus amomum	Silky Dogwood	125
Fagus grandifolia var. grandifolia	American Beech	425
Halesia tetraptera var. tetraptera	Common Silverbell	425
Hamamelis virginiana	Witch Hazel	700
Lindera benzoin var. benzoin	Spicebush	700
Liriodendron tulipifera var. tulipifera	Tulip Poplar	525
Platanus occidentalis var. occidentalis	Sycamore	100
Quercus montana	Chestnut Oak	425
Quercus rubra var. rubra	Northern Red Oak	425
Sassafras albidum	Sassafras	425
Tilia americana	Basswood	425
Tsuga canadensis	Eastern Hemlock	300
LIVE STAKES		
Botanical Name	**Common Name**	**Total Stems Planted**
Cornus amomum	Silky Dogwood	700
Salix nigra	Black Willow	700
Sambucus canadensis	Elderberry	300

Baseline Monitoring Results and Discussion

The Morgan Creek Stream and Wetland Restoration Site has an average of 533 stems per acre. Across all vegetation plots, baseline monitoring documented a survivability range of 405 to 729 stems per acre. Of these, approximately 46% have a vigor code of good and 36% have a vigor code of fair, most of which were Tulip poplar, followed by Silky dogwood. Nearly 5%, however, had a vigor code of 0 or 1 (dead or unlikely to survive). In particular, Plot 3 within the wetland enhancement area had the lowest total stem density (404 stems per acre), which is still 26% above the minimum criteria. The following is the stem count for each monitoring plot:

Plot 1 – 647 stems	Plot 2 – 445 stems	Plot 3 – 404 stems
Plot 4 – 485 stems	Plot 5 – 728 stems	Plot 6 – 526 stems

Sugar maple and Tulip poplar are among the most frequently occurring species. Most stems showed no signs of damage since planting recently occurred although some appeared to have been browsed, most likely by deer or cattle. There are several factors that may contribute to the survivability and average number of stems per acre reported above.

First, vegetation plots were established in the buffer and wetland planting areas. Therefore, it is assumed that these zones are representative of the entire stream and wetland restoration area. While this may largely be true, it is likely that other, smaller planting zones are underrepresented. For example, if the vegetation plots had captured streamside vegetation, which is planted at higher densities, planted stem survivability might be much greater.

Second, natural woody stems were not recorded for baseline monitoring, but will be documented during the Year 1 monitoring efforts and will likely increase the total, average stem density for the project area.

Photo Page 1

Vegetation Monitoring Plot 1

Vegetation Monitoring Plot 2

Vegetation Monitoring Plot 3

Vegetation Monitoring Plot 4

Vegetation Monitoring Plot 5

Vegetation Monitoring Plot 6