Collins Creek
Restoration Plan

Orange County, North Carolina

State Contract No. D05011

Prepared for:
North Carolina Ecosystem Enhancement Program

September 2007

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KCI Project No. 12054130-01

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EXECUTIVE SUMMARY

The Collins Creek Site (CCS) is a full-delivery project being developed for the North Carolina Ecosystem Enhancement Program (EEP). The site offers the opportunity to restore a heavily impacted stream system in order to improve water quality and aquatic and terrestrial habitat. The project proposes to restore and enhance 2,310 existing linear feet of an unnamed tributary to Collins Creek (UTCC) and 6,819 existing linear feet along four of its tributaries (T1, T1A, T1B, and T2).

The CCS is ideally situated to improve water quality in the Cape Fear Basin. The project tributaries first drain into Collins Creek and then continue into the Haw River before eventually reaching Jordan Lake. Approximately 5.4 miles downstream of the CCS, a section of Collins Creek is listed on the 2006 303(d) list as impaired for biological integrity; the potential source given is agriculture (NCDENR, DWQ 2006). Jordan Lake is also listed as impaired for exceeding chlorophyll *a* levels, which is attributed to excessive growth of algae from elevated nutrient levels. The restoration of the project tributaries will decrease the amount of nutrients entering the streams from livestock by creating an effective riparian buffer. The project will restore a stable stream system that will no longer contribute excessive sediment from bank erosion. The restored stream system at the CCS will also restore and improve the amount of aquatic and terrestrial habitat.

The project streams at the CCS were reviewed in historic aerial photographs from 1938 to 2003 and the site showed impacts from clearing and grazing as far back as 1938. One of the project reaches (T1B) had been ditched by this time and a majority of the riparian buffers on the site were already cleared of vegetation. Currently, the property surrounding the project streams is used as active pasture for livestock grazing. A small number of residential and farm buildings exist throughout the site.

The CCS has a contributing project watershed of approximately 2.6 square miles at its downstream limits. The land use in the project watershed consists of primarily forest with small portions of agriculture, rangeland, and urban or built-up land. In general, the project watershed is rural and faces moderate development pressure from the nearby Chapel Hill/Carrboro area.

The project streams have become degraded primarily through poor grazing management and vegetation removal. The streams have all experienced bank erosion, which has led to excessive sediment. Bed degradation and aggradation are also evident throughout the different project reaches. All of the reaches exhibit areas of incision and vertical instability. There are few stable riffle and pool sequences to provide bed diversity. As a result, the ecological diversity and water quality values of the site have been affected adversely.

The streams at the CCS will be restored using a combination of C, Bc, and B Rosgen stream types. In order to restore the difference stream systems on the CCS, a natural channel design approach was employed using stable reference reaches. Six different reference reach sites were identified for use in the project design.

Following the completion of the stream enhancement and restoration, any floodplain areas surrounding the project streams will be planted with species consistent with Piedmont Alluvial Forest. The slopes leading up from the floodplain areas and the valleys directly along the channels will be planted as Mesic Mixed Hardwood Forest. The planted areas will also be fenced to ensure that livestock no longer have access to project streams or riparian buffers.

Based on the existing site conditions and the potential to improve the site streams, the following goals were developed for the CCS:

- Improve water quality by reducing nutrient and sediment inputs.
- Create high-quality aquatic and terrestrial habitat along an interconnected forested riparian corridor.

In order to meet these goals, these objectives must be accomplished:

- Plant a functional Piedmont Alluvial Forest floodplain community along with Mesic Mixed Hardwood Forest to develop an effective riparian buffer.
- Restore stable stream reaches that can handle the hydrologic input from the surrounding drainages.
- Remove cattle and horses from the riparian areas through livestock exclusion fencing.

Mitigation Summary

Reach	Existing Stationing	Proposed Stationing	Mitigation Type	Priority Approach	Existing Linear Footage	Designed Linear Footage
UTCC-1	10+00 - 23+73	10+00 - 23+22	Enhancement I /Restoration	EI/P2	1,323	1,271
UTCC-2	23+73 - 34+11	23+22 - 33+30	Restoration	P2	987	956
T1-1	40+00 - 46+37	40+00 - 45+95	Restoration	P2	607	595
T1-2	46+37 - 53+20	45+95 - 54+03	Restoration	P2	604	767
T1-3	53+20 - 73+71	54+03 - 74+39	Restoration	P2	1,932	1,891
T1A-1	80+43 - 82+35	80+00 - 82+51	Restoration	P2	192	251
T1A-2	82+89 - 88+22	83+08 - 88+73	Restoration	P2/P3	533	565
T1B	100+00 - 110+02	100+00 - 111+34	Restoration	P2	1,072	1,134
T2-1	120+00 - 126+41	120+00 - 126+41	Restoration	P3	641	641
T2-2	126+41 - 138+95	126+41 - 138+46	Restoration	P3	1,238	1,189
					Total Stream Enhancement I	500
					Total Stream Restoration	8,760

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1.0 INTRODUCTION

The Collins Creek Stream Restoration Site (CCS) is a full-delivery project being developed for the North Carolina Ecosystem Enhancement Program (EEP) to mitigate stream impacts within the cataloging unit 03030002. The project consists of the restoration and enhancement of an unnamed tributary to Collins Creek (UTCC) and the restoration of four of its tributaries (T1, T1A, T1B, and T2). This restoration plan presents the existing site and watershed conditions, the restoration design criteria, the design summary, and the proposed monitoring protocol.

2.0 PROJECT SITE IDENTIFICATION AND LOCATION

2.1 Directions to Project Site

The CCS is spread over three different parcels of private property. The three parcels are owned by: Melvin Whitfield; Lyndon Whitfield and Karen Whitfield; and Greg Britz and Elizabeth Brown. The site is located off of Dodsons Crossroads 6 miles west of Carrboro, North Carolina in Orange County. Specifically, the site is approximately 800 feet north of the intersection of Dodsons Crossroads and NC 54 (Figure 1). The project is centered at approximately 35.9313 degrees north and 79.1788 degrees east (WGS84).

From Raleigh:
Proceed west on Interstate 40. Take Exit 273 and travel west on NC 54. Continue west on NC 54 as it joins NC 15-501 and then later splits off from NC 15-501. Approximately 7.5 miles after splitting off from NC 15-501, turn right onto Dodsons Crossroads. The project is accessible from the Whitfield property driveway approximately 0.3 mile on the left.

2.2 USGS Hydrologic Unit Code and NCDWQ River Basin Designations

The UTCC is a third order stream that flows northeast to southwest for approximately 2,310 linear feet on the project site starting at Station 10+00. T1 begins as a first order hydrologic feature that flows southeast to northwest for approximately 3,143 linear feet before its confluence with UTCC at Station 10+00. T1A is a first order hydrologic feature that flows south to north for approximately 725 linear feet before it joins T1 near Station 46+37 (Existing). T1B is a first order hydrologic feature that flows east to west for approximately 1,072 linear feet before reaching T1 near Station 53+20 (Existing). T2 is a first order hydrologic feature that flows southeast to northwest for approximately 1,879 linear feet before its confluence with UTCC near Station 23+73 (Existing). The structure of this restoration project is illustrated in Table 1.

The site is within the 03030002 (Cape Fear 02) Watershed Cataloging Unit (8-digit HUC) and the 03030002050060 Local Watershed Unit (14-digit HUC). It also falls within the North Carolina Division of Water Quality (DWQ) Subbasin 03-06-04. This 14-digit HUC has not been identified as a Targeted Local Watershed (NCDENR, WRP 2001).

3.0 WATERSHED CHARACTERIZATION

The project site is located in a rural setting within the Carolina Slate Belt ecoregion of the Piedmont physiographic province (Figure 2). Site topography within the project watershed is characterized as gently rolling hills. Elevations within the project watershed range from 780 feet above mean sea level (AMSL) at the top of the drainage to 504 feet AMSL at the bottom of the CCS.

3.1 Drainage Area

The site drains to the southeast with a contributing drainage area of approximately 2.6 square miles at the downstream project limits (Figure 3). The watershed's southern boundary runs along NC 54. The northern boundary is below the intersection of Dodsons Crossroads and Dairyland Road. The eastern and western boundaries of the watershed are formed by the topography of the rural landscape.

3.2 Water Surface Classification/Water Quality

The DWQ assigns surface water classifications in order to help protect, maintain, and preserve water quality. The project tributaries have not been designated classifications, but the main stem of Collins Creek downstream of the project is designated as a Class C and Nutrient Sensitive Water (NCDENR, DWQ 2005).

- **Class C Waters** in North Carolina are protected for secondary recreation, fishing, wildlife, fish and aquatic life propagation and survival, agriculture and other uses suitable for Class C. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner. There are no restrictions on watershed development or types of discharges.
- **Nutrient Sensitive Waters** is a supplemental classification intended for waters needing additional nutrient management due to their being subject to excessive growth of microscopic or macroscopic vegetation. In general, management strategies for point and nonpoint source pollution control require control of nutrients (nitrogen and/or phosphorus usually) such that excessive growths of vegetation are reduced or prevented and there is no increase in nutrients over target levels. Management strategies are site-specific (NCDENR, DWQ 2007).

In 2006, a downstream reach of Collins Creek was listed on the 303(d) list as impaired for biological integrity; the potential source for this impairment was listed as agriculture (NCDENR, DWQ 2006). During a 2003 assessment, excessive growths of algae were noted at this location on Collins Creek, which indicated high levels of nutrients (NCDENR, DWQ 2004). This section of Collins Creek is approximately 5.4 miles downstream of the CCS. Any excessive nutrients and sedimentation from the existing project tributaries will contribute to this impairment. Collins Creek then flows into the Haw River before eventually reaching Jordan Lake, which is also listed on the 2006 303(d) list. Jordan Lake is impaired for exceeding chlorophyll *a* levels, which are attributed to excessive growth of algae from elevated nutrient levels.

3.3 Geology and Soils

The local geology includes: Metamorphosed Granitic Rock described as megacrystic, well foliated locally and containing hornblende; Felsic Metavolcanic Rock described as metamorphosed dacitic to rhyolitic flows and tufts, light gray to greenish gray interbedded with mafic and intermediate metavolcanic rock, meta-argillite, and metamudstone; and Metavolcanic-Epiclastic Rock described as metamorphosed argillite, mudstone, volcanic sandstone, conglomerate, and volcanic rock (NCDENR, NCGS 1985).

According to the Soil Survey of Orange County, Congaree fine sandy loam is the predominant soil type located within the project boundary (Figure 4). Congaree soils form well-drained narrow bands parallel to streams on floodplains. The surface is typically brown fine sandy loam with an underlying layer of deep sandy loam, sandy clay loam, and light gray silt loam. Other soils in the drainage area are Georgeville silt loam, Appling sandy loam, Appling-Urban land complex, and Tatum silt loam. The Appling and Georgeville soils are well drained and associated with soils having a gravelly surface layer. Tatum soil is on side slopes and has a strong brown silt loam surface with a lower layer of red silty clay (USDA, SCS 1977).

3.4 Historical Land Use and Development Trends

3.4.1 Historical Resources

Historical aerial photographs were obtained from the Orange County Natural Resources Conservation Service (NRCS) in order to assess the history of the site. A thorough understanding of the chronology of land disturbance aids in the development of an appropriate restoration strategy. Aerial photographs of the site were obtained from 1938, 1955, 1966, 1972, 1982, 1993, 1998, and 2003 (Appendix A).

In 1938, the CCS appears to be predominantly in agriculture. Small sections of riparian forest still border the project streams, particularly along UTCC. It is difficult to distinguish the location of the stream channels on this photograph other than by the riparian vegetation. The surrounding area is a mixture of forest and agriculture.

The CCS appears mostly unchanged from 1938 in the 1955 image. North and south of the project site, some of the former agricultural lands have grown over with sparse forest. Some riparian vegetation along T1 may have been cleared since 1938.

In the 1966 photograph, the CCS is similar to the 1955 photograph. The headwaters of Tributary 2 are still forested and some riparian vegetation remains along the other streams. The project site remains under agricultural and/or grazing production. Some minor changes resulted in the conversion of forest to farmland as well as former agricultural land being abandoned in the surrounding area. The 1972 image also shows little change from the 1966 photograph.

In 1982, the CCS appears very similar to the previous historic photographs. The land use does not appear to have changed significantly. The pond in the southeast corner of the project site has been built by this time. There is a noticeable increase in the amount of low-density residential development surrounding the project site. The 1993 photograph shows a similar state as in the 1982 aerial.

By 1998, a private road had been constructed across the property along the upper portion of the CCS. The riparian vegetation does not show any significant changes and the surrounding land uses appear the same as in 1993. The photograph from 2003 shows only a few small changes. A gas easement is visible on the photograph just west of the project limits. A private residence has been constructed in the northwest corner of the site.

With the exception of the documented riparian vegetation reduction, no changes in the UTCC valley or channel pattern and dimension were observed within the project area during the period of photographic record. Based on the photographic record, the project streams were already modified at some point prior to 1938.

3.4.2 Land Use and Development Potential

Using an Anderson Level I classification, the predominate land uses in the project watershed consist of 88.2% forest, 4.8% agricultural, 4.6% rangeland, and 1.2% urban or built-up land (Table 2 and Figure 5) (McKerrow 2003). However, suburban development may make up a greater portion of land use since the land use classification was completed. The closest municipality to the project watershed is the Town of Chapel Hill, which is experiencing controlled suburban growth. In general, the project watershed is rural and faces moderate development pressure from the nearby Chapel Hill/Carrboro area.

Currently, the majority of the property is used as active pasture for livestock grazing with the remainder in residential use. A small number of buildings, farm equipment, and a small farm pond are located in the southeastern part of the project property. Another landowner resides in a house located in the northwest corner of the subject property.

3.5 Endangered/Threatened Species

A formal review by the North Carolina Natural Heritage Program (NHP) was requested in July 2005 to identify the presence of rare species, critical habitats, and priority natural areas on the project site and to determine the potential impact of the proposed project on these resources. In their Findings Letter dated July 11, 2005, the NHP indicated “no record of rare species, significant natural communities, or priority

natural areas at the site or within a mile of the project area." In addition, no threatened or endangered species were identified in the project area during the existing conditions site assessment (Appendix B).

3.6 Cultural Resources

To evaluate the presence of significant cultural resources on the subject property and any potential impacts from the proposed project, KCI requested a formal review of the site by the North Carolina Department of Cultural Resources, State Historic Preservation Office (SHPO). The SHPO review identified "no historic resources which would be affected by the project." The formal review by the State Archeology Office also identified no potential archaeological sites on or around the subject property (Appendix B).

3.7 Potential Constraints

The site was evaluated for any constraints that could hinder the implementation of a successful mitigation project. In addition, any field conditions that could restrict the restoration design and implementation were documented during the field investigation.

3.7.1 Property Ownership and Boundary

The CCS is located on three different parcels: Mr. and Mrs. Lyndon and Karen Whitfield, 9623 Dodsons Crossroads, Chapel Hill, North Carolina 27516 (PIN 9749-72-3924); Mr. Melvin Whitfield, 9901 Leta Drive, Chapel Hill, North Carolina 27516 (PIN 9749-63-7417); and Mr. Greg Britz and Ms. Elizabeth Brown, 9505 Dodsons Crossroads, Chapel Hill, North Carolina 27516 (PIN 9749-54-9265). On the area identified for stream restoration/enhancement and riparian buffer revegetation, KCI acquired a conservation easement that is now held by the State of North Carolina. The conservation easement boundary (plat with legal description) has been included in Appendix C.

3.7.2 Site Access

There are two access points off of Dodsons Crossroads to the CCS. T1A and a portion of T1 are accessible from the private road (Leta Drive) to Lyndon and Karen Whitfield's property, 9623 Dodsons Crossroads. The rest of the project can be reached from the gravel driveway of Greg Britz and Elizabeth Brown's property, 9505 Dodsons Crossroads.

3.7.3 Utilities

A power line is in place along Dodsons Crossroads. It runs along the western side of Dodsons Crossroads until Tributary 1 enters the project site and then it continues on the eastern side of Dodsons Crossroads after this point. Duke Energy has a recorded easement on Melvin Whitfield's property dated May 2, 1984 (Orange County Deed Book 463, Page 228); this is included in Appendix B. There are no legal survey boundaries stated within this document, but correspondence with Duke Energy revealed that the easement is a standard distribution right-of-way, which grants 15 feet of right-of-way on each side of the power line. Vegetation up to 15 feet in height is allowed within this right-of-way easement (Duke Energy 2007). In the areas where the Duke Energy easement and the conservation easement intersect, the stream restoration design will be completed as normal, but only shrubs will be planted. These areas will not be included in calculating mitigation credit.

There are also power lines that run along both driveways described in Section 3.7.1 above. These power lines deliver electricity to the project landowners and will not interfere with the mitigation activities at the CCS.

3.7.4 FEMA / Hydrologic Trespass

UTCC and portions of T1 and T2 are located within the 100-year floodplain (Zone AE as shown in Figure 6). The site is located in a limited detail study (FEMA 2007). Any modifications to the stream that would result in the increase of the 100-year flood elevation or distinct change in the character of the floodplain

would require a Conditional Letter of Map Revision (CLOMR) and/or a Letter of Map Revision (LOMR). KCI has initiated the coordination process with the floodplain administrator for Orange County (Glenn Bowles). Based on a general description of the proposed project, Mr. Bowles anticipated that a proposed model would be required and that a LOMR would be necessary if the proposed model showed a change in floodplain elevations.

KCI has acquired the existing HEC-RAS model from FEMA for Collins Creek Tributary I as shown on Map Number 3710974900J. KCI has developed a conditional floodplain model by updating the published hydraulic data with the detailed topographic survey used to prepare the construction drawings for the CCS. The proposed model represents the conditions following changes to the channel and floodplain as a result of the restoration. Following completion of the final design, the proposed model will be updated and submitted to Orange County for approval.

The CCS is contained on three properties. The proposed restoration is not anticipated to produce hydrologic trespass conditions on any adjacent properties.

4.0 PROJECT SITE STREAMS (EXISTING CONDITIONS)

A site field assessment was conducted in February 2006 to document existing conditions and evaluate the appropriate design approach for the project reaches. The locations of the cross-sections and profiles that were surveyed in the field are shown in Figure 7. Data collected during the assessment are summarized and presented along with site photographs in Appendices D and E, respectively.

4.1 General Site Description

The CCS consists of approximately 2,310 existing linear feet of UTCC and approximately 6,819 linear feet of four tributaries (T1, T2, T1A, and T1B as shown in Figure 7). The project begins at the confluence of UTCC and T1 near the northern property boundary of the site at Station 10+00. UTCC flows southwest and passes under a private driveway before continuing downstream toward the project end at the property line. T1 and T2 are perennial drainages that flow southeast to northwest before joining UTCC at Stations 10+00 (Existing) and 23+75 (Existing), respectively. T1A and T1B are perennial drainages that flow southwest to northeast and east to west before joining T1 at Stations 46+37 and 53+20 (Existing), respectively.

The project streams have become degraded primarily through poor grazing management and vegetation removal. Historic aerial photographs show that the land surrounding the streams has been in rangeland for at least 65 years and cattle and horses continue to have access to the project streams at this time. The streams have experienced bank erosion, which has led to excessive sediment throughout the CCS. Bed degradation and aggradation are also evident throughout the different project reaches. All of the reaches exhibit areas of vertical instability.

T1A comes out of a forested tract before entering the project site, but then becomes a diffuse channel with no defined thalweg due to grazing impacts. After crossing under a private road, T1A becomes a comparatively steep, deeply incised channel that travels through a horse pasture before entering T1. T1 enters the CCS as it exits a culvert under Dodsons Crossroads. There is a large scour pool below the culvert and a deeply overwidened section approximately 100 feet downstream of the beginning of the reach. Once T1A joins T1 at Station 46+37, the stream enters into open pasture where the banks have eroded. T1 continues under another private road before it reaches the confluence with T1B. Beginning at the northeast corner of the site, T1B also enters from a culvert under Dodsons Crossroads. T1B has been channelized at some point and it is a narrow channel with dense red cedars (*Juniperus virginiana*) along its length. There is also minimal bed feature variability along T1B. At Station 53+50, T1B enters T1 and T1 then continues through pasture until it reaches UTCC at Station 74+39. UTCC begins at Station 10+00 as it comes out of a forested bottomland. As UTCC comes onto the CCS, it has varying riparian coverage

with moderate access to a floodplain. As it continues downstream, UTCC's riparian coverage decreases and grazing has caused bank degradation and high sediment inputs. T2 is a headwater stream that is fed by a seep and flows through livestock pasture before entering UTCC at Station 138+95.

There is a large variation in the amount of riparian vegetation along each reach. Some of the reaches have 10 to 15 feet of sparse vegetation primarily composed of weedy herbaceous species and red cedar while along other reaches riparian vegetation is absent due to livestock access to the stream banks. Parts of T2 flow under a mature canopy, but the tributary lacks any vegetation along the immediate banks of the stream.

4.2 Channel Morphology (Pattern, Dimension, and Profile)

A Rosgen Level III assessment was conducted to gather existing stream dimension, pattern, and profile data and determine the degree of channel instability. Channel cross-sections and bed materials were surveyed at five representative locations along the UTCC, eleven locations along T1, two locations each along T1A and T1B, and six locations along T2. Data developed from these surveys are presented with channel morphology summaries in Appendix E.

4.3 Channel Stability Assessment

A qualitative stability assessment was performed to estimate the level of departure and determine the likely causes of the channel disturbance. This assessment facilitates the decision-making process with respect to restoration alternatives and establishing goals for successful restoration.

UTCC exhibits the typical characteristics of an unstable stream channel. Most notably, the channel shows evidence of bank degradation and widening. Poor grazing management is the primary cause of disturbance, but the past removal of riparian vegetation has exacerbated bank erosion by eliminating rooting strength and cover protection. Few defined features were found along UTCC. The majority of UTCC has banks that have been trampled by cattle and the stream lacks stable stream dimensions. One of the culverts on UTCC has become blocked with debris and created a ponded, overwidened section of channel. In other sections, the banks are vertical and have little riparian vegetation.

The tributaries draining to UTCC all show signs of instability as well. At the beginning of T1A, the reach has undefined banks as it flows through a trampled horse pasture. As T1A becomes more of defined channel at Station 82+89 (Existing), it becomes highly incised with bank height ratios ranging from 2.3-4.6. There are many vertical banks and the stream is headcutting up from its confluence with T1. The bank height ratios (2.0-2.4) along the beginning of T1 show that this tributary is also incised. The culvert at the beginning of T1 has formed a large pool that is followed by an overwidened section of channel downstream. After this point, T1 continues through pasture and is made up of incised channel interspersed with wide cattle crossings until the confluence with T1B. The top of T1B also begins with a culvert. Once the channel comes onto the site, the upstream portion of T1B has a high bank height ratio of 1.7. Further downstream, T1B has fewer unstable banks with a bank height ratio closer to 1, but the channel is confined by dense red cedars and there is little bed diversity. Once T1B joins T1, the downstream portion of T1 has bank height ratios in the range of 1.2–1.3 and also lacks defined bed features.

Along T2, bank height ratios are in the range of 1.3-2.5. Along this tributary, cattle and horse grazing have eroded the banks and caused the channel to become too wide in many sections. Although there are mature trees along the upper portion of T2, little riparian vegetation remains directly along the stream to stabilize the banks. At the downstream end of T2, the tributary is headcutting up from the confluence with UTCC and has created a highly sinuous, unstable pattern.

4.4 Bankfull Verification

The standard methodology used in natural channel design is based on the ability to select the appropriate bankfull discharge and generate the corresponding bankfull hydraulic geometry from a stable reference system(s). The determination of bankfull stage is the most critical component of the natural channel design process.

Bankfull can be defined as "the stage at which channel maintenance is most effective, that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphologic characteristics of the channels" (Dunne and Leopold 1978). Several characteristics that commonly indicate the bankfull stage include: breaks in slope, changes in vegetation, highest depositional features (i.e. point bars), and highest scour line. The identification of bankfull stage, especially in a degraded system, can be difficult. Therefore, verification measures were undertaken to facilitate the correct identification of the bankfull stage on the CCS.

The two methods used to verify bankfull stage at UTCC were regional hydraulic geometry relationships (regional curves) and a pressure transducer/data logger combination gauge that monitored actual water level in the UTCC throughout the study period.

Regional curves are typically utilized in ungauged areas to approximate bankfull discharge, area, width, and depth as a function of drainage area based on interrelated variables from other similar streams in the same hydrophysiographic province. Regional curves and corresponding equations were used to approximate bankfull in the project reaches (Harman et al. 1999). Based on the regional curve, a bankfull discharge of 182 cfs was estimated for the bottom of UTCC. Bankfull discharges based on the regional curve were also calculated for the project tributaries: 10 cfs for T1A; 10 cfs for T1B; 55 cfs for T1; and 14 cfs for T2. However, the calculations for T1, T1A, T1B, and T2 are based on drainage areas that are smaller than those used to create the regional geometry regression relationship and therefore these values have less confidence attached to them (see Table 3 for drainage areas). The beginnings of T1 and T1B are also both influenced by the increased amount of impervious surface from Dodsons Crossroads and NC 54, which creates the potential for flashier runoff after a storm event. T2 is a headwater stream that is fed by a seep at the top of its drainage area.

Stream stage data (water levels) were collected from a pressure transducer gauge on UTCC. Data were collected for seventeen months (November 2005 through May 2007) and water levels were correlated to an estimated discharge using a rating curve generated for the gauged section. Based on the stream dimensions at the gauge, the discharge at which water accesses the existing floodplain was approximated at 179 cfs at 4.4 feet. During the gauging period, the largest flow occurred on November 22, 2006 at a stage of 5.2 feet during a storm event that produced 3.3 inches over 24 hours. Using precipitation frequency estimates, this storm event has an average reoccurrence interval of approximately 1.7 years (NOAA, NWS 2007). The second largest event took place on March 2, 2007 with 1.2 inches of rain over 6 hours, which produced a stage of 5.0 feet.

4.5 Vegetation

The existing riparian areas throughout the CCS are in pasture, and there are no distinct community types present. The site has experienced clearing in the past, and cattle and horses continue to keep the vegetation to a minimum. Any vegetation along the stream channels is comprised mainly of small brushy shrubs sporadically interspersed with larger trees. Eastern red cedar (*Juniperus virginiana*) is a predominant species along the riparian corridors. Along the upstream section of T2, there are mature trees, but there is no understory community due to grazing. Tree species in this area consist of red maple (*Acer rubrum*), tulip poplar (*Liriodendron tulipifera),* willow oak (*Quercus phellos*), sweet gum (*Liquidambar styraciflua),* and persimmon (*Diospyros virginiana*). These species are also present at the

top of T1. It is the intent of the restoration project to minimize the amount of trees that are removed from existing riparian areas. Any valuable trees that may provide immediate shade to the restored channel will be protected as much as possible.

Several invasive species are pervasive throughout the CCS. Multiflora rose (*Rosa multiflora*) and Chinese privet (*Ligustrum sinense*) are present, often in thickets. Thorny olive (*Elaeagnus pungens*) and Japanese honeysuckle (*Lonicera japonica*) are also found at the project site.

5.0 REFERENCE STREAMS

A reference reach is a channel with a stable dimension, pattern, and profile within a particular valley morphology. The reference reach is used to develop dimensionless morphological ratios (based on bankfull stage) that can be extrapolated to disturbed/unstable streams to restore a stream of the same type and disposition as the reference stream (Rosgen 1998). For this project, six different reference reaches were used to design the proposed restored reaches: Collins Creek in Orange County, an unnamed tributary to Back Creek in Randolph County, Long Branch in Orange County, an unnamed tributary to Richland Creek in Moore County, an unnamed tributary to Fisher River in Surry County, and an unnamed tributary to Wilkinson Creek in Chatham County (see Appendix F for detailed reference reach data).

5.1 Collins Creek Reference Site

A section of Collins Creek, located west of Chapel Hill, was identified and surveyed as a reference reach to use for the restoration design of UTCC. Collins Creek flows southwest through the southern portion of Orange County towards its confluence with the Haw River in Chatham County (Figure 8). This section of Collins Creek is upstream of the confluence of UTCC into Collins Creek. The reference reach is located approximately one mile to the northwest of CCS. The reference site selection was based on the location in the same physiographic province and watershed, similar valley morphology, and similar sediment regime to the project stream. Approximately 300 linear feet of Collins Creek were surveyed in December 2006. This reach of Collins Creek was classified as a Rosgen C4/E4 channel type and has a valley slope of approximately 0.3%.

Collins Creek is situated in the Carolina Slate Belt ecoregion within the Piedmont physiographic province. The Carolina Slate Belt is typified by rolling topography with broad ridges, sharply indented stream valleys, and narrow, low-gradient floodplains. The Collins Creek watershed shares the same 14-digit watershed (hydrologic unit 03030002050060) as the CCS and is located within the DWQ Subbasin 03-06-04 of the Cape Fear River Basin. The reference reach watershed drains approximately 1.7 square miles of low-density residential and forested lands (Figure 9). The headwaters of Collins Creek start to the southwest of the intersection of Dodsons Crossroads and Dairyland Road and flow southwest until the stream meets Orange Grove Road. The topographic relief within the reference reach watershed ranges from approximately 600 feet AMSL at the upstream limits to 530 feet AMSL at the downstream limits.

5.2 UT to Back Creek Reference Site

An unnamed tributary to Back Creek (UTBC), a first order rural stream in Randolph County, was selected as a reference for the restoration of sections of T1 as well as T1B. The reference reach is located northwest of the City of Asheboro off of Lake Lucas Road and is approximately 40 miles to the south-southwest of the CCS (Figure 10). It has moderate to high sinuosity within a mature forested tract of land. The valley slope is 0.7% around the reference reach and the local topography is characterized by rolling hills. Approximately 700 linear feet of UTBC were surveyed and the reach was classified as a Rosgen C4 stream.

UTBC flows south into Back Creek and drains approximately 0.63 square mile (Figure 11). The land use within the reference reach watershed is predominantly forested land with small portions of agriculture and rangeland. The reference site is located within the 14-digit hydrologic unit 03040103050050 in the

Yadkin Basin and is in the DWQ Subbasin 03-07-09. UTBC is located in the Carolina Slate Belt ecoregion in the Piedmont physiographic province. Reference reach watershed elevations range from 700 feet AMSL at the top of the drainage to 545 feet AMSL at the downstream end of the reference reach.

5.3 Long Branch Reference Site

A section of Long Branch, located northwest of Chapel Hill, was identified and surveyed as a reference reach for the restoration of the lower portion of T1. The reference reach is approximately 5 miles to the northeast of the CCS (Figure 12). Long Branch flows northeast through Orange County toward its confluence with New Hope Creek. This reference site was selected based on its location in the same hydrophysiographic province, similar valley morphology, and similar sediment regime as the project stream. Approximately 430 linear feet of Long Branch were surveyed in January 2006. This reach of Long Branch was classified as a Rosgen C4 channel type. The surrounding reference reach valley has a slope of 0.6%.

Long Branch is situated within the Carolina Slate Belt ecoregion in the Piedmont physiographic province. The Long Branch watershed is located within the 14-digit Hydrologic Unit 03030002060110 of the Cape Fear Basin and within DWQ Subbasin 03-06-05. The headwaters of Long Branch form to the north of and along Dodsons Crossroads. The reference reach watershed boundary continues along Arthur Minnis Road to the north and extends almost to Union Grove Church Road to the east. It drains approximately 1.49 square miles of low-density residential, agriculture, and forested lands (Figure 13). The topographic relief within the reference reach ranged from approximately 538 feet AMSL at the upstream limits to 520 feet AMSL at the downstream limits.

5.4 UT to Richland Creek Reference Site

An unnamed tributary to Richland Creek (UTRC) is located in Moore County, west of the Town of Carthage and west of Mount Carmel Road on the Occoneechee Scout Reservation (Figure 14). This reference reach was used to design a portion of T1A. UTRC is approximately 45 miles southwest of the CCS and is a first order rural stream that flows into Richland Creek. This 525-foot reference reach has moderate sinuosity and is within a late-stage successional forest. At this location, UTRC has an average valley slope of 1.2% and was classified as a Rosgen C4 stream type.

The reference reach watershed drains approximately 0.90 square mile of predominately forested land (Figure 15). It is within the 14-digit hydrologic unit 03030003050010 in the Cape Fear Basin and is in the DWQ Subbasin 03-06-10. Old Carthage Road forms the reference watershed boundary to the south and Fire Lane Road bounds the watershed to the north-northwest. The reference site is in the Carolina Slate Belt ecoregion in the Piedmont physiographic province. Elevations range from 571 feet AMSL to 430 feet AMSL at the bottom of the reference reach watershed.

5.5 UT to Fisher River Reference Site

An unnamed tributary to Fisher River (UTFR), a first order rural stream in Surry County, was selected as a reference reach for the restoration of a section of T1A (Figure 16). The reference reach is located on Fisher Valley Road off of Exit 93 from Interstate 77. UTFR is approximately 100 miles to the northwest of the CCS. The valley slope is approximately 1.6%. The sediment distribution and transport closely match T1A. The local topography is characterized by rolling hills. Approximately 300 linear feet of UTFR was surveyed and was classified as a Rosgen B4c channel type.

UTFR flows northeast into Fisher River and drains approximately 0.38 square mile of predominantly forested land with a small section of rangeland (Figure 17). The reference reach watershed is within the Northern Inner Piedmont ecoregion in the Piedmont physiographic province. The site is in the 14-digit hydrologic unit 03040101090010 in the Yadkin Basin and is the DWQ Subbasin 03-07-02. The reference

reach watershed elevations range from 1,420 feet AMSL at the headwaters of the site to 1,210 at the bottom of the reference reach.

5.6 UT to Wilkinson Creek Reference Site

A section of an unnamed tributary to Wilkinson Creek (UTWC), located southwest of Chapel Hill, was identified and surveyed as a reference reach for the restoration of T2 (Figure 18). UTWC is approximately 7 miles southeast of the CCS. The reference reach flows west through Chatham County towards its confluence with Wilkinson Creek. This selection was based on its location in the same physiographic province, similar valley morphology, and similar sediment regime to the project site. Approximately 205 linear feet of UTWC were surveyed in May 2006. The site has a valley slope of 1.3% and this reach of UTWC was classified as a Rosgen B4c channel type.

UTWC is situated within the southeastern portion of the Carolina Slate Belt ecoregion in the Piedmont physiographic province. The UTWC site is located in the 14-digit hydrologic unit 03030002050100 in the Cape Fear Basin and is in DWQ Subbasin 03-06-04. The reference reach watershed drains approximately 0.16 square mile of low-density residential, agriculture, and forested lands (Figure 19). Manns Chapel Road bounds the headwaters of the watershed to the east. The topographic relief within the project reach ranged from approximately 590 feet AMSL at the upstream limits to 445 feet AMSL at the downstream limits.

5.7 Reference Vegetative Communities

A survey was conducted to identify and document the dominant plant communities associated with the different reference reaches. Several distinct communities were recognized and species lists were compiled. These lists were used to identify two communities described by Schafale and Weakley that are representative of the reference systems and appropriate for the CCS site (1990).

The natural community identified as representative of the reference reach floodplain areas was the Piedmont Alluvial Forest. This community type is described as existing along river and stream floodplains in more isolated patches when compared to broader floodplain forests. The canopy species that are typically found within a Piedmont Alluvial Forest include river birch (*Betula nigra*), green ash (*Fraxinus pennsylvanica*), sycamore (*Platanus occidentalis*), sweetgum (*Liquidambar styraciflua*), sugarberry (*Celtis laevigata*), black walnut (*Juglans nigra*), shagbark hickory (*Carya ovata*), American elm (*Ulmus americana*), and tulip poplar (*Liriodendron tulipifera*). Species that dominate the understory are ironwood (*Carpinus caroliniana*), common pawpaw (*Asimina triloba*), American holly (*Ilex opaca*), spicebush (*Lindera benzoin*), and painted buckeye (*Aesculus sylvatica*) (Schafale and Weakley 1990).

Mesic Mixed Hardwood Forest was identified as the community type appropriate for stream valleys and slopes leading away from small stream floodplains. Typical species found in the Mesic Mixed Hardwood Forest canopy include American beech (*Fagus grandifolia*), red oak (*Quercus rubra*), tulip poplar (*Liriodendron tulipifera*), red maple (*Acer rubrum*), and sugar maple (*Acer saccarum*). The understory layer commonly has flowering dogwood (*Cornus florida*), hop hornbeam (*Ostrya virginiana*), and American holly (*Ilex opaca*) along with shrub species such as deerberry (*Vaccinium stamineum*), downy arrowwood (*Viburnum rafinesquianum*), and strawberry bush (*Euonymus americana*) (Schafale and Weakley 1990).

6.0 PROJECT SITE RESTORATION PLAN

6.1 Restoration Project Goals and Objectives

The CCS has been degraded as a result of poor grazing management and removal of riparian vegetation. As a result, the ecological diversity and water quality values of the site have been affected adversely.

Based on the existing and reference condition assessments, the restoration goals for the CCS are as follow:

- Improve water quality by reducing nutrient and sediment inputs.
- Create high-quality aquatic and terrestrial habitat along an interconnected forested riparian corridor.

In order to meet these goals, the following objectives must be accomplished:

- Plant a functional Piedmont Alluvial Forest floodplain community along with Mesic Mixed Hardwood Forest to develop an effective riparian buffer.
- Restore stable stream reaches that can handle the hydrologic input from the surrounding drainages.
- Remove cattle and horses from the riparian areas through livestock exclusion fencing.

6.1.1 Designed Channel Classification

The streams at the CCS will be restored using a combination of C, Bc, and B Rosgen stream types. UTCC and its tributaries are divided into reaches based on the drainages entering the streams and the restoration or enhancement approach needed to design the proposed channels (Table 1). The morphological design criteria for each of the reaches are found in Tables 4a, 4b, and 4c.

UTCC has been divided into two reaches for design purposes. UTCC-1 is proposed to start from Station 10+00 and end at Station 23+22, which is where T2 will join UTCC. The second reach, UTCC-2, will go from the confluence with T2 at 23+22 to the end of the project at Station 33+30. Both of these reaches will be restored as C4 channels using the Collins Creek Reference Reach morphological criteria. The entire project length of UTCC currently lacks any defined bed diversity, so the proposed profile will create a riffle-pool sequence with point bars. Stations 10+00-15+00 along UTCC will be enhanced (EI) within the existing pattern through dimensional changes. Downstream of Station 15+00, UTCC will be restored using a Priority 2 approach. The design discharges of UTCC-1 and UTCC-2 are 157 and 169, respectively. These values are slightly lower (7%) than predicted by the regional curve, but the designed stream discharges were also evaluated using the channel hydraulics and sediment transport for the proposed cross-sectional areas. For UTCC-1 and UTCC-2, the Piedmont regional curve estimates cross-sectional areas of 40 and 41 ft^2, whereas the proposed cross-sectional areas are 47.0 and 49.5 ft^2, respectively. The cross-sectional dimensions and resulting discharges were balanced between the predicted area and discharge.

T1 will be restored as a C4 stream type along its entire length and it has been divided into three separate reaches based on the increases in drainage area and changes in valley slope. T1-1 begins at Station 40+00 and ends at Station 45+95 where the new alignment of T1A will enter. After the confluence with T1A, T1-2 continues until T1B enters Station 54+03. T1-3 continues downstream until it joins with UTCC at Station 74+39. The entire length of T1 will be restored using a Priority 2 Approach. The UT to Back Creek Reference Reach was used to develop the morphological criteria for T1-1 and T1-2. The Long Branch Reference Reach was used for the restoration design of T1-3 due to the change in valley slope after the confluence of T1 with T1B.

T1A was also divided into separate reaches. The first reach, T1A-1, enters the site from a forested tract and flows through existing pasture. T1A-1 will be restored from Stations 80+00-82+51 as a C4 stream type using design criteria developed from the UT to Richland Creek Reference Reach. Currently, the stream does not have a defined planform due to livestock impacts, but a meandering C channel with a floodplain will be restored through the existing pasture. Developing a distinct channel for T1A-1 will link the top and bottom channels together and restore habitat and hydrologic connectivity through this section. T1A-2 begins after the stream crosses under a private road at Station 83+08 and ends at the confluence with T1 at Station 88+73. The existing T1-2 channel is a steep, incised channel that has downcut through a straight alignment until it joins T1. The restored reach will be a B4c/C4 channel designed using criteria

from the UT to Fisher River Reference Reach. The restored T1A-2 reach will be a B channel with increased stream length through pattern adjustment interspersed with sections of C channel in areas with floodplain access.

T1B has been designed all as one reach. The existing channel was likely excavated to flow straight down until the confluence with T1. Remnants of a former meandering pattern can still be seen on aerials when looking just south of the existing T1B channel. The proposed reach will be a C4 stream type designed using the UT to Back Creek Reference Reach. The restored T1B pattern will meander back out into the pasture where the channel flowed historically.

T2 has been divided into two reaches. The tributary receives its hydrological input from a headwater seep at the top of its drainage. The upper reach, T2-1, is a steeper channel that is formed as the seep feeds the channel below. This reach, which runs from Stations 120+00 to 126+41, has been designed as a B4 channel. An appropriate reference reach was not found for T2-1. The morphological criteria were developed using the design criteria from the UT to Wilkinson Creek Reference Reach while maintaining the average water surface slope from the existing reach. The pattern was altered to avoid sections where the stream had become too wide. The profile was changed to create a step-pool series that will stabilize the channel while also creating bed diversity. The downstream reach, T2-2, is less steep than T2-1, and is designed as a B4c stream type based on morphological criteria from the UT to Back Creek Reference Reach. At the downstream end of B4c, the existing channel had become more sinuous and unstable, so T2 will have a resulting reduction in linear footage at this point.

Once all of the work on the project tributaries has been completed, livestock exclusion will be installed around the easement area to eliminate the impacts from grazing cattle and horses on the CCS.

6.1.2 Target Buffer Communities

The project will restore a Piedmont Alluvial Forest community along the floodplains of UTCC and its tributaries. Piedmont Alluvial Forests are typical of the small floodplain areas that will be restored at the CCS (see Section 5.7 above). This community will fit into the natural topography and setting created by the newly restored channels.

The buffer areas outside of the stream floodplains will be planted as Mesic Mixed Hardwood Forest (also described in Section 5.7). This community typically exists along lower slopes, north-facing slopes, ravines, and occasionally on well-drained small stream bottoms (Schafale and Weakley 1990).

6.2 Sediment Transport Analysis

The sediment competency of UTCC and its associated tributaries was studied and detailed data are available in Appendix E. Pebble counts were performed on all of the project reaches and pavement, subpavement, and bar samples were taken from T1 and T2. Based on this analysis, the majority of the project reaches are dominated by gravel material. One exception is UTCC. The channel lacks a defined riffle and pool sequence, which has slowed the movement of material from the stream and allowed silt to collect. T1 begins as a true gravel stream, but it is greatly impacted by sedimentation from cattle grazing. At the bottom of T1, the tributary often experiences backwater events from UTCC and is therefore dominated by silt/clay material just before the confluence. T1A does not have a defined channel at the beginning of the tributary, but once it passes under a private road crossing, it becomes much steeper and has a D_{84} of 35 mm from a riffle pebble count. T1B is not as steep as T1A and has a D_{84} of 7 mm from a reach pebble count before it joins T1. T2 has the largest D_{84} material among the project reaches, ranging from 42 mm at the top to 26 mm at the bottom of the tributary. This tributary has a steep grade with a small contributing drainage area, which is causing T2 to function as a transport reach and carry all watershed sediment inputs through while not moving any bed material.

After analyzing the existing sediment conditions, the site was studied with respect to sediment transport in the proposed reaches. In fluvial systems, there is a threshold level of bedload movement that will result in a noticeable change in the channel bed. In natural streambeds, there are particles in a wide range of sizes. At low flow levels, only the smallest particles will move, with the larger particles resisting the flow of the stream. This is the condition of partial sediment transport. As the stream flow increases, eventually every particle on the streambed will show threshold movement. This is the condition of full sediment transport. If the largest particle that moves during a bankfull event can be identified, then the flow conditions that produced this movement can be determined and this flow condition (channel competency) can be used in the design of the restored stream. Determinations of the design shear stresses were made based on the sediment distribution from the surface and subsurface sampling.

These shear stresses were validated for the design riffle cross-sections and channel gradient using the equation:

$$\tau = \gamma Rs$$

Where: τ = shear stress (lbs/ft^2)
γ = specific gravity of water (62.4 lbs/ft^3)
R = hydraulic radius (ft)
s = average water slope (ft/ft)

The shear stress values for the designed reaches were calculated and related to the movement of a particular grain size using Shield's threshold of motion curve (Shields et al. 1936). For UTCC, the shear stress ranges from 0.20-0.25 lbs/ft^2, which corresponds to a particle size of 13-16 mm. The shear stress values for T1, T1A-1, and T1B all are in the range of 0.29-0.37 lbs/ft^2, indicating a mobilized particle size of 17-20 mm. T1A-2 is a steeper reach and has a shear stress of 0.73 lbs/ft^2, which relates to a particle size of 44 mm. T2 has been designed as a threshold channel, and therefore the threshold mobility evaluation provided for the other reaches is not appropriate in this scenario. Based on these calculations, the designed channels provide sufficient competency and are capable of transporting sediment during bankfull events.

6.3 Natural Plant Community Restoration

Riparian vegetation
Riparian plantings shall consist of native woody species. To achieve a mature survivability of 320 stems per acre, 436 stems per acre (10 feet by 10 feet spacing) will be planted. Plant placement and groupings will be randomized during installation in order to develop a more naturalized appearance. Woody vegetation planting will be take place during dormancy. Species to be planted in the floodplain area as Piedmont Alluvial Forest will consist of at least five of the following:

Coralberry	*Symphoricarpos orbiculatas*	Sycamore	*Platanus occidentalis*
Spicebush	*Lindera benzoin*	Sugarberry	*Celtis laevigata*
Winterberry	*Ilex verticillata*	Green Ash	*Fraxinus pennsylvanica*
Beautyberry	*Callicarpa americana*	Willow Oak	*Quercus phellos*
Swamp Chestnut Oak	*Quercus michauxii*	River Birch	*Betula nigra*
Persimmon	*Diospyros virginiana*		

The slopes leading from the floodplain will be planted as Mesic Mixed Hardwood Forest and may consist of the following species:

Black Walnut	*Juglans nigra*	S. Red Oak	*Quercus falcata*
Shagbark Hickory	*Carya ovata*	Spicebush	*Lindera benzoin*
Coralberry	*Symphoricarpos orbiculatas*	Persimmon	*Diospyros virginiana*

On the restored stream banks, live stakes will be used to provide natural stabilization. Appropriate species identified for live staking include:

Elderberry	*Sambucus canadensis*	Silky willow	*Salix sericea*
Silky dogwood	*Cornus amomum*	Black willow	*Salix nigra*

An herbaceous seed mix composed of appropriate native species will also be developed and used to further stabilize and restore the riparian and bank zones following construction.

In additional to planting the proposed community types, vegetative restoration will also include eliminating invasive species that have taken over portions of the site. The targeted species (multiflora rose, Chinese privet, thorny olive, and Japanese honeysuckle) will be treated with a glyphosate herbicide.

7.0 PERFORMANCE CRITERIA

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 success will be assessed utilizing measurements of stream dimension, pattern, and profile; site photographs, and vegetation sampling.

7.1 Stream Stability

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

Dimension – Permanent cross-sections will be established at 10 riffle and 5 pool locations along the project reaches. The following cross-sections will be used to evaluate stream dimension: 3 riffle and 2 pool cross-sections on UTCC, 4 riffle and 2 pool cross-sections on T1, 1 riffle cross-section on T1A, 1 riffle cross-section on T1B, and 1 riffle and 1 pool cross-section each on T2. Permanent monuments will be established by conventional survey. The cross-section surveys shall provide a detailed measurement of the stream and banks and will include points on the adjacent floodplain or valley, at the top of bank, bankfull, at all breaks in slope, the edge of water, and thalweg. Width/depth and entrenchment ratios will be calculated for each cross-section based on the survey data.

Cross-section measurements should show little or no change from the as-built cross-sections. If changes do occur, they will be evaluated to determine whether they are minor adjustments associated with settling and increased stability or whether they indicate movement toward an unstable condition.

Profile – Longitudinal profiles will be conducted on approximately 3,000 linear feet of the project reaches. Along UTCC, a total of 1,000 linear feet of longitudinal profile will be surveyed. An additional 1,000 linear feet will be surveyed on T1. The remaining longitudinal profile will be surveyed along 500 linear feet of T2 and 250 linear feet each along T1A and T1B. Measurements will include slopes (average, pool, and riffle) as well as calculations of pool-to-pool spacing. Annual measurements should indicate that bedform features are stable with little change from the as-built survey. The pools should maintain their depth with lower water surface slopes, while the riffles should remain shallower and steeper than the average values for the stream.

Pattern - Measurements associated with the restored channel pattern shall be taken on the section of the stream included in the longitudinal profiles. These data will include belt width, meander length, and radius of curvature. Subsequently, sinuosity, meander width ratios, radius of curvature, and meander length/bankfull width ratios will be calculated.

Bed Materials **-** Pebble counts will be conducted at each representative cross-section for the purpose of repeated classification and to evaluate sediment transport.

Photograph Reference Points – Thirty photograph reference points (PRP) will be established to assist in characterizing the site and to allow qualitative evaluation of the site conditions. The location and bearing/orientation of each photo point will be documented to allow for repeated use.

Cross-section Photograph Reference Points – Each cross-section will be photographed to show the form of the channel with the tape measure stretched over the channel for reference in each photograph. An effort will be made to consistently show the same area in each photograph.

7.2 Vegetation

The success of the riparian buffer plantings will be evaluated using 15 ten by ten meter vegetative sampling plots and will use the stream vegetation monitoring protocol set out by the EEP. The corners of each monitoring plot will be permanently marked in the field. The coordinates of the plot corners well as the individual trees will be recorded using conventional survey. The monitoring will consist of the following data inventory: composition and number of surviving species, total number of stems per acre, diameter at decimeter height (DDH), diameter at breast height (DBH) for trees greater than 5 feet in height, and vigor. Additionally, a photograph will be taken of each plot that will be replicated each monitoring year. Riparian vegetation must meet a minimum survival success rate of 320 stems/acre after five years. If monitoring indicates that the specified survival rate is not being met, appropriate corrective actions will take place, which may include invasive species control, the removal of dead/dying plants and replanting.

7.3 Schedule/Reporting

The first scheduled monitoring will be conducted during the first full growing season following project completion. Monitoring shall subsequently be conducted annually for a total period of five years.

Annual monitoring reports will be prepared and submitted after all monitoring tasks for each year are completed. The report will document the monitored components of the restoration plan and include all collected data, analyses, and photographs. Each report will provide the new monitoring data and compare the most recent results against previous findings. The monitoring report format will be similar to that set out in the most recent EEP monitoring protocol.

Variations from the designed project reaches can be anticipated due to unknown site conditions, inputs from outside the restoration site, regional climatic variations, or acts of God, etc. Regular management activities will be implemented as necessary to ensure that the goals and objectives of the project are met. These activities will be conducted throughout the year and may include invasive species control or other management activities. If the monitoring identifies failures in the project site, a remedial action plan will be developed to investigate the causes of the failure and propose actions to rectify the problem.

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Tables

Table 1. Project Restoration Structure and Objectives

Reach	Existing Stationing	Proposed Stationing	Mitigation Type	Priority Approach	Existing Linear Footage	Designed Linear Footage	Comments
UTCC-1	10+00 - 23+73	10+00 - 23+22	Enhancement/Restoration	P2	1,323	1,271	Excludes one 50 ft crossing
UTCC-2	23+73 - 34+11	23+22 - 33+30	Restoration	P2	987	956	Excludes one 50 ft crossing
T1-1	40+00 - 46+37	40+00 - 45+95	Restoration	P2	607	595	T1A-2 is proposed to enter at a point further upstream than the existing confluence, thus reducing the length of T1-1
T1-2	46+37 - 53+20	45+95 - 54+28	Restoration	P2	604	767	Excludes one 16 ft crossing and one 50 ft crossing
T1-3	53+20 - 73+71	54+28 - 74+39	Restoration	P2	1,932	1,891	Excludes one 16 ft crossing and 103 ft that go off of the project property
T1A-1	80+43 - 82+35	80+00 - 82+51	Restoration	P2	192	251	
T1A-2	82+89 - 88+22	83+08 - 88+73	Restoration	P2/P3	533	565	
T1B	100+00 - 110+02	100+00 - 111+34	Restoration	P2	1,072	1,134	
T2-1	120+00 - 126+41	120+00 - 126+41	Restoration	P3	641	641	
T2-2	126+41 - 138+95	126+41 - 138+46	Restoration	P3	1,238	1,189	Excludes one 16 ft crossing

Table 2. Project Watershed Land Use

Land Use	Acreage	Percentage of Watershed
Forest	1479.1	88.2%
Agriculture	80.1	4.8%
Rangeland	76.5	4.6%
Urban or Built-up L	19.6	1.2%
Wetland	13.3	0.8%
Water	7.8	0.5%

Table 3. Project Drainage Areas

Reach	Drainge Area (Square Miles)
T1-1	0.12
T1-2	0.18
T1-3	0.49
T1A-1	0.04
T1A-2	0.05
T1B	0.24
T2-1	0.03
T2-2	0.07
UTCC-1	2.51
UTCC-2	2.62

Table 4a. Morphological Criteria for UTCC and T2

Variables		Existing		Ref. Reach UTWC	Proposed		Existing		Ref. Reach Collins Creek	Proposed	
		T2-1	T2-2		T2-1	T2-2	UTCC-1	UTCC-2		UTCC-1	UTCC-2
Rosgen Stream Type		B4/G4	E4/G4c	B4c	B4	B4c	E4	C4/E4	C4/E4	C4	C4
Drainage Area (mi^2)		0.07	0.07	0.16	0.07	0.07	2.51	2.62	1.68	2.51	2.62
Bankfull Width (W_{bkf}) (ft)		3.0-4.5	4.2-7.2	7.7-10.8	7.0	7.0	15.4-16.5	20.5	11.9-20.1	24.0	25.0
Bankfull Mean Depth (d_{bkf}) (ft)		0.4-0.6	0.9-1.1	0.7-0.9	0.6	0.6	2.4-3.1	2.4	1.7-2.7	2.0	2.0
Bankfull Cross Sectional Area (A_{bkf}) (ft^2)		1.7-1.8	4.0-6.4	6.1-8.8	4.8	4.8	40.4-47.1	49.7	32.4-33.4	47.0	49.5
Width/depth Ratio (W_{bkf}/d_{bkf})		5.0-11.3	3.8-8.0	8.5-11.4	11.0	11.0	5.0-6.9	8.5	4.4-12.1	12.0	12.5
Maximum Depth (d_{mbkf}) (ft)		0.7-0.9	1.3-1.5	1.1-1.4	1.0	1.0	3.3-4.6	3.5	3.3-4.2	2.9	2.9
Width of flood prone area (W_{fpa}) (ft)		6-7	8-28	13-16	13	13	54	>60	>60	54	55
Entrenchment Ratio (ER)		1.6-2.0	1.3-4.6	1.6-2.1	1.9	1.9	3.3-3.5	>2.9	3.0	2.3	2.2
Sinuosity (stream length/valley length) (K)		1.1	1.16	1.2	1.1	1.2	1.27	1.17	1.25	1.2	1.2
Dimension	Pool Depth (ft)	0.8	1.6	0.8-0.9	0.6-0.8	0.6-0.8	3.2	-	2.4	2.6	2.6
	Riffle Depth (ft)	0.4-0.6	0.9-1.1	0.7-0.9	0.6	0.6	2.4-3.1	2.4	1.7-2.7	2.0	2.0
	Pool Width (ft)	5.3	4.9	10.0-10.8	6.5-9.9	6.5-9.9	13.4	-	24.3	28.0	28.0
	Riffle Width (ft)	3.0-4.5	4.2-7.2	7.7-10.8	7.0	7.0	15.4-16.5	20.5	11.9-20.1	24.0	25.0
	Pool XS Area (sf)	1.3	7.7	8.6-8.8	4.4-6.5	4.4-6.5	42.6	-	57.9	72.8	72.8
	Riffle XS Area (sf)	1.7-1.8	4.0-6.4	6.1-8.8	4.5	4.5	40.4-47.1	49.7	32.4-33.4	47.0	49.5
	Pool depth/mean riffle depth	1.3-2.0	1.5-1.8	0.9-1.3	0.9-1.3	0.9-1.3	1.0-1.3	-	0.9-1.4	1.3	1.3
	Pool width/riffle width	1.2-1.8	0.6-1.2	0.9-1.4	0.9-1.4	0.9-1.4	0.8-0.9	-	1.2-2.0	1.2	1.1
	Pool area/riffle area	2.4-2.5	1.2-1.9	1.0-1.4	1.0-1.4	1.0-1.4	0.9-1.1	-	1.0-1.8	1.5	1.5
	Max pool depth/d_{bkf}	2.2-3.2	1.8-2.2	2.7-4.4	2.7-4.4	2.7-4.4	1.2-1.6	-	1.5-2.5	2.3	2.3
	Low bank height/max bankfull depth	2.7-2.8	1.3-2.5	-	1.0	1.0	1.0	1.1	1.0-1.1	1.0	1.0
	Mean Bankfull Velocity (V) (fps)	3.5-4.7	5.2-5.6	5.1-5.8	4.1	4.1	3.1-3.8	3.2	3.4-4.4	3.0	3.0
	Bankfull Discharge (Q) (cfs)	6-8	21-33	31-49	20	20	123-174	160	115-150	157	169
Pattern	Meander length (L_m) (ft)	174-182	50-306	49-59	32-54	32-54	79-286	96-164	77-138	91-275	92-278
	Radius of curvature (R_c) (ft)	32-56	14-78	11-23	7-21	7-21	18-38	16-126	24-31	28-62	29-63
	Belt width (W_{blt}) (ft)	45	22-50	22	14-20	14-20	55-136	53-73	50-60	59-120	60-121
	Meander width ratio (W_{blt}/W_{bkf})	10.0-15.0	3.1-11.9	2.0-2.9	2.0-2.9	2.0-2.9	3.3-8.8	2.6-3.6	2.5-5.0	2.5-5.0	2.5-5.0
	Radius of curvature/bankfull width	7.1-18.7	1.9-18.6	1.0-3.0	1.0-3.0	1.0-3.0	1.1-2.5	0.8-6.1	1.2-2.6	1.2-2.6	1.2-2.6
	Meander length/bankfull width	38.7-60.7	6.9-72.9	4.5-7.7	4.5-7.7	4.5-7.7	4.8-18.6	4.7-8.0	3.8-11.6	3.8-11.6	3.8-11.6
Profile	Valley slope	0.0270	0.0207	0.0170	0.0270	0.0210	0.0024	0.0024	0.0030	0.0024	0.0024
	Average water surface slope	0.0250	0.0147	0.0120	0.0250	0.0170	0.0020	0.0020	0.0030	0.0019	0.0019
	Riffle slope	-	0.016-0.054	0.012-0.028	0.025-0.047	0.017-0.039	-	-	0.003-0.008	0.002-0.005	0.002-0.005
	Pool slope	-	0-0.0041	0-0.0030	0-0.0040	0-0.0040	-	-	0	0	0
	Pool to pool spacing	-	16-96	-	21-72	25-54	-	-	32-80	40-200	115-165
	Pool length	-	3-8	5-9	3-15	4-20	-	-	13-21	11-32	35-56
	Riffle slope/avg water surface slope	-	1.1-3.7	1.0-2.3	1.0-1.9	1.0-2.3	-	-	1.0-2.7	1.0-2.7	1.0-2.7
	Pool slope/avg water surface slope	-	0-0.28	0-0.24	0-0.16	0-0.24	-	-	0	0	0
	Run slope/avg water surface slope	-	-	-	-	-	-	-	-	-	-
	Run depth/d_{bkf}	-	-	-	-	-	-	-	-	-	-
	Pool length/bankfull width	-	0.4-1.9	0.5-1.2	0.4-2.1	0.6-2.9	-	-	0.6-1.8	0.5-1.3	1.4-2.2
	Pool to pool spacing/bankfull width	-	2.2-22.9	-	3.0-10.3	3.6-7.7	-	-	1.6-6.7	1.7-8.3	4.6-6.6

T2-1, UTCC-1, and UTCC-2 all lacked defined riffle and pool sequences and therefore not all profile data are available.

Table 4b. Morphological Criteria for T1

Variables		Existing		Ref. Reach UT Back Creek	Proposed		Existing	Ref. Reach Long Branch	Proposed
		T1-1	T1-2		T1-1	T1-2	T1-3		T1-3
Rosgen Stream Type		G4c/E4	G4c/E4	C4	C4	C4	E4	C4	C4
Drainage Area (mi^2)		0.12	0.18	0.63	0.12	0.18	0.49	1.49	0.49
Bankfull Width (W_{bkf}) (ft)		5.8-10.8	5.7-10.1	10.4-16.1	10.4	12.0	7.7-11.9	14.8-18.8	15.0
Bankfull Mean Depth (d_{bkf}) (ft)		1.1-1.5	1.1-1.4	0.9-1.2	0.8	0.9	1.3-2.0	1.3-1.8	1.1
Bankfull Cross Sectional Area (A_{bkf}) (ft^2)		8.6-9.3	8.2-10.8	12.5-14.4	8.2	11.2	14.5-15.5	25.0	16.9
Width/depth Ratio (W_{bkf}/d_{bkf})		3.9-9.8	4.1-9.2	11.6-13.4	13.3	13.3	3.9-9.2	9.0-14.0	13.3
Maximum Depth (d_{mbkf}) (ft)		1.6-2.3	1.4-1.8	1.4-1.7	1.2	1.4	2.5-2.7	1.9-2.4	1.6
Width of flood prone area (W_{fpa}) (ft)		10.3 - >38	11.1-16.0	150	> 37	>40	>70	>50	>40
Entrenchment Ratio (ER)		1.0 - >6.5	1.1-2.8	9.3-14.4	>3.6	>3.3	>8.2	>2.5	>2.5
Sinuosity (stream length/valley length) (K)		1.15	1.21	>1.5	1.25	1.23	1.19	1.3	1.14
Dimension	Pool Depth (ft)	-	-	1.0-1.5	1.2	1.2	1.9-2.1	1.6-1.8	1.5
	Riffle Depth (ft)	1.1-1.5	1.1-1.4	0.9-1.2	0.8	0.9	1.3-2.0	1.3-1.8	1.1
	Pool Width (ft)	-	-	10.1-16.0	12.4	14.4	9.4-11.1	16.2-18.8	18.5
	Riffle Width (ft)	5.8-10.8	5.7-10.1	10.4-16.1	10.4	12.0	7.7-11.9	14.8-18.8	15.0
	Pool XS Area (sf)	-	-	10.4-19.3	10.0	17.9	20.1-21.2	25.5-33.4	27.3
	Riffle XS Area (sf)	8.6-15.1	8.2-10.8	12.5-14.4	8.2	11.2	14.5-15.5	25	16.9
	Pool depth/mean riffle depth	-	-	1.1-1.3	1.5	1.3	1.0-1.6	0.9-1.4	1.4
	Pool width/riffle width	-	-	1.0-1.1	1.2	1.2	0.8-1.4	1.2-1.3	1.2
	Pool area/riffle area	-	-	1.0-1.1	1.2	1.6	1.3-1.5	1.0-1.3	1.2
	Max pool depth/d_{bkf}	-	-	1.4-1.6	2.0	2.2	1.6-2.5	2.2	2.2
	Low bank height/max bankfull depth	2.0-2.4	2.0-2.1	1.0-1.1	1.0	1.0	1.2-1.3	1.0-1.2	1.0
	Mean Bankfull Velocity (V) (fps)	3.4-4.5	4.2-4.5	4.7	2.8	3.2	3.9-4.6	3.7-4.2	3.2
	Bankfull Discharge (Q) (cfs)	30-42	36-46	60-65	23	36	62-70	93-105	54
Pattern	Meander length (L_m) (ft)	135-250	106-148	70-120	70-125	80-140	60-476	66-191	115-250
	Radius of curvature (R_c) (ft)	18-110	17-34	15-26	20-30	20-30	14-55	16-87	30-70
	Belt width (W_{blt}) (ft)	44-78	42-83	135	20-50	40-60	39-86	60	30-75
	Meander width ratio (W_{blt}/W_{bkf})	4.1-13.4	4.2-14.6	10.2-13.0	2.0-5.0	3.3-5.0	3.3-11.2	4.1	2.0-5.0
	Radius of curvature/bankfull width	1.7-19.0	1.7-6.0	1.4-1.6	2.0-3.0	1.7-2.5	1.2-7.1	0.9-5.9	2.0-4.7
	Meander length/bankfull width	12.2-43.1	10.5-26.0	6.7-7.5	6.7-12.0	6.7-11.7	5.0-61.8	3.5-12.9	9.6-20.8
Profile	Valley slope	0.0088	0.0137	0.0070-0.0080	0.0088	0.0080 ^	0.0063	0.0060	0.0060
	Average water surface slope	0.0073	0.0075	0.0070	0.0075	0.0059	0.0052	0.0050	0.0050
	Riffle slope	0.044	0.006-0.009	0.010-0.040	0.010-0.012	0.005-0.011	0.011	0.013-0.035	0.007-0.009
	Pool slope	0-0.0001	0-0.0014	0-0.0010	0-0.0015	0-0.0013	0-0.0006	0-0.0003	0-0.0003
	Pool to pool spacing	32-43	-	43-181	40-90	40-90	23-100	50-105	70-140
	Pool length	10-20	7	31-108	10-30	12-35	8-16	14-33	16-55
	Riffle slope/avg water surface slope	6.0	0.8-1.2	2.8	1.3-1.6	0.8-1.9	2.1	2.6-7.0	1.4-1.8
	Pool slope/avg water surface slope	0-0.01	0-0.19	0-0.20	0-0.20	0-0.22	0-0.12	0-0.06	0-0.06
	Run slope/avg water surface slope	-	-	-	-	-	-	-	-
	Run depth/d_{bkf}	-	-	-	-	-	-	-	-
	Pool length/bankfull width	0.9-3.4	0.7-1.2	3.0-6.7	1.0-3.0	1.0-3.0	0.7-2.1	0.7-2.2	1.1-3.7
	Pool to pool spacing/bankfull width	3.0-7.4	-	4.2-11.2	4.0-9.0	3.3-7.5	1.9-13.0	2.7-7.1	4.6-9.3

^ The change in the existing and proposed T1-2 valley slopes comes from the relocation of the channel through a part of the site with different topography.

Table 4c. Morphological Criteria for T1A and T1B

Variables		Existing T1A-1	Ref. Reach Richland Creek (A)	Proposed T1A-1	Existing T1A-2	Ref. Reach UT to Fisher River	Proposed T1A-2	Existing T1B	Ref. Reach UT Back Creek	Proposed T1B
Rosgen Stream Type		C4	C4	C4	G4	B4c	B4c	E4	C4	C4
Drainage Area (mi^2)		0.04	0.90	0.04	0.05	0.38	0.05	0.24	0.63	0.24
Bankfull Width (W_{bkf}) (ft)		6.8	14.8-27.1	7.0	4.5	9.0-10.0	7.6	5.9-6.0	10.4-16.1	10.4
Bankfull Mean Depth (d_{bkf}) (ft)		0.3	0.8-1.5	0.5	1.2	1.1-1.2	0.8	1.4-1.7	0.9-1.2	0.8
Bankfull Cross Sectional Area (A_{bkf}) (ft^2)		2	21.2-22.3	3.4	5.5	10.4-10.7	6.0	8.4-9.9	12.5-14.4	8.2
Width/depth Ratio (W_{bkf}/d_{bkf})		22.0	18.1-18.5	14.4	3.8	8.0-10.0	9.6	3.5-4.3	11.6-13.4	13.3
Maximum Depth (d_{mbkf}) (ft)		0.5	1.9-2.0	0.7	1.6	1.3-1.5	1.0	2.0-2.1	1.4-1.7	1.2
Width of flood prone area (W_{fpa}) (ft)		>50	200	>16	6.7	13-20	15	>70	150	> 37
Entrenchment Ratio (ER)		>7.0	7.4-13.5	>2.3	1.5	1.3-2.3	2.0	>11.7	9.3-14.4	>3.6
Sinuosity (stream length/valley length) (K)		1.05	1.50	1.40	1.05	1.20	1.15	1.12	>1.50	1.20
Dimension	Pool Depth (ft)	-	2.4	0.7	-	1.2-1.4	1.0	-	1.0-1.5	1.0
	Riffle Depth (ft)	0.3	0.8-1.5	0.5	1.2	1.1-1.2	0.8	2.0-2.1	0.9-1.2	0.8
	Pool Width (ft)	-	15.2	9.0	-	8.4-11.6	9.8	-	10.1-16.0	12.4
	Riffle Width (ft)	6.8	14.8-27.1	7.0	4.5	9.0-9.9	7.6	5.9-6.0	10.4-16.1	10.4
	Pool XS Area (sf)	-	36.5	6.5	-	11.6-13.4	9.6	-	10.4-19.3	11.8
	Riffle XS Area (sf)	2	21.2-22.3	3.4	5.5	10.4-10.7	6.0	8.4-9.9	12.5-14.4	8.2
	Pool depth/mean riffle depth	-	2.1	1.4	-	1.0-1.3	1.3	-	1.1-1.3	1.3
	Pool width/riffle width	-	0.7	1.3	-	0.8-1.3	1.3	-	1.0-1.1	1.2
	Pool area/riffle area	-	1.7	1.9	-	1.1-1.3	1.6	-	0.8-1.1	1.4
	Max pool depth/d_{bkf}	-	1.3-2.4	2.4	-	1.9-2.0	2.0	-	1.4-1.6	2.3
	Low bank height/max bankfull depth	-	1.0-1.1	1.0	2.3	1.0	1.0	1.0-1.7	1.0-1.1	1.0
	Mean Bankfull Velocity (V) (fps)	2.8	6.3	2.6	6.7	4.1-4.5	4.35	3.9-5.0	4.7	3.2
	Bankfull Discharge (Q) (cfs)	6	130-140	9	36	42-46	26	32-48	60-65	27
Pattern	Meander length (L_m) (ft)	-	108-148	40-75	-	93-136	68-114	400	70-120	42-125
	Radius of curvature (R_c) (ft)	-	16-26	7-21	-	13-42	10-33	54-125	14-25	10-60
	Belt width (W_{blt}) (ft)	-	75	15-40	-	45	34-38	110	135	86-135
	Meander width ratio (W_{blt}/W_{bkf})	-	3.6-5.1	2.1-5.7	-	4.5-5.0	4.5-5.0	18.3-18.6	10.2-13.0	10.2-13.0
	Radius of curvature/bankfull width	-	1.0-1.1	1.0-3.0	-	1.3-4.4	1.3-4.4	9.0-21.2	1.4-1.6	1-6
	Meander length/bankfull width	-	4.0-10.0	5.7-10.7	-	9.0-15.0	9.0-15.0	66.7-67.8	6.7-7.5	6.7-7.5
Profile	Valley slope	0.0130	0.0130	0.0130	0.0214	0.0160	0.0178	0.0114	0.0070-0.0080	0.0101
	Average water surface slope	0.0115	0.0120	0.0100	0.0218	0.0130	0.0160	0.0084	0.0070	0.0077
	Riffle slope	-	0.003-0.076	0.001-0.024	0.019-0.077	0.013-0.028	0.016-0.035	0.006-0.008	0.010-0.040	0.008-0.020
	Pool slope	-	0.001-0.007	0-0.002	0-0.001	0-0.001	0-0.001	0-0.001	0-0.001	0-0.0015
	Pool to pool spacing	-	38-147	25-52	8-34	30-59	40-104	13-80	43.5-181	61-111
	Pool length	-	28-89	9-21	4-9	3-25	9-26	9-17	31-108	12-35
	Riffle slope/avg water surface slope	-	2.4	1.0-2.4	0.9-3.5	1.0-2.2	1.0-2.2	0.7-1.0	2.8	1.0-2.8
	Pool slope/avg water surface slope	-	0.08-0.20	0-0.20	0-0.06	0	0	0-0.12	0-0.2	0-0.2
	Run slope/avg water surface slope	-	-	-	-	0.7-1.1	-	-	-	-
	Run depth/d_{bkf}	-	-	-	-	0.8-1.2	-	-	-	-
	Pool length/bankfull width	-	1.9-2.3	1.3-3.0	0.9-2.0	0.3-2.5	1.2-3.4	1.5-2.9	3.0-6.7	1.2-3.4
	Pool to pool spacing/bankfull width	-	2.6-5.4	3.6-7.4	1.8-7.6	3.3-6.0	5.3-13.7	2.2-13.6	4.2-11.2	5.9-10.7

T1A and T1B (Existing) lacked defined pool and riffle features and a distinct pattern. Therefore, no existing calculations are available for those features.

Figures

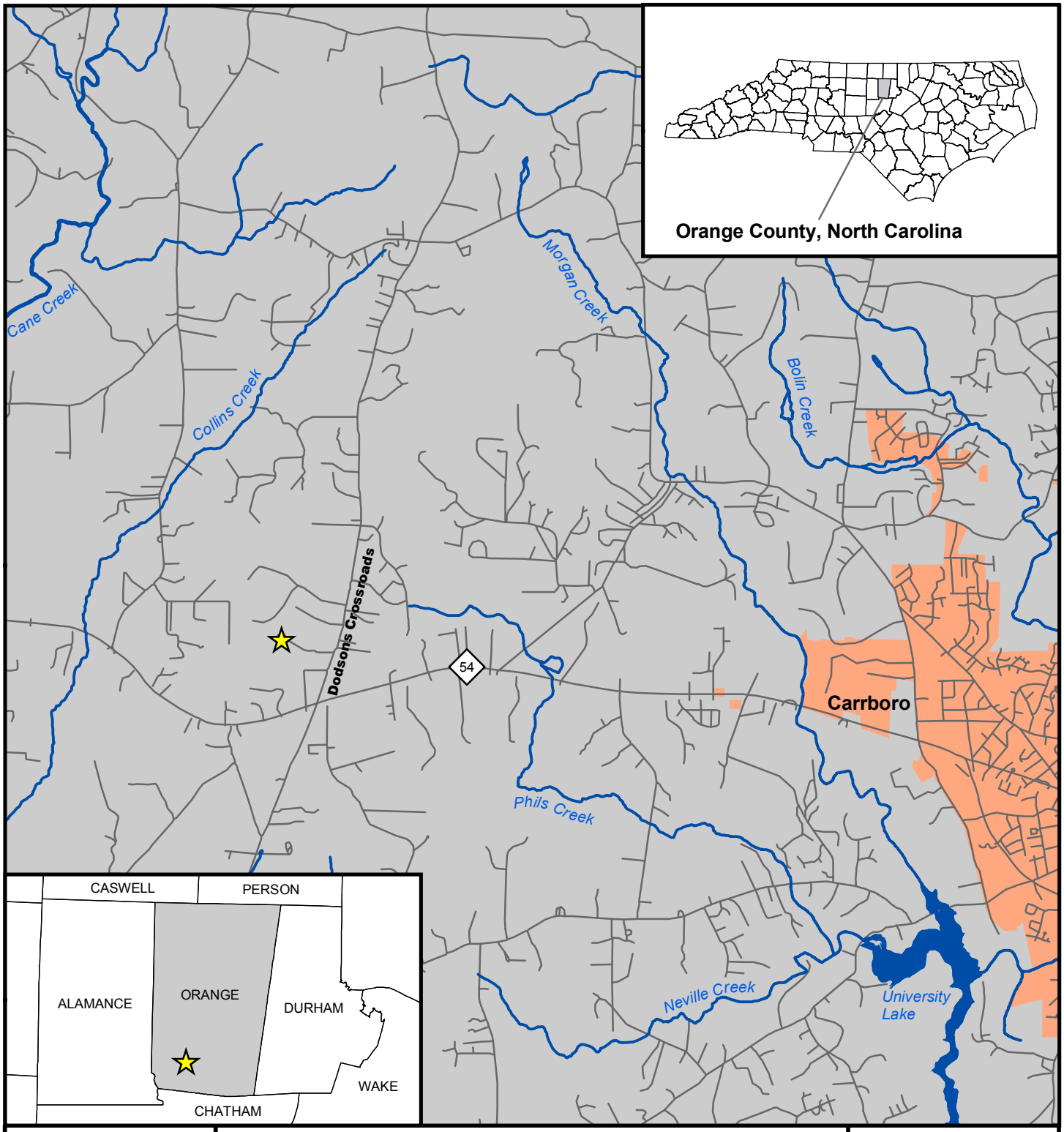

Figure 1. Vicinity Map

- Project Site Location
- Streams
- Lakes and Reservoirs
- Major Roads
- Cities and Towns
- Orange County
- County Boundaries

N
W E
S

1:63,360
1 inch equals 1 miles

1 0.5 0 1 Miles

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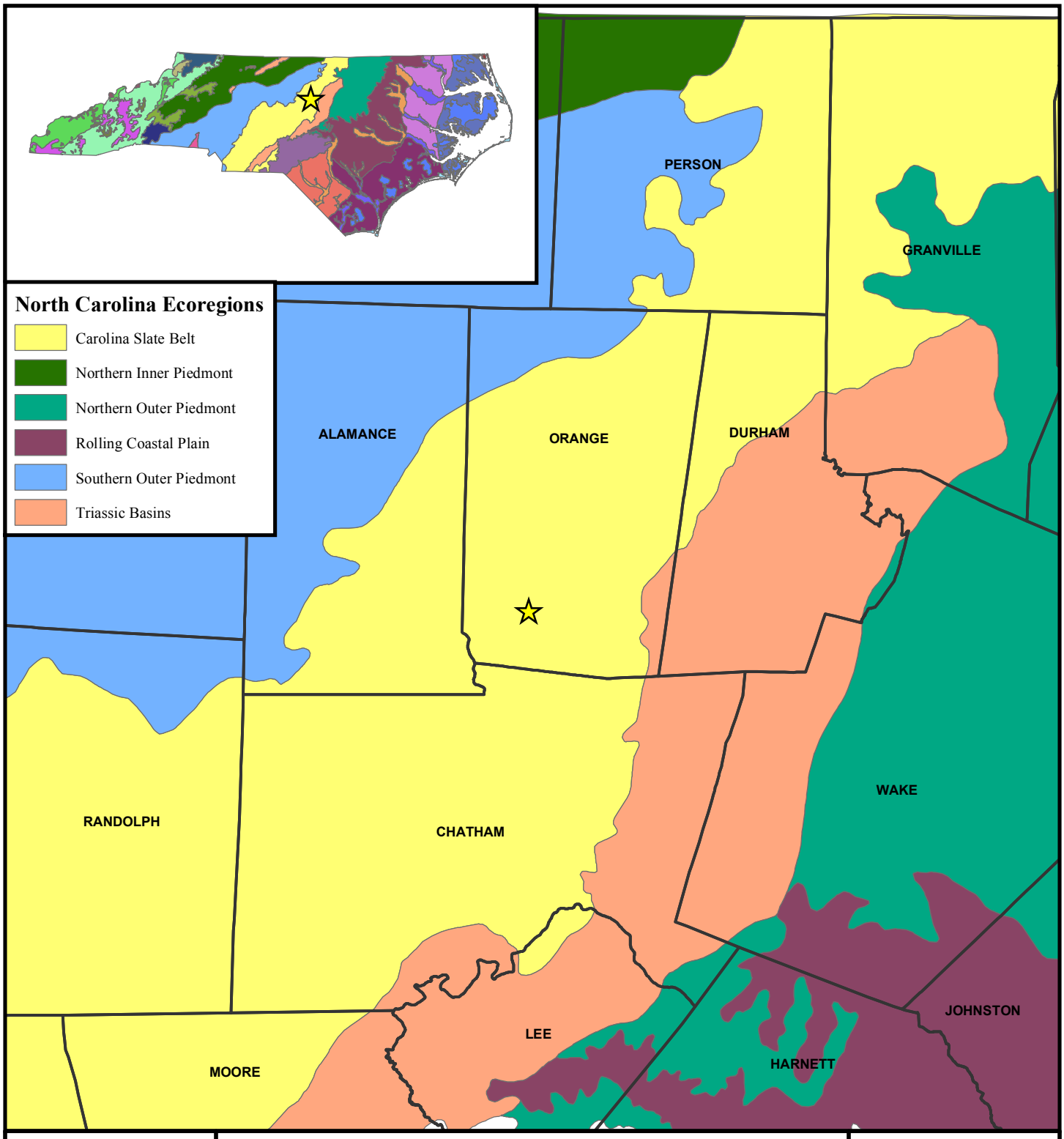

Figure 2. North Carolina Ecoregions

Project Site Location

County Boundaries

N
W E
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1:633,600

1 inch equals 10 miles

10 5 0 10 Miles

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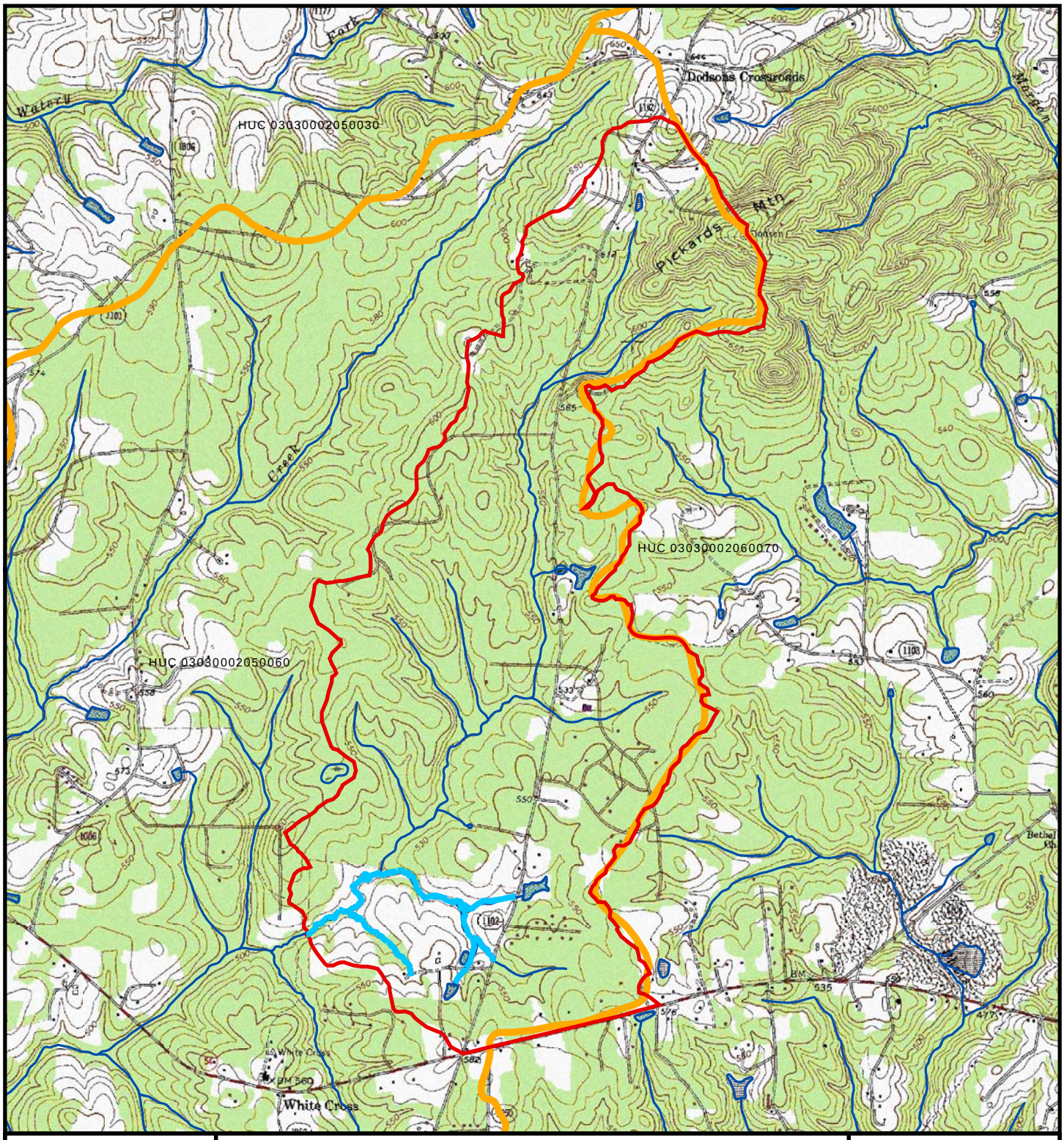

Figure 3. Project Watershed

Project Reaches

Other Streams

Project Watershed (2.6 sq. miles)

14-digit HUC boundaries

Note: The project watershed boundary is based on NCDOT 2-ft contours and does not match the existing 14-digit HUC exactly.

1:30,000

1 inch equals 2,500 feet

2,500 1,250 0 2,500 Feet

Source: USGS Topographic Quadrangle, White Cross 1981

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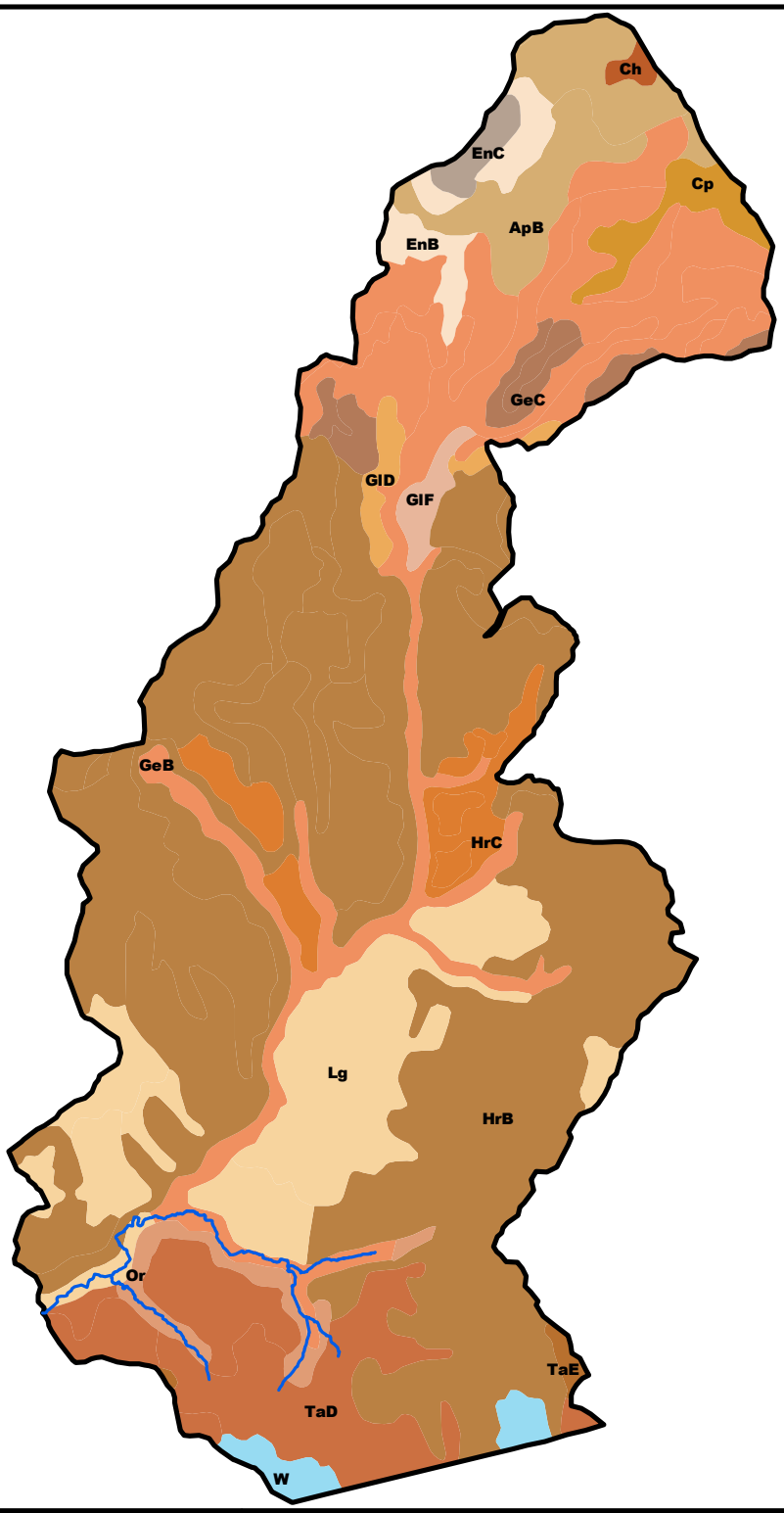
KCI ASSOCIATES OF NC

ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.



- ApB - Appling sandy loam, 2 - 6%
- Ch - Chewacla loam
- Cp - Congaree fine sandy loam
- EnB - Enon loam, 2 - 6% slope
- EnC - Enon loam, 6 - 12% slope
- GeB - Goergeville silt loam, 2 - 6%
- GeC - Georgeville silt loam, 6 - 10% slope
- GlD - Goldston slaty silt loam, 6 - 15% slope
- GlF - Goldston slaty silt loam, 15 - 45% slope
- HrB - Herndon silt loam, 2 - 6% slopes
- HrC - Herndon silt loam, 6 - 10% slopes
- Lg - Lignum silt loam, 0 - 3% slopes
- Or - Orange silt loam, 0 - 3% slopes
- TaD - Tatum silt loam, 8 - 15% slopes
- TaE - Tatum silt loam, 15 - 25% slopes
- W - Water

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Figure 4. Project Site NRCS Soil Survey

Project Reaches

Project Watershed

N
W E
S

1:25,200

1 inch equals 2,100 feet

2,100 1,050 0 2,100 Feet

Source: Soil Survey of Orange County, SCS 1977

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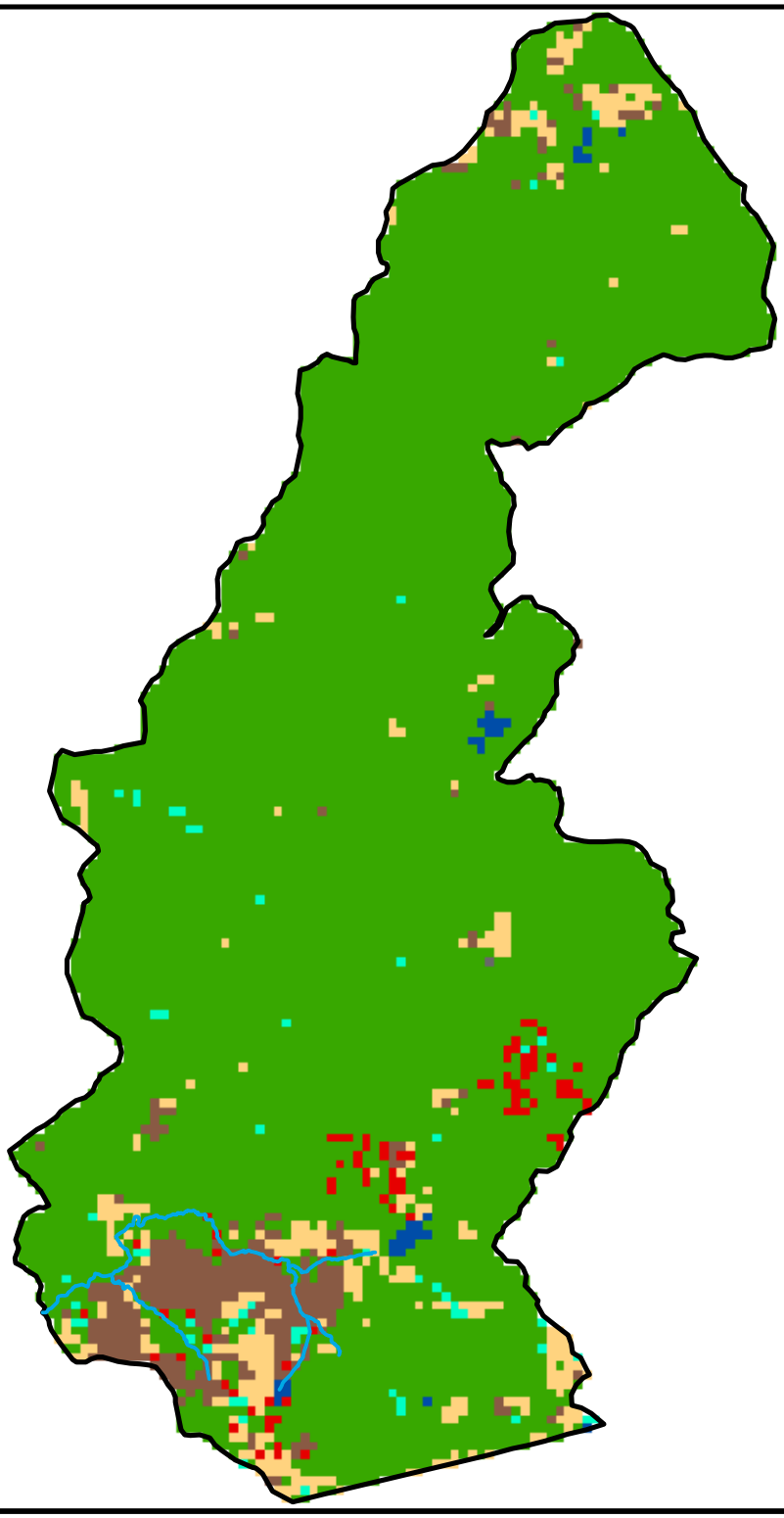

Figure 5. Project Watershed Land Use

- Urban or built-up land (1.2%)
- Agriculture (4.8%)
- Rangeland (4.6%)
- Forest land (88.2%)
- Water (0.5%)
- Wetland (0.8%)
- Barren land (< 0.1%)
- Project Reaches
- Project Watershed

1:25,200

1 inch equals 2,100 feet

N W E S

2,100 1,050 0 2,100 Feet

Source: NC GAP Land Cover Dataset, Published 2003
Classified Using Anderson I

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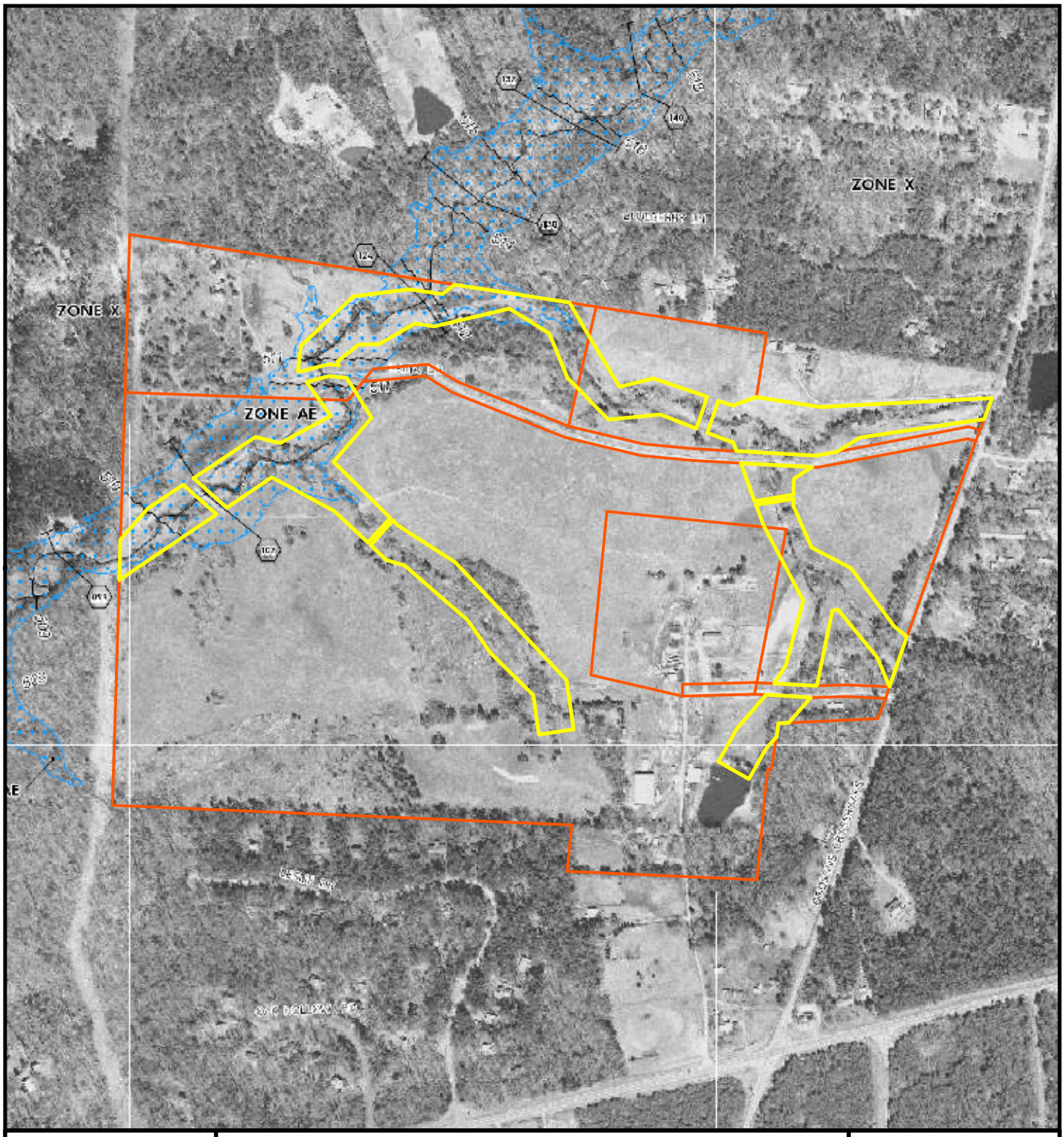

KCI TECHNOLOGIES

Figure 6. Project Site Floodplain Map

Project Easement

Project Parcels

N
W E
S

1:7,200
1 inch equals 600 feet

600 300 0 600
Feet

Source: FEMA Panel 9749J
Map 3710974900J
2/2/2007

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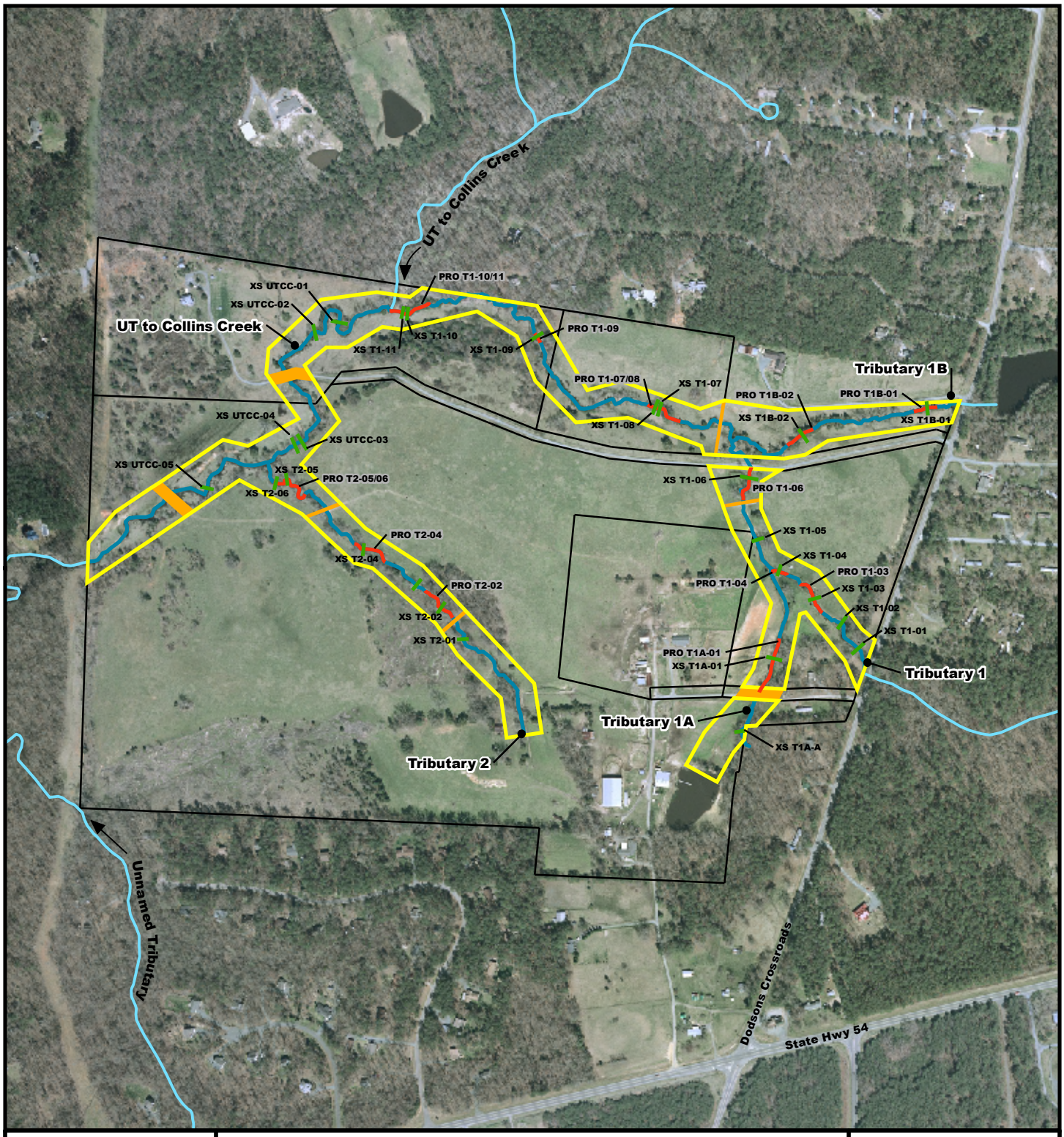

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Figure 7. Existing Conditions

- Project Streams
- Other Streams
- Project Easement
- Project Parcel Boundaries
- Existing Crossings
- Cross-Section
- Longitudinal Profile

N W E S

1:7,200
1 inch equals 600 feet

600 300 0 600 Feet

Image Source: Orange County Land Records/GIS Orthoimagery 2003

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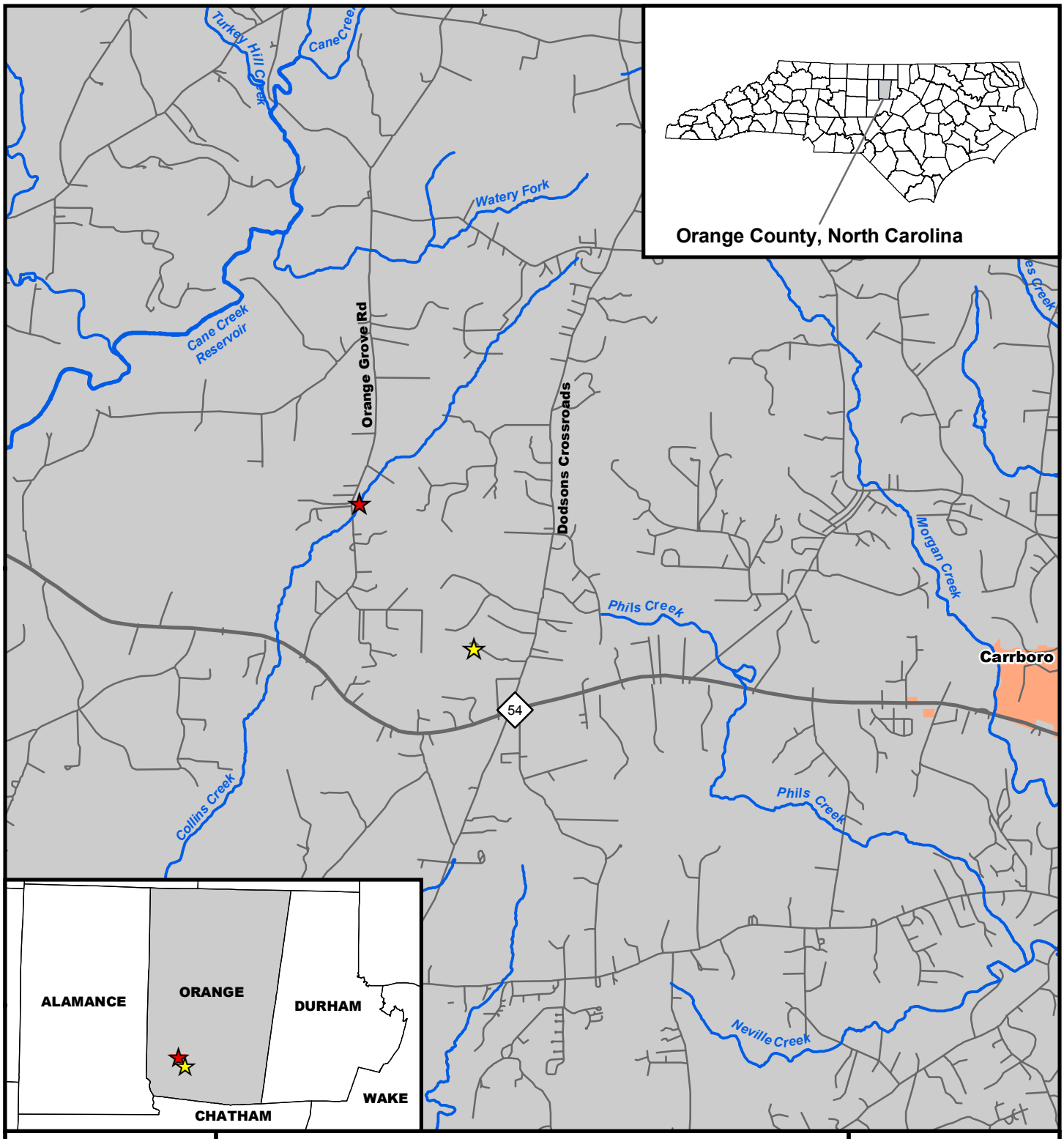

Figure 8. Reference Site Vicinity Map (Collins Creek)

- Project Site
- Reference Reach (Collins Creek)
- Major Streams
- Major Roads
- Other Roads
- Cities and Towns
- County Boundaries
- Orange County

1:63,360
1 inch equals 1 miles

1 0.5 0 1 Miles

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ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.

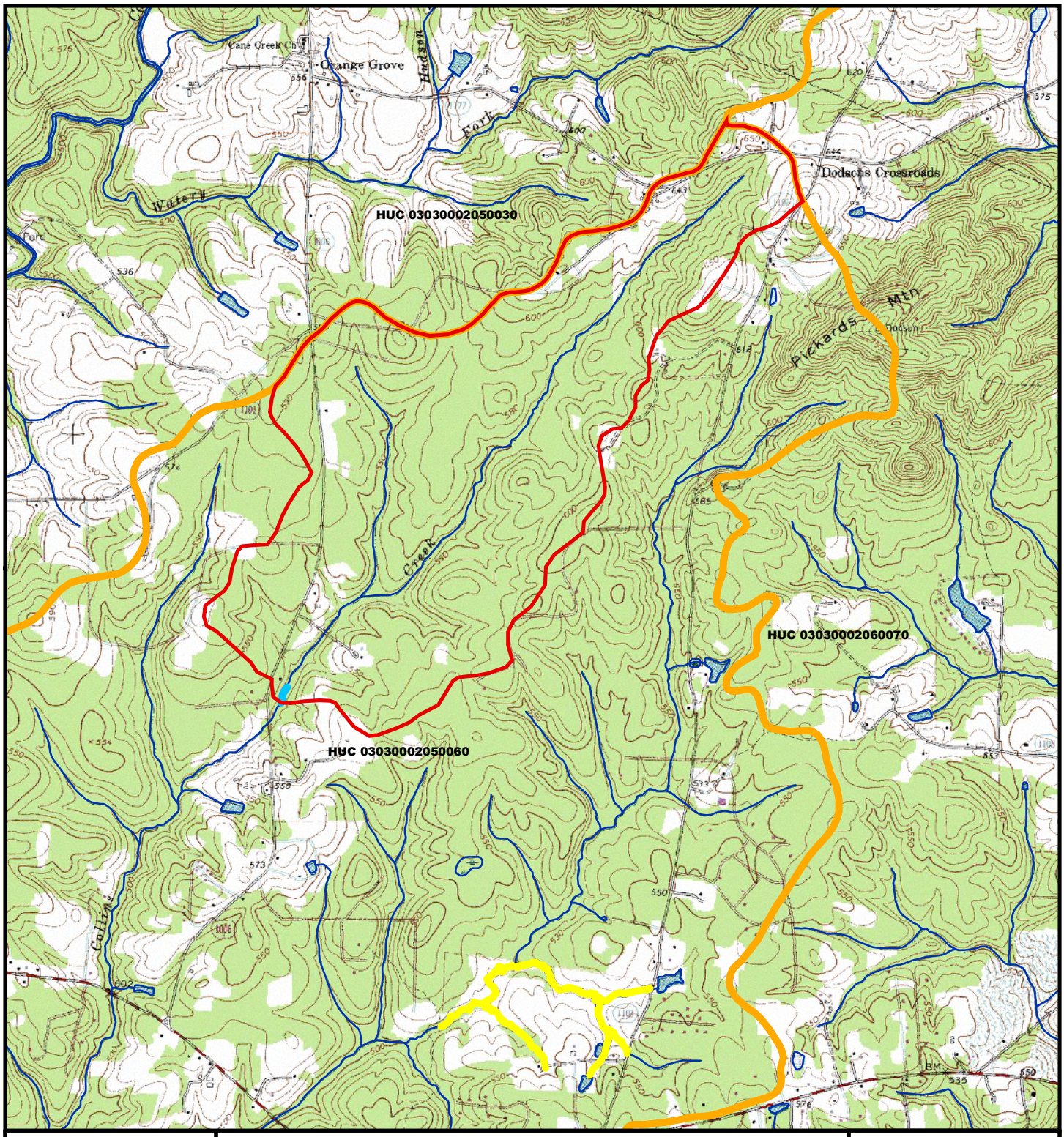

Figure 9. Reference Site Watershed (Collins Creek)

- Reference Reach Watershed (1.68 sq. miles)
- 14-digit HUC Boundaries
- Reference Reach (Collins Creek)
- Project Reaches
- Other Streams

N
W E
S

1:30,000
1 inch equals 2,500 feet

2,500 1,250 0 2,500 Feet

Source: USGS Topographic Quadrangle White Cross, 1981

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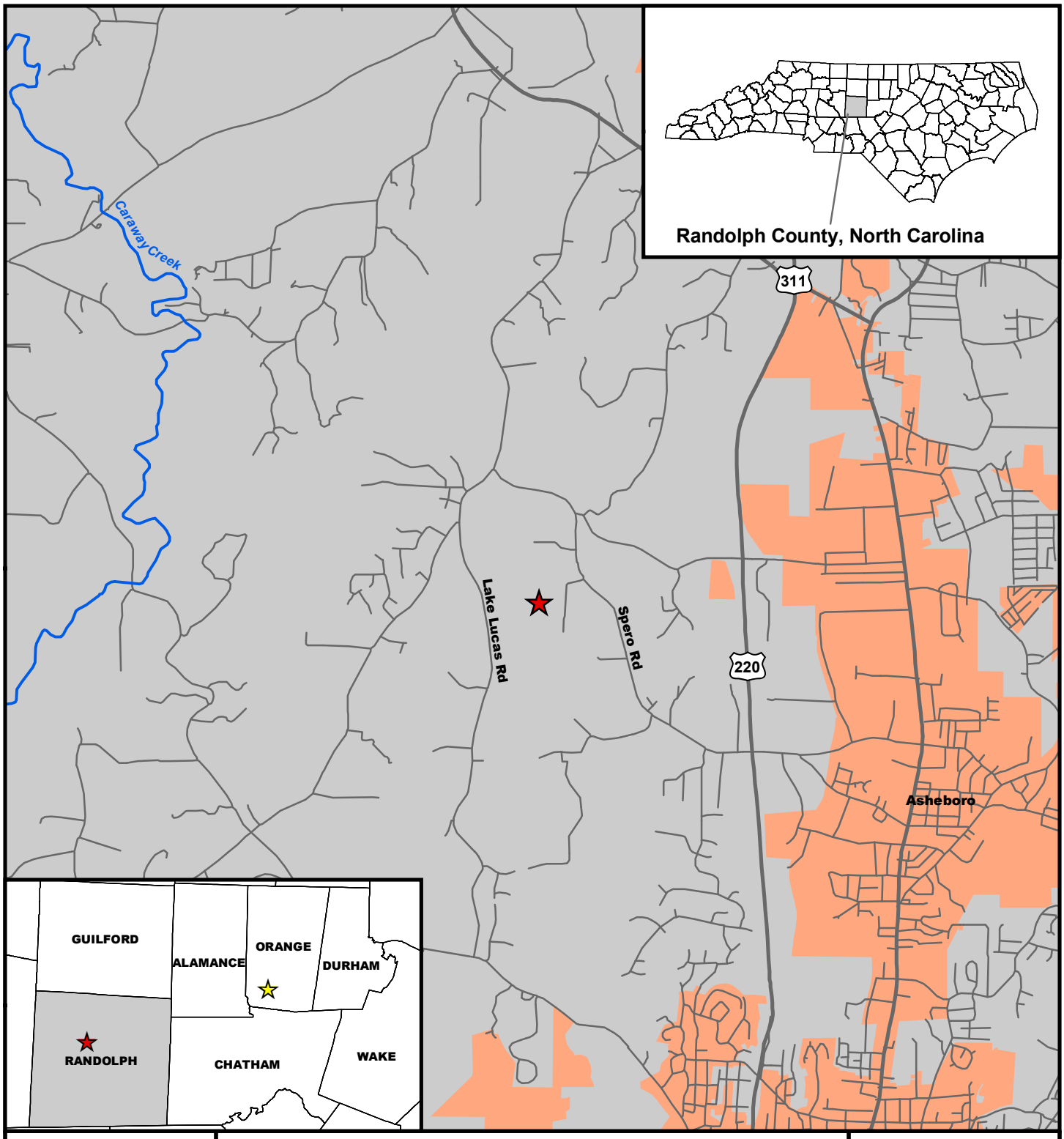

Figure 10. Reference Site Vicinity Map (UT to Back Creek)

- Reference Site (UT to Back Creek)
- Project Site
- Major Streams
- Major Roads
- Other Roads
- Cities and Towns
- County Boundaries

1:63,360
1 inch equals 1 miles

1 0.5 0 1 Miles

KCI TECHNOLOGIES

KCI ASSOCIATES OF NC

ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.

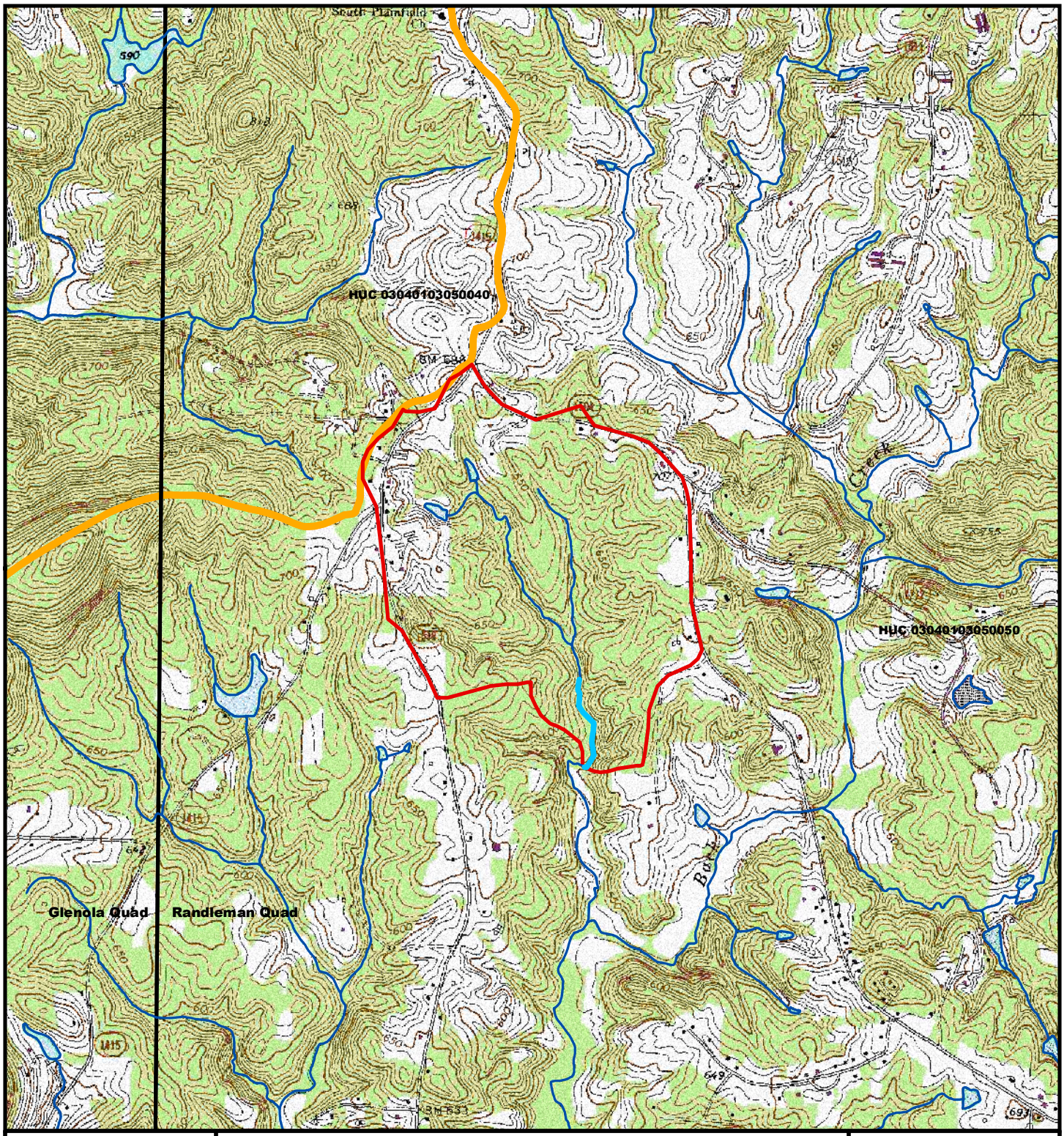

Figure 11. Reference Site Watershed (UT to Back Creek)

Reference Reach Watershed (0.63 sq. mile)

14-digit HUC boundaries

Reference Reach (UT to Back Creek)

Other Streams

Quadrangle Boundaries

Source: USGS Topographic Quadrangles Glenola (1981) and Randleman (1981)

1:24,000

1 inch equals 2,000 feet

2,000 1,000 0 2,000 Feet

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ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.

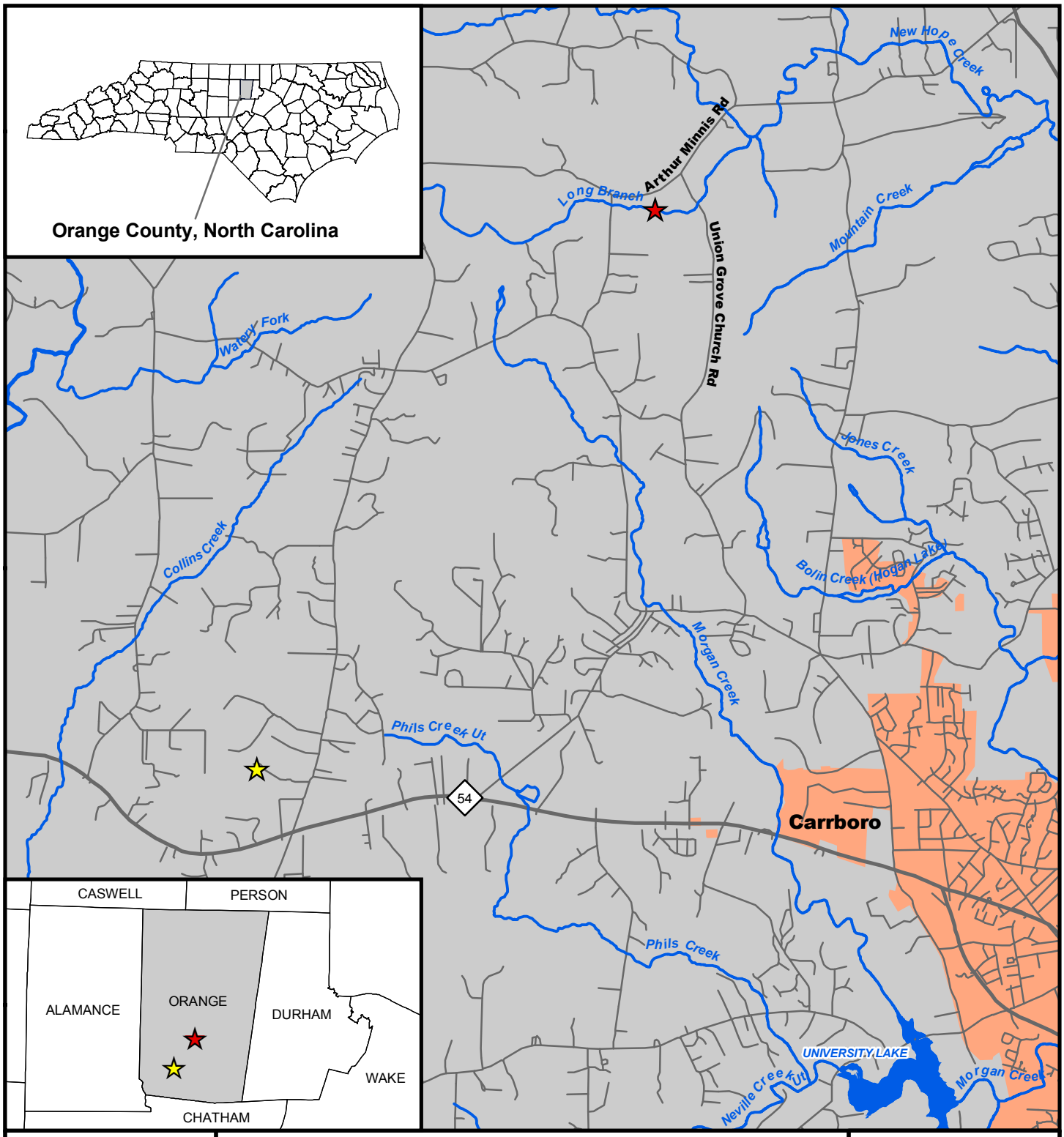

Figure 13. Reference Site Vicinity Map (Long Branch)

- Project Site
- Reference Reach (Long Branch)
- Streams
- Lakes and Reservoirs
- Cities and Towns
- Orange County
- County Boundaries
- Major Roads
- Other Roads

1:63,360
1 inch equals 1 miles

1 0.5 0 1 Miles

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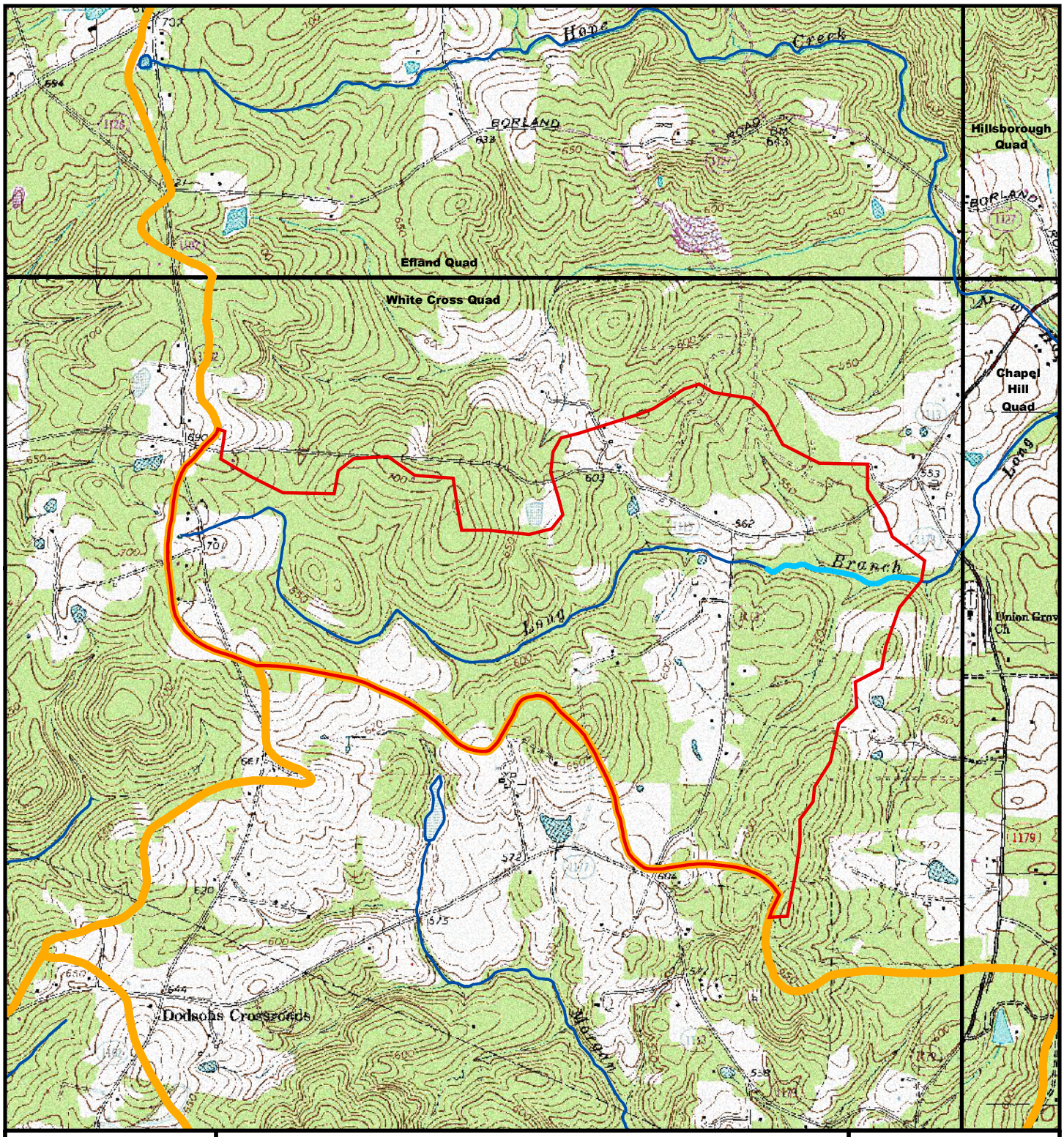

Figure 13. Reference Site Watershed (Long Branch)

Reference Reach Watershed (1.49 sq. miles)

14-digit HUC Boundaries

Reference Reach (Long Branch)

Other Streams

Quadrangle Boundaries

N
W E
S

1:24,000

1 inch equals 2,000 feet

2,000 1,000 0 2,000 Feet

Source: USGS Topographic Quadrangles Chapel Hill (1978), Efland (1968), Hillsborough (1981), and White Cross (1981)

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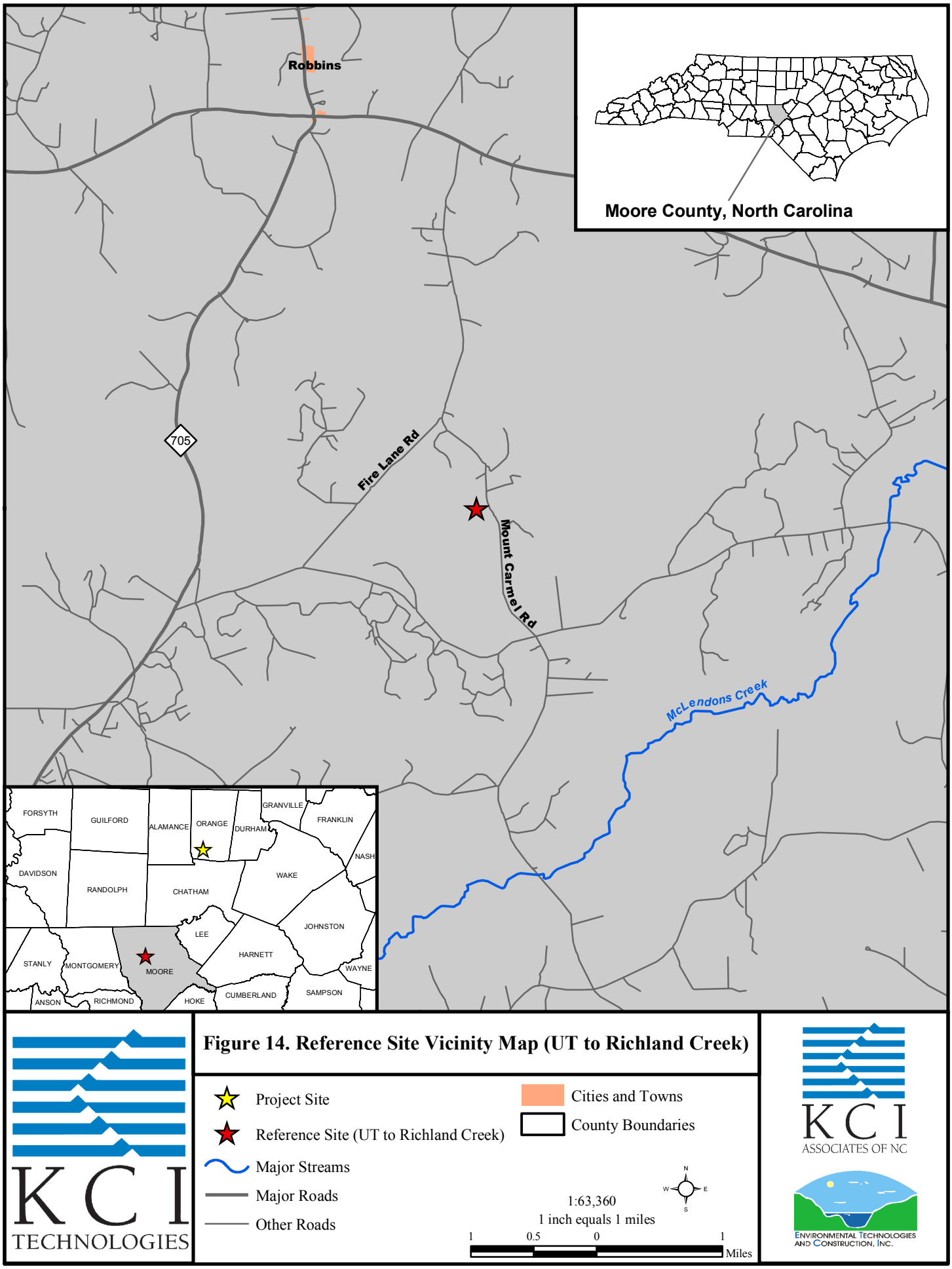

Figure 14. Reference Site Vicinity Map (UT to Richland Creek)

- Project Site
- Reference Site (UT to Richland Creek)
- Major Streams
- Major Roads
- Other Roads
- Cities and Towns
- County Boundaries

1:63,360
1 inch equals 1 miles

1 0.5 0 1 Miles

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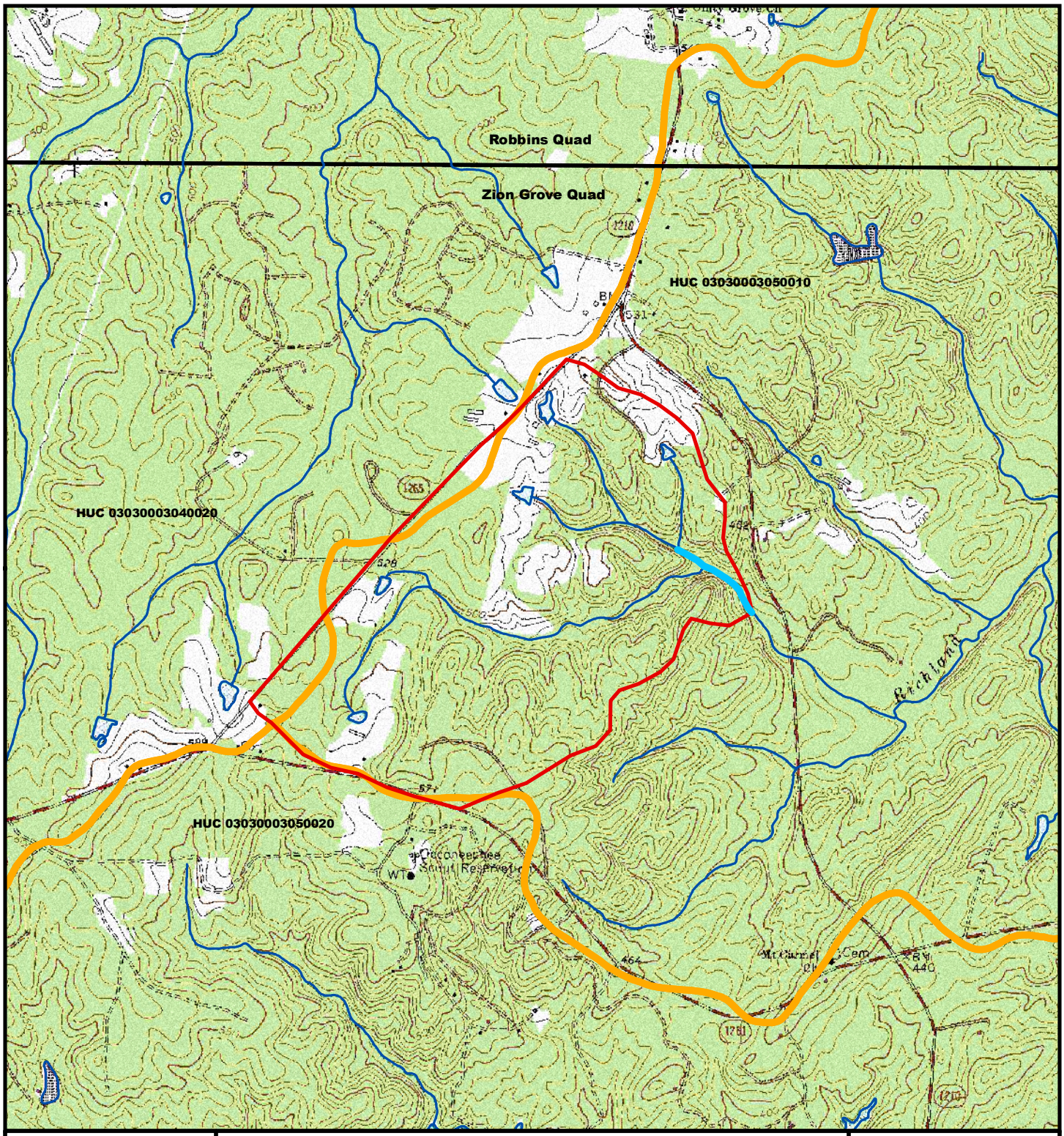

Figure 15. Reference Site Watershed (UT to Richland Creek)

Reference Reach Watershed (0.90 sq. mile)

14-digit HUC boundaries

Reference Reach (UT to Richland Creek)

Other Streams

Quadrangle Boundaries

N
W E
S

1:24,000

1 inch equals 2,000 feet

2,000 1,000 0 2,000 Feet

Source: USGS Topographic Quadrangles Robbins (1974) and Zion Grove (1981)

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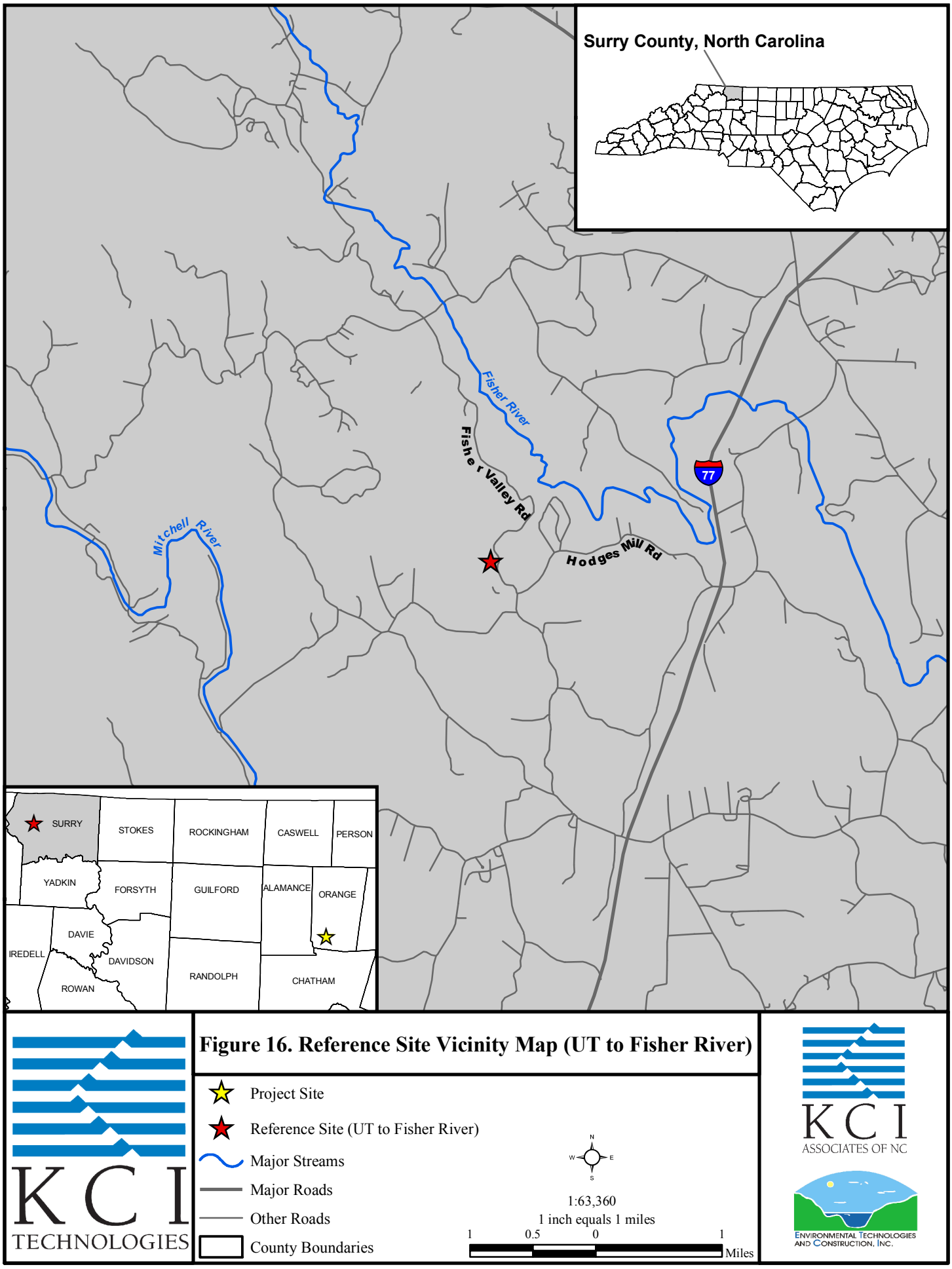

Figure 16. Reference Site Vicinity Map (UT to Fisher River)

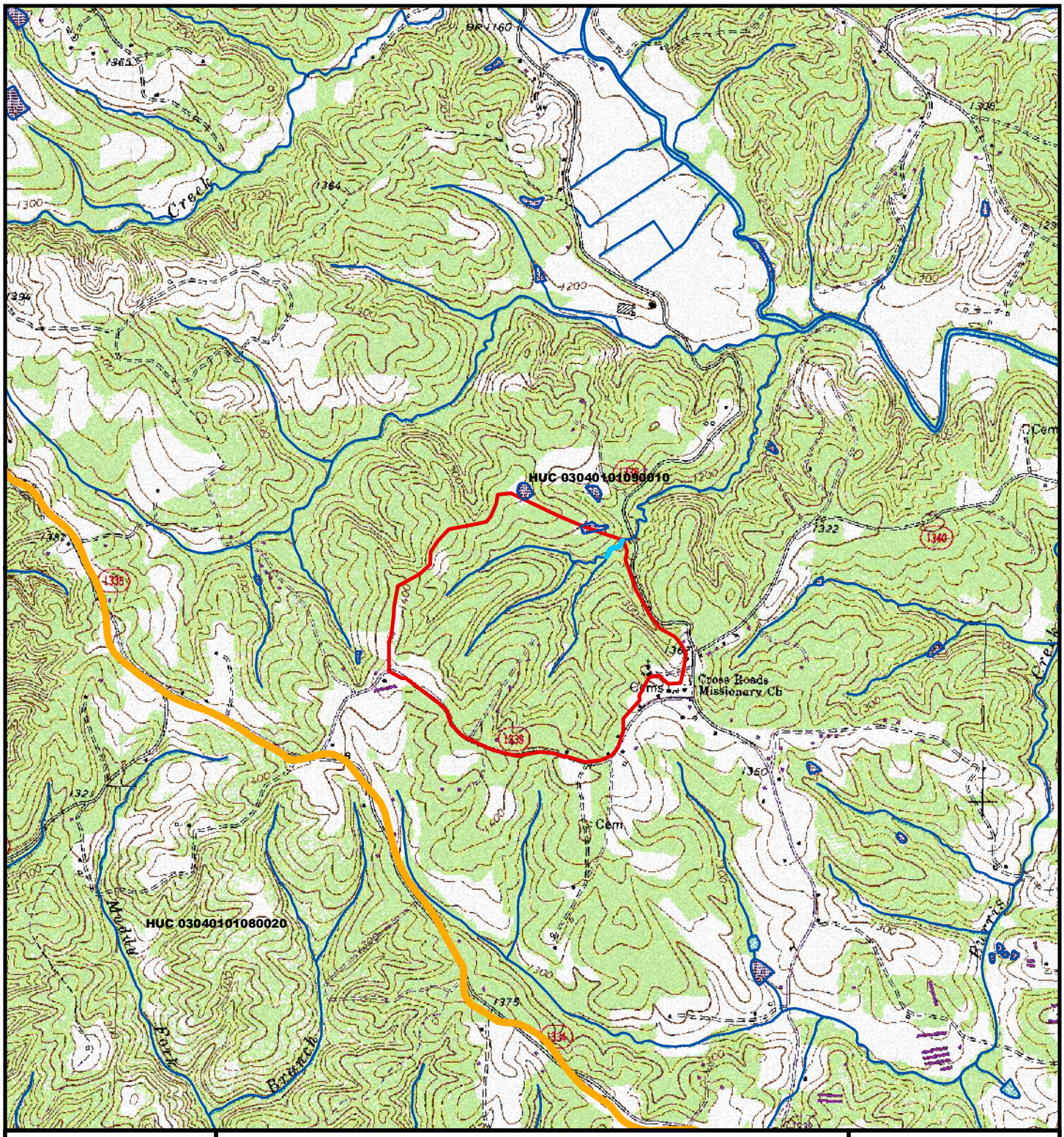

Figure 17. Reference Site Watershed (UT to Fisher River)

Reference Reach Watershed (0.38 sq. mile)

14-digit HUC boundaries

Reference Reach (UT to Back Creek)

Other Streams

N
W E
S

1:24,000

1 inch equals 2,000 feet

2,000 1,000 0 2,000 Feet

Source: USGS Topographic Quadrangle Bottom (1971)

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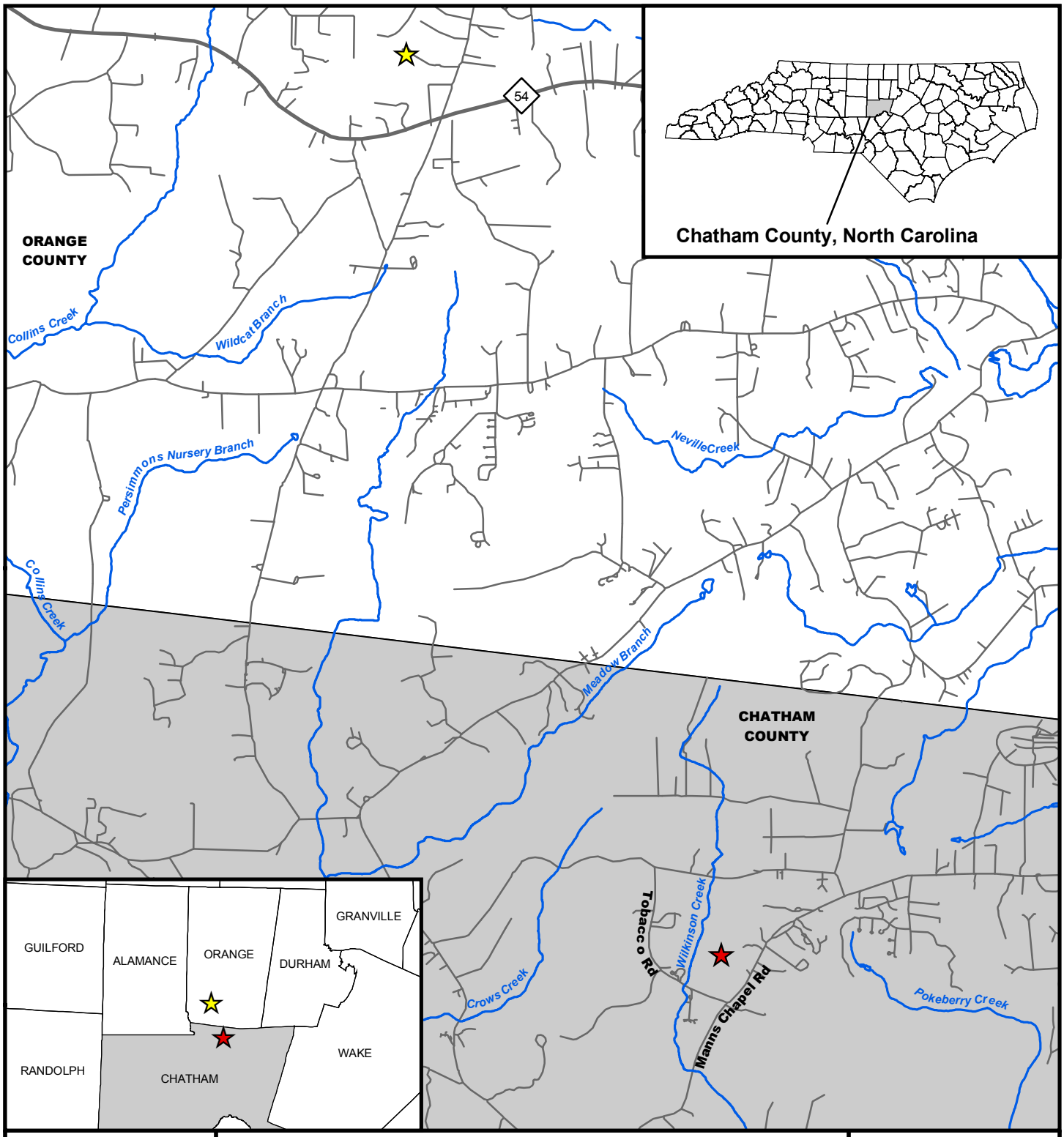

Figure 18. Reference Site Vicinity Map (UT to Wilkinson Creek)

- Project Site
- Reference Reach (UT to Wilkinson)
- Major Streams
- Major Roads
- Other Roads
- County Boundaries

1:63,360
1 inch equals 1 miles

1 0.5 0 1 Miles

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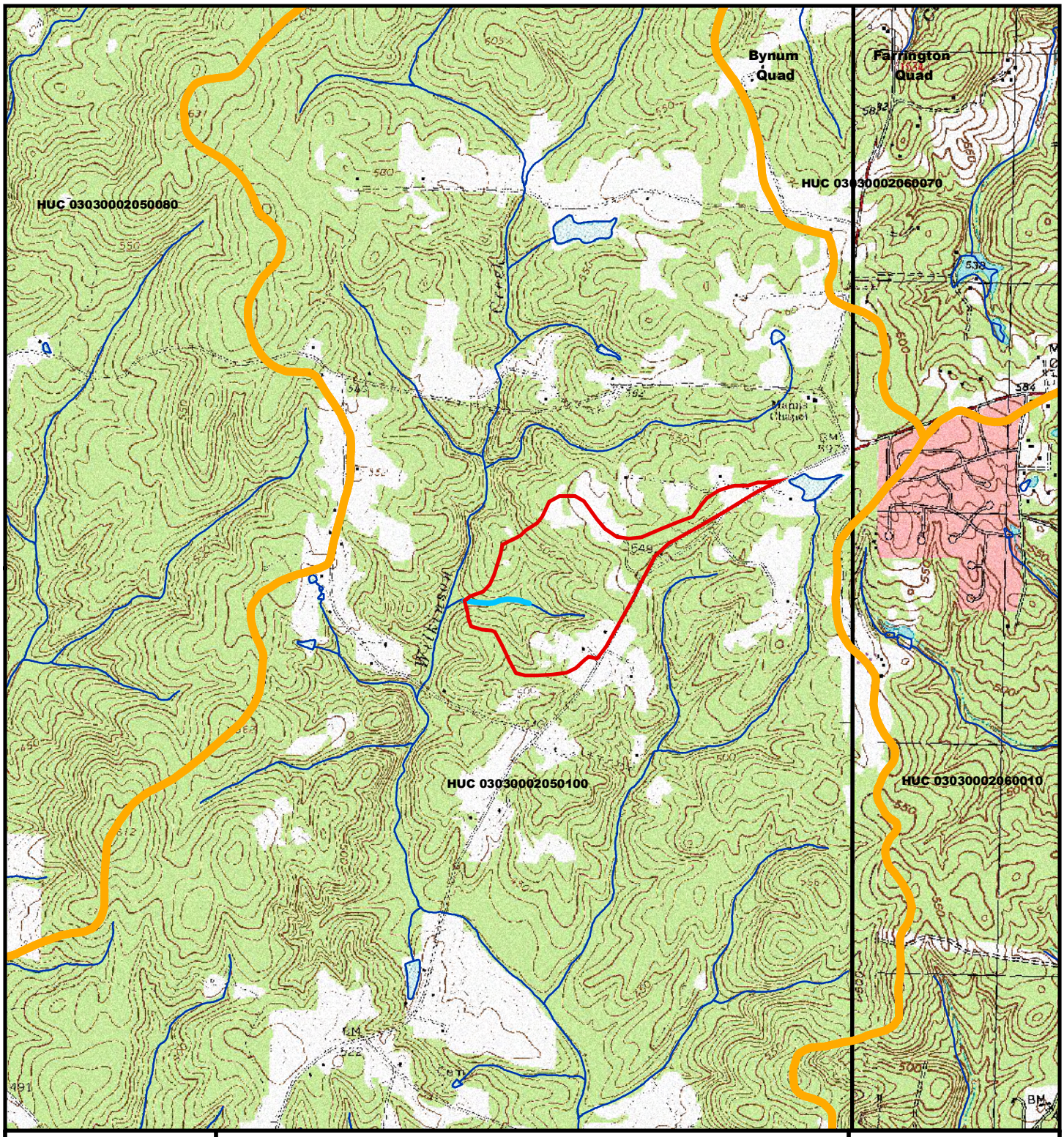

Figure 19. Reference Site Watershed (UT to Wilkinson Creek)

Reference Reach Watershed (0.16 sq. mile)

14-digit HUC Boundaries

Reference Reach (UT to Wilkinson Creek)

Other Streams

Quadrangle Boundaries

N
W E
S

1:24,000

1 inch equals 2,000 feet

2,000 1,000 0 2,000 Feet

Source: USGS Topographic Quadrangles Bynum (1968) and Farrington (1981)

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ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.

Stream Plan Sheets

KCI JOB# : 12054130–01

CONTRACT #: D05011

STATE	CONTRACT NUMBER	SHEET NO.	TOTAL SHEETS
N.C.	D05011	1	40

SYM.	DESCRIPTION	DATE	APPROVED
A	SUBMITTED WITH RESTORATION PLAN	AUG 2007	

REVISIONS

STATE OF NORTH CAROLINA
ECOSYSTEM ENHANCEMENT PROGRAM

ORANGE COUNTY

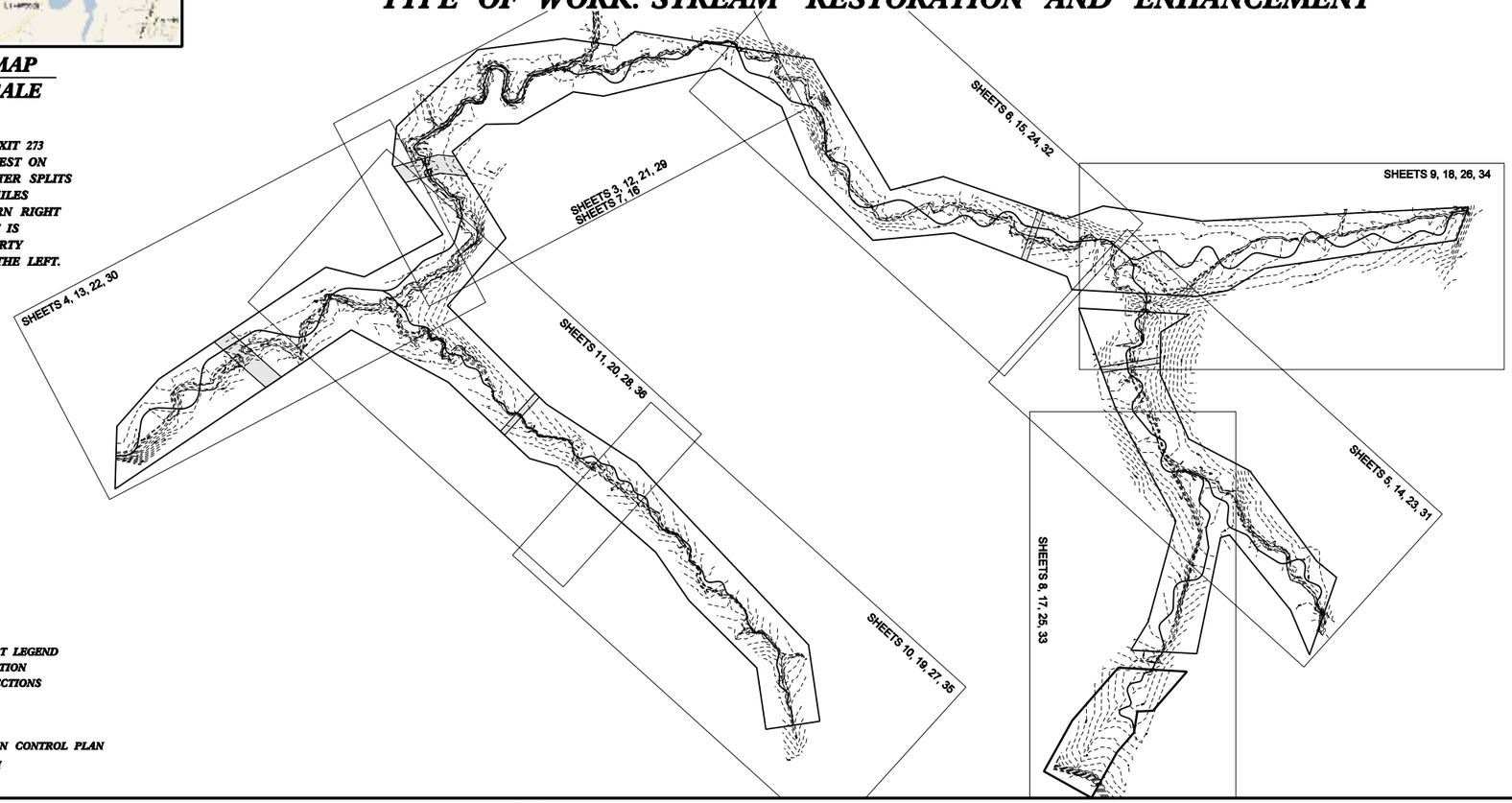
LOCATION: COLLINS CREEK SITE
UNNAMED TRIBUTARIES TO COLLINS CREEK
CHAPEL HILL, NORTH CAROLINA

TYPE OF WORK: STREAM RESTORATION AND ENHANCEMENT

VICINITY MAP
NOT TO SCALE

DIRECTIONS TO SITE

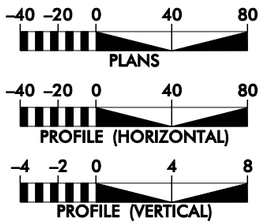
PROCEED WEST ON INTERSTATE 40. TAKE EXIT 273 AND TRAVEL WEST ON NC 54. CONTINUE WEST ON NC 54 AS IT JOINS NC 15–501 AND THEN LATER SPLITS OFF FROM NC 15–501. APPROXIMATELY 7.5 MILES AFTER SPLITTING OFF FROM NC 15–501, TURN RIGHT ONTO DODSONS CROSSROADS. THE PROJECT IS ACCESSIBLE FROM THE WHITFIELD PROPERTY DRIVEWAY APPROXIMATELY 0.3 MILES ON THE LEFT.



INDEX OF SHEETS

* INCLUDED IN STREAM RESTORATION PLAN

GRAPHIC SCALES



PROJECT DATA

STREAM RESTORATION LENGTH = 8,760 FEET

STREAM ENHANCEMENT LENGTH = 500 FEET

PROJECT TOTAL AREA OF DISTURBANCE = 33 ACRES

Prepared in the Office of:

KCI TECHNOLOGIES
ENGINEERS•PLANNERS•ECOLOGISTS
SUITE 220 LANDMARK CENTER II
4601 SIX FORKS RD., RALEIGH, NC

GARY M. MRYNCZA, PE
PROJECT ENGINEER

ALEX FRENCH / ADAM SPILLER
NATURAL CHANNEL DESIGN

PROJECT ENGINEER

SIGNATURE: *P.E.*

Prepared for:

Ecosystem Enhancement PROGRAM

GUY PEARCE
CONTRACT ADMINISTRATOR

GENERAL NOTES

GENERAL NOTES:

BEARING AND DISTANCES:
ALL BEARINGS ARE NAD 1983 GRID BEARINGS.
ALL DISTANCES AND COORDINATES SHOWN ARE HORIZONTAL (GROUND) VALUES.
ALL INFORMATION IS BASED ON THE FOLLOWING GPS CONTROL POINTS.

GPS#3	N = 792848.0323	E = 1945612.5396	ELEV.= 541.18′
GPS#4	N = 792314.1620	E = 1946762.1720	ELEV.= 554.84′
GPS#11	N = 793481.9570	E = 1947490.2200	ELEV.= 533.78′
GPS#12	N = 793552.8810	E = 1946705.9700	ELEV.= 537.39′
GPS#13	N = 792848.0270	E = 1945612.5510	ELEV.= 541.18′
GPS#14	N = 792314.1620	E = 1946762.1720	ELEV.= 554.78′

GRADING:
-ALL EXCAVATED MATERIALS, INCLUDING NATURAL STONE MEETING SIZE LIMITATIONS, ARE TO BE SALVAGED FOR REUSE WITHIN THE PROJECT AT THE DISCRETION OF THE DESIGNER.
-ALL INFLECTION POINTS BETWEEN SLOPE ANGLES SHALL BE ROUNDED SLIGHTLY IN ORDER TO PROVIDE FOR SMOOTH TRANSITIONS AND A MORE NATURAL APPEARANCE.

UTILITY/SUBSURFACE PLANS:
-NO SUBSURFACE PLANS ARE AVAILABLE ON THIS PROJECT. EXISTING UNDERGROUND UTILITIES HAVE NOT BEEN VERIFIED. THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING A UTILITY LOCATOR AND ESTABLISHING THE EXACT LOCATION OF ANY AND ALL EXISTING UTILITIES IN THE PROJECT REACH.

SITE CONTROL POINTS

Point	Northing	Easting	Elevation	Description
100	793311.7270	1945031.6810	502.88	COLLINS#100
101	793491.8760	1945108.0250	504.32	COLLINS#101
102	793643.3940	1945007.7500	512.03	COLLINS#102
103	793570.4083	1945303.9976	505.43	COLLINS#103
104	793629.4742	1945440.6670	504.13	COLLINS#104
105	793742.1154	1945585.5015	505.63	COLLINS#105
106	793739.3811	1945701.1238	505.50	COLLINS#106
107	793835.5469	1945871.5143	505.46	COLLINS#107
108	793554.8148	1945748.8779	510.80	COLLINS#108
109	794025.9308	1945906.3103	506.53	COLLINS#109
110	794082.4527	1945774.1552	508.70	COLLINS#110
111	794396.8820	1945942.2503	509.58	COLLINS#111
112	794389.6911	1946109.9892	508.26	COLLINS#112
113	794407.1647	1946238.4387	508.42	COLLINS#113
114	794317.0373	1946314.4324	508.44	COLLINS#114
115	793537.1837	1945903.5109	511.05	COLLINS#115
116	793395.9842	1946119.3732	514.95	COLLINS#116
117	793320.0224	1946254.3795	517.39	COLLINS#117
118	793210.4075	1946438.4997	523.36	COLLINS#118
119	792989.8700	1946590.1622	527.66	COLLINS#119
120	792795.9216	1946798.3650	535.99	COLLINS#120
121	792611.6719	1946827.1289	539.66	COLLINS#121
122	794357.9104	1946451.3297	510.00	COLLINS#122
123	794380.3955	1946807.3701	512.29	COLLINS#123
124	794211.6697	1946916.6979	511.78	SET60DNAIL
125	794030.1652	1946922.8882	513.21	COLLINS#125
126	793760.8382	1946854.3655	526.24	COLLINS#126
127	793927.7534	1947039.9135	515.58	COLLINS#127
128	793912.0036	1947188.9079	515.19	COLLINS#128
129	793851.0608	1947443.8037	515.54	KCI#129
130	793792.2348	1947645.0418	519.28	KCI#130
131	793796.7038	1947736.7635	518.10	KCI#131
132	793876.9212	1947885.1947	520.78	KCI#132
133	793798.9453	1948150.6188	522.56	KCI#133
135	793881.7551	1948595.0812	526.62	KCI#135
136	793572.4766	1947651.1322	525.07	KCI#136
500	792701.8477	1947990.0674	541.87	COLLINS#500
501	792716.7035	1947745.4627	536.76	COLLINS#501
502	792401.9132	1947690.3264	541.55	COLLINS#502
503	792152.1873	1947653.9535	551.28	COLLINS#503
504	792030.3016	1947394.1358	558.63	COLLINS#504
505	792048.0253	1946957.6541	567.06	COLLINS#505
506	792200.7320	1946896.4057	560.84	COLLINS#506
507	792181.4270	1946555.7641	562.27	COLLINS#507
508	792223.6253	1946126.5918	559.95	COLLINS#508
509	792254.5859	1945927.6452	557.41	COLLINS#509
510	792238.4374	1945751.3772	549.59	COLLINS#510
511	792252.0891	1945508.9280	535.88	COLLINS#511
512	792611.1832	1945464.1580	535.30	COLLINS#512
513	792240.0490	1945292.8240	529.11	COLLINS#513
514	792950.6002	1947871.6343	531.06	COLLINS#514
515	793178.1268	1947845.4214	527.39	COLLINS#515
516	793079.8230	1948024.2214	527.37	COLLINS#516

PROJECT LEGEND

STREAM RESTORATION

- Proposed Thalweg w/Approximate Bankfull Limits (12+00, 13+00)
- Proposed Offset Rock Cross Vane
- Proposed Step Pool
- Proposed Channel Block
- Proposed Riffle Grade Control
- Proposed Constructed Riffle with Constrictor
- Proposed Stone Toe Stabilization

TOPOGRAPHY

- Minor Contour Line
- Major Contour Line (720)
- Existing Bedrock

SEDIMENT & EROSION CONTROL

- Stabilized Construction Entrance (SCE)
- Silt Fence (SF)
- Limits of Disturbance (LOD)
- Temporary Stream Crossing
- Silt Fence Rock Outlet
- Rock Silt Screen (Std. Drawing 1636.01)

SYM.	DESCRIPTION	DATE	APPROVED
A	SUBMITTED WITH RESTORATION PLAN	AUG 2007	

REVISIONS

Ecosystem Enhancement PROGRAM

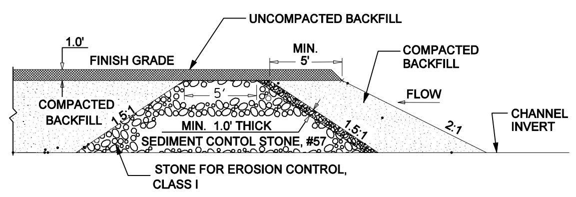
KCI TECHNOLOGIES
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

COLLINS CREEK
STREAM RESTORATION PROJECT
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

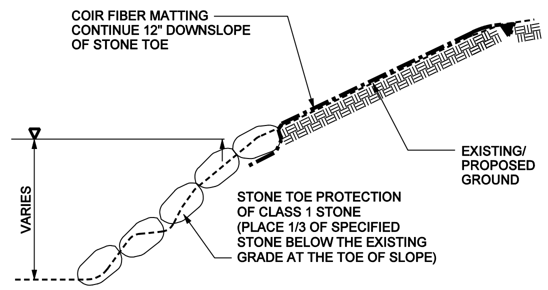
DATE: AUGUST 2007
SCALE: N.T.S.

GENERAL NOTES & PROJECT LEGEND

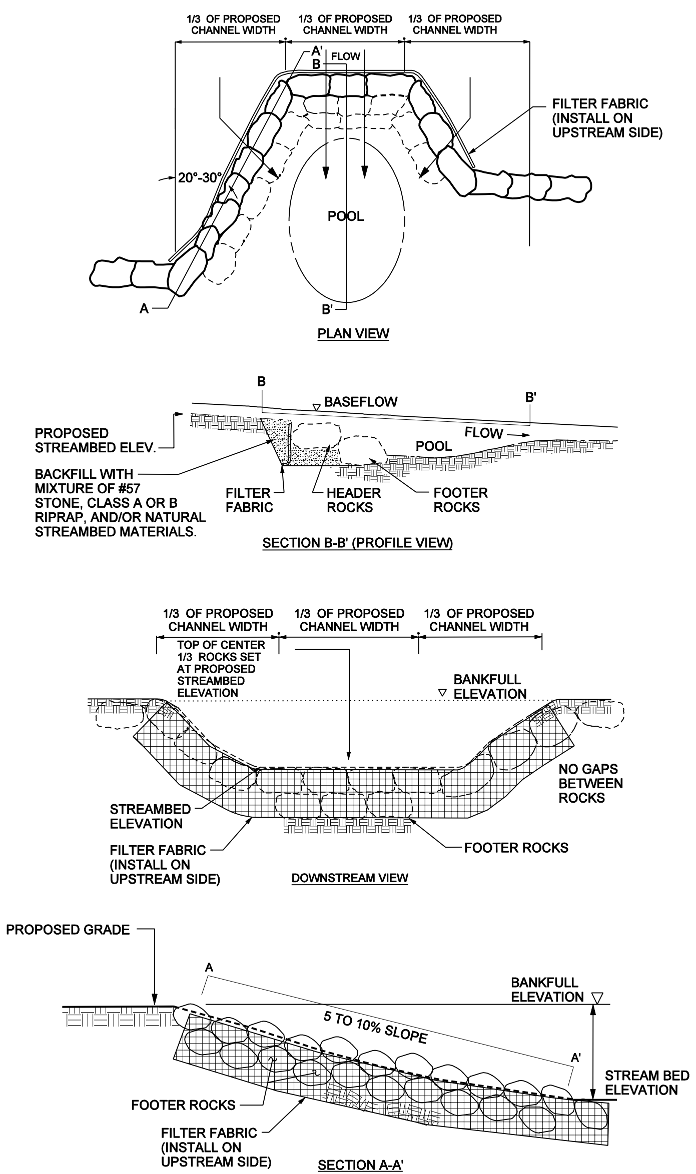
SHEET 1A OF 36



CHANNEL BLOCK
SCALE: NTS

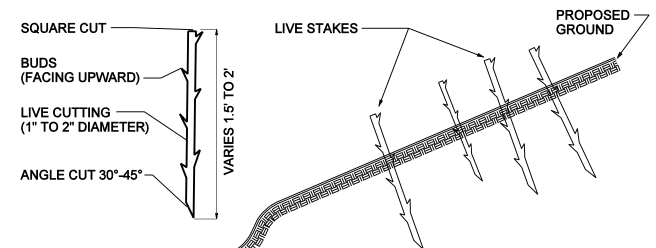


STONE TOE STABILIZATION
SCALE: NTS



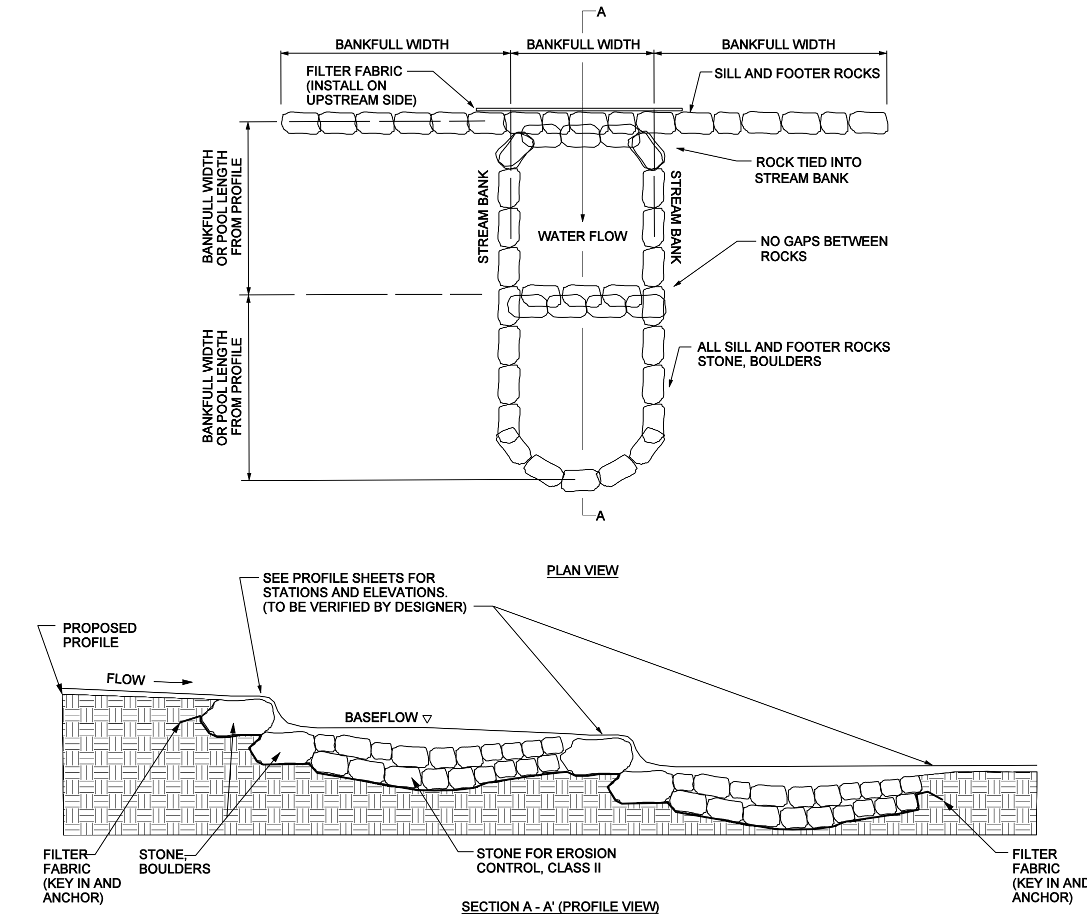
OFFSET ROCK CROSS VANE
SCALE: NTS

NOTE: (1) ALL ROCKS OR STONES IN THE VANE STRUCTURE ARE STONE BOULDERS.
(2) SHORT CROSS VANE ARM TO BE HALF THE SLOPE OF THE FULL ARM SLOPE.



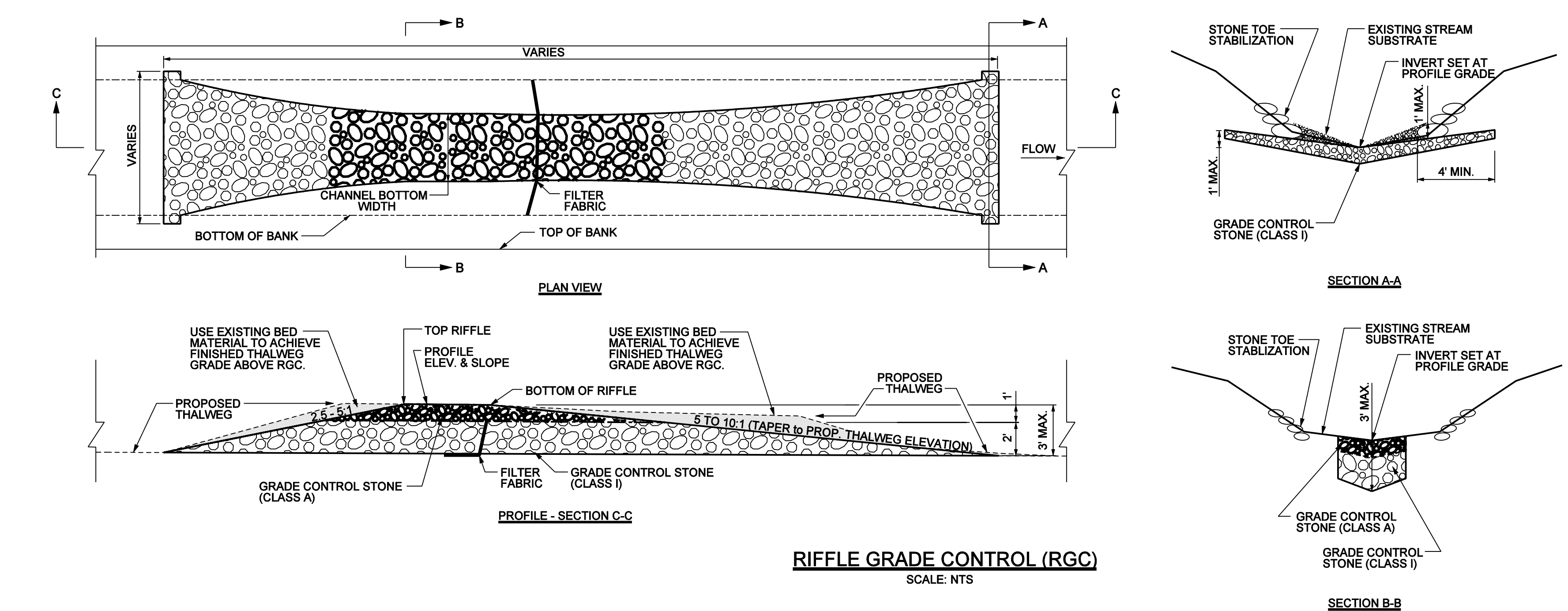
LIVE STAKES
SCALE: NTS

NOTE: LIVE STAKES TO BE INSTALLED IN ACCORDANCE WITH PROJECT SPECIAL PROVISIONS AND AS DIRECTED BY THE ENGINEER.



DOUBLE STEP POOL
SCALE: NTS

NOTES: - ALL SILL OR FOOTER ROCKS ARE STONE, BOULDERS
- DETAIL SHOWN IS FOR A DOUBLE STEP POOL. ADJUST ACCORDINGLY FOR SINGLE AND TRIPLE STEP POOLS. (SEE PROFILE SHEET TO DETERMINE AMOUNT OF STEPS)



RIFFLE GRADE CONTROL (RGC)
SCALE: NTS

SYM.	DESCRIPTION	DATE	APPROVED
A	SUBMITTED WITH RESTORATION PLAN	AUG 2007	

REVISIONS

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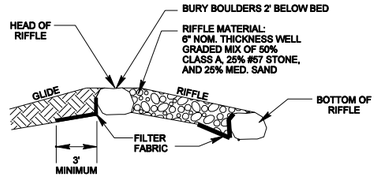
COLLINS CREEK
STREAM RESTORATION PROJECT
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

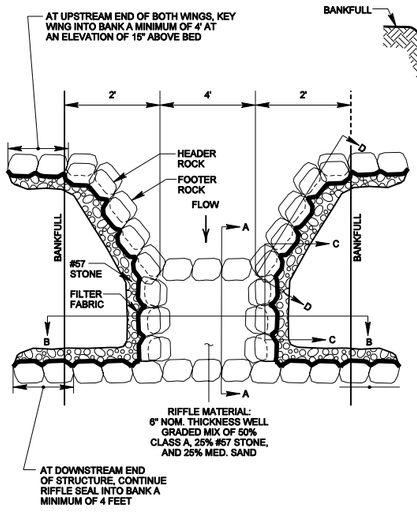
DATE: AUGUST 2007
SCALE: N.T.S.

DETAILS:
STABILIZATION

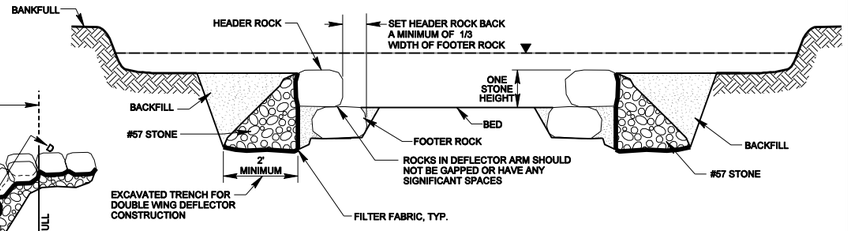
SHEET 2 OF 36



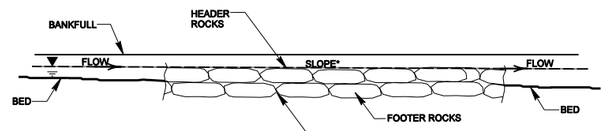
SECTION A-A



PLAN VIEW



SECTION B-B



SECTIONS C-C & D-D

*C-C SLOPE SHOULD FOLLOW PROPOSED STREAM GRADIENT. D-D SLOPE IS 0%

NOTES:
1. USE BOULDERS FOR ALL HEADER AND FOOTER ROCKS.
2. CLASS "A" STONE CAN BE USED TO REDUCE VOIDS BETWEEN HEADERS AND FOOTERS.
3. COMPACT BACKFILL TO EXTENT POSSIBLE OR AT THE DIRECTION OF THE DESIGNER.

CONSTRUCTED RIFFLE WITH CONSTRICTOR

NOT TO SCALE

A	SUBMITTED WITH RESTORATION PLAN	AUG 2007		
		STM.	DESCRIPTION DATE	APPROVED

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COLLINS CREEK
STREAM RESTORATION PROJECT
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

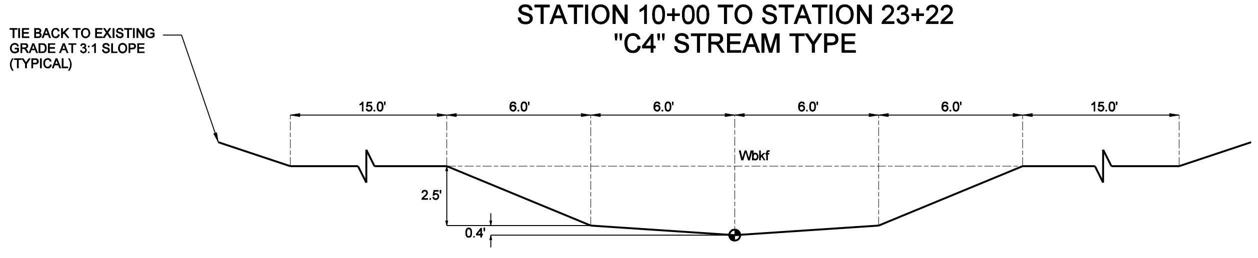
DATE: AUGUST 2007
SCALE: N.T.S.

DETAILS:
STABILIZATION

SHEET 2A OF 36

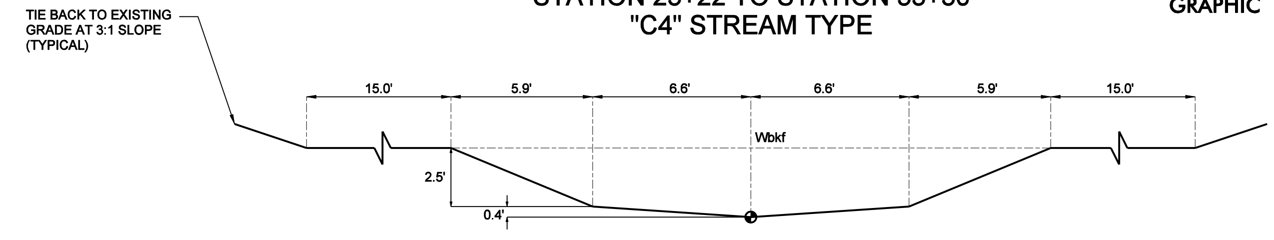
-4 -2 0 4 8
GRAPHIC SCALE

UTCC-1
STATION 10+00 TO STATION 23+22
"C4" STREAM TYPE

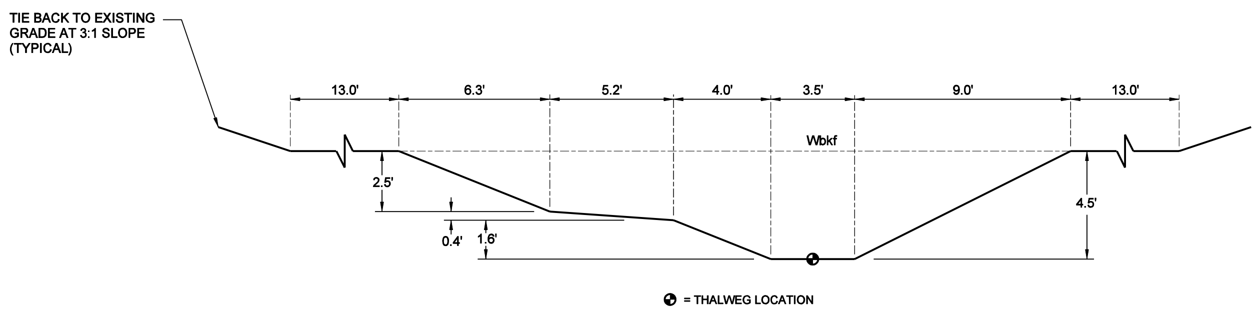


TYPICAL RIFFLE

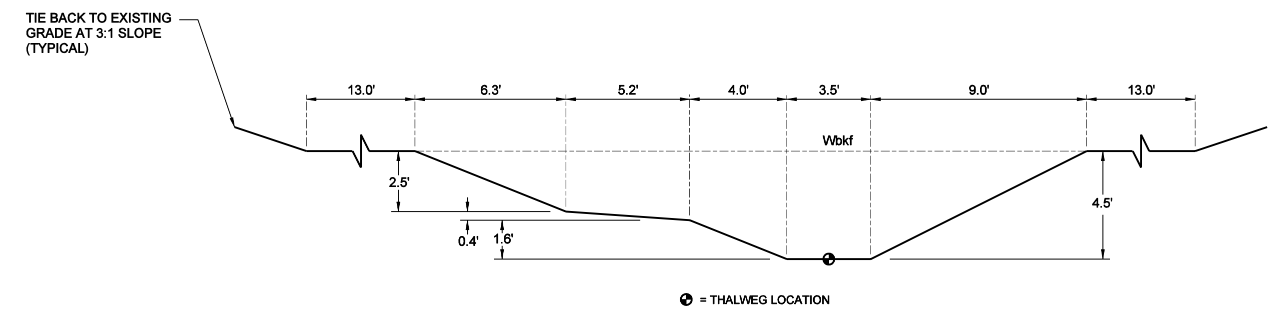
UTCC-2
STATION 23+22 TO STATION 33+30
"C4" STREAM TYPE



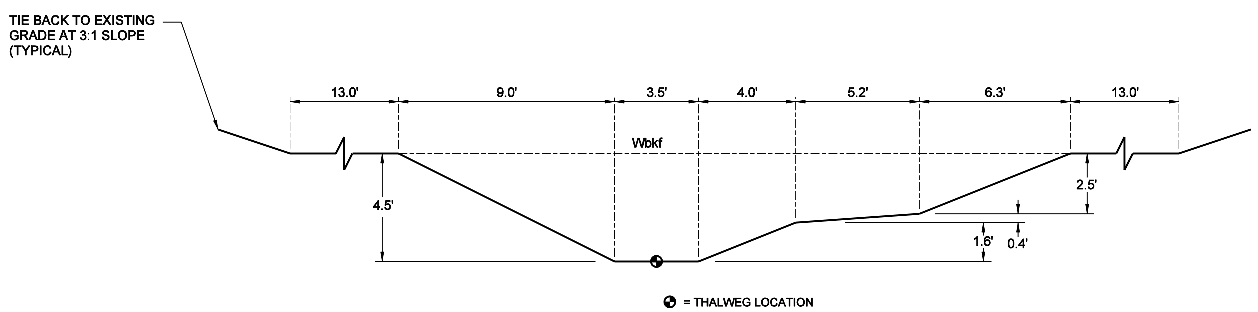
TYPICAL RIFFLE



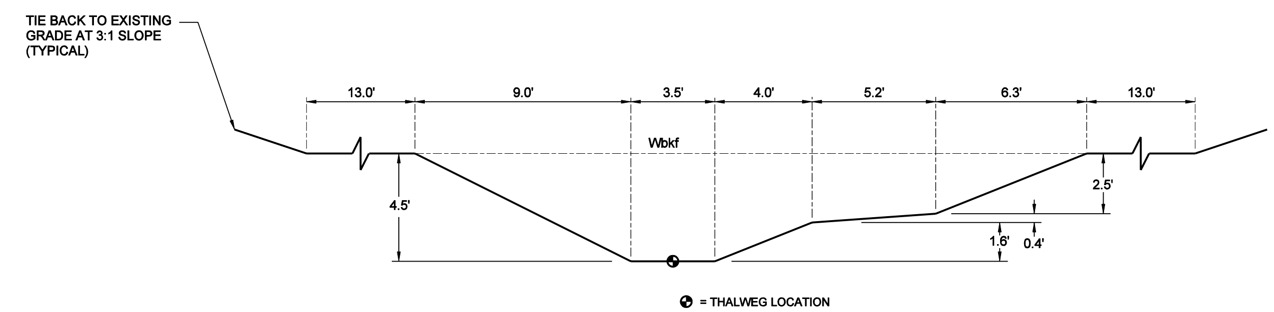
TYPICAL POOL - RIGHT MEANDER



TYPICAL POOL - RIGHT MEANDER

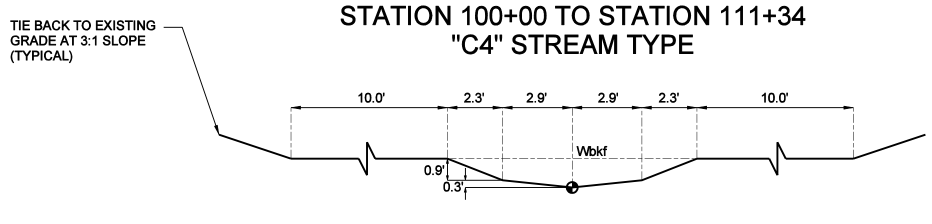


TYPICAL POOL - LEFT MEANDER



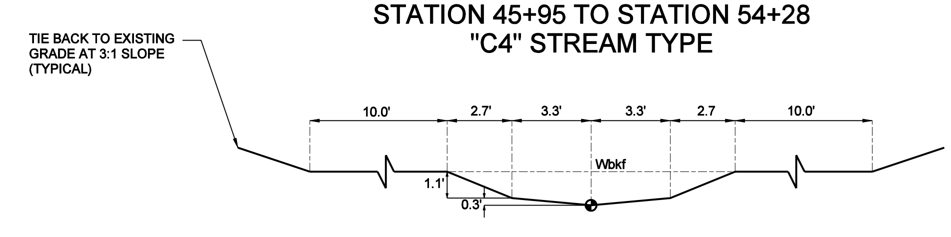
TYPICAL POOL - LEFT MEANDER

TRIBUTARIES 1-1 & 1B
STATION 40+00 TO STATION 45+95 AND
STATION 100+00 TO STATION 111+34
"C4" STREAM TYPE

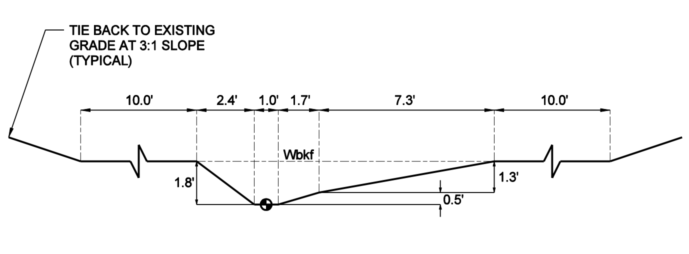


TYPICAL RIFFLE

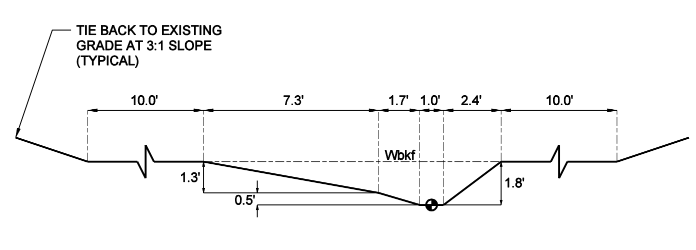
TRIBUTARY 1-2
STATION 45+95 TO STATION 54+28
"C4" STREAM TYPE



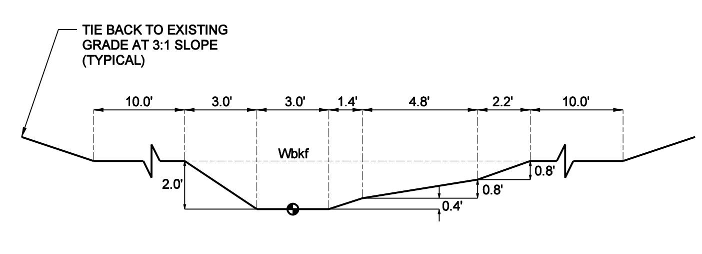
TYPICAL RIFFLE



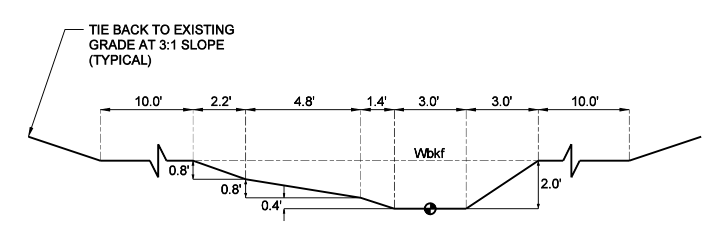
TYPICAL POOL - LEFT MEANDER



TYPICAL POOL - RIGHT MEANDER



TYPICAL POOL - LEFT MEANDER



TYPICAL POOL - RIGHT MEANDER

SYM.	DESCRIPTION	DATE	APPROVED
A	SUBMITTED WITH RESTORATION PLAN	AUG 2007	

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COLLINS CREEK
STREAM RESTORATION PROJECT
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

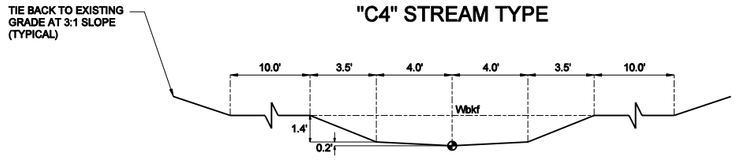
DATE: AUGUST 2007
SCALE: 1" = 4'

DETAILS:
TYPICAL XS

SHEET 2B OF 36

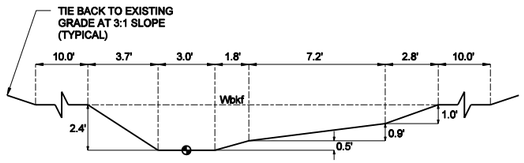
GRAPHIC SCALE
–4 –2 0 4 8

TRIBUTARY 1-3
STATION 54+28 TO STATION 74+39
"C4" STREAM TYPE



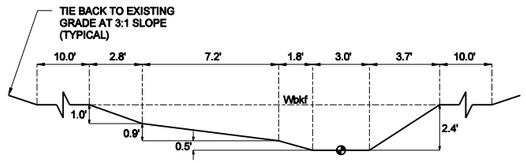
= THALWEG LOCATION

TYPICAL RIFFLE



= THALWEG LOCATION

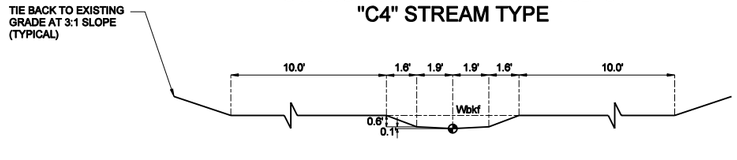
TYPICAL POOL - LEFT MEANDER



= THALWEG LOCATION

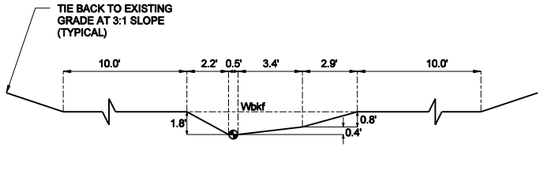
TYPICAL POOL - RIGHT MEANDER

TRIBUTARY 1A-1
STATION 80+00 TO STATION 82+51
"C4" STREAM TYPE



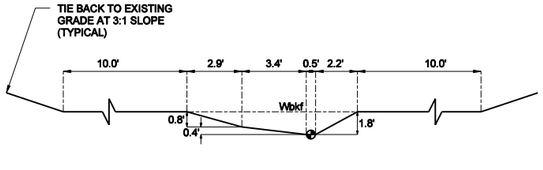
= THALWEG LOCATION

TYPICAL RIFFLE



= THALWEG LOCATION

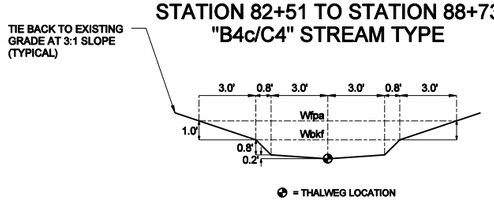
TYPICAL POOL - LEFT MEANDER



= THALWEG LOCATION

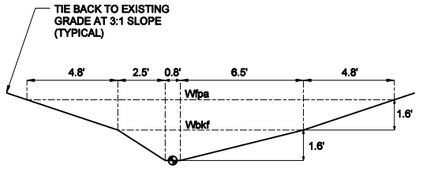
TYPICAL POOL - RIGHT MEANDER

TRIBUTARY 1A-2
STATION 82+51 TO STATION 88+73
"B4c/C4" STREAM TYPE



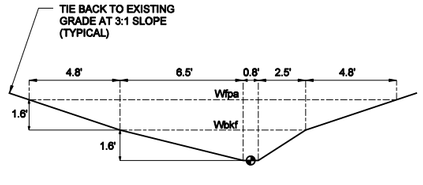
= THALWEG LOCATION

TYPICAL RIFFLE



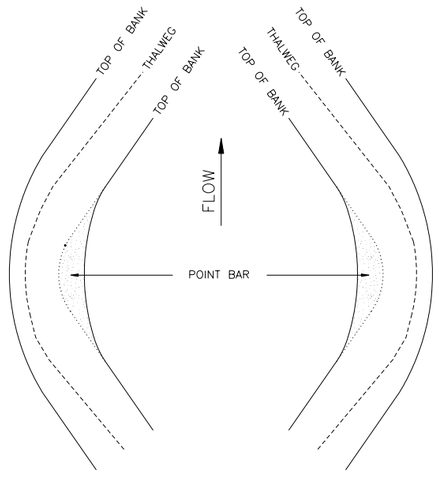
= THALWEG LOCATION

TYPICAL POOL - LEFT MEANDER



= THALWEG LOCATION

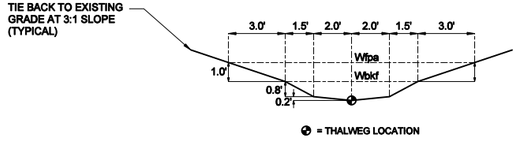
TYPICAL POOL - RIGHT MEANDER



LEFT MEANDER
NOT TO SCALE

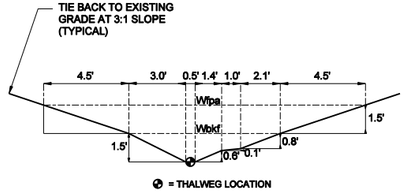
RIGHT MEANDER
NOT TO SCALE

TRIBUTARY 2
STATION 120+00 TO STATION 138+46
"B4c" STREAM TYPE



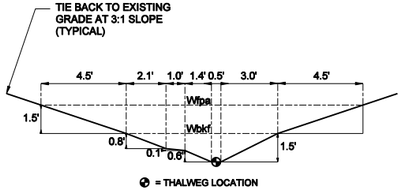
= THALWEG LOCATION

TYPICAL RIFFLE



= THALWEG LOCATION

TYPICAL POOL - LEFT MEANDER



= THALWEG LOCATION

TYPICAL POOL - RIGHT MEANDER

A	SUBMITTED WITH RESTORATION PLAN					AUG 2007	
					SYM.	DESCRIPTION	DATE

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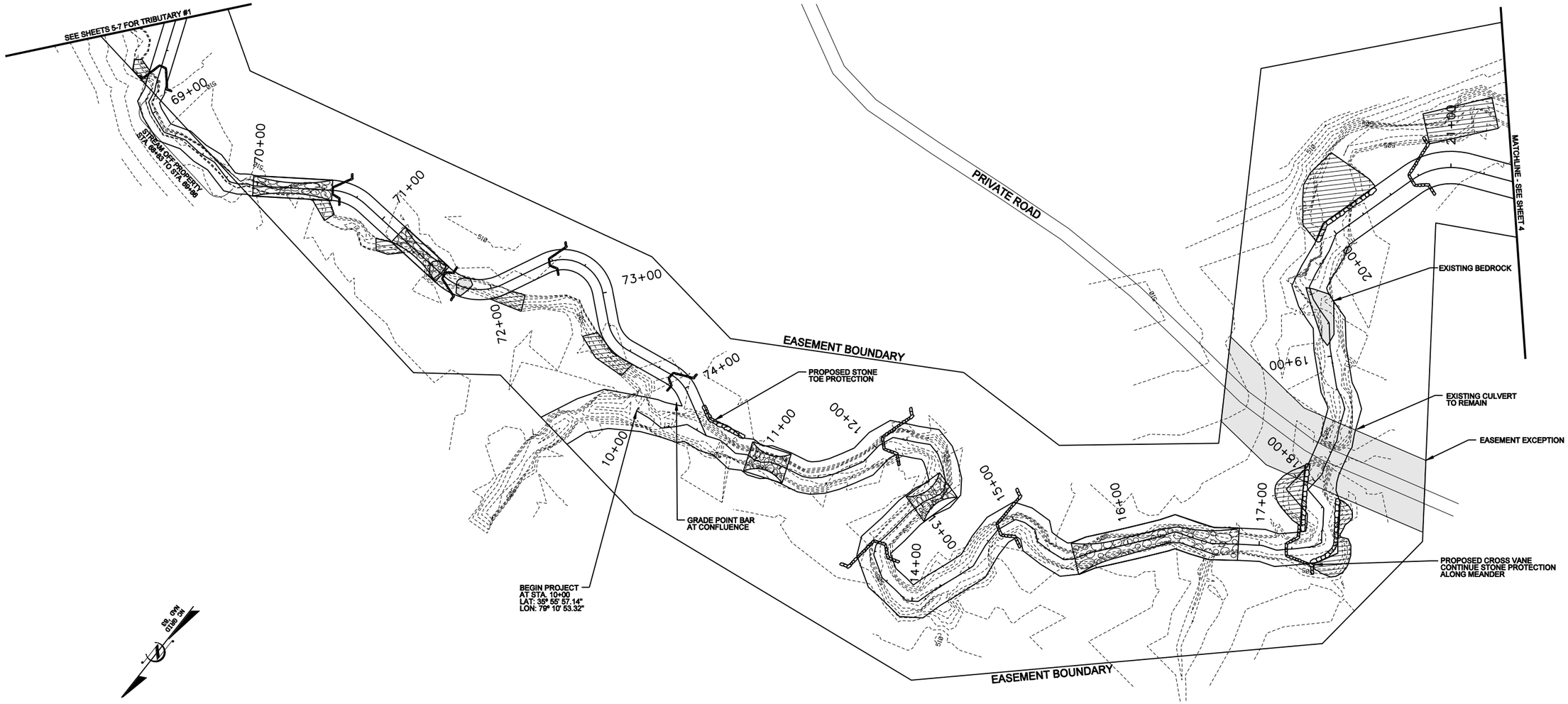
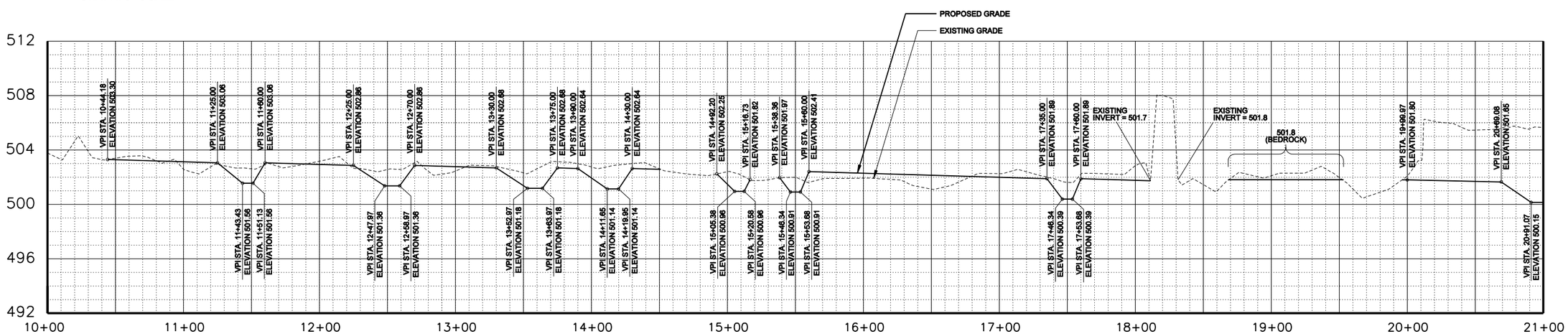
STREAM RESTORATION PROJECT
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

DATE: AUGUST 2007
SCALE: 1" = 4'

DETAILS:
TYPICAL XS

SHEET 2C OF 36





A	SUBMITTED WITH RESTORATION PLAN	AUG 2007		
	DESCRIPTION	DATE	APPROVED	
SYM.	REVISIONS			

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COLLINS CREEK
STREAM RESTORATION PROJECT
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
STATION 10+00 TO STATION 21+47

DATE: AUGUST 2007
SCALE: 1"=40'

PLAN
AND
PROFILE

SHEET 3 OF 36

SEE SHEETS 10-11 FOR TRIBUTARY #2

MATCHLINE - SEE SHEET 3

137+00

22+00

23+00

24+00

25+00

26+00

27+00

28+00

29+00

30+00

31+00

32+00

33+00

PROPOSED STONE TOE PROTECTION

GRADE POINT BAR AT CONFLUENCE

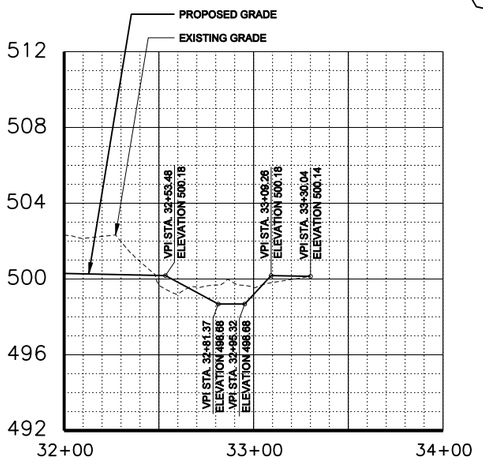
PROPOSED STONE TOE PROTECTION

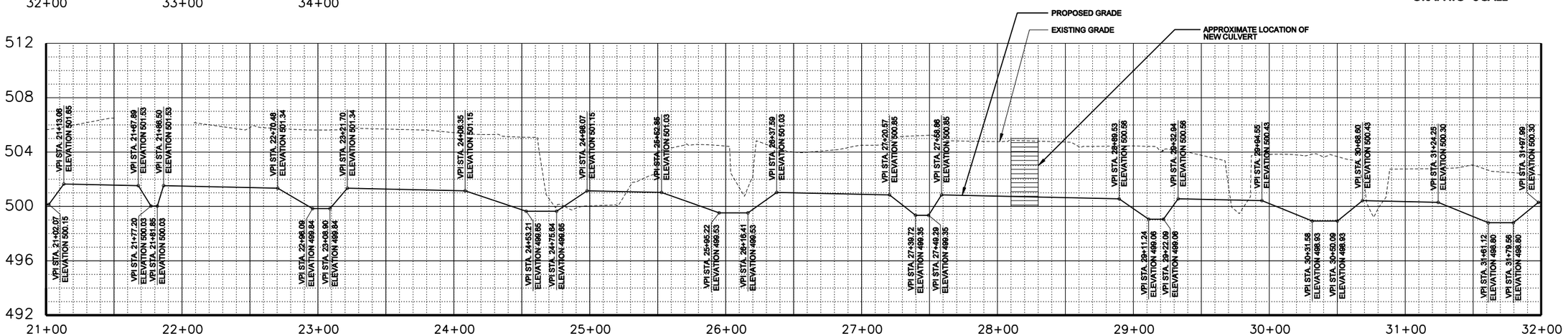
EASEMENT EXCEPTION

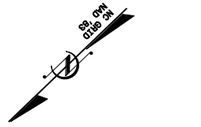
EASEMENT BOUNDARY

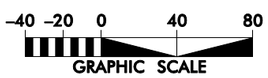
EASEMENT BOUNDARY

EXISTING CULVERT TO BE REPLACED. INSTALL NEW CULVERT ALONG PROPOSED STREAM ALIGNMENT.









A	SUBMITTED WITH RESTORATION PLAN	AUG 2007		

REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

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CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
STATION 21+47 TO STATION 33+30

DATE: AUGUST 2007
SCALE: 1"=40'

PLAN AND PROFILE

SHEET 4 OF 36

SEE SHEET 8 FOR TRIBUTARY #1A

ENHANCE EXISTING PLUNGE POOL WITH CLASS 1 STONE

DODSONS CROSSROADS

EASEMENT BOUNDARY

EXISTING BEDROCK

GRADE POINT BAR AT CONFLUENCE

PROPOSED CROSS VANE CONTINUE STONE PROTECTION ALONG MEANDER

EXISTING CULVERT TO BE REPLACED. INSTALL NEW CULVERT ALONG PROPOSED STREAM ALIGNMENT.

EASEMENT EXCEPTION

EASEMENT BOUNDARY

PRIVATE ROAD

EXISTING CULVERT TO REMAIN

PROPOSED STONE TOE PROTECTION

PROPOSED STONE TOE PROTECTION

MATCHLINE - SEE SHEET 6

SEE SHEET 9 FOR TRIBUTARY #1B

NC GRID NAD 83

GRAPHIC SCALE
–40 –20 0 40 80

PROPOSED GRADE
EXISTING GRADE
EXISTING BEDROCK
APPROXIMATE LOCATION OF NEW CULVERT

528.50
532
528
524
520
516
512
508
40+00
41+00
42+00
43+00
44+00
45+00
46+00
47+00
48+00
49+00
50+00
51+00

VPI STA. 40+20.46 ELEVATION 528.50
VPI STA. 40+33.52 ELEVATION 528.06
VPI STA. 40+45.57 ELEVATION 528.42
VPI STA. 40+52.25 ELEVATION 528.23
VPI STA. 40+60.04 ELEVATION 528.04
VPI STA. 40+78.00 ELEVATION 525.78
VPI STA. 40+95.75 ELEVATION 526.13
VPI STA. 40+97.38 ELEVATION 525.76
VPI STA. 41+18.89 ELEVATION 526.84
VPI STA. 41+32.98 ELEVATION 525.40
VPI STA. 41+39.34 ELEVATION 525.38
VPI STA. 41+45.82 ELEVATION 525.77
VPI STA. 41+63.74 ELEVATION 526.55
VPI STA. 41+94.23 ELEVATION 525.09
VPI STA. 41+94.46 ELEVATION 526.08
VPI STA. 42+04.72 ELEVATION 525.43
VPI STA. 42+29.76 ELEVATION 525.18
VPI STA. 42+43.57 ELEVATION 524.74
VPI STA. 42+57.37 ELEVATION 525.09
VPI STA. 42+50.47 ELEVATION 524.72
VPI STA. 43+18.38 ELEVATION 524.39
VPI STA. 43+20.33 ELEVATION 523.97
VPI STA. 43+28.98 ELEVATION 524.30
VPI STA. 43+22.29 ELEVATION 523.97
VPI STA. 43+68.79 ELEVATION 523.50
VPI STA. 43+80.63 ELEVATION 523.93
VPI STA. 43+72.86 ELEVATION 523.49
VPI STA. 43+78.94 ELEVATION 523.86
VPI STA. 44+17.06 ELEVATION 523.49
VPI STA. 44+28.52 ELEVATION 523.04
VPI STA. 44+32.74 ELEVATION 523.02
VPI STA. 44+41.67 ELEVATION 523.40
VPI STA. 44+77.12 ELEVATION 522.96
VPI STA. 44+89.72 ELEVATION 522.54
VPI STA. 44+96.02 ELEVATION 522.52
VPI STA. 45+02.32 ELEVATION 522.90
VPI STA. 45+13.74 ELEVATION 522.21
VPI STA. 45+25.00 ELEVATION 522.63
VPI STA. 45+38.10 ELEVATION 522.19
VPI STA. 45+42.47 ELEVATION 522.58
VPI STA. 45+80.99 ELEVATION 521.86
VPI STA. 45+87.33 ELEVATION 522.33
VPI STA. 45+87.81 ELEVATION 521.87
VPI STA. 45+94.64 ELEVATION 522.25
VPI STA. 46+51.39 ELEVATION 519.00
VPI STA. 46+43.20 ELEVATION 520.21
VPI STA. 46+55.49 ELEVATION 519.00
VPI STA. 46+67.78 ELEVATION 520.17
VPI STA. 46+78.72 ELEVATION 520.11
VPI STA. 47+11.20 ELEVATION 519.42
VPI STA. 47+27.43 ELEVATION 519.37
VPI STA. 47+43.67 ELEVATION 518.92
VPI STA. 47+81.95 ELEVATION 519.04
VPI STA. 47+87.22 ELEVATION 519.08
VPI STA. 47+98.31 ELEVATION 519.02
VPI STA. 47+90.67 ELEVATION 519.59
VPI STA. 48+31.36 ELEVATION 518.67
VPI STA. 48+27.64 ELEVATION 518.29
VPI STA. 48+36.52 ELEVATION 518.67
VPI STA. 48+45.68 ELEVATION 519.15
VPI STA. 49+22.61 ELEVATION 517.86
VPI STA. 49+02.52 ELEVATION 518.52
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VPI STA. 49+42.70 ELEVATION 518.40
VPI STA. 49+89.08 ELEVATION 517.46
VPI STA. 49+73.03 ELEVATION 518.13
VPI STA. 49+97.11 ELEVATION 517.46
VPI STA. 50+05.13 ELEVATION 518.03
VPI STA. 50+41.64 ELEVATION 517.10
VPI STA. 50+33.36 ELEVATION 517.72
VPI STA. 50+46.77 ELEVATION 517.08
VPI STA. 50+54.64 ELEVATION 517.62
VPI STA. 50+69.70 ELEVATION 517.23

A	SUBMITTED WITH RESTORATION PLAN	AUG 2007	
SYM.	DESCRIPTION	DATE	APPROVED

REVISIONS

Ecosystem Enhancement PROGRAM

KCI TECHNOLOGIES
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RALEIGH, NORTH CAROLINA 27609

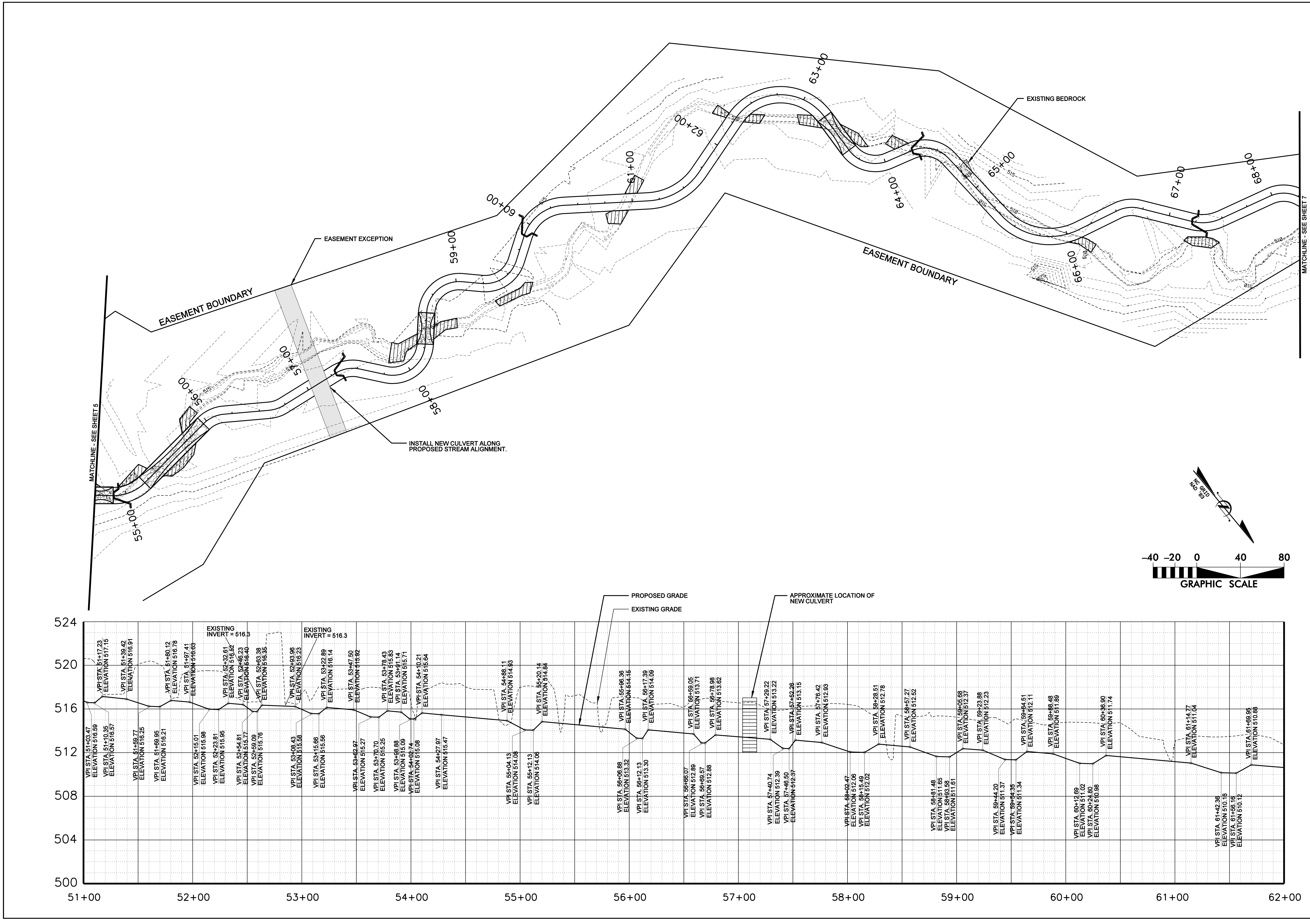
COLLINS CREEK STREAM RESTORATION PROJECT

CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

STATION 40+00 TO STATION 54+71

DATE: AUGUST 2007
SCALE: 1"=40'

PLAN AND PROFILE



SYM.	DESCRIPTION	DATE	APPROVED
A	SUBMITTED WITH RESTORATION PLAN	AUG 2007	

REVISIONS

Ecosystem Enhancement PROGRAM

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COLLINS CREEK STREAM RESTORATION PROJECT

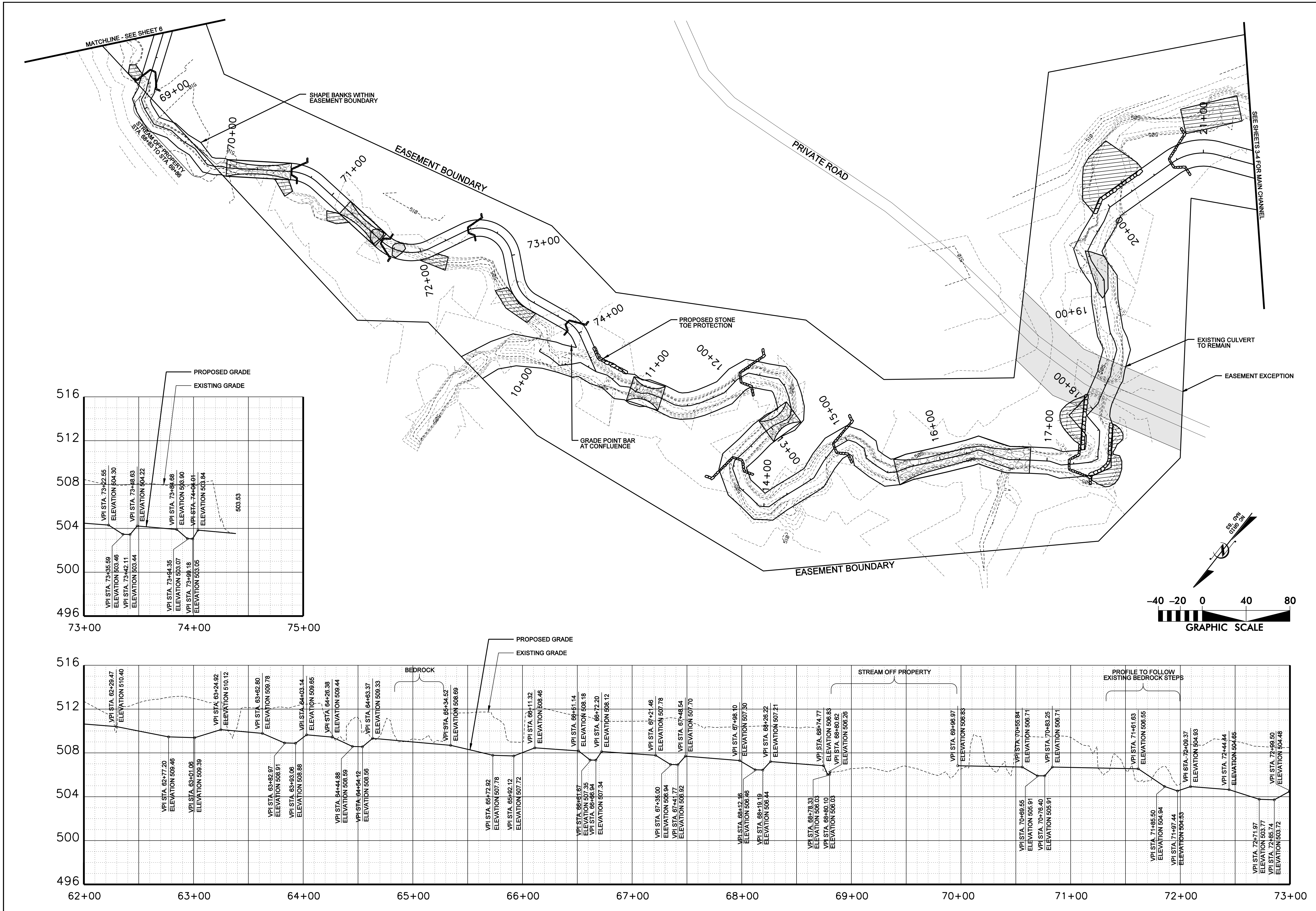
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

STATION 54+71 TO STATION 68+26

DATE: AUGUST 2007

SCALE: 1"=40'

PLAN AND PROFILE



SYM.	DESCRIPTION	DATE	APPROVED
A	SUBMITTED WITH RESTORATION PLAN	AUG 2007	

REVISIONS

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RALEIGH, NORTH CAROLINA 27609

COLLINS CREEK STREAM RESTORATION PROJECT

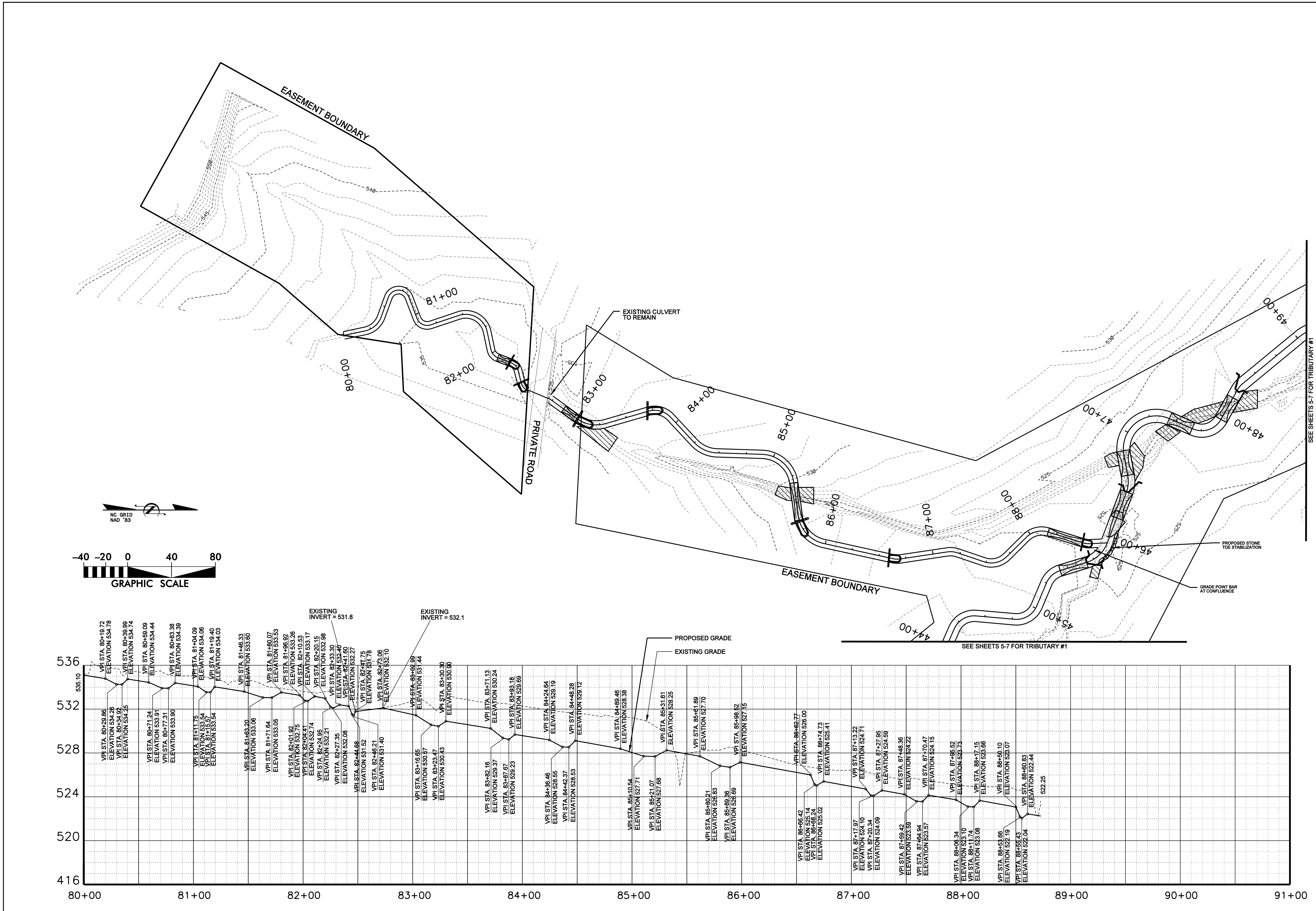
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

STATION 68+26 TO STATION 74+39

DATE: AUGUST 2007
SCALE: 1"=40'

PLAN AND PROFILE

SHEET 7 OF 36



SYM.	DESCRIPTION	DATE	APPROVED
A	SUBMITTED WITH RESTORATION PLAN	AUG 2007	

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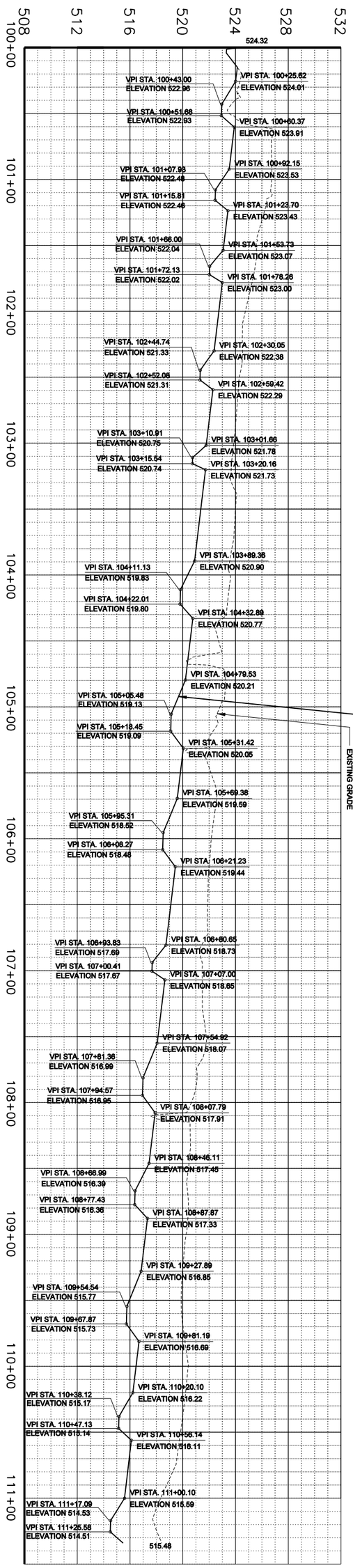
RALEIGH, NORTH CAROLINA 27609

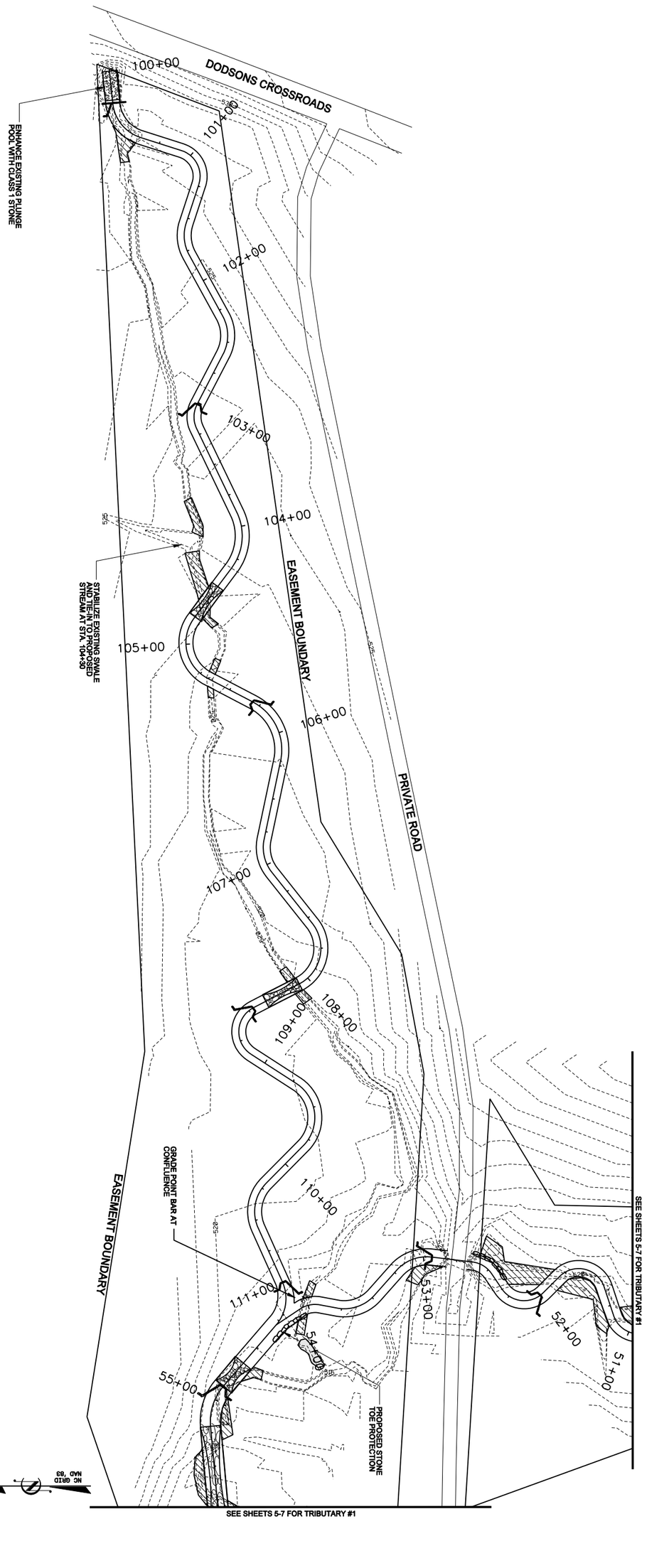
COLLINS CREEK
STREAM RESTORATION PROJECT
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
STATION 80+00 TO STATION 88+73

DATE: AUGUST 2007
SCALE: 1"=40'

PLAN AND PROFILE

SHEET 8 OF 36





SHEET 9 OF 36

PLAN AND PROFILE

DATE: AUGUST 2007

SCALE: 1"=40'

COLLINS CREEK STREAM RESTORATION PROJECT

CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

STATION 100+00 TO STATION 111+34

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RALEIGH, NORTH CAROLINA 27609

Ecosystem Enhancement Program

SYM.	DESCRIPTION	DATE	APPROVED
A	SUBMITTED WITH RESTORATION PLAN	AUG 2007	

REVISIONS

A	SUBMITTED WITH RESTORATION PLAN	AUG 2007		
		DESCRIPTION	DATE	APPROVED
	SYM.	REVISIONS		

Ecosystem Enhancement Program

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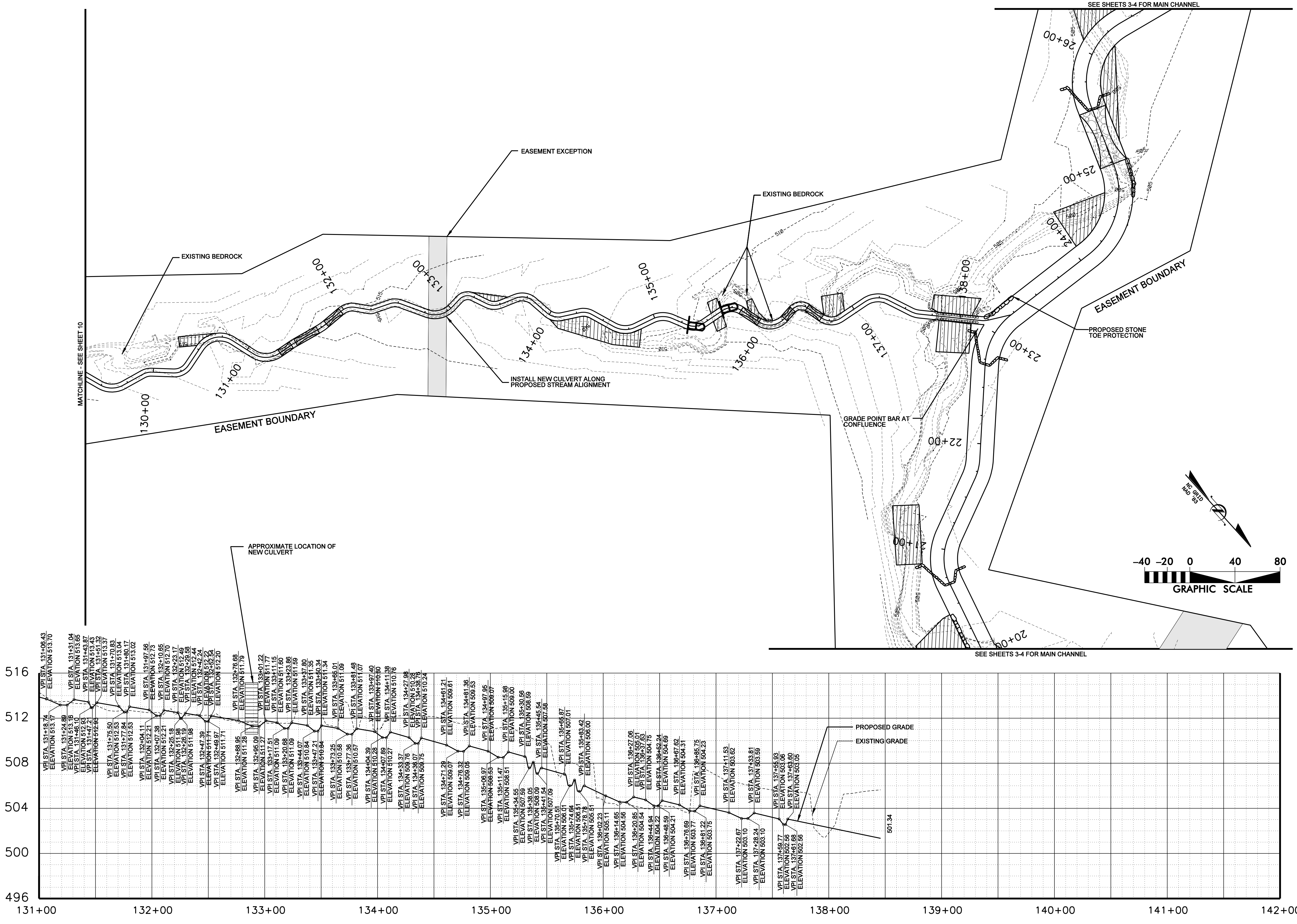
RALEIGH, NORTH CAROLINA 27609

COLLINS CREEK
STREAM RESTORATION PROJECT
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
STATION 120+00 TO STATION 129+34

DATE: AUGUST 2007
SCALE: 1"=40'

PLAN AND PROFILE

SHEET 10 OF 38



SYM.	DESCRIPTION	DATE	APPROVED
A	SUBMITTED WITH RESTORATION PLAN	AUG 2007	

REVISIONS

Ecosystem Enhancement PROGRAM

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RALEIGH, NORTH CAROLINA 27609

COLLINS CREEK STREAM RESTORATION PROJECT

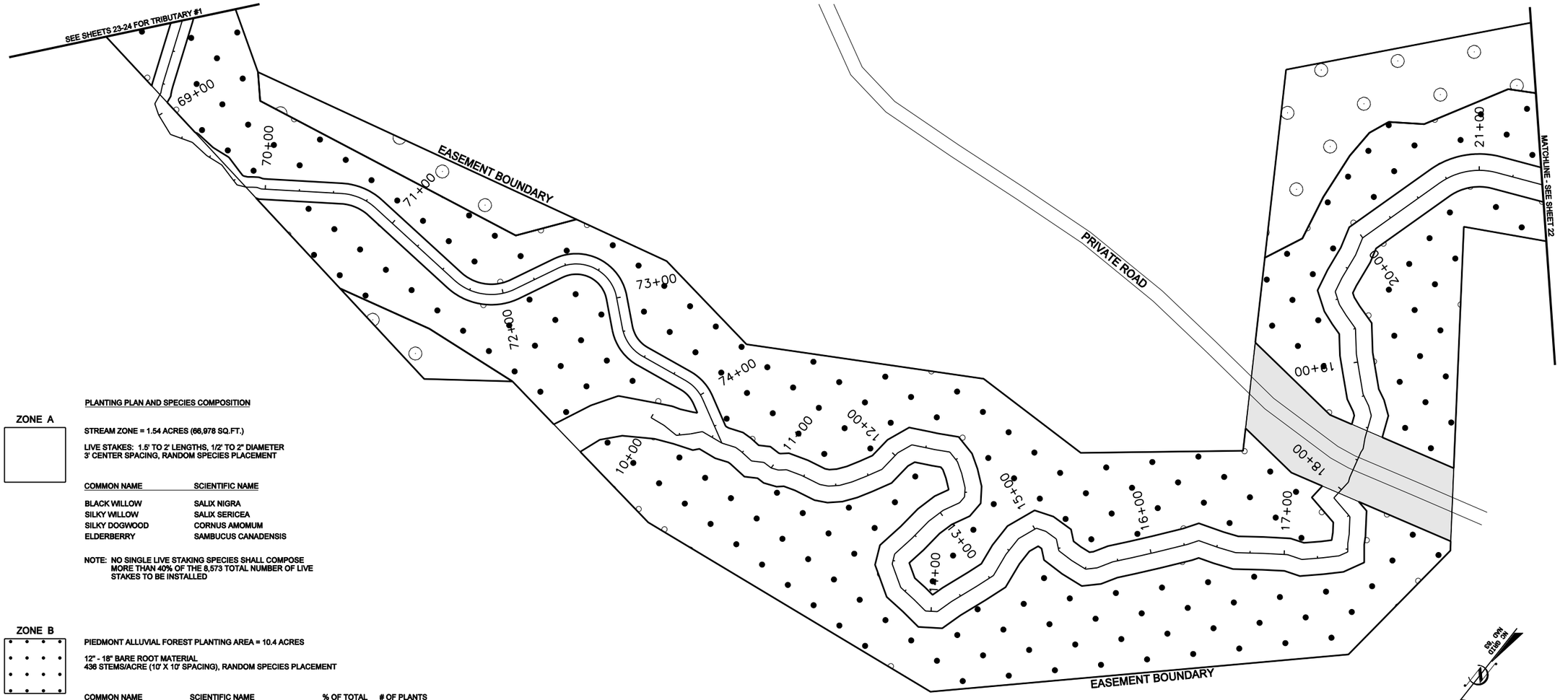
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

STATION 129+34 TO STATION 138+46

DATE: AUGUST 2007
SCALE: 1"=40'

PLAN AND PROFILE

SHEET 11 OF 36



ZONE A

PLANTING PLAN AND SPECIES COMPOSITION

STREAM ZONE = 1.54 ACRES (66,978 SQ.FT.)

LIVE STAKES: 1.5' TO 2' LENGTHS, 1/2' TO 2" DIAMETER
3' CENTER SPACING, RANDOM SPECIES PLACEMENT

COMMON NAME	SCIENTIFIC NAME
BLACK WILLOW	SALIX NIGRA
SILKY WILLOW	SALIX SERICEA
SILKY DOGWOOD	CORNUS AMOMUM
ELDERBERRY	SAMBUCUS CANADENSIS

NOTE: NO SINGLE LIVE STAKING SPECIES SHALL COMPOSE MORE THAN 40% OF THE 8,573 TOTAL NUMBER OF LIVE STAKES TO BE INSTALLED

ZONE B

PIEDMONT ALLUVIAL FOREST PLANTING AREA = 10.4 ACRES

12" - 18" BARE ROOT MATERIAL
436 STEMS/ACRE (10' X 10' SPACING), RANDOM SPECIES PLACEMENT

COMMON NAME	SCIENTIFIC NAME	% OF TOTAL	# OF PLANTS
CORALBERRY	SYMPHORICARPOS ORBICULATAS	5	229
GREEN ASH	FRAXINUS PENNSYLVANICA	5	229
SPICEBUSH	LINDERA BENZOIN	10	453
WINTERBERRY	ILEX VERTICILLATA	10	453
BEAUTYBERRY	CALLICARPA AMERICANA	10	453
SYCAMORE	PLATANUS OCCIDENTALIS	10	453
SUGARBERRY	CELTIS LAEVIGATA	10	453
RIVER BIRCH	BETULA NIGRA	10	453
SWAMP CHESTNUT OAK	QUERCUS MICHAUXII	10	453
WILLOW OAK	QUERCUS PHELLOS	10	453
PERSIMMON	DIOSPYROS VIRGINIANA	10	453
		100	4,535

* UNDISTURBED FORESTED AREAS WITHIN PLANTING ZONE WILL NOT BE PLANTED

ZONE C

MESIC MIXED HARDWOOD FOREST PLANTING AREA = 14.5 ACRES

12" - 18" BARE ROOT MATERIAL
436 STEMS/ACRE (10' X 10' SPACING), RANDOM SPECIES PLACEMENT

COMMON NAME	SCIENTIFIC NAME	% OF TOTAL	# OF PLANTS
CORALBERRY	SYMPHORICARPOS ORBICULATAS	10	633
SPICEBUSH	LINDERA BENZOIN	10	633
PERSIMMON	DIOSPYROS VIRGINIANA	20	1,264
BLACK WALNUT	JUGLANS NIGRA	20	1,264
SHAGBARK HICKORY	CARYA OVATA	20	1,264
S. RED OAK	QUERCUS FALCATA	20	1,264
		100	6,322

* UNDISTURBED FORESTED AREAS WITHIN PLANTING ZONE WILL NOT BE PLANTED

A	SUBMITTED WITH RESTORATION PLAN	AUG 2007		
SYM.	DESCRIPTION	DATE	APPROVED	

REVISIONS

Ecosystem Enhancement Program

KCI TECHNOLOGIES
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4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

COLLINS CREEK
STREAM RESTORATION PROJECT
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
STATION 10+00 - 21+47 AND STATION 68+26 - 74+39

DATE: AUGUST 2007
SCALE: 1"=40'

PLANTING PLAN

SHEET 21 OF 38

ZONE A — STREAM ZONE PLANTING AREA

ZONE B — PIEDMONT ALLUVIAL FOREST PLANTING AREA

ZONE C — MESIC MIXED HARDWOOD FOREST PLANTING AREA

A	SUBMITTED WITH RESTORATION PLAN	AUG 2007	
SYM.	DESCRIPTION	DATE	APPROVED

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Ecosystem Enhancement Program

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RALEIGH, NORTH CAROLINA 27609

COLLINS CREEK STREAM RESTORATION PROJECT

CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

STATION 21+47 TO STATION 33+30

DATE: AUGUST 2007

SCALE: 1"=40'

PLANTING PLAN

ZONE A

STREAM ZONE PLANTING AREA

ZONE B

PIEDMONT ALLUVIAL FOREST PLANTING AREA

ZONE C

MESIC MIXED HARDWOOD FOREST PLANTING AREA

A	SUBMITTED WITH RESTORATION PLAN	AUG 2007		
SYM.	DESCRIPTION	DATE	APPROVED	

REVISIONS

Ecosystem Enhancement Program

KCI TECHNOLOGIES
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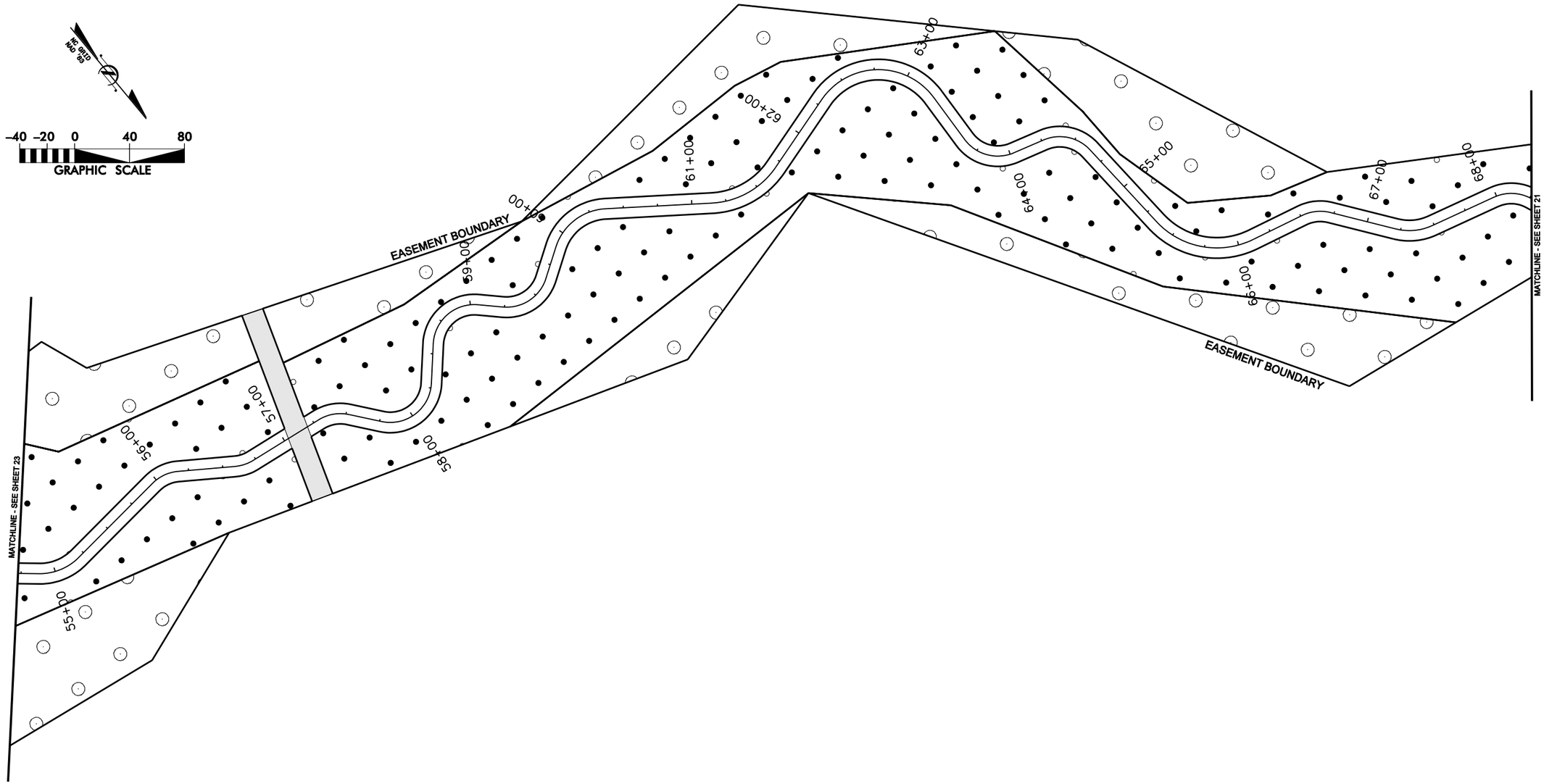
460 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

COLLINS CREEK
STREAM RESTORATION PROJECT
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
STATION 40+00 TO STATION 54+71

DATE: AUGUST 2007
SCALE: 1"=40'

PLANTING PLAN

SHEET 23 OF 36



ZONE A — STREAM ZONE PLANTING AREA

ZONE B — PIEDMONT ALLUVIAL FOREST PLANTING AREA

ZONE C — MESIC MIXED HARDWOOD FOREST PLANTING AREA

A	SUBMITTED WITH RESTORATION PLAN		AUG 2007	
SYM.	DESCRIPTION		DATE	APPROVED

REVISIONS

Ecosystem Enhancement Program

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COLLINS CREEK
STREAM RESTORATION PROJECT
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
STATION 54+71 TO STATION 68+26

DATE: AUGUST 2007
SCALE: 1"=40'

PLANTING PLAN

SHEET 24 OF 36

ZONE A

STREAM ZONE PLANTING AREA

ZONE B

PIEDMONT ALLUVIAL FOREST PLANTING AREA

ZONE C

MESIC MIXED HARDWOOD FOREST PLANTING AREA

A	SUBMITTED WITH RESTORATION PLAN	AUG 2007	
SYM.	DESCRIPTION	DATE	APPROVED

REVISIONS

Ecosystem Enhancement Program

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460 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

COLLINS CREEK STREAM RESTORATION PROJECT

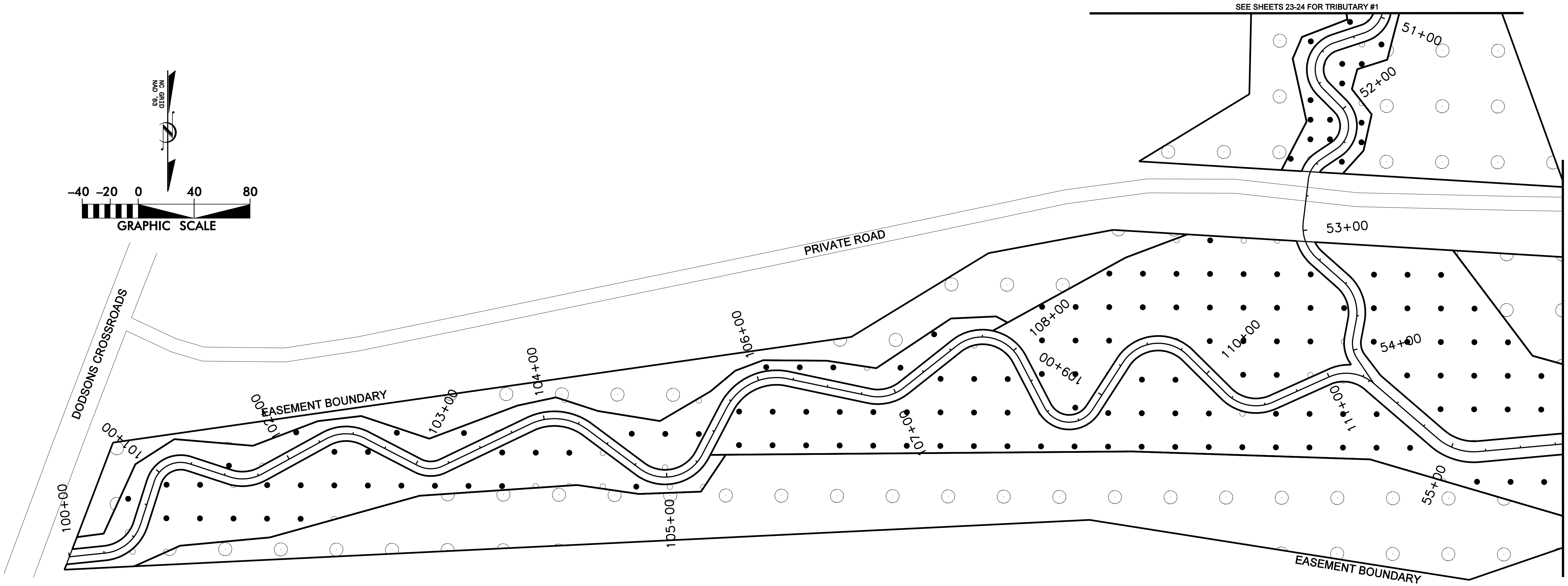
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

STATION 80+00 TO STATION 88+73

DATE: AUGUST 2007

SCALE: 1"=40'

PLANTING PLAN



ZONE A

STREAM ZONE PLANTING AREA

ZONE B

PIEDMONT ALLUVIAL FOREST PLANTING AREA

ZONE C

MESIC MIXED HARDWOOD FOREST PLANTING AREA

SYM.	DESCRIPTION	DATE	APPROVED
A	SUBMITTED WITH RESTORATION PLAN	AUG 2007	

REVISIONS

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RALEIGH, NORTH CAROLINA 27609

COLLINS CREEK
STREAM RESTORATION PROJECT
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA
STATION 100+00 TO STATION 111+34

DATE: AUGUST 2007
SCALE: 1"=40'

PLANTING PLAN

SHEET 26 OF 36

ZONE A — STREAM ZONE PLANTING AREA

ZONE B — PIEDMONT ALLUVIAL FOREST PLANTING AREA

ZONE C — MESIC MIXED HARDWOOD FOREST PLANTING AREA

A	SUBMITTED WITH RESTORATION PLAN	AUG 2007		
SYM.	DESCRIPTION	DATE	APPROVED	

REVISIONS

Ecosystem Enhancement Program

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4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

COLLINS CREEK STREAM RESTORATION PROJECT

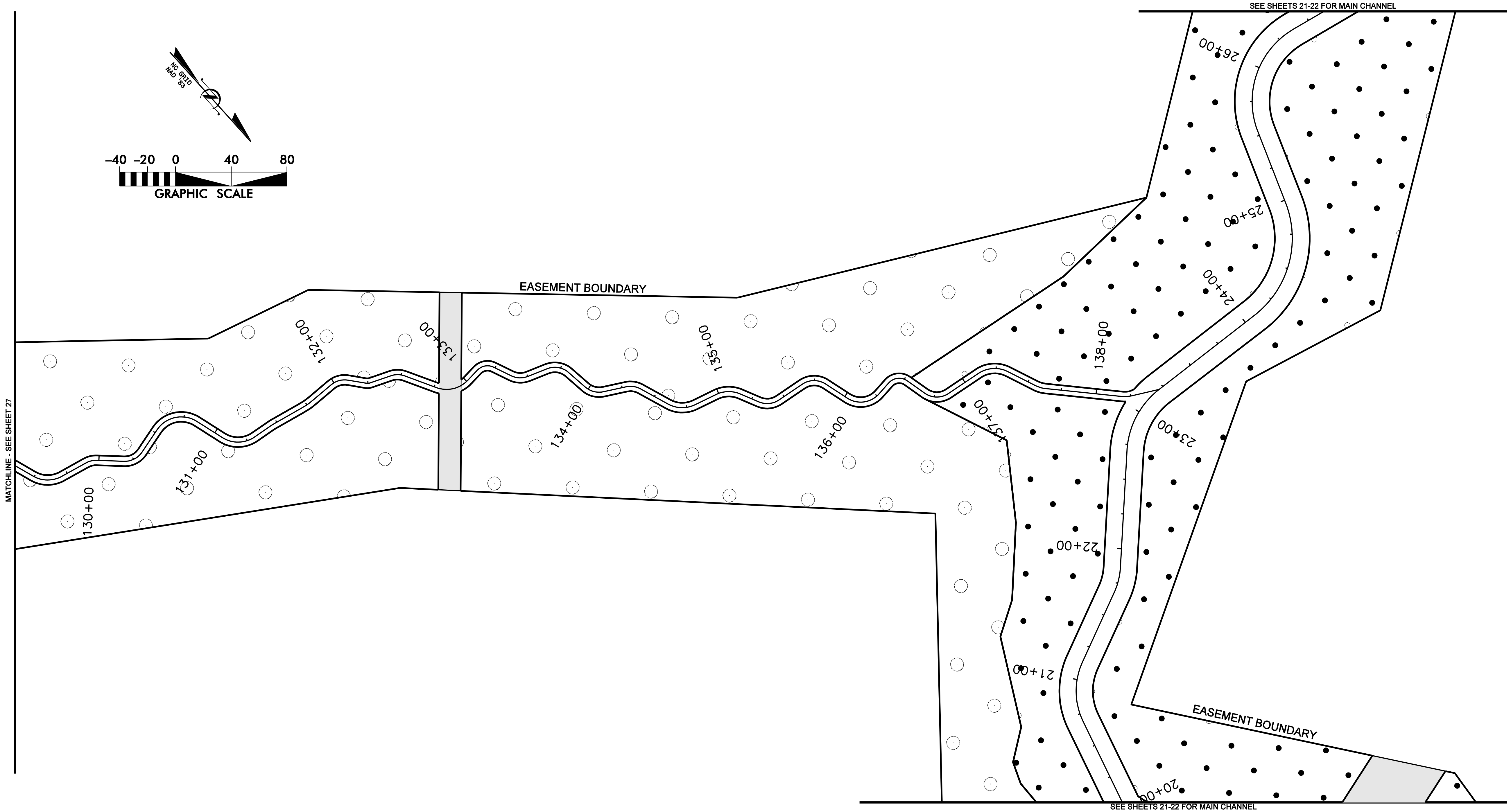
CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

STATION 120+00 TO STATION 129+34

DATE: AUGUST 2007

SCALE: 1"=40'

PLANTING PLAN



ZONE A

STREAM ZONE PLANTING AREA

ZONE B

PIEDMONT ALLUVIAL FOREST PLANTING AREA

ZONE C

MESIC MIXED HARDWOOD FOREST PLANTING AREA

SYM.	DESCRIPTION	DATE	APPROVED
A	SUBMITTED WITH RESTORATION PLAN	AUG 2007	

REVISIONS

Ecosystem Enhancement PROGRAM

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RALEIGH, NORTH CAROLINA 27609

COLLINS CREEK STREAM RESTORATION PROJECT

CHAPEL HILL, ORANGE COUNTY, NORTH CAROLINA

STATION 129+34 TO STATION 138+46

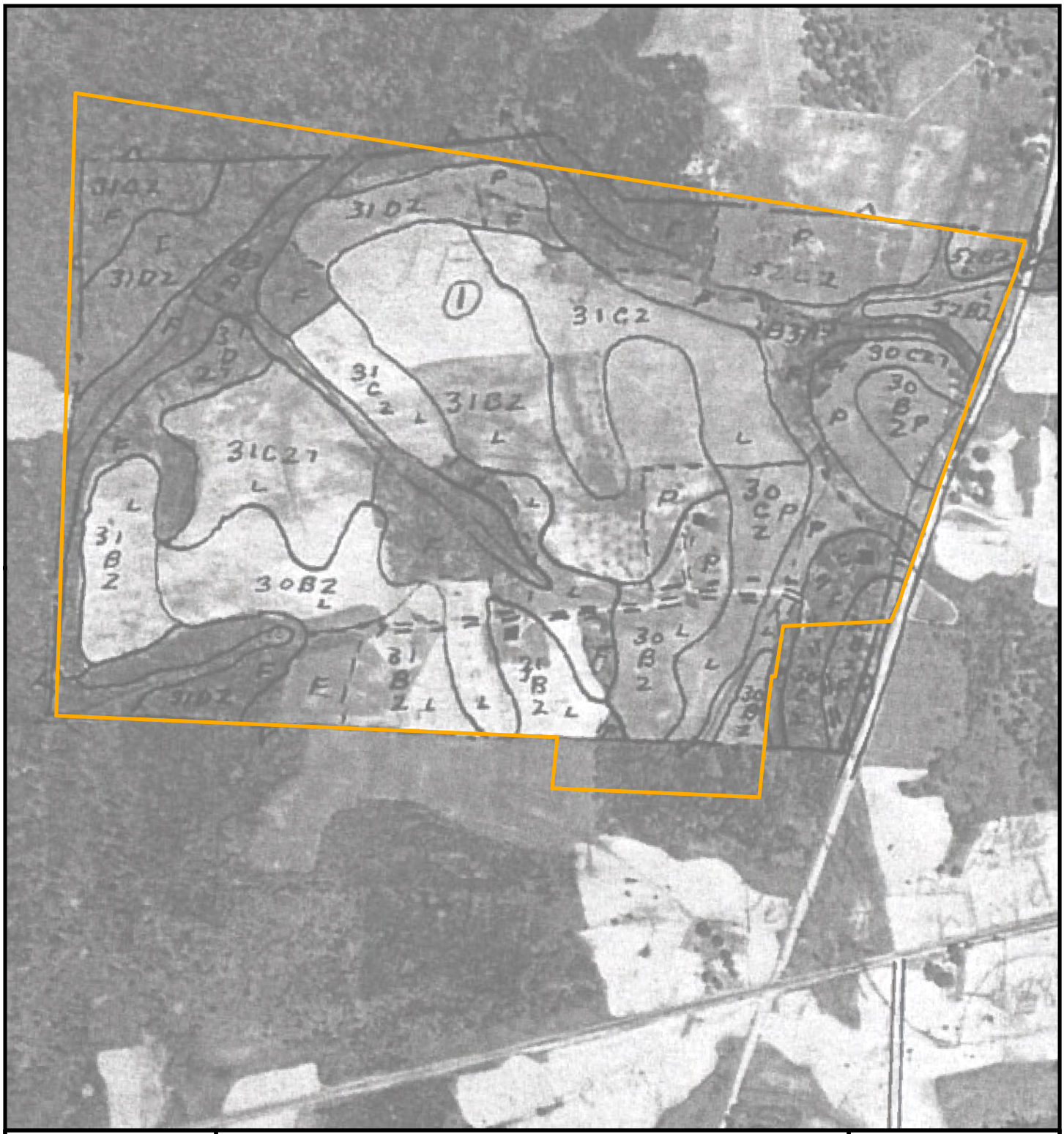
DATE: AUGUST 2007

SCALE: 1"=40'

PLANTING PLAN

SHEET 28 OF 36

Appendix A
Historic Aerial Photographs



UT to Collins Creek - Historic Aerial 1938

Limit of Project Parcels

1:6,600

1 inch equals 550 feet

550 275 0 550 Feet

Source: USDA NRCS

KCI TECHNOLOGIES

KCI ASSOCIATES OF NC

ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.

KCI TECHNOLOGIES

UT to Collins Creek - Historic Aerial 1955

Limit of Project Parcels

N
W E
S

1:6,600

1 inch equals 550 feet

550 275 0 550

Feet

Source: USDA NRCS

KCI ASSOCIATES OF NC

ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.

UT to Collins Creek - Historic Aerial 1966

KCI TECHNOLOGIES

Limit of Project Parcels

N
W E
S

1:6,600

1 inch equals 550 feet

550 275 0 550

Feet

Source: USDA NRCS

KCI ASSOCIATES OF NC

ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.

UT to Collins Creek - Historic Aerial 1972

Limit of Project Parcels

1:6,600

1 inch equals 550 feet

550 275 0 550 Feet

Source: USDA NRCS

KCI TECHNOLOGIES

KCI ASSOCIATES OF NC

ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.

UT to Collins Creek - Historic Aerial 1982

Limit of Project Parcels

1:6,600

1 inch equals 550 feet

550 275 0 550 Feet

Source: USDA NRCS

KCI TECHNOLOGIES

KCI ASSOCIATES OF NC

ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.

UT to Collins Creek - Historic Aerial 1993

Limit of Project Parcels

1:6,600

1 inch equals 550 feet

550 275 0 550 Feet

Source: USDA NRCS

KCI TECHNOLOGIES

KCI ASSOCIATES OF NC

ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.

UT to Collins Creek - Historic Aerial 1998

Limit of Project Parcels

1:6,600

1 inch equals 550 feet

550 275 0 550 Feet

Source: USDA NRCS

KCI TECHNOLOGIES

KCI ASSOCIATES OF NC

ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.

UT to Collins Creek - Historic Aerial 2003

Limit of Project Parcels

1:6,600

1 inch equals 550 feet

550 275 0 550

Feet

Source: USDA NRCS

KCI TECHNOLOGIES

KCI ASSOCIATES OF NC

ENVIRONMENTAL TECHNOLOGIES AND CONSTRUCTION, INC.

Appendix B
Correspondence

KCI TECHNOLOGIES

ENGINEERS • SURVEYORS • SCIENTISTS • CONSTRUCTION MANAGERS

LANDMARK CENTER II • SUITE 220 • 4601 SIX FORKS ROAD • RALEIGH • NC 27609 • 919-783-9214 • (FAX) 919-783-9266

July 6, 2005

Ms. Renee Gledhill-Earley
Environmental Review Coordinator - SHPO
4617 Mail Service Center
Raleigh, NC 27699-4617

Attn: Juliana Hoekstra

Subject: Cultural Resources Review
Collins Creek Stream Restoration Project
Project Number 12054130

Dear Ms. Hoekstra:

Please accept this information pertaining to the proposed Collins Creek Stream Restoration Project, which is located 6 miles west of Carrboro approximately 800 feet north of the intersection of Dodsons Cross Road and State Hwy 54 in Orange County, as a submittal for cultural resources review by the State Historic Preservation Office.

A portion of this property (refer to attached layout) is currently under investigation as a stream restoration project for the North Carolina Ecosystem Enhancement Program. The vegetation at this site is primarily Agricultural Pasture/Hay and Natural Herbaceous with portions of Piedmont Mesic Forest and Piedmont Dry-Mesic Oak and Hardwood Forests according to the 2003 NC GAP land cover dataset. The planned restoration work typically involves modifying stream channels to a natural stable form through minor grading, use of in-stream rock features, and establishment of vegetated riparian buffers. In addition, grazing management (fencing/watering devices/access control) will be incorporated in this particular project. No impacts to any structures on the subject property are anticipated.

Following the review of the included documentation, please provide a determination regarding any potential impacts to cultural resources associated with this project.

Please feel free to contact me at (919) 783-9214, ext. 141, should you have any questions or require any further information to process this request. Thank you in advance for your assistance and attention.

Sincerely,

Michael B. Schlegel
Project Manager

North Carolina Department of Cultural Resources

State Historic Preservation Office

Peter B. Sandbeck, Administrator

Michael F. Easley, Governor
Lisbeth C. Evans, Secretary
Jeffrey J. Crow, Deputy Secretary

Office of Archives and History
Division of Historical Resources
David Brook, Director

July 29, 2005

Michael B. Schlegel
KCI Technologies
Landmark Center II, Suite 220
4601 Six Forks Road
Raleigh, NC 27609

Re: Collins Creek Stream Restoration, Erwin and Mt. Moriah Church Roads, #12054130, Orange County, ER 05-1558

Dear Mr. Schlegel:

Thank you for your letter of July 6, 2005, concerning the above project.

We have conducted a review of the proposed undertaking and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the undertaking as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919/733-4763. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

Peter Sandbeck

	Location	Mailing Address	Telephone/Fax
ADMINISTRATION	507 N. Blount Street, Raleigh NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-4763/733-8653
RESTORATION	515 N. Blount Street, Raleigh NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-6547/715-4801
SURVEY & PLANNING	515 N. Blount Street, Raleigh, NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-6545/715-4801

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LANDMARK CENTER II • SUITE 220 • 4601 SIX FORKS ROAD • RALEIGH • NC 27609 • 919-783-9214 • (FAX) 919-783-9266

July 18, 2005

Mr. Gary Jordan
US Fish and Wildlife Service
Raleigh Field Office
P.O. Box 33726
Raleigh, NC 27636

Subject: Endangered Species Act, Fish and Wildlife Coordination Act, Migratory Bird Treaty Act
Collins Creek Stream Restoration Site
Project Number 1205413001

Dear Mr. Jordan

Please accept this information pertaining to the proposed Collins Creek Stream Restoration Project, which is located 6 miles west of Carrboro approximately 800 feet north of the intersection of Dodsons Cross Road and State Hwy 54 in Orange County, as a submittal for review of the Endangered Species Act, Fish and Wildlife Coordination Act, and Migratory Bird Treaty Act by the US Fish and Wildlife Service.

A portion of this property (refer to attached layout) is currently under investigation as a stream restoration project for the North Carolina Ecosystem Enhancement Program. The funding for this project comes from the USDOT Federal Highway Administration through NCDOT. The current land use at this site is primarily Agricultural Pasture/Hay and Natural Herbaceous with small portions of Piedmont Mesic Forest and Piedmont Dry-Mesic Oak and Hardwood Forests according to the 2003 NC GAP land cover dataset. The planned restoration work typically involves modifying stream channels to a natural stable form through minor grading, use of in-stream rock features, and establishment of vegetated riparian buffers. In addition, grazing management (fencing/watering devices/access control) will be incorporated in this particular project. As part of the environmental documentation process (Categorical Exclusion), coordination with the USFWS is requested for compliance with the Endangered Species Act, Fish and Wildlife Coordination Act, and Migratory Bird Treaty Act.

Following the review of the included documentation, please provide a determination of the potential effects to endangered species, wildlife, or migratory birds associated with this project.

Please feel free to contact me at (919) 783-9214, ext. 141, should you have any questions or require any further information to process this request. Thank you in advance for your assistance and attention.

Sincerely,

Michael B. Schlegel
Project Manager

KCI TECHNOLOGIES

ENGINEERS • SURVEYORS • SCIENTISTS • CONSTRUCTION MANAGERS

LANDMARK CENTER II • SUITE 220 • 4601 SIX FORKS ROAD • RALEIGH • NC 27609 • 919-783-9214 • (FAX) 919-783-9266

July 6, 2005

Linda Pearsall, Program Head
North Carolina Natural Heritage Program
1601 Mail Service Center
Raleigh, NC 27529

Subject: Natural Heritage Review
Collins Creek Stream Restoration Project
Project Number 12054130

Dear Ms. Pearsall:

Please accept this information pertaining to the proposed Collins Creek Stream Restoration Project, which is located 6 miles west of Carrboro approximately 800 feet north of the intersection of Dodsons Cross Road and State Hwy 54 in Orange County, as a submittal for natural area and rare species review by the North Carolina Natural Heritage Program.

A portion of this property (refer to attached layout) is currently under investigation as a stream restoration project for the North Carolina Ecosystem Enhancement Program. The vegetation at this site is primarily Agricultural Pasture/Hay and Natural Herbaceous with portions of Piedmont Mesic Forest and Piedmont Dry-Mesic Oak and Hardwood Forests according to the 2003 NC GAP land cover dataset. The planned restoration work typically involves modifying stream channels to a natural stable form through minor grading, use of in-stream rock features, and establishment of vegetated riparian buffers. In addition, grazing management (fencing/watering devices/access control) will be incorporated in this particular project. No impacts to any structures on the subject property are anticipated.

Following the review of the included documentation, please provide a determination regarding any potential impacts to rare species or natural areas associated with this project.

Please feel free to contact me at (919) 783-9214, ext. 141, should you have any questions or require any further information to process this request. Thank you in advance for your assistance and attention.

Sincerely,

Michael B. Schlegel
Project Manager

NCDENR

North Carolina Department of Environment and Natural Resources

Michael F. Easley, Governor

William G. Ross Jr., Secretary

July 11, 2005

Mr. Michael B. Schlegel
KCI Technologies
Landmark Center II, Suite 220
4601 Six Forks Road
Raleigh, NC 27609

Subject: Collins Creek Stream Restoration Project; White Cross, Orange County
Project No. 12054130

Dear Mr. Schlegel:

The Natural Heritage Program has no record of rare species, significant natural communities, or priority natural areas at the site nor within a mile of the project area. Although our maps do not show records of such natural heritage elements in the project area, it does not necessarily mean that they are not present. It may simply mean that the area has not been surveyed. The use of Natural Heritage Program data should not be substituted for actual field surveys, particularly if the project area contains suitable habitat for rare species, significant natural communities, or priority natural areas.

You may wish to check the Natural Heritage Program database website at <www.ncnhp.org> for a listing of rare plants and animals and significant natural communities in the county and on the topographic quad map. Please do not hesitate to contact me at 919-715-8697 if you have questions or need further information.

Sincerely,

Harry E. LeGrand, Jr.

Harry E. LeGrand, Jr., Zoologist
Natural Heritage Program

HEL/hel

1601 Mail Service Center, Raleigh, North Carolina 27699-1601
Phone: 919-733-4984 • FAX: 919-715-3060 • Internet: www.enr.state.nc.us

KCI TECHNOLOGIES

ENGINEERS • SURVEYORS • SCIENTISTS • CONSTRUCTION MANAGERS

LANDMARK CENTER II • SUITE 220 • 4601 SIX FORKS ROAD • RALEIGH • NC 27609 • 919-783-9214 • (FAX) 919-783-9266

July 18, 2005

Ms. Shannon Deaton
Habitat Conservation Program Manager
NC Wildlife Resources Commission
Division of Inland Fisheries
1721 Mail Service Center
Raleigh, NC 27699-1721

Subject: Fish and Wildlife Coordination Act
Collins Creek Stream Restoration Site
Project Number 1205413001

Dear Ms. Deaton:

Please accept this information pertaining to the proposed Collins Creek Stream Restoration Project, which is located 6 miles west of Carrboro approximately 800 feet north of the intersection of Dodsons Cross Road and State Hwy 54 in Orange County, as a submittal for the Fish and Wildlife Coordination Act review by the NC Wildlife Resources Commission.

A portion of this property (refer to attached layout) is currently under investigation as a stream restoration project for the North Carolina Ecosystem Enhancement Program. The funding for this project comes from the USDOT Federal Highway Administration through NCDOT. The current land use at this site is primarily Agricultural Pasture/Hay and Natural Herbaceous with small portions of Piedmont Mesic Forest and Piedmont Dry-Mesic Oak and Hardwood Forests according to the 2003 NC GAP land cover dataset. The planned restoration work typically involves modifying stream channels to a natural stable form through minor grading, use of in-stream rock features, and establishment of vegetated riparian buffers. In addition, grazing management (fencing/watering devices/access control) will be incorporated in this particular project. As part of the environmental documentation process (Categorical Exclusion), coordination with the NCWRC and the USFWS is requested for compliance with the Fish and Wildlife Coordination Act.

Following the review of the included documentation, please provide a determination of the potential effects to wildlife associated with this project.

Please feel free to contact me at (919) 783-9214, ext. 141, should you have any questions or require any further information to process this request. Thank you in advance for your assistance and attention.

Sincerely,

Michael B. Schlegel
Project Manager

North Carolina Wildlife Resources Commission

Richard B. Hamilton, Executive Director

8 August 2005

Mr. Michael Schlegel, Project Manager
KCI Associates of North Carolina
Landmark Center II, Suite 220
4601 Six Forks Road
Raleigh, NC 27609

Subject: Fish and Wildlife Coordination Act, Collins Creek Stream Restoration Site, Orange County, North Carolina. Project Number 1205413001

Dear Mr. Schlegel:

Biologists with the North Carolina Wildlife Resources Commission have reviewed the subject document. Our comments are provided in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667d), and North Carolina General Statutes (G.S. 113-131 et seq.).

The North Carolina Ecosystem Enhancement Program is currently investigating a stream restoration site along an unnamed tributary to Collins Creek in the Cape Fear River basin. There are records for the federal species of concern and state endangered brook floater (*Alasmidonta varicosa*) in Collins Creek. Current land use is agricultural pasture and forest. The project would involve minor grading to form natural, stable stream channels, use of instream rock features and establishment of vegetated riparian buffers. Also, grazing management (fencing/watering devices/access control) will be used.

The proposed restoration project should improve water quality and aquatic habitat. We recommend establishing native, forested buffers in riparian areas to improve terrestrial habitat and provide a travel corridor for wildlife species. We do not anticipate significant adverse impacts to fish and wildlife resources from the proposed project.

Thank you for the opportunity to review this project. If you require further assistance, please contact our office at (336) 449-7625.

Mailing Address: Division of Inland Fisheries • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 733-3633 • **Fax:** (919) 715-7643

8 August 2005
Collins Creek Stream Restoration Site
Project No. 1205413001

Sincerely,

Shari L. Bryant
Piedmont Region Coordinator
Habitat Conservation Program

ec: Sarah McRae, NHP
Ryan Heise, WRC

BOOK 463 PAGE 228

DRAWN BY: Harvey Bynum

JOB NAME: Upchurch/Whitfield Property/Dodson's Crossroads

Form 00216 (2-80) Formerly 182 N.C.

STATE OF NORTH CAROLINA }
COUNTY OF Orange }

JOB NO: 438131778 & 438140202

KNOW ALL MEN BY THESE PRESENTS, That Melvin Whitfield

grantor (whether one or more)

of said County and State, in consideration of the sum of one ($1.00) dollar and other good and valuable considerations, do hereby grant unto said DUKE POWER COMPANY, its successors and assigns, the right, privilege and easement to go in and upon that certain tract or lot of land situated in said County and State, ~~bounded by lands of~~ as recorded in Deed Book 118, page 380

9749-63-9227
6.27 . . 10 pls

and to construct, maintain and operate in, upon and through said premises, in a proper manner, with poles, wires, guys, conduits, cables, transformers, and other necessary apparatus and appliances, overhead or underground lines for transmitting and distributing power by electricity, and for communication purposes, together with the right at all times to enter said premises for the purpose of inspecting said lines and making necessary repairs and alterations thereon and additions thereto together with the right at all times to cut away or by other means to keep clear of said lines all trees, brush and other obstructions that may, in any way, endanger the proper maintenance and operation of the same; also including the right to relocate said lines over said premises to conform to any future highway or street location, widening or improvement.

IN WITNESS WHEREOF, the said grantor(s) do es hereunto set his hand(s) and seal(s) this 24 day of Feb, 1984

Witness Thomas M. Gravitt

*Melvin Whitfield (SEAL)

(SEAL)

(SEAL)

(SEAL)

STATE OF NORTH CAROLINA }
COUNTY OF Orange }

I, Thomas M. Gravitt a Notary Public in and for the County and State aforesaid, do hereby certify that Melvin Whitfield and wife

personally appeared before me this day and acknowledged the due execution of the foregoing instrument.

Witness my hand and official seal, this the 24, day of Feb, A.D. 1984

My Commission expires 10-22-84

Thomas M. Gravitt Notary Public

THOMAS M. GRAVITT

STATE OF NORTH CAROLINA }
COUNTY OF _____ }

I, _____ a Notary Public for _____ County, State of North Carolina, certify that _____ personally appeared before me this day and being duly sworn, stated that in his presence _____ signed the foregoing instrument. Witness my hand and notarial seal, this the _____ day of _____, 19____

My Commission expires _____

_____ Notary Public

STATE OF NORTH CAROLINA }
COUNTY OF Orange }

The foregoing certificate of Thomas M. Gravitt, Notary Public of Orange County, N. C., ~~Notary(s) Public~~ is/are certified to be correct. This instrument was presented for registration and recorded in this office in Book 463, page 228.

This 2nd day of May, 1984, at 4:19 o'clock P. M.

Betty June Hayes, Register of Deeds

By: Deborah B. Brewer Deputy Register of Deeds

RETURN TO:
DUKE POWER COMPANY
Attn: Edith Carter
P. O. Box 2000
Chapel Hill, NC 27514

Signature _____ Poor Quality

FILED
1984 MAY -2 AM 11:05

Appendix C
Conservation Easement

CONSERVATION EASEMENT – PARCEL "A"

ALL THAT CERTAIN PARCEL OF LAND, SITUATE IN ORANGE COUNTY, NORTH CAROLINA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT, SAID POINT BEING N01°45'05"E, 457.38 FEET FROM THE SOUTHWESTERLY PROPERTY CORNER, TO A POINT, THENCE; N01°45'05"E, 504.79 FEET, TO THE POINT AND PLACE OF BEGINNING. FROM SAID BEGINNING POINT, CONTINUING THENCE;
(1) N01°45'05"E, 172.41 FEET, TO A POINT, THENCE;
(2) N41°27'14"E, 174.31 FEET, TO A POINT, THENCE;
(3) N56°12'39"E, 552.85 FEET, TO A POINT, THENCE;
(4) S75°48'14"E, 108.93 FEET, TO A POINT, THENCE;
(5) N61°41'32"E, 246.07 FEET, TO A POINT, THENCE;
(6) N35°54'19"W, 86.05 FEET, TO A POINT, THENCE;
(7) S87°55'20"E, 124.20 FEET, TO A POINT, THENCE;
(8) N38°39'04"E, 47.83 FEET, TO A POINT, THENCE;
(9) S31°51'07"E, 132.15 FEET, TO A POINT, THENCE;
(10) S40°51'47"W, 246.09 FEET, TO A POINT, THENCE;
(11) S45°08'08"E, 384.37 FEET, TO A POINT, THENCE;
(12) S56°54'44"E, 294.46 FEET, TO A POINT, THENCE;
(13) S43°25'07"E, 690.27 FEET, TO A POINT, THENCE;
(14) S08°24'15"E, 212.62 FEET, TO A POINT, THENCE;
(15) S81°35'45"W, 150.00 FEET, TO A POINT, THENCE;
(16) N08°24'15"W, 170.95 FEET, TO A POINT, THENCE;
(17) N45°13'50"W, 261.86 FEET, TO A POINT, THENCE;
(18) N34°40'33"W, 163.10 FEET, TO A POINT, THENCE;
(19) N48°58'13"W, 357.96 FEET, TO A POINT, THENCE;
(20) N73°48'08"W, 79.87 FEET, TO A POINT, THENCE;
(21) N46°50'08"W, 307.64 FEET, TO A POINT, THENCE;
(22) N61°37'55"W, 302.03 FEET, TO A POINT, THENCE;
(23) S56°02'35"W, 784.06 FEET, TO THE POINT AND PLACE OF BEGINNING.

SAID EASEMENT CONTAINING WITHIN SAID BOUNDS 449,358 SQUARE FEET OR 10.316 ACRES MORE OR LESS.

LESS AND EXCEPT

ALL THAT CERTAIN 50 FEET WIDE STRIP OF LAND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT, SAID POINT BEING SOUTH 56°02'35" WEST, 249.63 FEET FROM THE TERMINUS OF THE TWENTY SECOND COURSE OF THE AFOREMENTIONED PARCEL 'A'. FROM SAID BEGINNING POINT, CONTINUING THENCE;
(L7) SOUTH 56°02'35" WEST, 51.69 FEET, TO A POINT, THENCE;
(L8) NORTH 48°39'00" WEST, 189.56 FEET, TO A POINT, THENCE;
(L9) NORTH 56°12'39" EAST, 51.73 FEET, TO A POINT, THENCE;
(L10) SOUTH 48°39'00" EAST, 189.41 FEET, TO THE POINT AND PLACE OF BEGINNING.

SAID 50 FEET WIDE STRIP OF LAND CONTAINING WITHIN SAID BOUNDS 9474 SQUARE FEET OR 0.218 ACRES MORE OR LESS.

LESS AND EXCEPT

ALL THAT CERTAIN 16 FEET WIDE STRIP OF LAND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT, SAID POINT BEING NORTH 46°50'08" WEST, 94.03' FEET FROM THE TERMINUS OF THE TWENTIETH COURSE OF THE AFOREMENTIONED PARCEL 'A'. FROM SAID BEGINNING POINT, CONTINUING THENCE;
(L11) NORTH 46°50'08" WEST, 16.00 FEET, TO A POINT, THENCE;
(L12) NORTH 42°29'37" EAST, 142.18 FEET, TO A POINT, THENCE;
(L13) SOUTH 45°08'08" EAST, 16.01 FEET, TO A POINT, THENCE;
(L14) SOUTH 42°29'37" WEST, 141.71 FEET, TO THE POINT AND PLACE OF BEGINNING.

SAID 16 FEET WIDE STRIP OF LAND CONTAINING WITHIN SAID BOUNDS 2271 SQUARE FEET OR 0.052 ACRES MORE OR LESS.

CONSERVATION EASEMENT – PARCEL "B"

ALL THAT CERTAIN PARCEL OF LAND, SITUATE IN ORANGE COUNTY, NORTH CAROLINA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT, SAID POINT BEING THE TERMINUS OF THE SIXTH COURSE OF THE AFOREMENTIONED PARCEL 'A'. FROM SAID BEGINNING POINT, CONTINUING THENCE;
(1) N35°54'19"W, 151.13 FEET, TO A POINT, THENCE;
(2) N06°11'30"E, 106.41 FEET, TO A POINT, THENCE;
(3) N46°37'05"E, 306.86 FEET, TO A POINT, THENCE;
(4) N82°40'29"E, 240.69 FEET, TO A POINT, THENCE;
(5) S82°11'53"E, 143.19 FEET, TO A POINT, THENCE;
(6) N53°17'30"E, 64.63' FEET, TO A POINT, THENCE;
(7) S81°10'32"E, 496.56 FEET, TO A POINT, THENCE;
(8) S30°37'30"E, 165.21 FEET, TO A POINT, THENCE;
(9) S12°55'48"W, 227.61 FEET, TO A POINT, THENCE;
(10) N44°23'31"W, 60.73 FEET, TO A POINT, THENCE;
(11) N22°16'11"W, 205.48 FEET, TO A POINT, THENCE;
(12) N57°59'01"W, 199.36 FEET, TO A POINT, THENCE;
(13) S76°32'45"W, 329.36 FEET, TO A POINT, THENCE;
(14) N82°06'34"W, 84.36 FEET, TO A POINT, THENCE;
(15) S59°58'30"W, 175.20 FEET, TO A POINT, THENCE;
(16) S89°02'22"W, 89.36 FEET, TO A POINT, THENCE;
(17) S50°58'44"W, 118.72 FEET, TO A POINT, THENCE;
(18) S31°51'07"E, 148.46 FEET, TO A POINT, THENCE;
(19) N38°39'04"E, 47.83 FEET, TO A POINT, THENCE;
(20) N87°55'20"W, 124.20 FEET, TO THE POINT AND PLACE OF BEGINNING.

SAID EASEMENT CONTAINING WITHIN SAID BOUNDS 224,130 SQUARE FEET OR 5.145 ACRES MORE OR LESS.

LESS AND EXCEPT

ALL THAT CERTAIN 50 FEET WIDE STRIP OF LAND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT, SAID POINT BEING NORTH 31°51'07" WEST, 68.74 FEET FROM THE TERMINUS OF THE EIGHTEENTH COURSE OF THE AFOREMENTIONED PARCEL 'B'. FROM SAID BEGINNING POINT, CONTINUING THENCE;
(L23) SOUTH 31°51'07" EAST, 63.19 FEET, TO A POINT, THENCE;
(L24) NORTH 84°09'18" WEST, 76.05 FEET, TO A POINT, THENCE;
(L25) SOUTH 75°01'05" WEST, 98.62 FEET, TO A POINT, THENCE;
(L26) NORTH 35°54'19" WEST, 53.53 FEET, TO A POINT, THENCE;
(L27) NORTH 75°01'05" EAST, 126.92 FEET, TO A POINT, THENCE;
(L28) SOUTH 84°09'18" EAST, 46.60 FEET, TO THE POINT AND PLACE OF BEGINNING.

SAID 50 FEET WIDE STRIP OF LAND CONTAINING WITHIN SAID BOUNDS 8705 SQUARE FEET OR 0.200 ACRES MORE OR LESS.

CONSERVATION EASEMENT – PARCEL "C"

ALL THAT CERTAIN PARCEL OF LAND, SITUATE IN ORANGE COUNTY, NORTH CAROLINA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT, SAID POINT BEING THE TERMINUS OF THE EIGHTH COURSE OF THE AFOREMENTIONED PARCEL 'B'. FROM SAID BEGINNING POINT, CONTINUING THENCE;
(1) S30°37'30"E, 253.19 FEET, TO A POINT, THENCE; (2) N75°41'23"E, 149.74 FEET, TO A POINT, THENCE;
(3) S70°58'01"E, 357.10 FEET, TO A POINT, THENCE; (4) N70°49'09"E, 108.51 FEET, TO A POINT, THENCE;
(5) S81°15'41"E, 274.84 FEET, TO A POINT, THENCE; (6) N86°58'56"E, 734.08 FEET, TO A POINT, THENCE;
(7) S20°41'12"W, 97.33 FEET, TO A POINT, THENCE; (8) S81°37'17"W, 533.35 FEET, TO A POINT, THENCE;
(9) S58°23'39"W, 115.16 FEET, TO A POINT, THENCE; (10) S79°11'10"W, 90.43 FEET, TO A POINT, THENCE;
(11) N86°46'53"W, 342.59 FEET, TO A POINT, THENCE; (12) N20°11'10"W, 38.05 FEET, TO A POINT, THENCE;
(13) N68°54'10"W, 334.37 FEET, TO A POINT, THENCE; (14) S84°44'18"W, 223.27 FEET, TO A POINT, THENCE;
(15) N44°23'31"W, 187.80 FEET, TO A POINT, THENCE; (16) N12°55'48"E, 227.61 FEET, TO THE POINT AND PLACE OF BEGINNING.

SAID EASEMENT CONTAINING WITHIN SAID BOUNDS 282,003 SQUARE FEET OR 6.474 ACRES MORE OR LESS.

LESS AND EXCEPT

ALL THAT CERTAIN 16 FEET WIDE STRIP OF LAND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT, SAID POINT BEING NORTH 68°54'10" WEST, 119.37 FEET FROM THE TERMINUS OF THE TWELFTH COURSE OF THE AFOREMENTIONED PARCEL 'C'. FROM SAID BEGINNING POINT, CONTINUING THENCE;
(L19) NORTH 68°54'10" WEST, 16.01 FEET, TO A POINT, THENCE;
(L20) NORTH 19°01'59" EAST, 144.05 FEET, TO A POINT, THENCE;
(L21) SOUTH 70°58'01" EAST, 16.00 FEET, TO A POINT, THENCE;
(L22) SOUTH 19°01'59" WEST, 144.63 FEET, TO THE POINT AND PLACE OF BEGINNING.

SAID 16 FEET WIDE STRIP OF LAND CONTAINING WITHIN SAID BOUNDS 2309 SQUARE FEET OR 0.053 ACRES MORE OR LESS.

CONSERVATION EASEMENT – PARCEL "D"

ALL THAT CERTAIN PARCEL OF LAND, SITUATE IN ORANGE COUNTY, NORTH CAROLINA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT, SAID POINT BEING S20°11'10"E, 54.48 FEET FROM THE TERMINUS OF THE TWELFTH COURSE OF THE AFOREMENTIONED PARCEL 'C'. FROM SAID BEGINNING POINT, CONTINUING THENCE;
(1) S86°46'53"E, 305.29 FEET, TO A POINT, THENCE; (2) S58°23'39"W, 92.44 FEET, TO A POINT, THENCE;
(3) S00°59'13"W, 115.89 FEET, TO A POINT, THENCE;(4) S23°38'02"E, 194.69 FEET, TO A POINT, THENCE;
(5) S62°25'41"E, 190.17 FEET, TO A POINT, THENCE; (6) S36°35'24"E, 308.76 FEET, TO A POINT, THENCE;
(7) S50°26'17"E, 71.11 FEET, TO A POINT, THENCE; (8) S19°20'33"W, 225.56 FEET, TO A POINT, THENCE;
(9) N22°56'11"W, 133.53 FEET, TO A POINT, THENCE; (10) N39°02'30"W, 266.40 FEET, TO A POINT, THENCE;
(11) S74°13'09"W, 25.28 FEET, TO A POINT, THENCE; (12) S11°37'13"W, 326.53 FEET, TO A POINT, THENCE;
(13) N86°55'56"W, 181.52 FEET, TO A POINT, THENCE; (14) N31°22'45"E, 92.22 FEET, TO A POINT, THENCE;
(15) N15°18'46"E, 286.59 FEET, TO A POINT, THENCE; (16) N28°08'20"W, 205.27 FEET, TO A POINT, THENCE;
(17) N10°51'58"E, 125.50 FEET, TO A POINT, THENCE; (18) N84°25'57"W, 94.52 FEET, TO A POINT, THENCE;
(19) N20°11'10"W, 290.24 FEET, TO THE POINT AND PLACE OF BEGINNING.

SAID EASEMENT CONTAINING WITHIN SAID BOUNDS 219,040 SQUARE FEET OR 5.029 ACRES MORE OR LESS.

LESS AND EXCEPT

ALL THAT CERTAIN 16 FEET WIDE STRIP OF LAND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT, SAID POINT BEING NORTH 20°11'10" WEST, 101.12 FEET FROM THE TERMINUS OF THE EIGHTEENTH COURSE OF THE AFOREMENTIONED PARCEL 'D'. FROM SAID BEGINNING POINT, CONTINUING THENCE;

(L15) NORTH 20°11'10" WEST, 16.29 FEET, TO A POINT, THENCE;
(L16) NORTH 80°42'59" EAST, 167.44 FEET, TO A POINT, THENCE;
(L17) SOUTH 00°59'13" WEST, 16.26 FEET, TO A POINT, THENCE;
(L18) SOUTH 80°42'59" WEST, 161.46 FEET, TO THE POINT AND PLACE OF BEGINNING.

SAID 16 FEET WIDE STRIP OF LAND CONTAINING WITHIN SAID BOUNDS 2631 SQUARE FEET OR 0.060 ACRES MORE OR LESS.

CONSERVATION EASEMENT – PARCEL "E"

ALL THAT CERTAIN PARCEL OF LAND, SITUATE IN ORANGE COUNTY, NORTH CAROLINA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT, SAID POINT BEING S35°51'40"W, 59.26 FEET FROM THE TERMINUS OF THE THIRTEENTH COURSE OF THE AFOREMENTIONED PARCEL 'D'. FROM SAID BEGINNING POINT, CONTINUING THENCE;
(1) S86°36'04"E, 189.44 FEET, TO A POINT, THENCE;
(2) S41°02'44"W, 142.68 FEET, TO A POINT, THENCE;
(3) S87°13'58"W, 43.16 FEET, TO A POINT, THENCE;
(4) S08°52'02"W, 58.48 FEET, TO A POINT, THENCE;
(5) S41°02'44"W, 70.71 FEET, TO A POINT, THENCE;
(6) S29°07'00"W, 144.87 FEET, TO A POINT, THENCE;
(7) N60°53'00"W, 150.00 FEET, TO A POINT, THENCE;
(8) N29°07'00"E, 160.54 FEET, TO A POINT, THENCE;
(9) N41°02'44"E, 192.72 FEET, TO THE POINT AND PLACE OF BEGINNING.

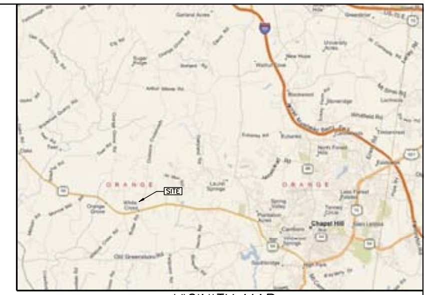
SAID EASEMENT CONTAINING WITHIN SAID BOUNDS 58,081 SQUARE FEET OR 1.333 ACRES MORE OR LESS.

CONSERVATION EASEMENT – PARCEL "F"

ALL THAT CERTAIN PARCEL OF LAND, SITUATE IN ORANGE COUNTY, NORTH CAROLINA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT, SAID POINT BEING THE TERMINUS OF THE SIXTEENTH COURSE OF THE AFOREMENTIONED PARCEL 'D'. FROM SAID BEGINNING POINT, CONTINUING THENCE;
(1) N28°00'14"W, 149.98 FEET, TO A POINT, THENCE;
(2) S84°25'57"E, 94.52 FEET, TO A POINT, THENCE;
(3) S10°51'58"W, 125.50 FEET, TO THE POINT AND PLACE OF BEGINNING.

SAID EASEMENT CONTAINING WITHIN SAID BOUNDS 5,906 SQUARE FEET OR 0.136 ACRES MORE OR LESS.



VICINITY MAP
(NOT TO SCALE)

NOTES:

THE BASIS OF THE MERIDIANS AND COORDIANTES FOR THIS PLAT IS THE NORTH CAROLINA STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM 1983 (N.C.S.P.C.S. NAD 83), BASED ON DIFFERENTIAL GPS OBSERVATIONS PERFORMED BY NCDOT DURING THE MONTH OF SEPTEMBER 2005.

THIS SURVEY HAS BEEN PREPARED WITH THE BENEFIT OF A TITLE COMMITMENT NUMBER MET2005-01019, AS PROVIDED BY METRO TITLE COMPANY, DATED AUGUST 24, 2005.

THE FOLLOWING SPECIAL EXCEPTIONS AS RECITED IN THE AFOREMENTIONED TITLE REPORT NOT PLOTTED AS NOTED:
-ITEM#4 : DEED BOOK 463, PAGE 228 – DUKE POWER COMPANY BLANKET UTILITY EASEMENT (NOT PLOTTABLE)
-ITEM#7 : DEED BOOK 1835, PAAGE 274 – RESTRICTIONS AND PROVISIONS FOR ROAD MAINTANANCE (NOT PLOTTABLE)

ALL DISTANCES ARE GROUND UNLESS OTHERWISE NOTED.

INTERIOR LOT IMPROVEMENTS NOT SHOWN ON THIS SURVEY.

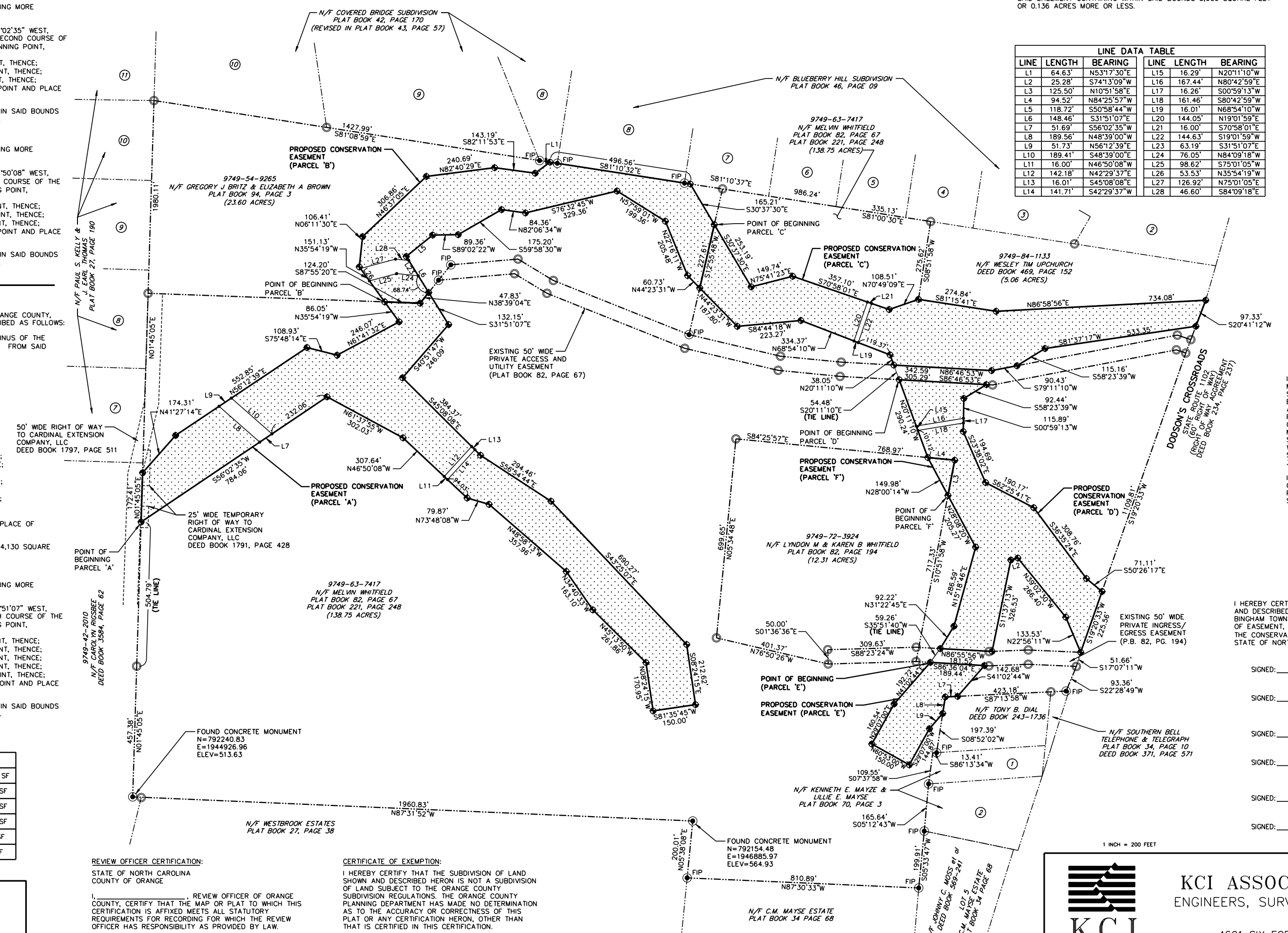
NO GEODETIC MONUMENTS WERE RECOVERED WITHIN 2000 FEET OF SUBJECT PROPERTY.

DEED AND PLAT REFERENCES: AS NOTED.

AREA OF SUBJECT PROPERTY: FROM TAX RECORDS (AS NOTED).

LANDOWNER INFORMATION:
MELVIN & LINNIE WHITFIELD
9901 LETA DRIVE
CHAPEL HILL, NC 27516

LINE DATA TABLE					
LINE	LENGTH	BEARING	LINE	LENGTH	BEARING
L1	64.63'	N53°17'30"E	L15	16.29'	N20°11'10"W
L2	25.28'	S74°13'09"W	L16	167.44'	N80°42'59"E
L3	125.50'	N10°51'58"E	L17	16.26'	S00°59'13"W
L4	94.52'	N84°25'57"W	L18	161.46'	S80°42'59"W
L5	118.72'	S50°58'44"W	L19	16.01'	N68°54'10"W
L6	148.46'	S31°51'07"E	L20	144.05'	N19°01'59"E
L7	51.69'	S56°02'35"W	L21	16.00'	S70°58'01"E
L8	189.56'	N48°39'00"W	L22	144.63'	S19°01'59"W
L9	51.73'	N56°12'39"E	L23	63.19'	S31°51'07"E
L10	189.41'	S48°39'00"E	L24	76.05'	N84°09'18"W
L11	16.00'	N46°50'08"W	L25	98.62'	S75°01'05"W
L12	142.18'	N42°29'37"E	L26	53.53'	N35°54'19"W
L13	16.01'	S45°08'08"E	L27	126.92'	N75°01'05"E
L14	141.71'	S42°29'37"W	L28	46.60'	S84°09'18"E



NORTH CAROLINA – ORANGE COUNTY

THE FOREGOING CERTIFICATE(S) OF PAULINE KOSS, N.P. AND STEVEN F. STOKES. N.P. ARE CERTIFIED TO BE CORRECT. THIS INSTRUMENT WAS PRESENTED FOR REGISTRATION AND RECORDED IN THIS OFFICE AT BOOK _____, PAGE ______, THIS ____ DAY OF ___________, A.D. 2005, AT _____ O'CLOCK __M.

REGISTER OF DEEDS

I, JAMES M. GELLENTHIN, HEREBY DECLARE THAT THIS MAP WAS DRAWN UNDER MY SUPERVISION FROM A SURVEY MADE UNDER MY SUPERVISION, THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED, AS DRAWN FROM INFORMATION FOUND IN BOOK 1357, PAGE 0492; THAT THE RATIO OF PRECISION AS CALCULATED IS GREATER THAN 1:10,000; THAT THIS MAP DOES REPRESENT AN OFFICIAL BOUNDARY SURVEY AND HAS BEEN PREPARED IN ACCORDANCE WITH G.S. 47-30, AS AMENDED. WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER AND SEAL THIS 31ST DAY OF JUNE, 2006.

I FURTHER CERTIFY THAT:
C – THIS SURVEY IS OF AN EXISTING PARCEL OR PARCELS OF LAND AND DOES NOT CREATE A NEW STREET OR CHANGE AN EXISTING STREET.

NORTH CAROLINA REGISTRATION NUMBER L-3860
JAMES M. GELLENTHIN

STATE OF ______________
COUNTY OF ______________

I CERTIFY THAT THE FOLLOWING PERSON(S) PERSONALLY APPEARED BEFORE ME THIS DAY, EACH ACKNOWLEDGING TO ME THAT HE OR SHE VOLUNTARILY SIGNED THE FOREGOING DOCUMENT FOR THE PURPOSE STATED THEREIN AND IN THE CAPACITY INDICATED:

PRINTED NAME: ______________ ,NOTARY PUBLIC
MY COMMISION EXPIRES: ______________

I HEREBY CERTIFY THAT I AM THE OWNER OF THE PROPERTY SHOWN AND DESCRIBED HEREON, WHICH IS LOCATED IN ORANGE COUNTY, BINGHAM TOWNSHIP, THAT I HEREBY ACCEPT AND ADOPT THIS PLAN OF EASEMENT, WITH MY FREE CONSENT, ESTABLISH AND DEDICATE THE CONSERVATION EASEMENT(S), AS DEPICTED HEREON, TO THE STATE OF NORTH CAROLINA.

SIGNED: ______________
MELVIN WHITFIELD

SIGNED: ______________
LINNIE WHITFIELD

SIGNED: ______________
LYNDON M. WHITFIELD

SIGNED: ______________
KAREN B. WHITFIELD

SIGNED: ______________
GREGORY J. BRITZ

SIGNED: ______________
ELIZABETH A. BROWN

STATE OF ______________
COUNTY OF ______________

I CERTIFY THAT THE FOLLOWING PERSON(S) PERSONALLY APPEARED BEFORE ME THIS DAY, EACH ACKNOWLEDGING TO ME THAT HE OR SHE VOLUNTARILY SIGNED THE FOREGOING DOCUMENT FOR THE PURPOSE STATED THEREIN AND IN THE CAPACITY INDICATED:

PRINTED NAME: ______________ ,NOTARY PUBLIC
MY COMMISION EXPIRES: ______________

GRAPHIC SCALE
200 0 100 200 400

EASEMENT AREA TABLE	
EASEMENT PARCEL A	10.098 AC OR 439,884 SF
EASEMENT PARCEL B	4.946 AC OR 215,425 SF
EASEMENT PARCEL C	6.421 AC OR 279,694 SF
EASEMENT PARCEL D	4.968 AC OR 216,409 SF
EASEMENT PARCEL E	1.333 AC OR 58,081 SF
EASEMENT PARCEL F	0.136 AC OR 5,906 SF

LEGEND
- EXISTING PROPERTY LINE (SURVEYED)
- EXISTING PROPERTY LINE (NOT SURVEYED)
- EASEMENT BOUNDARY LINE
- SET IRON PIN WITH NCDOT CAP AND CARSONITE
- CALCULATED CORNER (NO IRON SET OR FOUND)
- IRON PIN FOUND

REVIEW OFFICER CERTIFICATION:
STATE OF NORTH CAROLINA
COUNTY OF ORANGE

I, ______________, REVIEW OFFICER OF ORANGE COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING FOR WHICH THE REVIEW OFFICER HAS RESPONSIBILITY AS PROVIDED BY LAW.

REVIEW OFFICER ______ DATE
ORANGE COUNTY LAND RECORDS/GIS

CERTIFICATE OF EXEMPTION:
I HEREBY CERTIFY THAT THE SUBDIVISION OF LAND SHOWN AND DESCRIBED HERON IS NOT A SUBDIVISION OF LAND SUBJECT TO THE ORANGE COUNTY SUBDIVISION REGULATIONS. THE ORANGE COUNTY PLANNING DEPARTMENT HAS MADE NO DETERMINATION AS TO THE ACCURACY OR CORRECTNESS OF THIS PLAT OR ANY CERTIFICATION HERON, OTHER THAN THAT IS CERTIFIED IN THIS CERTIFICATION.

PLANNING DIRECTOR OR AUTHORIZED AGENT ______ DATE

12054238

KCI ASSOCIATES OF NORTH CAROLINA
KCI ASSOCIATES OF N.C.
ENGINEERS, SURVEYORS AND PLANNERS
4601 SIX FORKS ROAD, SUITE 200
RALEIGH, NC 27609
PHONE (919) 783-9214 * FAX (919) 783-9266

CONSERVATION EASEMENT PLAT
FOR
COLLIN'S CREEK
STREAM RESTORATION SITE
9623 DODSON'S CROSSROADS
BINGHAM TOWNSHIP, ORANGE COUNTY, NC

DATE:	SCALE:	SHEET:
JUNE 28, 2006	1" = 200'	1 OF 1

Appendix D
Project Site Photographs

PROJECT SITE PHOTOGRAPHS

Looking upstream at the start of Tributary 1A as it leaves the woods and enters the project easement.

A downstream view of Tributary 1A, which shows undefined banks caused by grazing horses.

Tributary 1A downstream of the private driveway crossing.

An overview of Tributary 1A looking downstream (cedars are at the channel).

A section of Tributary 1A that shows the incision that the channel is experiencing.

The beginning of Tributary 1B as it comes under Dodsons Crossroads through two culverts.

PROJECT SITE PHOTOGRAPHS

Tributary 1B just downstream of Dodsons Crossroads where the banks have become unstable.

Tributary 1B as it enters a channelized section of stream.

Looking upstream along Tributary 1B within the channelized reach.

The beginning of Tributary 1 as it exits a culvert under Dodsons Crossroads.

Looking downstream of the culvert where the channel of Tributary 1 has become too wide.

A view downstream of Tributary 1 approximately 100 feet below the culvert.

PROJECT SITE PHOTOGRAPHS

Tributary 1 is to the left and the landowner's pasture to the right.

Looking downstream along Tributary 1 just upstream of the existing confluence with Tributary 1A

Looking upstream on Tributary 1 just below the confluence with Tributary 1A.

A look upstream on Tributary 1 before the crossing of a private road.

Looking downstream on Tributary 1 at the existing crossing of a private road. This area is used heavily by cattle.

A downstream view of Tributary 1 after the confluence with Tributary 1B.

PROJECT SITE PHOTOGRAPHS

Looking downstream on Tributary 1 approximately 100 feet before the confluence with the UT to Collins Creek.

An upstream look at Tributary 2 near its beginning. Tires have been placed in the stream and cattle and horses have open access.

A downstream view of Tributary 2 (approximately 700 feet down from the beginning of the project reach).

Looking downstream on Tributary 2 about 100 feet above the confluence with the UT to Collins Creek.

The confluence of Tributary 2 and the UT to Collins Creek.

Eroding banks on the UT to Collins Creek when looking downstream.

PROJECT SITE PHOTOGRAPHS

A view downstream of UT to Collins Creek approximately 500 feet downstream of the confluence with Tributary 1.

Looking downstream on UT to Collins Creek as it enters two culverts and crosses under a private road.

Looking downstream on UT to Collins Creek below the crossing where it is experiencing bank erosion and widening.

A look upstream on UT to Collins Creek at the same section that has become too wide.

UT to Collins Creek looking downstream approximately 350 feet downstream of the confluence with Tributary 2.

A look at the upstream side of a culvert on UT to Collins Creek that has become jammed with debris.

PROJECT SITE PHOTOGRAPHS

The downstream view of the jammed culvert along UT to Collins Creek. Water is currently working its way over the top of the crossing during bankfull events.

Looking downstream along UT to Collins Creek near the end of the project reach. The stream narrows in this section, which was likely caused by a temporary ford crossing.

Appendix E
Existing Conditions Data

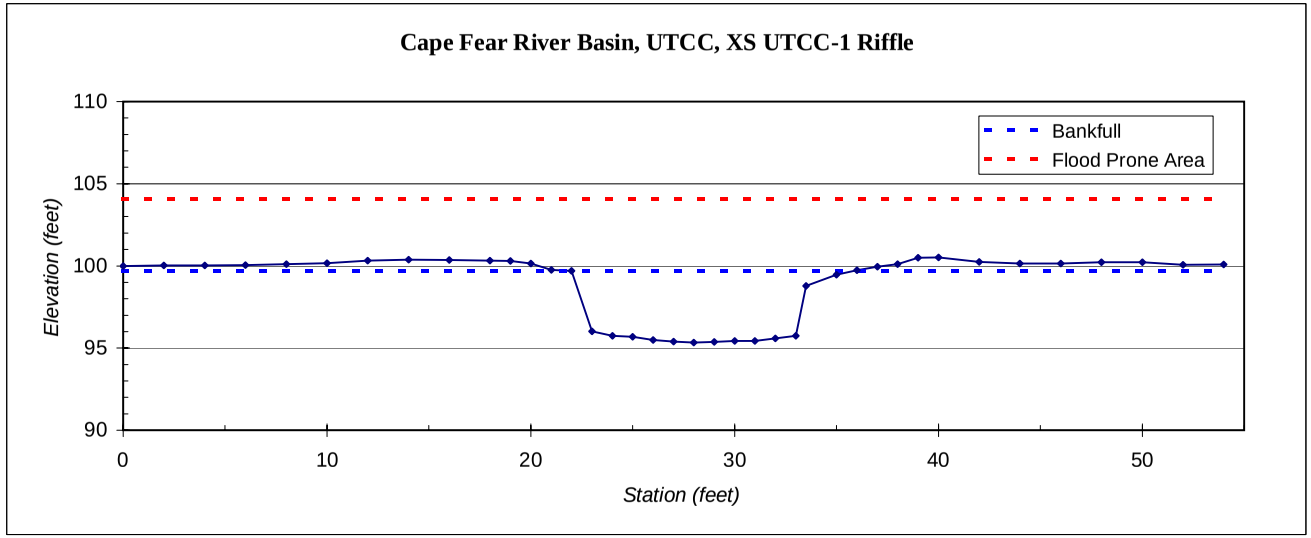
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS UTCC-1 Riffle
Drainage Area (sq mi):	2.5
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

Station	Elevation
0.0	100.00
2.0	100.03
4.0	100.03
6.0	100.05
8.0	100.11
10.0	100.17
12.0	100.32
14.0	100.38
16.0	100.37
18.0	100.32
19.0	100.31
20.0	100.14
21.0	99.76
22.0	99.69
23.0	96.02
24.0	95.74
25.0	95.69
26.0	95.49
27.0	95.39
28.0	95.34
29.0	95.38
30.0	95.43
31.0	95.44
32.0	95.59
33.0	95.74
33.5	98.78
35.0	99.47
36.0	99.73
37.0	99.95
38.0	100.11
39.0	100.49
40.0	100.51
42.0	100.24
44.0	100.14
46.0	100.14
48.0	100.23
50.0	100.22
52.0	100.06
54.0	100.08

SUMMARY DATA	
Bankfull Elevation:	99.7
Bankfull Cross-Sectional Area:	47.1
Bankfull Width:	15.4
Flood Prone Area Elevation:	104.1
Flood Prone Width:	54.0
Max Depth at Bankfull:	4.4
Mean Depth at Bankfull:	3.1
W / D Ratio:	5.0
Entrenchment Ratio:	3.5
Bank Height Ratio:	1.0
Slope (ft/ft):	0.002
Discharge (cfs)	173

Stream Type:	E4



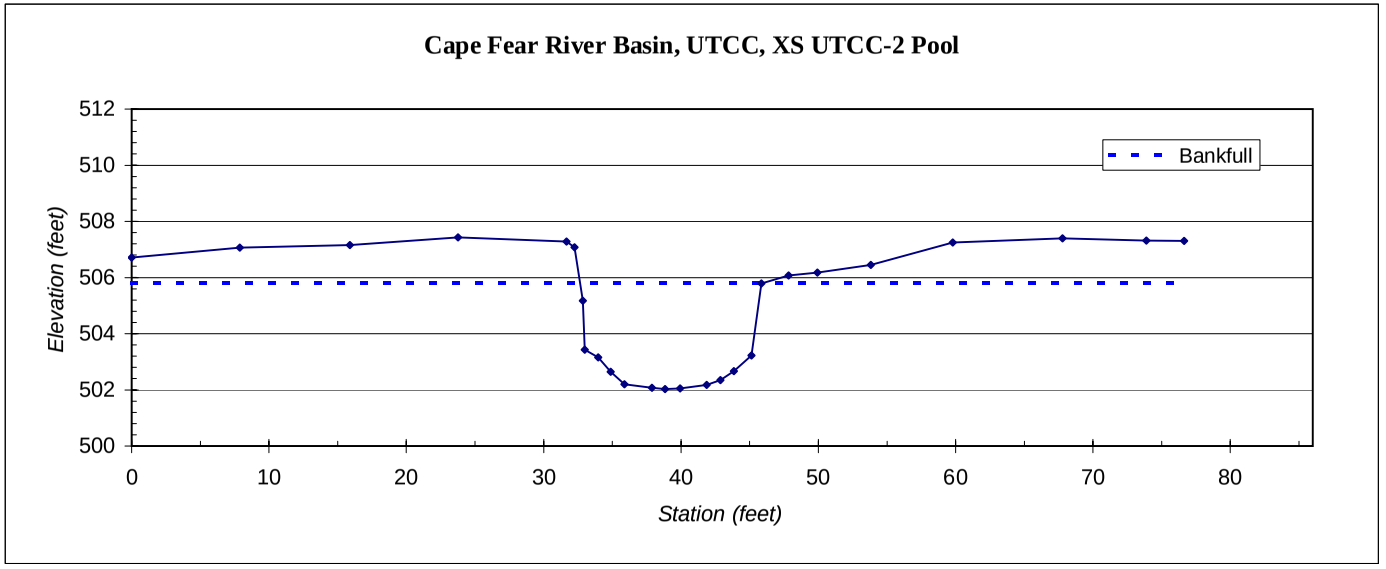
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS UTCC-2 Pool
Drainage Area (sq mi):	2.5
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

Station	Elevation
0.0	506.71
7.9	507.07
15.9	507.15
23.8	507.43
31.7	507.28
32.3	507.08
32.8	505.18
33.0	503.44
34.0	503.16
34.9	502.64
35.9	502.20
37.9	502.07
38.8	502.03
39.9	502.05
41.9	502.18
42.9	502.34
43.8	502.66
45.1	503.22
45.9	505.79
47.8	506.08
49.9	506.17
53.8	506.45
59.8	507.25
67.8	507.39
73.9	507.32
76.6	507.30

SUMMARY DATA	
Bankfull Elevation:	505.8
Bankfull Cross-Sectional Area:	42.6
Bankfull Width:	13.4
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	3.8
Mean Depth at Bankfull:	3.2
W / D Ratio:	4.2
Entrenchment Ratio:	-
Bank Height Ratio:	1.0
Slope (ft/ft):	0.002
Discharge (cfs)	-

Stream Type:	



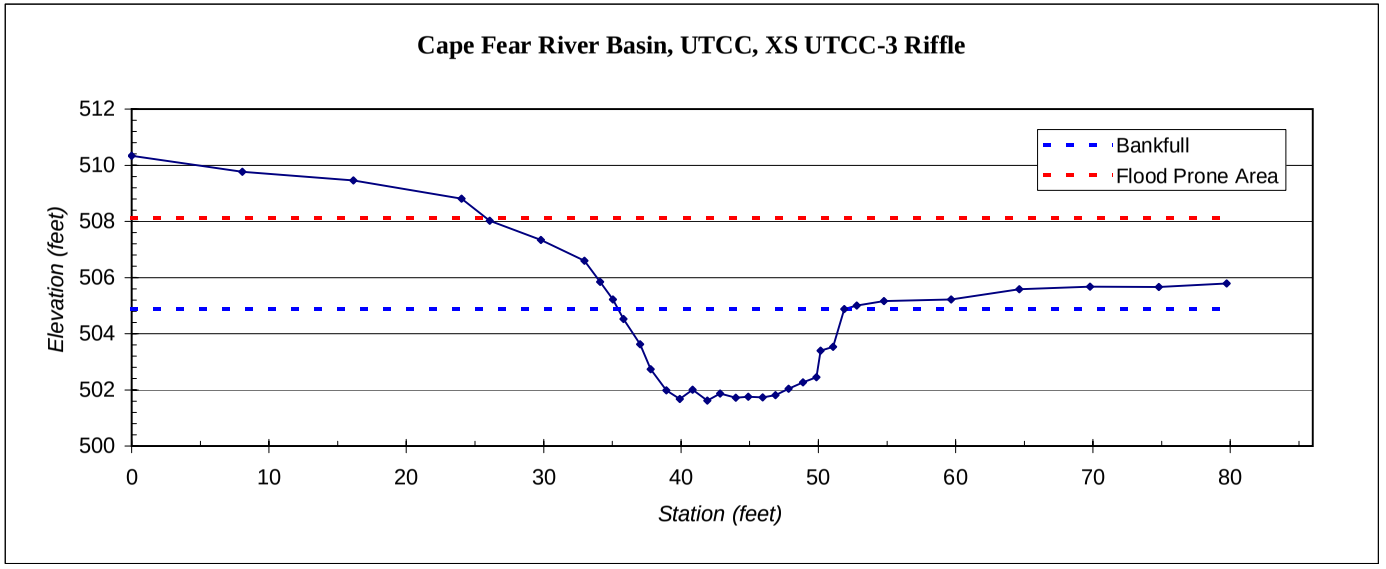
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS UTCC-3 Riffle
Drainage Area (sq mi):	2.5
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

Station	Elevation
0.0	510.34
8.1	509.77
16.1	509.46
24.0	508.81
26.1	508.02
29.8	507.34
33.0	506.60
34.1	505.85
35.0	505.22
35.8	504.52
37.0	503.62
37.8	502.74
38.9	501.99
39.9	501.68
40.8	502.00
41.9	501.62
42.8	501.87
44.0	501.72
44.9	501.76
45.9	501.73
46.9	501.82
47.8	502.04
48.9	502.26
49.9	502.45
50.2	503.40
51.1	503.53
51.9	504.88
52.8	505.00
54.8	505.16
59.7	505.21
64.6	505.59
69.8	505.67
74.8	505.67
79.7	505.78

SUMMARY DATA	
Bankfull Elevation:	504.9
Bankfull Cross-Sectional Area:	40.4
Bankfull Width:	16.5
Flood Prone Area Elevation:	508.1
Flood Prone Width:	>20
Max Depth at Bankfull:	3.3
Mean Depth at Bankfull:	2.4
W / D Ratio:	6.8
Entrenchment Ratio:	>1.2
Bank Height Ratio:	1.0
Slope (ft/ft):	0.002
Discharge (cfs)	126

Stream Type:	E4



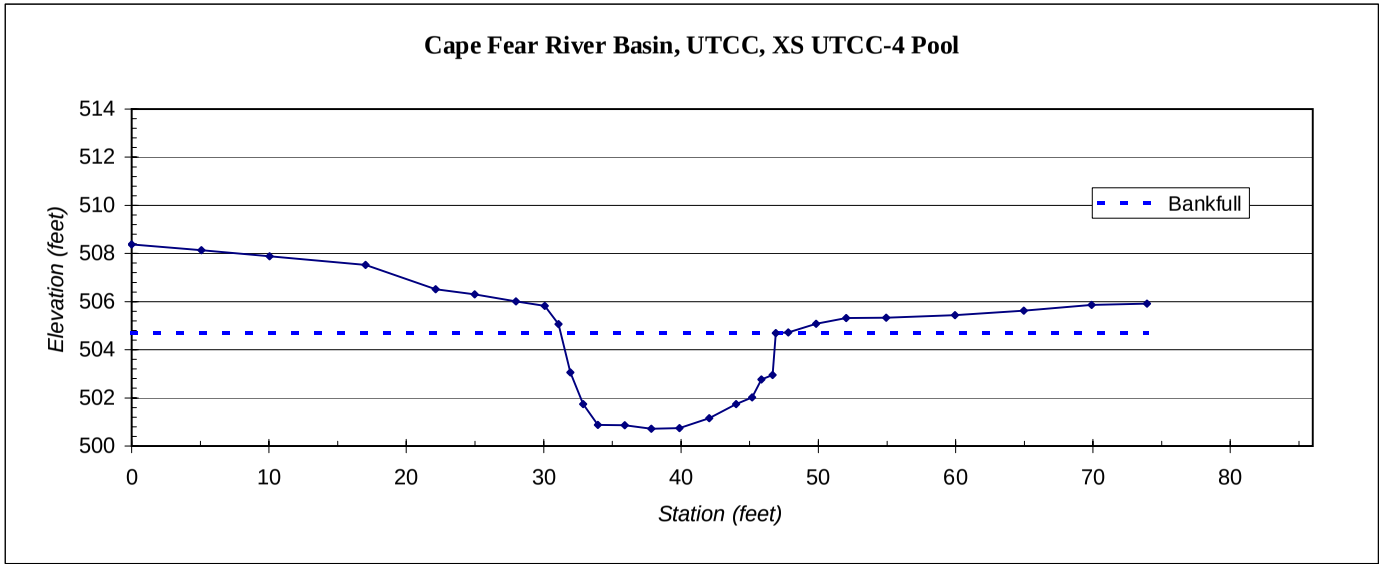
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS UTCC-4 Pool
Drainage Area (sq mi):	2.5
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

Station	Elevation
0.0	508.37
5.1	508.14
10.0	507.89
17.0	507.53
22.1	506.52
25.0	506.31
28.0	506.01
30.1	505.82
31.1	505.07
31.9	503.06
32.9	501.74
33.9	500.88
35.9	500.86
37.8	500.72
39.9	500.75
42.1	501.16
44.0	501.74
45.2	502.03
45.9	502.76
46.7	502.95
46.9	504.70
47.8	504.73
49.8	505.08
52.0	505.31
55.0	505.34
60.0	505.44
65.0	505.63
69.9	505.86
73.9	505.91

SUMMARY DATA	
Bankfull Elevation:	504.7
Bankfull Cross-Sectional Area:	50.6
Bankfull Width:	15.7
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	4.0
Mean Depth at Bankfull:	3.2
W / D Ratio:	4.9
Entrenchment Ratio:	-
Bank Height Ratio:	1.0
Slope (ft/ft):	0.002
Discharge (cfs)	-

Stream Type:	



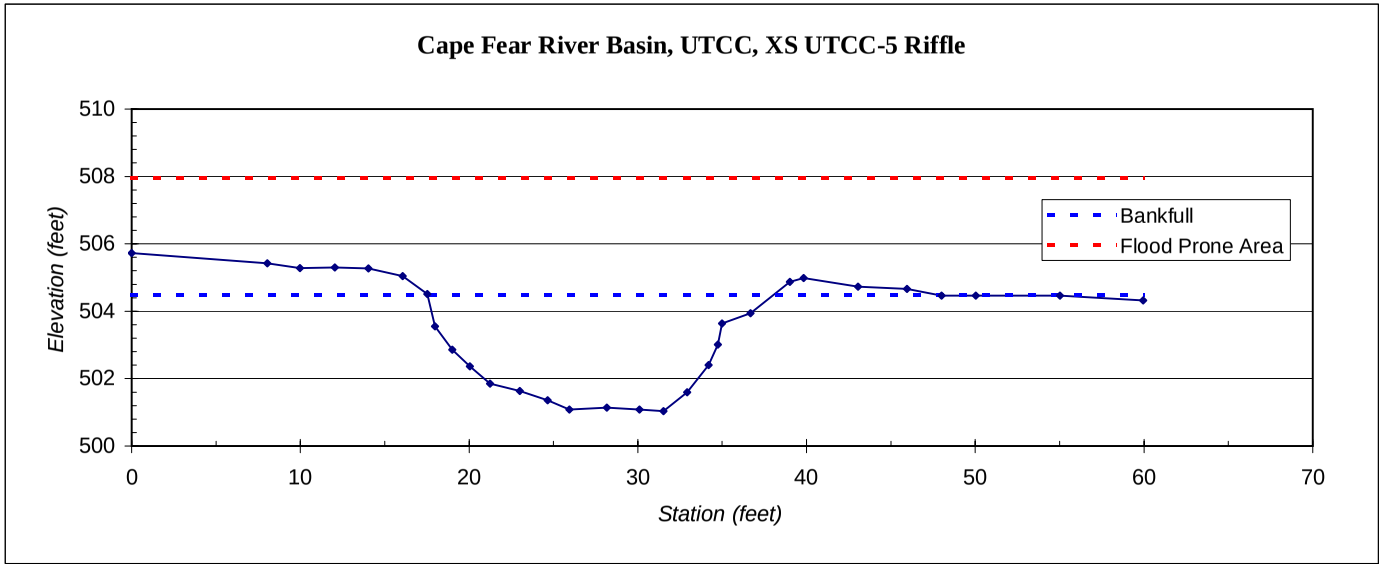
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS UTCC-5 Riffle
Drainage Area (sq mi):	2.6
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

Station	Elevation
0.0	505.73
8.0	505.42
10.0	505.28
12.0	505.30
14.0	505.27
16.1	505.04
17.5	504.51
18.0	503.55
19.0	502.85
20.0	502.37
21.2	501.85
23.0	501.63
24.7	501.36
26.0	501.08
28.2	501.14
30.1	501.08
31.5	501.03
32.9	501.59
34.2	502.41
34.8	503.01
35.0	503.64
36.7	503.94
39.0	504.87
39.8	504.99
43.0	504.73
46.0	504.67
48.0	504.46
50.0	504.46
55.0	504.46
60.0	504.32

SUMMARY DATA	
Bankfull Elevation:	504.5
Bankfull Cross-Sectional Area:	49.7
Bankfull Width:	20.5
Flood Prone Area Elevation:	507.9
Flood Prone Width:	>60
Max Depth at Bankfull:	3.5
Mean Depth at Bankfull:	2.4
W / D Ratio:	8.5
Entrenchment Ratio:	>1.8
Bank Height Ratio:	1.1
Slope (ft/ft):	0.002
Discharge (cfs)	160

Stream Type:	C4



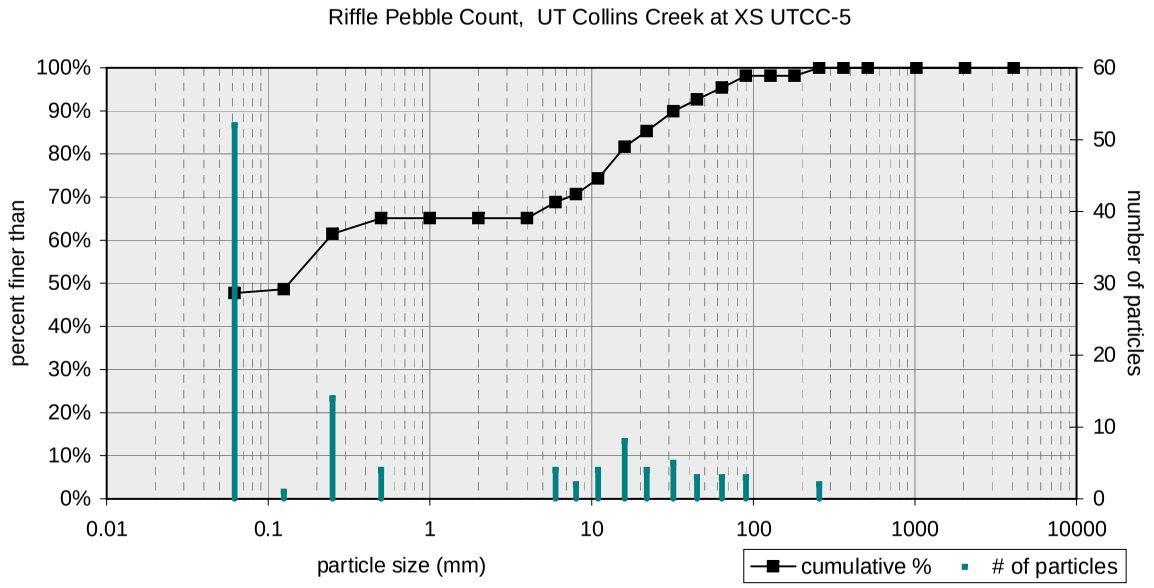
Riffle Pebble Count Riffle Pebble Count,

Material	Size Range (mm)		Count
silt/clay	0	0.062	**52**
very fine sand	0.062	0.13	**1**
fine sand	0.13	0.25	**14**
medium sand	0.25	0.5	**4**
coarse sand	0.5	1	
very coarse sand	1	2	
very fine gravel	2	4	
fine gravel	4	6	**4**
fine gravel	6	8	**2**
medium gravel	8	11	**4**
medium gravel	11	16	**8**
coarse gravel	16	22	**4**
coarse gravel	22	32	**5**
very coarse gravel	32	45	**3**
very coarse gravel	45	64	**3**
small cobble	64	90	**3**
medium cobble	90	128	
large cobble	128	180	
very large cobble	180	256	**2**
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		109

bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		109

UT Collins Creek at XS UTCC-5
Collins Creek- Cape Fear River

Note: **Riffle Pebble Count**



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	0.06	0.1	0	20	61	73.9	1.1	17.8

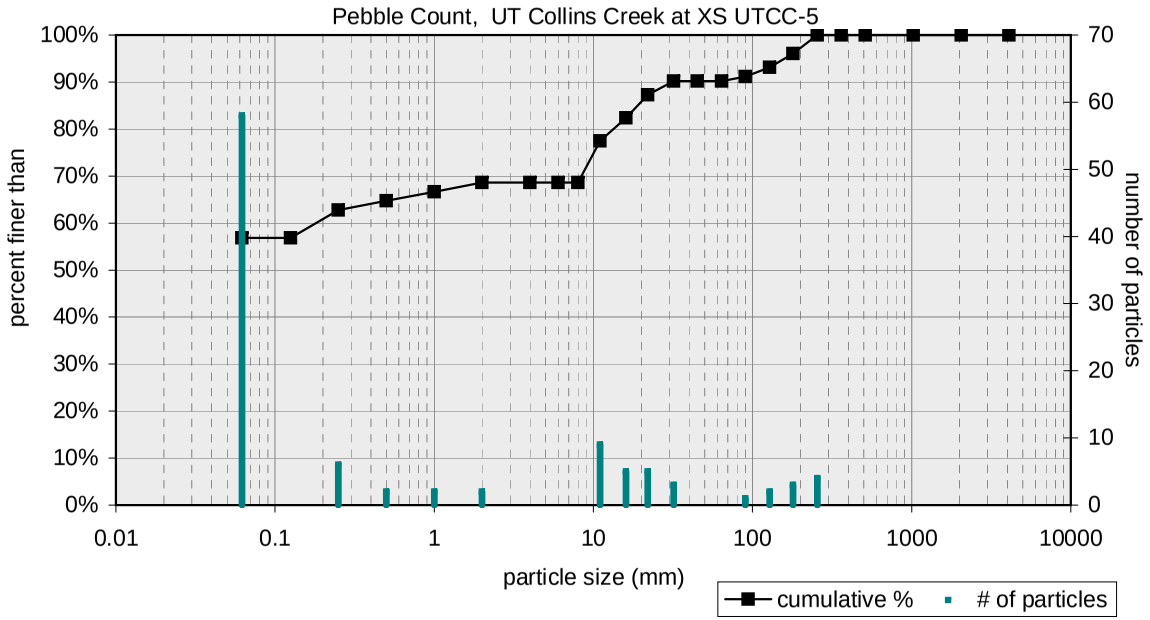
based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	48%	17%	30%	5%	0%	0%	0%	0%	0%

Pebble Count of Channel Reach

Pebble Count,
UT Collins Creek at XS UTCC-5
Collins Creek- Cape Fear River

Note: **Reach Pebble Count**

Material	Size Range (mm)		Count
silt/clay	0	0.062	**58**
very fine sand	0.062	0.13	
fine sand	0.13	0.25	**6**
medium sand	0.25	0.5	**2**
coarse sand	0.5	1	**2**
very coarse sand	1	2	**2**
very fine gravel	2	4	
fine gravel	4	6	
fine gravel	6	8	
medium gravel	8	11	**9**
medium gravel	11	16	**5**
coarse gravel	16	22	**5**
coarse gravel	22	32	**3**
very coarse gravel	32	45	
very coarse gravel	45	64	
small cobble	64	90	**1**
medium cobble	90	128	**2**
large cobble	128	180	**3**
very large cobble	180	256	**4**
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		102



bedrock		**1**
clay hardpan		
detritus/wood		
artificial		
	total count:	103

based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	0.06	0.1	1	18	159	144.1	1.1	16.9

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	56%	12%	21%	10%	0%	1%	0%	0%	0%

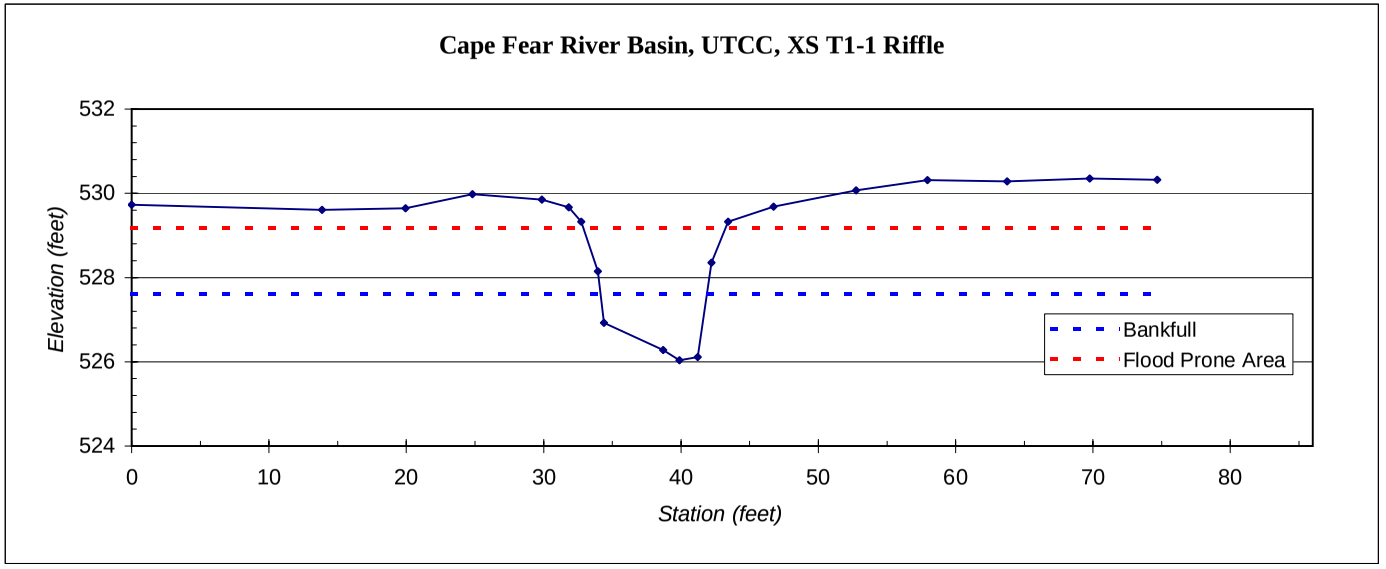
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1-1 Riffle
Drainage Area (sq mi):	0.12
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

Station	Elevation
0.0	529.73
13.9	529.61
20.0	529.65
24.8	529.98
29.9	529.85
31.8	529.67
32.7	529.33
34.0	528.15
34.4	526.93
38.7	526.28
39.9	526.04
41.2	526.11
42.2	528.35
43.4	529.33
46.7	529.68
52.8	530.07
57.9	530.32
63.7	530.28
69.8	530.35
74.7	530.32

SUMMARY DATA	
Bankfull Elevation:	527.6
Bankfull Cross-Sectional Area:	8.6
Bankfull Width:	7.7
Flood Prone Area Elevation:	529.2
Flood Prone Width:	10.3
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	1.1
W / D Ratio:	6.9
Entrenchment Ratio:	1.3
Bank Height Ratio:	2.1
Slope (ft/ft):	0.007
Discharge (cfs)	35

Stream Type:	G4c



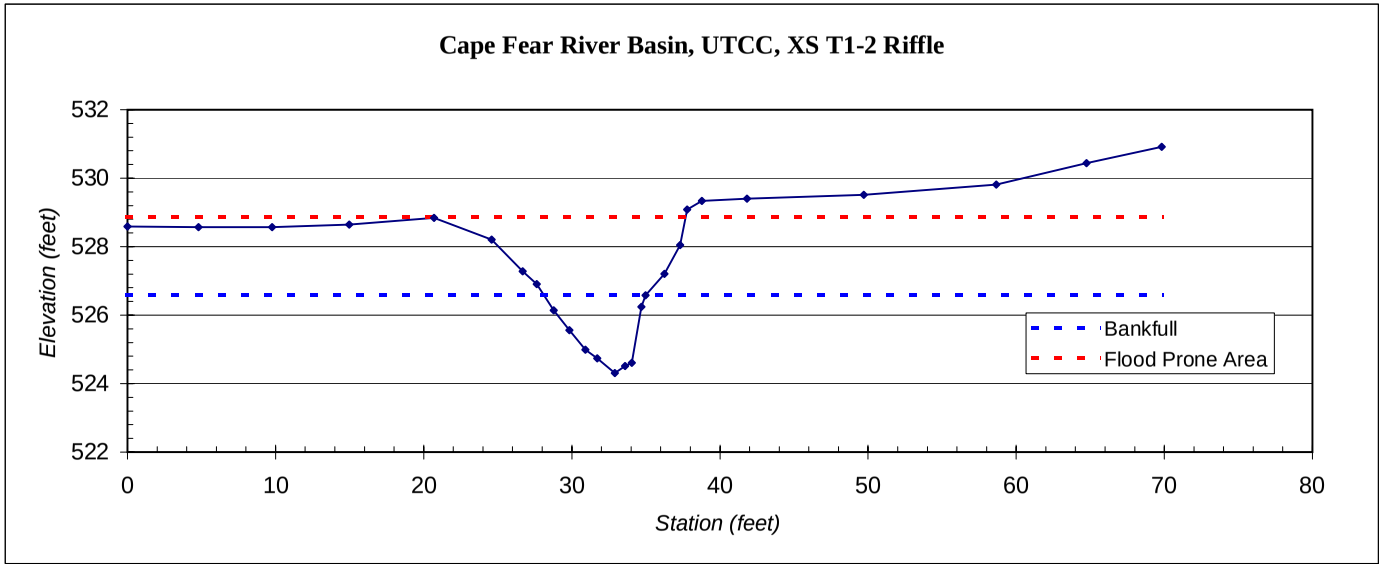
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1-2 Riffle
Drainage Area (sq mi):	0.12
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

Station	Elevation
0.0	528.59
4.8	528.57
9.8	528.57
15.0	528.65
20.7	528.84
24.6	528.21
26.7	527.28
27.6	526.91
28.8	526.14
29.8	525.56
30.9	524.99
31.7	524.74
32.9	524.30
33.6	524.52
34.1	524.61
34.7	526.25
35.0	526.58
36.3	527.20
37.3	528.05
37.8	529.08
38.8	529.34
41.8	529.40
49.7	529.51
58.7	529.81
64.8	530.44
69.8	530.92

SUMMARY DATA	
Bankfull Elevation:	526.6
Bankfull Cross-Sectional Area:	9.3
Bankfull Width:	6.8
Flood Prone Area Elevation:	528.9
Flood Prone Width:	>38
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	1.4
W / D Ratio:	5.0
Entrenchment Ratio:	>5.6
Bank Height Ratio:	2.0
Slope (ft/ft):	0.007
Discharge (cfs)	42

Stream Type:	E4

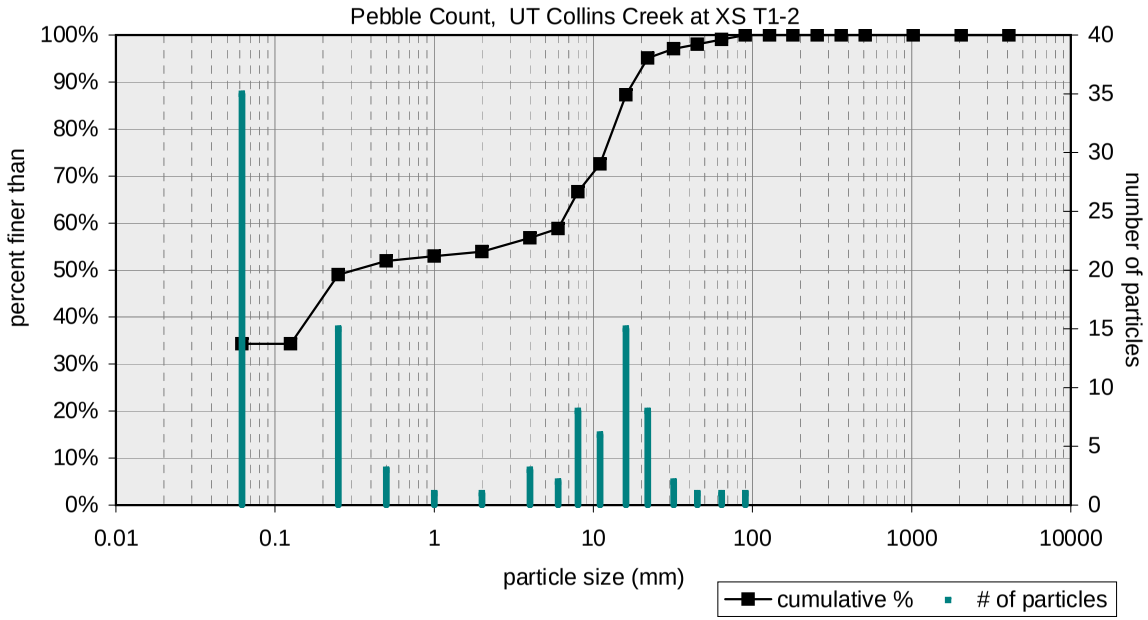


Pebble Count of Channel Reach

Pebble Count,
UT Collins Creek at XS T1-2
Collins Creek- Cape Fear River

Note: **Reach Pebble Count**

Material	Size Range (mm)		Count
silt/clay	0	0.062	**35**
very fine sand	0.062	0.13	
fine sand	0.13	0.25	**15**
medium sand	0.25	0.5	**3**
coarse sand	0.5	1	**1**
very coarse sand	1	2	**1**
very fine gravel	2	4	**3**
fine gravel	4	6	**2**
fine gravel	6	8	**8**
medium gravel	8	11	**6**
medium gravel	11	16	**15**
coarse gravel	16	22	**8**
coarse gravel	22	32	**2**
very coarse gravel	32	45	**1**
very coarse gravel	45	64	**1**
small cobble	64	90	**1**
medium cobble	90	128	
large cobble	128	180	
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		102



bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	102

based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	0.13	0.3	8	15	22	25.9	1.0	15.4

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	34%	20%	45%	1%	0%	0%	0%	0%	0%

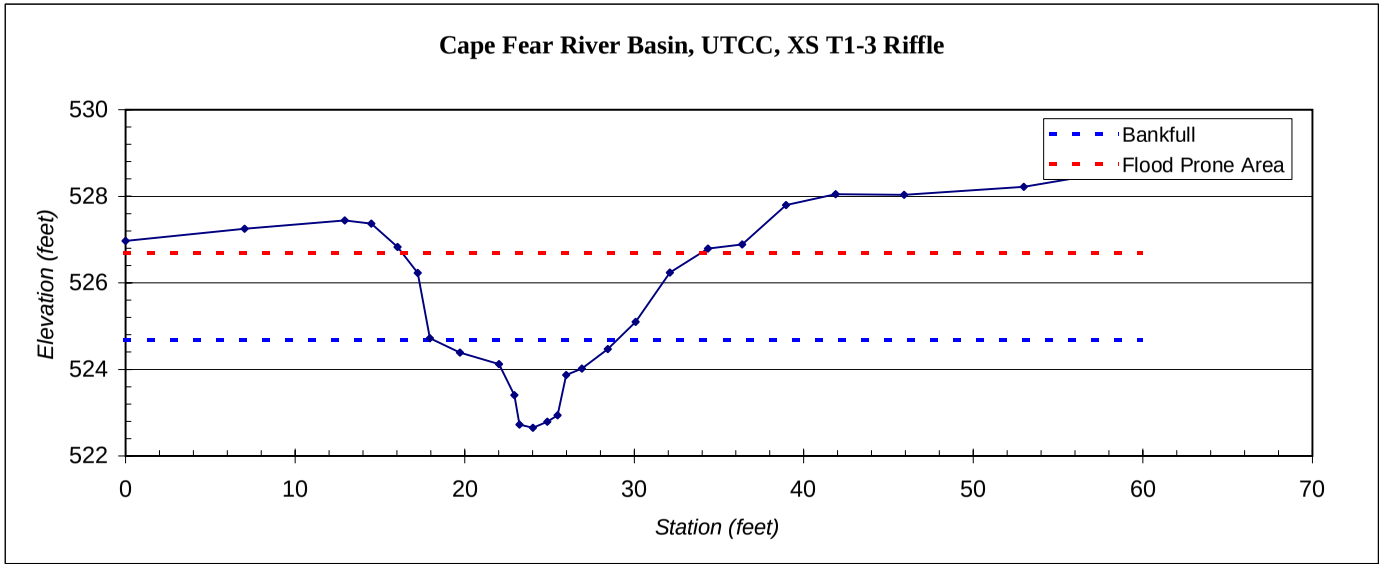
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1-3 Riffle
Drainage Area (sq mi):	0.12
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

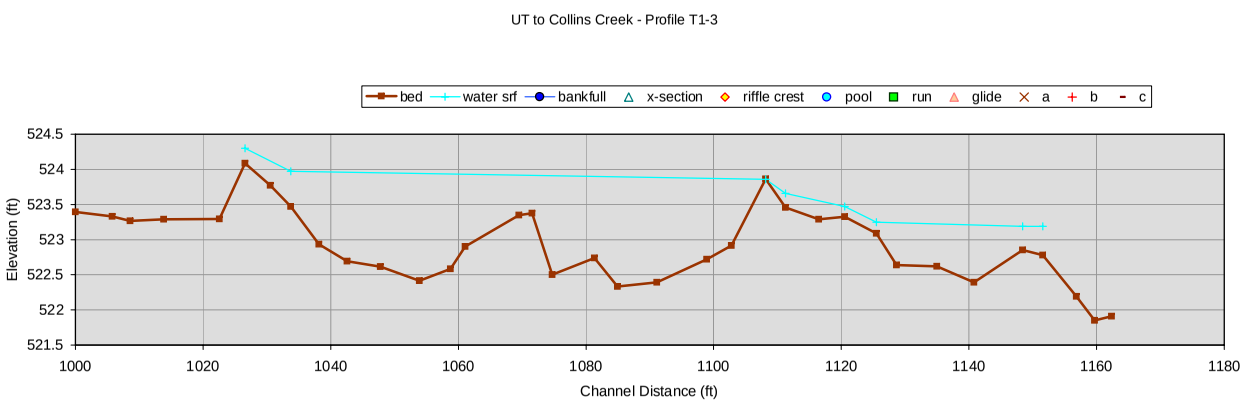
Station	Elevation
0.0	526.97
7.0	527.25
12.9	527.44
14.5	527.37
16.0	526.83
17.2	526.23
18.0	524.72
19.7	524.39
22.0	524.12
22.9	523.40
23.2	522.72
24.0	522.65
24.9	522.79
25.5	522.94
26.0	523.87
26.9	524.02
28.4	524.47
30.1	525.10
32.1	526.24
34.4	526.79
36.4	526.89
39.0	527.79
41.9	528.05
45.9	528.03
53.0	528.22
59.9	528.68

SUMMARY DATA	
Bankfull Elevation:	524.7
Bankfull Cross-Sectional Area:	8.8
Bankfull Width:	10.8
Flood Prone Area Elevation:	526.7
Flood Prone Width:	17.6
Max Depth at Bankfull:	2.0
Mean Depth at Bankfull:	0.8
W / D Ratio:	13.3
Entrenchment Ratio:	1.6
Bank Height Ratio:	2.4
Slope (ft/ft):	0.007
Discharge (cfs)	30

Stream Type:	G4c



Longitudinal Profile



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	---	---	1162.3	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---
	---	---	---	---	---	---

notes	cross section ID	bed feature	BkF channel centerline easting (ft)	BkF channel centerline northing (ft)	station	ELEV centerline	ELEV thalwag	ELEV water	ELEV bankfull	user defined ELEV a	user defined ELEV b	user defined ELEV c
					1000.00	523.39						
					1005.76	523.33						
PO					1008.55	523.26						
PO					1013.83	523.29						
EPO					1022.56	523.29						
BRI					1026.56	524.09		524.30				
RI					1030.55	523.77						
ERI					1033.73	523.47		523.97				
					1038.14	522.94						
					1042.56	522.69						
PO					1047.77	522.62						
PO					1053.91	522.42						
EPO					1058.75	522.59						
					1061.05	522.90						
BRI					1069.51	523.35						
ERI					1071.55	523.38						
					1074.73	522.50						
					1081.34	522.74						
PO					1084.94	522.33						
PO					1091.08	522.39						
PO					1098.94	522.72						
EPO					1102.76	522.92						
BRI=WS					1108.15	523.86		523.86				
BRI					1111.27	523.46		523.66				
					1116.45	523.29						
BRI					1120.54	523.32		523.47				
ERI					1125.49	523.09		523.25				
EBPO					1128.68	522.64						
PO					1135.00	522.62						
EPO					1140.81	522.39						
BRI					1148.39	522.85		523.19				
ERI					1151.58	522.78		523.19				
BPO					1156.84	522.19						
PO					1159.68	521.85						
PO					1162.34	521.91						

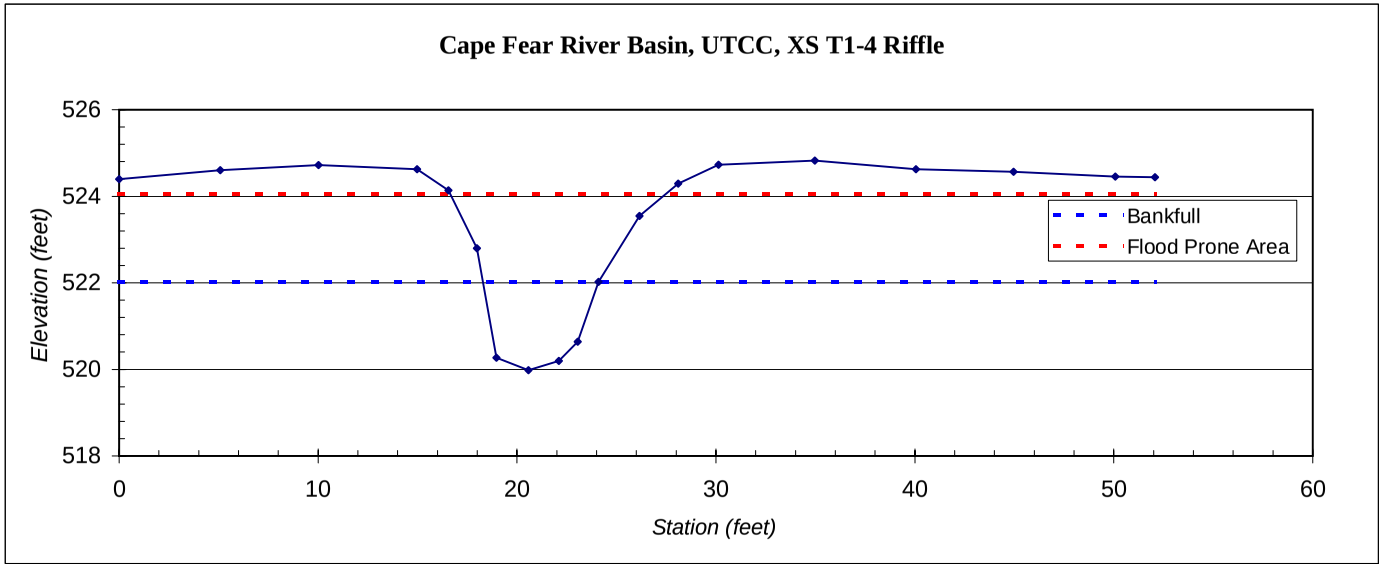
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1-4 Riffle
Drainage Area (sq mi):	0.12
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

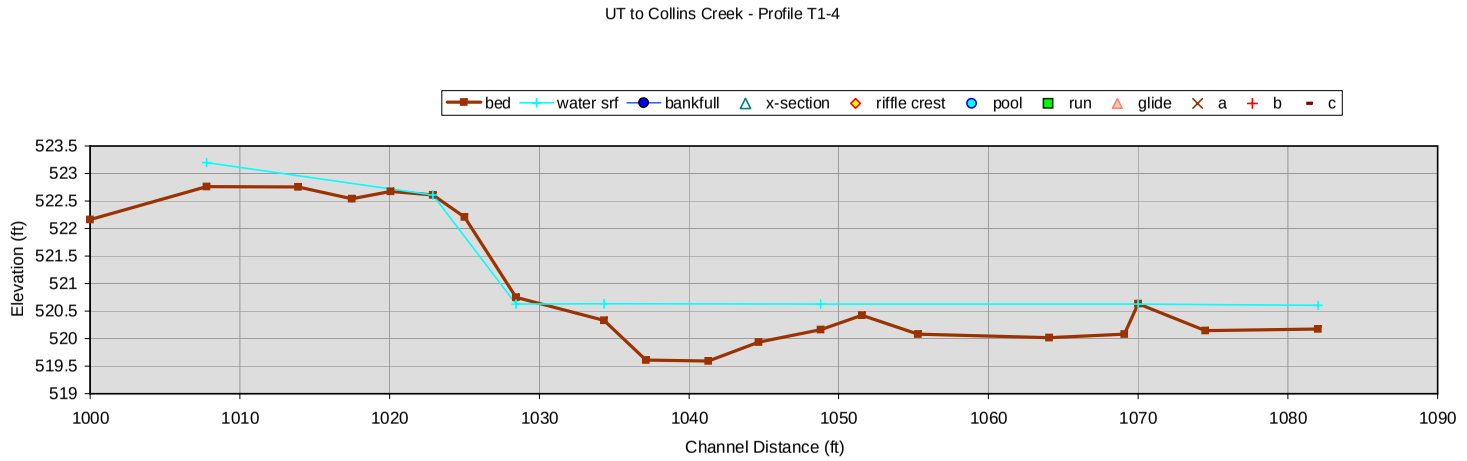
Station	Elevation
0.0	524.39
5.1	524.60
10.0	524.72
15.0	524.62
16.6	524.13
18.0	522.80
19.0	520.27
20.6	519.98
22.1	520.20
23.0	520.64
24.1	522.02
26.2	523.55
28.1	524.29
30.1	524.72
35.0	524.82
40.1	524.62
45.0	524.56
50.1	524.46
52.1	524.44

SUMMARY DATA	
Bankfull Elevation:	522.0
Bankfull Cross-Sectional Area:	8.8
Bankfull Width:	5.8
Flood Prone Area Elevation:	524.1
Flood Prone Width:	10.8
Max Depth at Bankfull:	2.0
Mean Depth at Bankfull:	1.5
W / D Ratio:	3.8
Entrenchment Ratio:	1.9
Bank Height Ratio:	2.3
Slope (ft/ft):	0.007
Discharge (cfs)	40

Stream Type:	E4b/G4



Longitudinal Profile



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	---	---	1082.0	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---
	---	---	---	---	---	---

notes	cross section ID	bed feature	BkF channel centerline easting (ft)	BkF channel centerline northing (ft)	BkF channel centerline station	BkF channel centerline ELEV centerline	ELEV thalwag	water	ELEV bankfull	user defined ELEV a	user defined ELEV b	user defined ELEV c
TW_BRK					1000.00	522.16						
TW_BRK					1007.78	522.76		523.20				
TW_BRK					1013.90	522.76						
TW_BRK					1017.47	522.54						
TW_BRK					1020.07	522.67						
TW_BRK=WS					1022.89	522.61		522.61				
TW_BRK					1025.02	522.21						
TW_BRK					1028.45	520.75		520.63				
TW_ENDBRK					1034.32	520.33		520.63				
TW_BPO					1037.12	519.61						
TW_PO					1041.28	519.60						
TW_EPO					1044.64	519.94						
TW_BRI					1048.80	520.16		520.63				
TW_RI					1051.54	520.42						
TW_ERI					1055.30	520.08						
TW					1064.06	520.02						
TW					1069.07	520.08						
BRK=WS					1070.00	520.63		520.63				
TW					1074.48	520.15						
TW=CL_CL					1082.00	520.18		520.60				

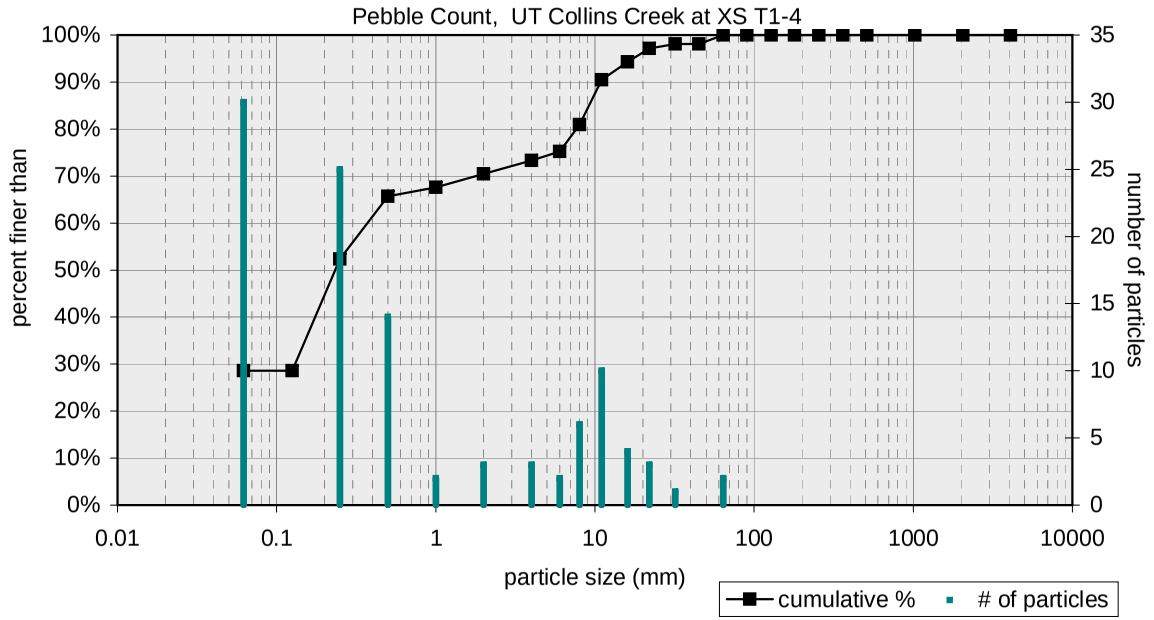
Pebble Count of Channel Reach

Material	Size Range (mm)		Count
silt/clay	0	0.062	**30**
very fine sand	0.062	0.13	
fine sand	0.13	0.25	**25**
medium sand	0.25	0.5	**14**
coarse sand	0.5	1	**2**
very coarse sand	1	2	**3**
very fine gravel	2	4	**3**
fine gravel	4	6	**2**
fine gravel	6	8	**6**
medium gravel	8	11	**10**
medium gravel	11	16	**4**
coarse gravel	16	22	**3**
coarse gravel	22	32	**1**
very coarse gravel	32	45	
very coarse gravel	45	64	**2**
small cobble	64	90	
medium cobble	90	128	
large cobble	128	180	
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		105

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	105

Pebble Count,
UT Collins Creek at XS T1-4
Collins Creek- Cape Fear River

Note: **Reach Pebble Count**



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	0.15	0.2	0	9	17	20.9	0.7	12.0

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	29%	42%	30%	0%	0%	0%	0%	0%	0%

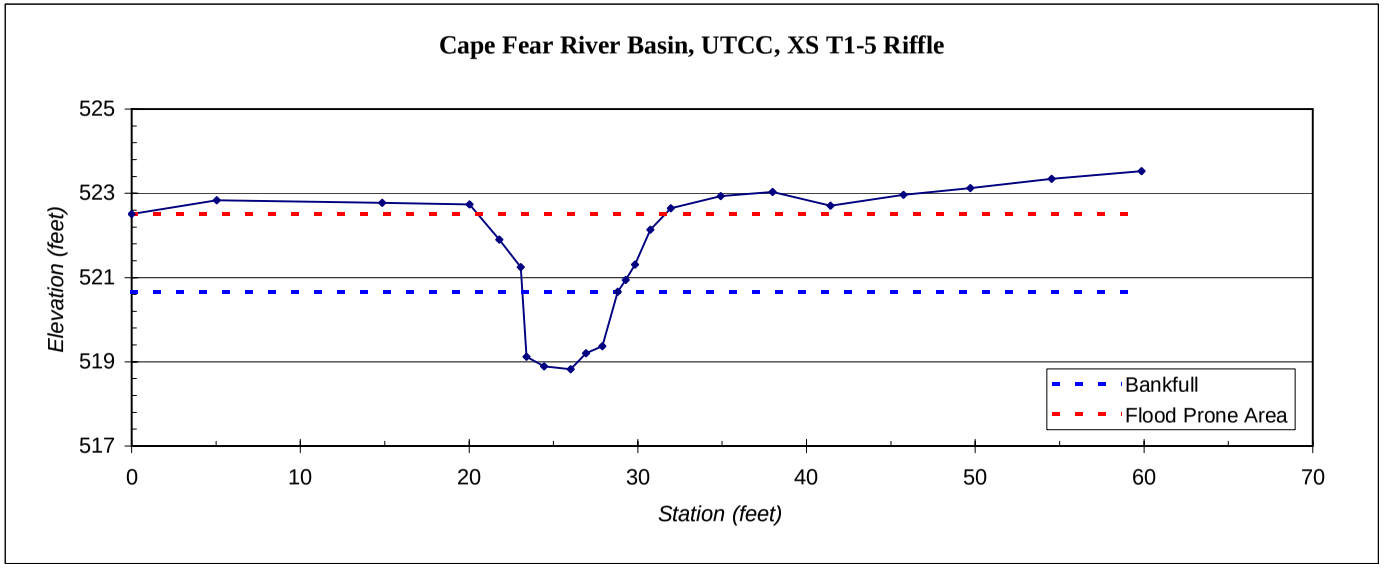
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1-5 Riffle
Drainage Area (sq mi):	0.18
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

Station	Elevation
0.0	522.51
5.0	522.84
14.9	522.78
20.0	522.74
21.8	521.90
23.1	521.25
23.4	519.12
24.5	518.89
26.0	518.82
26.9	519.20
27.9	519.37
28.8	520.66
29.3	520.95
29.8	521.31
30.7	522.13
32.0	522.65
34.9	522.93
38.0	523.03
41.4	522.70
45.7	522.96
49.7	523.12
54.5	523.34
59.9	523.53

SUMMARY DATA	
Bankfull Elevation:	520.7
Bankfull Cross-Sectional Area:	8.2
Bankfull Width:	5.7
Flood Prone Area Elevation:	522.5
Flood Prone Width:	11.1
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	1.4
W / D Ratio:	3.9
Entrenchment Ratio:	2.0
Bank Height Ratio:	2.1
Slope (ft/ft):	0.008
Discharge (cfs)	36

Stream Type:	E4



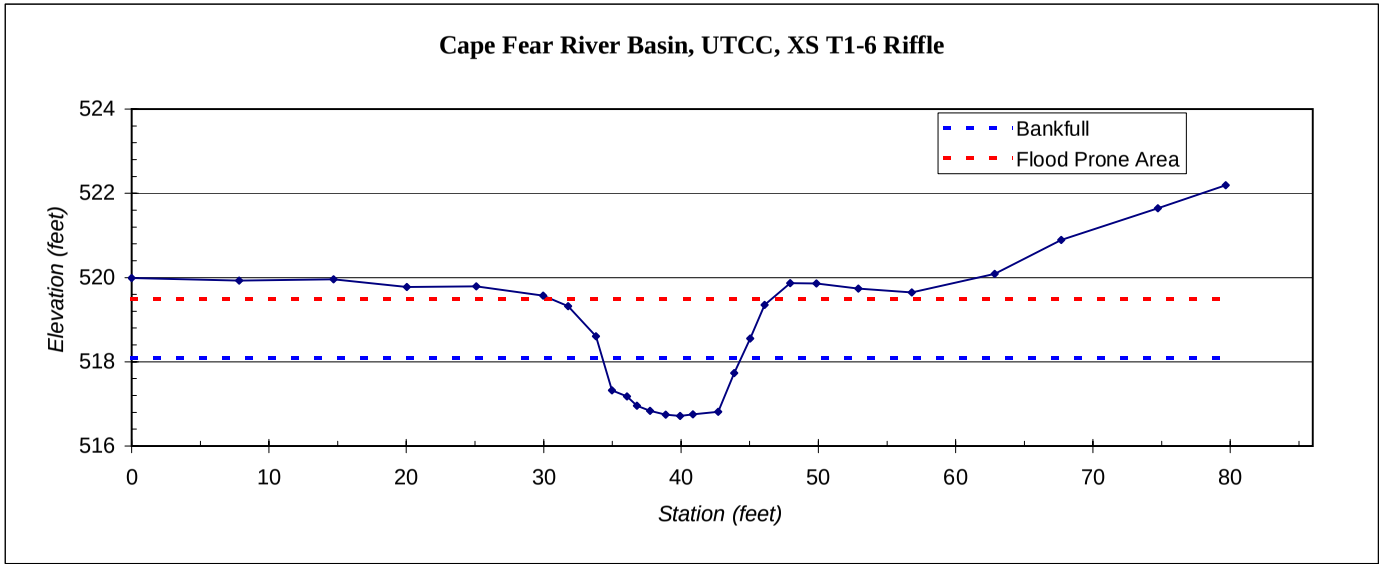
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1-6 Riffle
Drainage Area (sq mi):	0.18
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

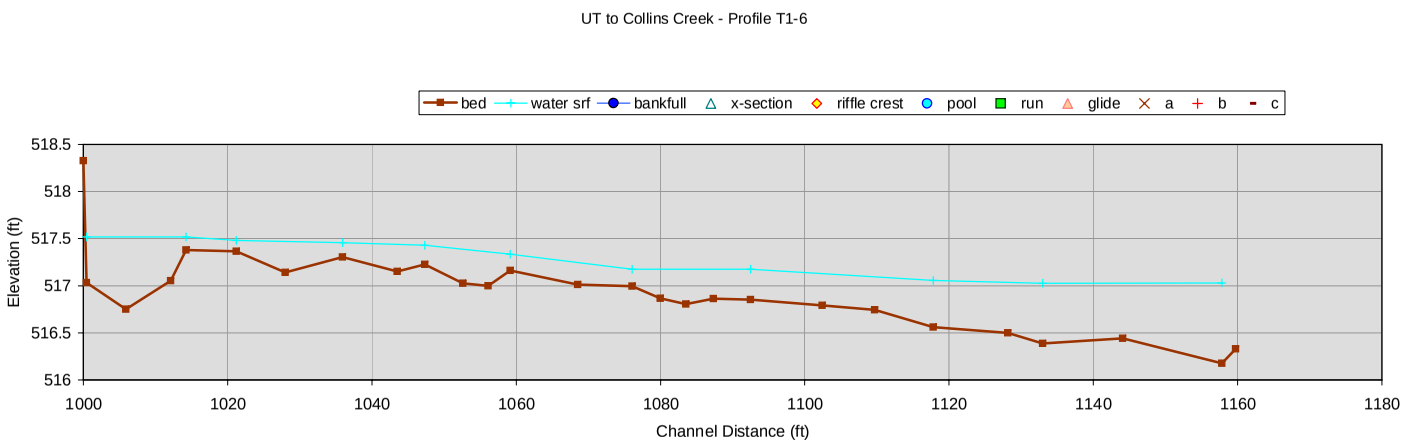
Station	Elevation
0.0	519.99
7.8	519.93
14.7	519.96
20.0	519.77
25.1	519.79
30.0	519.57
31.8	519.32
33.8	518.61
35.0	517.32
36.1	517.17
36.8	516.96
37.7	516.84
38.9	516.75
39.9	516.72
40.9	516.76
42.7	516.82
43.9	517.73
45.0	518.56
46.1	519.35
48.0	519.87
49.9	519.86
52.9	519.74
56.8	519.65
62.8	520.09
67.7	520.89
74.7	521.64
79.7	522.19

SUMMARY DATA	
Bankfull Elevation:	518.1
Bankfull Cross-Sectional Area:	10.8
Bankfull Width:	10.1
Flood Prone Area Elevation:	519.5
Flood Prone Width:	16.0
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	1.1
W / D Ratio:	9.5
Entrenchment Ratio:	1.6
Bank Height Ratio:	2.0
Slope (ft/ft):	0.008
Discharge (cfs)	46

Stream Type:	E4/G4c



Longitudinal Profile



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	---	---	1159.7	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---
	---	---	---	---	---	---

notes	cross section ID	bed feature	BkF channel centerline easting (ft)	BkF channel centerline northing (ft)	BkF channel centerline station	BkF channel centerline ELEV centerline	ELEV thalwag	ELEV water	ELEV bankfull	user defined ELEV a	user defined ELEV b	user defined ELEV c
INV					1000.00	518.33						
BPO					1000.44	517.03		517.52				
TWPO					1005.89	516.75						
TWEPO					1012.11	517.05						
TWBRI					1014.25	517.38		517.52				
TWERI					1021.21	517.36		517.48				
TW					1027.98	517.14						
TWBRI					1035.91	517.30		517.46				
TW					1043.49	517.15						
TWBRI					1047.33	517.23		517.43				
TWERI					1052.59	517.03						
TW					1056.09	517.00						
TWBRI					1059.19	517.16		517.33				
TWRI					1068.54	517.01						
ERI					1076.07	516.99		517.18				
BPO					1079.99	516.87						
PO					1083.54	516.81						
EPO					1087.36	516.86						
TW					1092.50	516.85		517.17				
TW					1102.42	516.79						
TW					1109.71	516.75						
TW					1117.83	516.56		517.06				
TW					1128.13	516.50						
BKWTR					1132.99	516.39		517.03				
TW					1144.07	516.44						
BKWTR					1157.81	516.18		517.03				
TW=PIPE					1159.74	516.33						

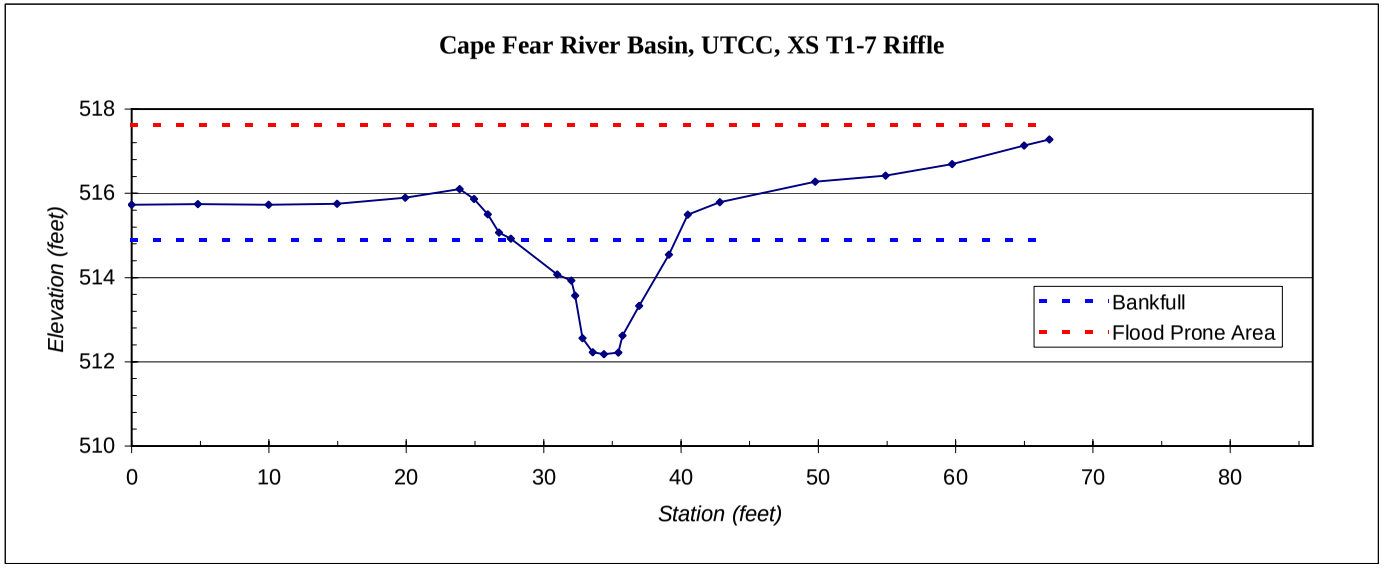
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1-7 Riffle
Drainage Area (sq mi):	0.49
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

Station	Elevation
0.0	515.73
4.8	515.75
10.0	515.73
15.0	515.75
19.9	515.90
23.9	516.10
24.9	515.87
25.9	515.50
26.8	515.07
27.6	514.92
31.0	514.07
32.0	513.93
32.3	513.57
32.8	512.56
33.6	512.23
34.4	512.18
35.4	512.22
35.7	512.62
36.9	513.33
39.1	514.54
40.5	515.50
42.8	515.79
49.8	516.27
54.9	516.42
59.7	516.70
65.0	517.13
66.8	517.27

SUMMARY DATA	
Bankfull Elevation:	514.9
Bankfull Cross-Sectional Area:	15.1
Bankfull Width:	11.9
Flood Prone Area Elevation:	517.6
Flood Prone Width:	>70
Max Depth at Bankfull:	2.7
Mean Depth at Bankfull:	1.3
W / D Ratio:	9.4
Entrenchment Ratio:	>5.9
Bank Height Ratio:	1.2
Slope (ft/ft):	0.005
Discharge (cfs)	62

Stream Type:	E4



Riffle Pebble Count

Riffle Pebble Count,

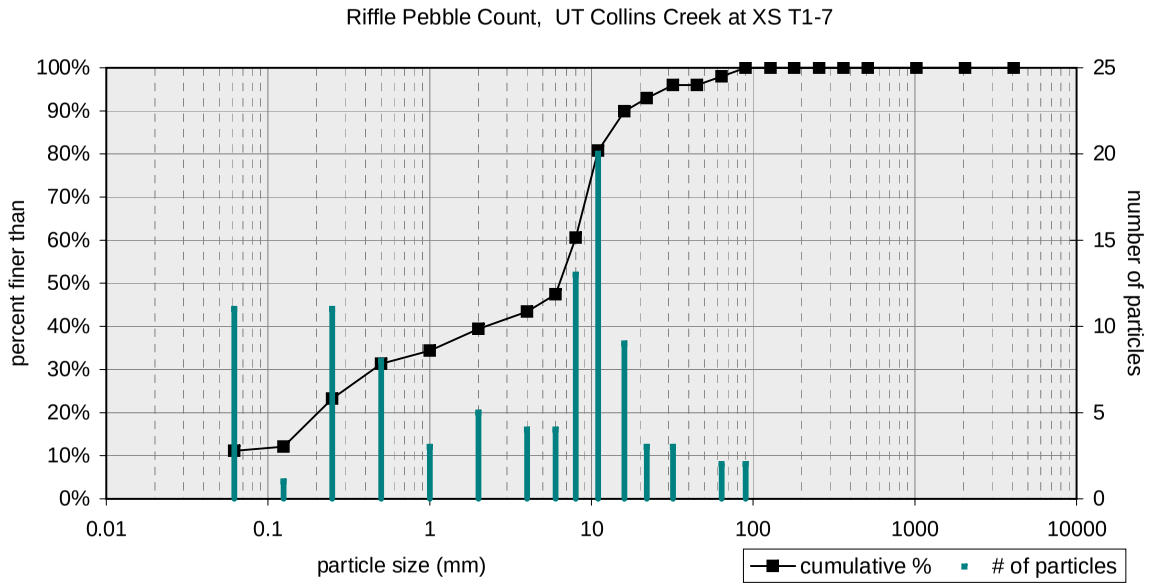
Material	Size Range (mm)		Count
silt/clay	0	0.062	**11**
very fine sand	0.062	0.13	**1**
fine sand	0.13	0.25	**11**
medium sand	0.25	0.5	**8**
coarse sand	0.5	1	**3**
very coarse sand	1	2	**5**
very fine gravel	2	4	**4**
fine gravel	4	6	**4**
fine gravel	6	8	**13**
medium gravel	8	11	**20**
medium gravel	11	16	**9**
coarse gravel	16	22	**3**
coarse gravel	22	32	**3**
very coarse gravel	32	45	
very coarse gravel	45	64	**2**
small cobble	64	90	**2**
medium cobble	90	128	
large cobble	128	180	
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		99

bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		99

UT Collins Creek at XS T1-7

Collins Creek- Cape Fear River

Note: **Riffle Pebble Count**



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.159	1.09	6.3	9	13	28	20.9	1.4	8.9

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	11%	28%	59%	2%	0%	0%	0%	0%	0%

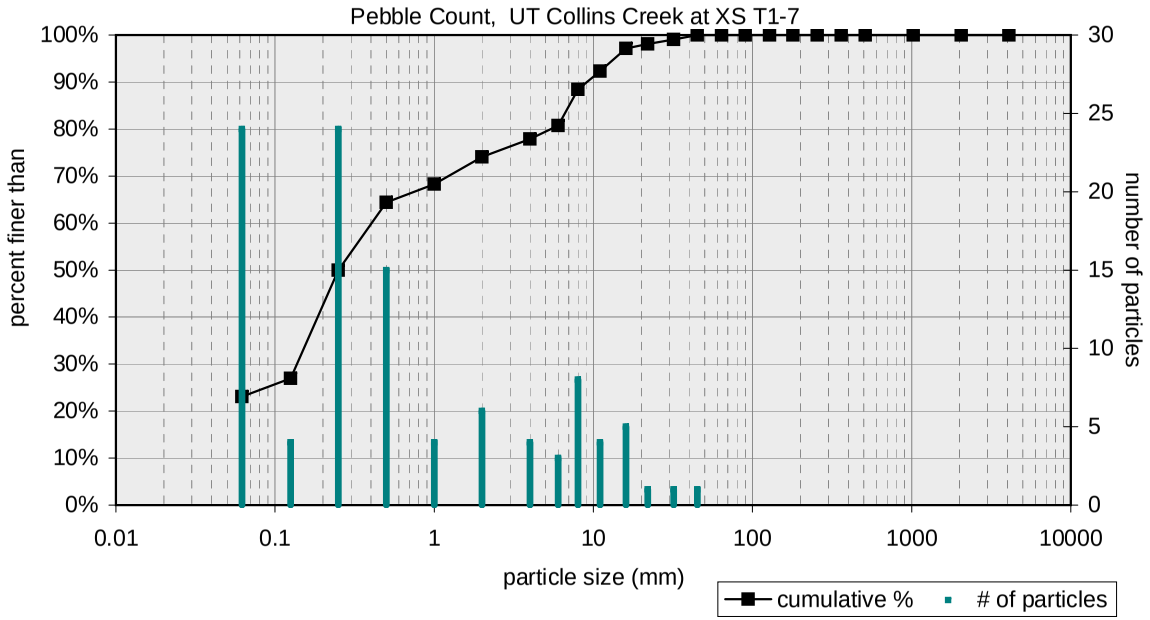
Pebble Count of Channel Reach

Material	Size Range (mm)		Count
silt/clay	0	0.062	**24**
very fine sand	0.062	0.13	**4**
fine sand	0.13	0.25	**24**
medium sand	0.25	0.5	**15**
coarse sand	0.5	1	**4**
very coarse sand	1	2	**6**
very fine gravel	2	4	**4**
fine gravel	4	6	**3**
fine gravel	6	8	**8**
medium gravel	8	11	**4**
medium gravel	11	16	**5**
coarse gravel	16	22	**1**
coarse gravel	22	32	**1**
very coarse gravel	32	45	**1**
very coarse gravel	45	64	
small cobble	64	90	
medium cobble	90	128	
large cobble	128	180	
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		104

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	104

Pebble Count,
UT Collins Creek at XS T1-7
Collins Creek- Cape Fear River

Note: **Reach Pebble Count**



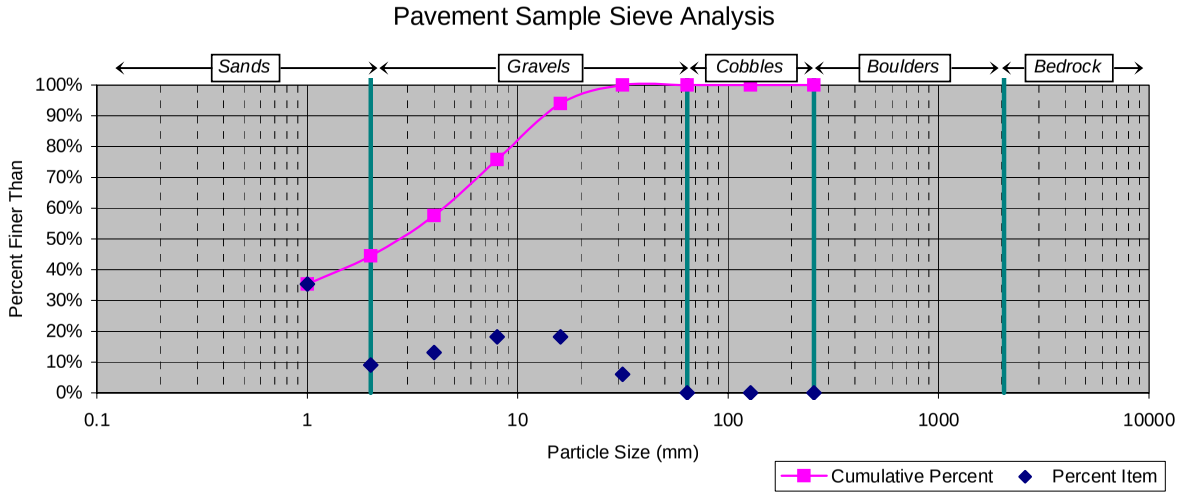
based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	0.16	0.3	1	7	14	15.6	0.6	10.5

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	23%	51%	26%	0%	0%	0%	0%	0%	0%

Sample Sieve Analysis

Smallest Sieve Passed (mm)	Weight (oz)	% Item	Percent Finer Than
1.0	17.5	35.4%	35.4%
2.0	4.5	9.1%	44.4%
4.0	6.5	13.1%	57.6%
8.0	9.0	18.2%	75.8%
16.0	9.0	18.2%	93.9%
31.5	3.0	6.1%	100.0%
64.0	0.0	0.0%	100.0%
128.0	0.0	0.0%	100.0%
256.0	0.0	0.0%	100.0%
Total:	49.5	100%	

Stream:	UT Collins Creek - Pavement #1
Watershed:	Collins Creek - Cape Fear River
Location:	Pavement #1 at XS T1-7
Note:	

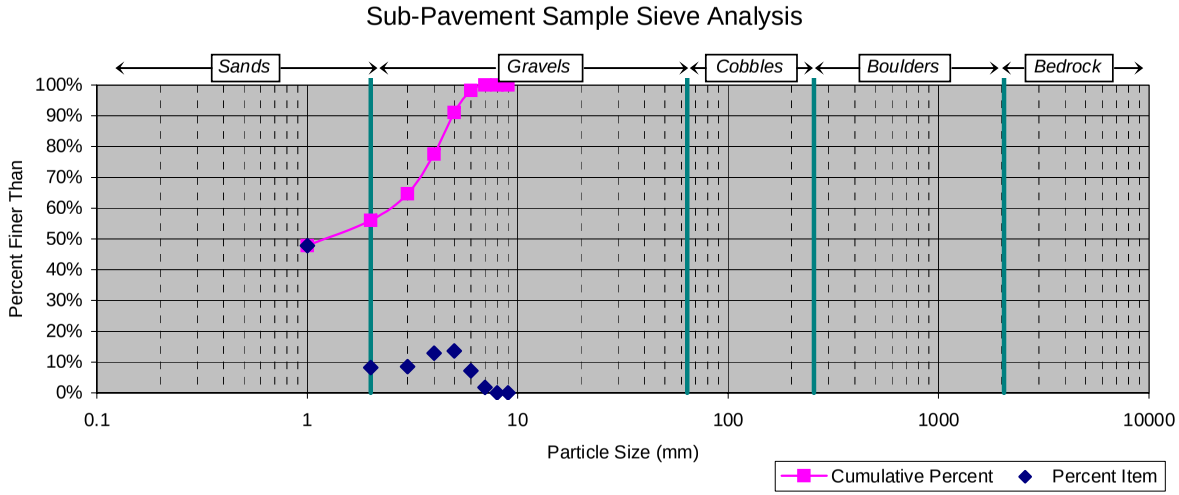


Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
2.7	2.7	2.7	11.0	18.0	0%	44%	56%	0%	---	---

Sample Sieve Analysis

Smallest Sieve Passed (mm)	Weight (oz)	% Item	Percent Finer Than
1.0	67	47.9%	47.9%
2.0	11.5	8.2%	56.1%
4.0	12.0	8.6%	64.6%
8.0	18.0	12.9%	77.5%
16.0	19.0	13.6%	91.1%
31.5	10.0	7.1%	98.2%
64.0	2.5	1.8%	100.0%
256.0	0.0	0.0%	100.0%
> 256.0	0.0	0.0%	100.0%
Total:	140.0	100%	

Stream:	Collins Creek - Sub-Pavement
Watershed:	Collins Creek - Cape Fear River
Location:	Sub-Pavement XS T1-7
Note:	

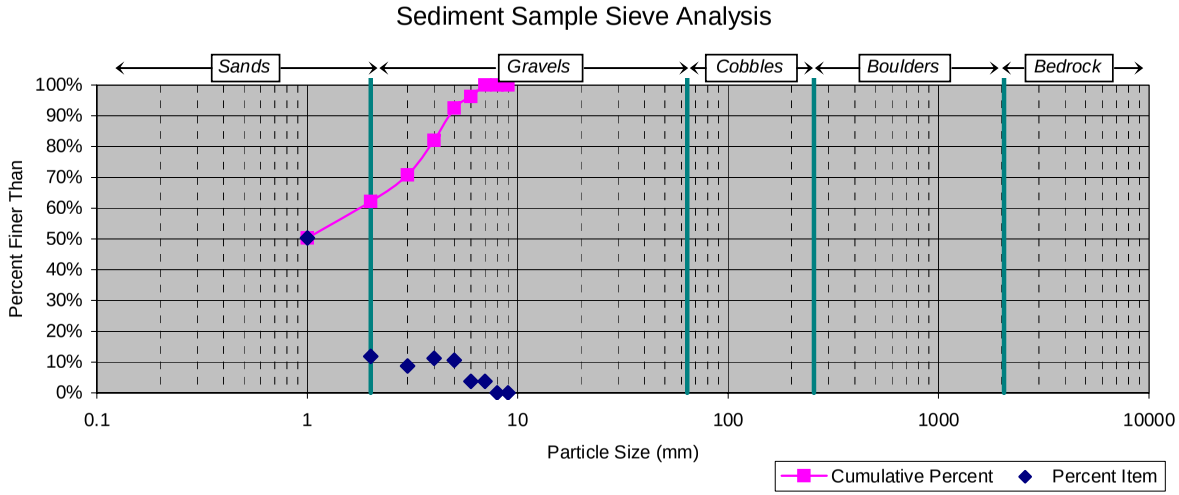


Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
1.2	1.2	1.2	11.1	23.2	0%	56%	44%	0%	---	---

Bar Sample Sieve Analysis

Smallest Sieve Passed (mm)	Weight (oz)	% Item	Percent Finer Than
1.0	40.5	50.3%	50.3%
2.0	9.5	11.8%	62.1%
4.0	7.0	8.7%	70.8%
8.0	9.0	11.2%	82.0%
16.0	8.5	10.6%	92.5%
31.5	3.0	3.7%	96.3%
64.0	3.0	3.7%	100.0%
128.0	0.0	0.0%	100.0%
> 256.0	0.0	0.0%	100.0%
Total:	80.5	100%	

Stream:	UT Collins Creek Bar
Watershed:	Collins Creek - Cape Fear River
Location:	Bar XS T1-7
Note:	



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
9.1	9.1	9.1	9.1	25.0	0%	62%	38%	0%	---	---

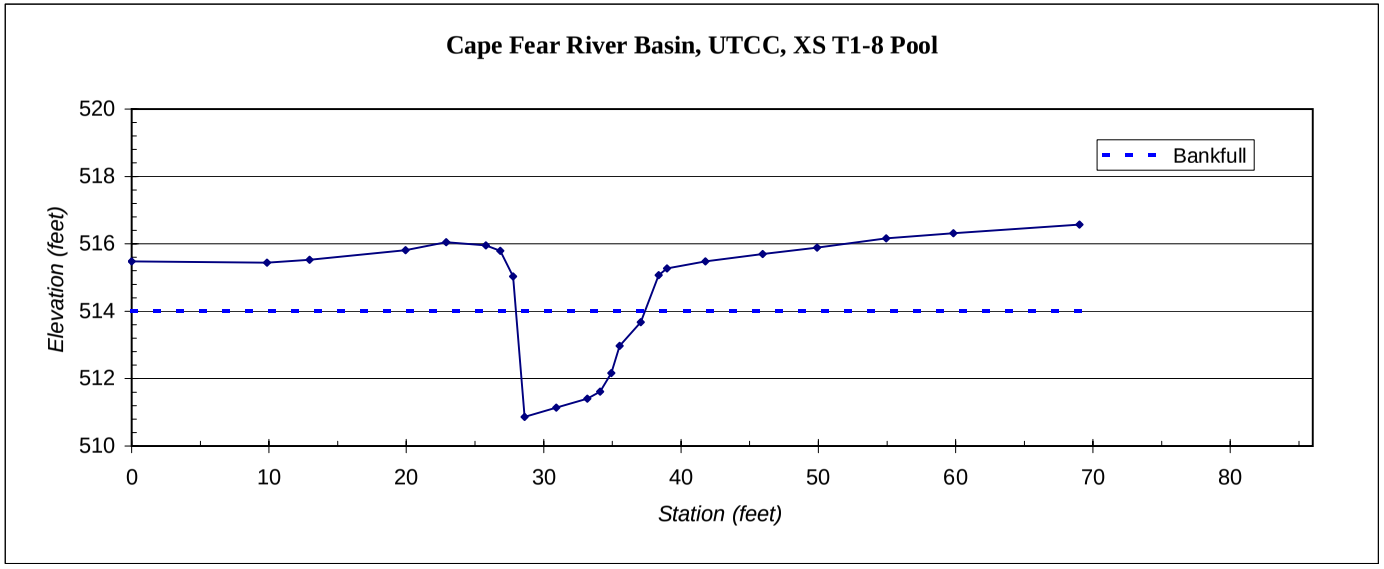
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1-8 Pool
Drainage Area (sq mi):	0.49
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

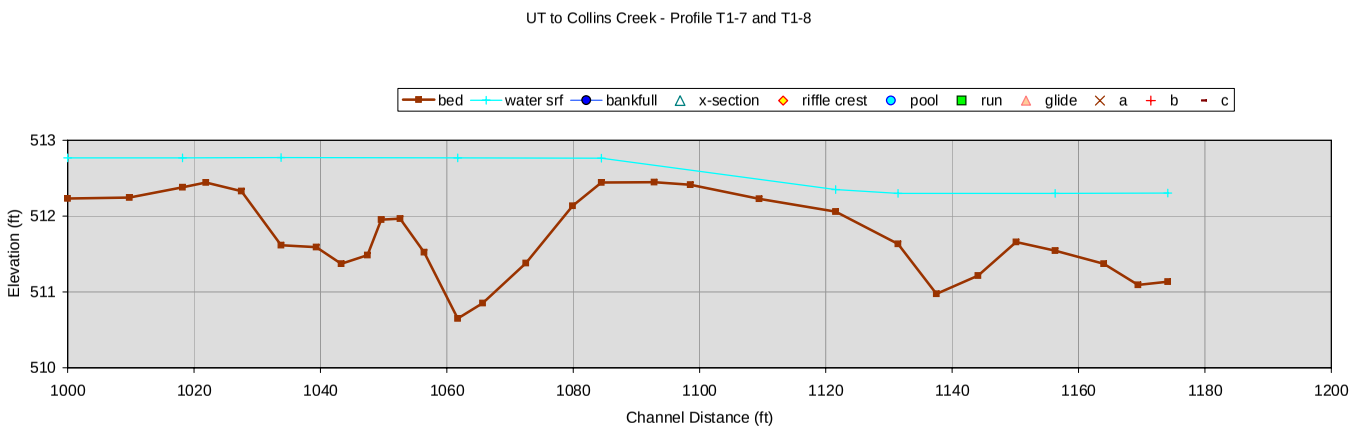
Station	Elevation
0.0	515.48
9.8	515.44
12.9	515.53
19.9	515.81
22.9	516.05
25.8	515.96
26.9	515.79
27.8	515.03
28.6	510.87
30.9	511.14
33.2	511.41
34.1	511.62
34.9	512.16
35.5	512.97
37.1	513.68
38.4	515.08
39.0	515.27
41.8	515.48
46.0	515.70
49.9	515.89
54.9	516.17
59.8	516.32
69.0	516.57

SUMMARY DATA	
Bankfull Elevation:	514.0
Bankfull Cross-Sectional Area:	20.1
Bankfull Width:	9.4
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	3.1
Mean Depth at Bankfull:	2.1
W / D Ratio:	4.4
Entrenchment Ratio:	-
Bank Height Ratio:	1.4
Slope (ft/ft):	0.003
Discharge (cfs)	-

Stream Type:	-



Longitudinal Profile



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	---	---	1174.1	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---
	---	---	---	---	---	---

notes	cross section ID	bed feature	BkF channel centerline easting (ft)	BkF channel centerline northing (ft)	station	ELEV centerline	ELEV thalwag	ELEV water	ELEV bankfull	user defined ELEV a	user defined ELEV b	user defined ELEV c
TW					1000.00	512.23		512.77				
TW					1009.79	512.24						
BRI					1018.19	512.38		512.77				
BRI					1021.88	512.44						
ERI					1027.52	512.33						
TW					1033.79	511.62		512.77				
BPO					1039.37	511.59						
PO					1043.31	511.37						
PO					1047.44	511.48						
EPO					1049.61	511.95						
TW					1052.60	511.97						
BPO					1056.44	511.52						
PO					1061.73	510.65		512.77				
PO					1065.68	510.85						
EPO					1072.54	511.38						
TW					1079.93	512.14						
BRI					1084.49	512.44		512.76				
TW					1092.82	512.45						
RI					1098.57	512.41						
RI					1109.45	512.23						
ERI					1121.53	512.06		512.35				
BPO					1131.43	511.63		512.30				
PO					1137.51	510.97						
EPO					1144.06	511.21						
TW					1150.09	511.66						
TW					1156.31	511.54		512.30				
TW					1163.98	511.37						
TW					1169.39	511.09						
TW					1174.11	511.14		512.30				

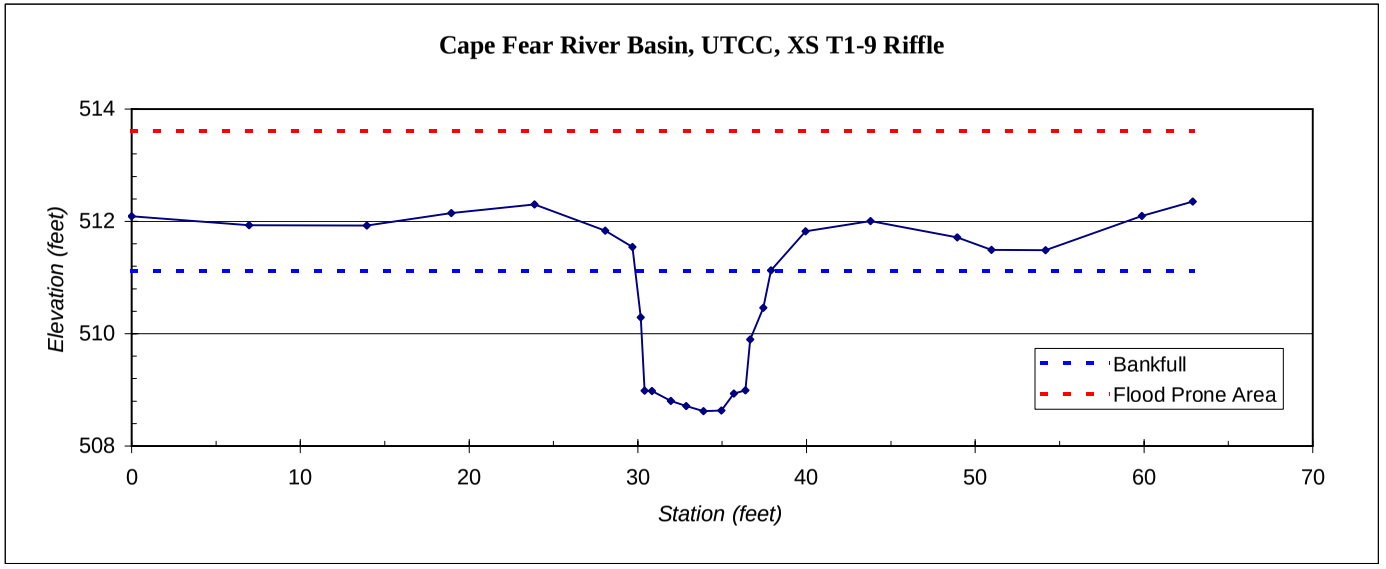
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1-9 Riffle
Drainage Area (sq mi):	0.49
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

Station	Elevation
0.0	512.09
7.0	511.93
13.9	511.93
18.9	512.15
23.9	512.30
28.1	511.83
29.7	511.54
30.2	510.29
30.4	508.99
30.8	508.98
32.0	508.81
32.9	508.71
33.9	508.62
35.0	508.63
35.7	508.93
36.4	508.99
36.7	509.90
37.4	510.46
37.9	511.13
39.9	511.83
43.8	512.00
48.9	511.71
51.0	511.49
54.2	511.49
59.9	512.09
62.9	512.36

SUMMARY DATA	
Bankfull Elevation:	511.1
Bankfull Cross-Sectional Area:	15.5
Bankfull Width:	7.7
Flood Prone Area Elevation:	513.6
Flood Prone Width:	>63
Max Depth at Bankfull:	2.5
Mean Depth at Bankfull:	2.0
W / D Ratio:	3.8
Entrenchment Ratio:	>8.2
Bank Height Ratio:	1.2
Slope (ft/ft):	0.005
Discharge (cfs)	70

Stream Type:	E4



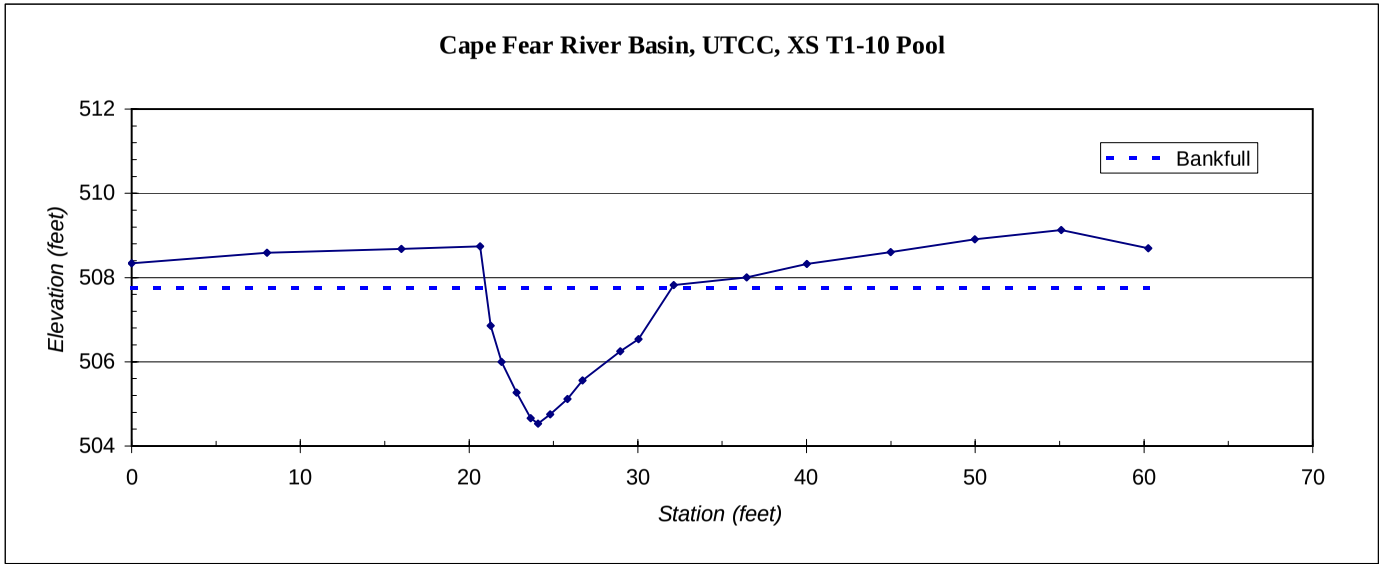
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1-10 Pool
Drainage Area (sq mi):	0.49
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

Station	Elevation
0.0	508.33
8.0	508.59
16.0	508.68
20.7	508.74
21.3	506.85
21.9	506.00
22.8	505.27
23.7	504.66
24.1	504.53
24.8	504.75
25.8	505.12
26.7	505.56
29.0	506.25
30.0	506.54
32.1	507.82
36.4	508.00
40.0	508.32
45.0	508.60
50.0	508.91
55.1	509.13
60.2	508.69

SUMMARY DATA	
Bankfull Elevation:	507.8
Bankfull Cross-Sectional Area:	21.2
Bankfull Width:	11.1
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	3.2
Mean Depth at Bankfull:	1.9
W / D Ratio:	5.8
Entrenchment Ratio:	-
Bank Height Ratio:	1.0
Slope (ft/ft):	0.005
Discharge (cfs)	-

Stream Type:	-



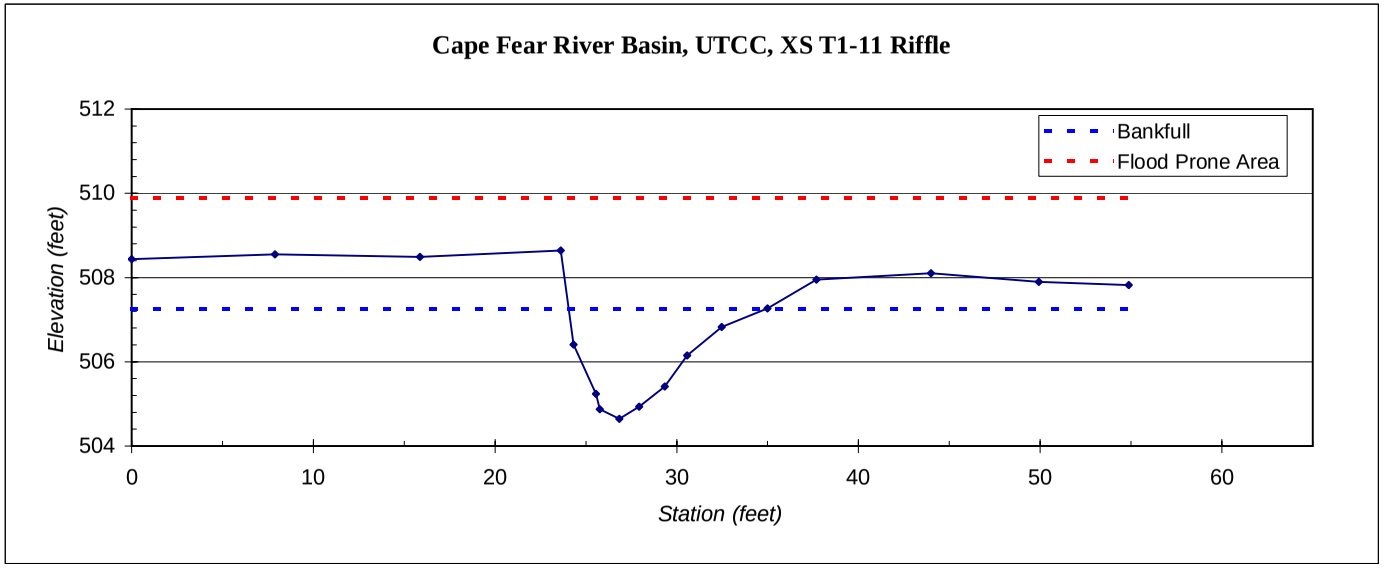
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1-11 Riffle
Drainage Area (sq mi):	0.49
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

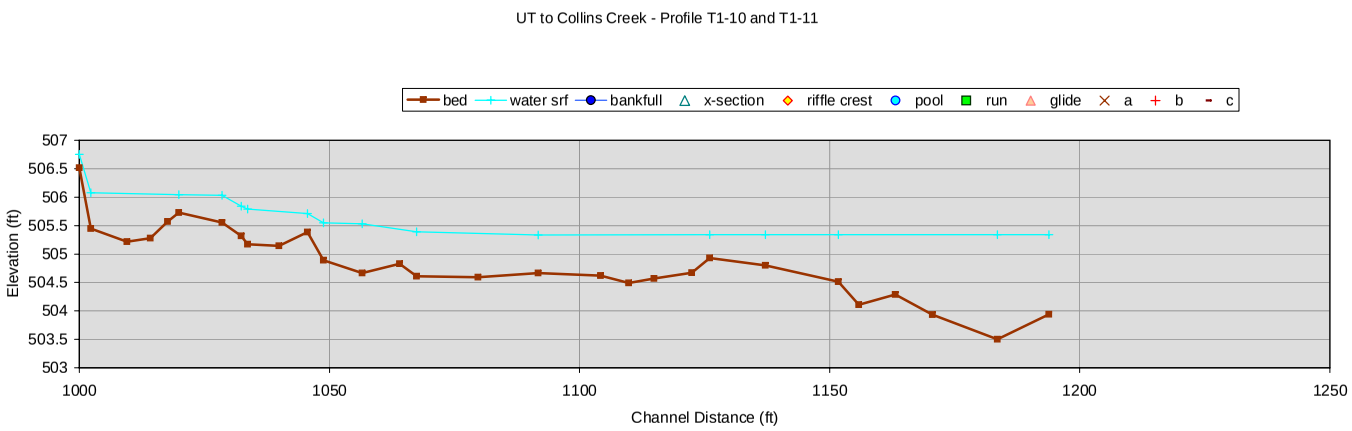
Station	Elevation
0.0	508.44
7.9	508.55
15.9	508.49
23.6	508.64
24.3	506.41
25.5	505.24
25.8	504.87
26.8	504.64
27.9	504.94
29.3	505.42
30.6	506.15
32.5	506.83
35.0	507.26
37.7	507.95
44.0	508.10
49.9	507.90
54.9	507.82

SUMMARY DATA	
Bankfull Elevation:	507.3
Bankfull Cross-Sectional Area:	14.5
Bankfull Width:	10.9
Flood Prone Area Elevation:	509.9
Flood Prone Width:	>55
Max Depth at Bankfull:	2.6
Mean Depth at Bankfull:	1.3
W / D Ratio:	8.2
Entrenchment Ratio:	>5.0
Bank Height Ratio:	1.3
Slope (ft/ft):	0.007
Discharge (cfs)	67

Stream Type:	E4



Longitudinal Profile



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	---	---	1193.8	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---
	---	---	---	---	---	---

notes	cross section ID	bed feature	BkF channel centerline easting (ft)	BkF channel centerline northing (ft)	BkF channel centerline station	BkF channel centerline ELEV centerline	ELEV thalwag	ELEV water	ELEV bankfull	user defined ELEV a	user defined ELEV b	user defined ELEV c
BDRK					1000.00	506.52		506.75				
BDRK					1002.30	505.45		506.08				
BPO					1009.54	505.22						
PO					1014.19	505.28						
EPO					1017.66	505.57						
STEP					1019.91	505.73		506.04				
STEP=BLDR					1028.54	505.55		506.03				
STEP					1032.40	505.32		505.84				
END_STEP					1033.63	505.17		505.79				
TW					1039.90	505.14						
BEG_DEBRIS					1045.59	505.39		505.71				
TW=DEBRIS					1048.80	504.89		505.55				
TW					1056.57	504.67		505.53				
TW					1064.02	504.83						
TW=END DEBRIS					1067.40	504.61		505.39				
TH					1079.71	504.59						
TW					1091.75	504.67		505.34				
TW					1104.23	504.62						
BPO					1109.86	504.49						
PO					1114.90	504.57						
EPO					1122.45	504.67						
TW					1126.05	504.93		505.34				
TW					1137.12	504.80		505.34				
BPO					1151.71	504.51		505.34				
PO					1155.86	504.11						
EPO					1163.16	504.29						
TW					1170.56	503.93						
TW					1183.50	503.50		505.34				
TW					1193.84	503.94		505.34				

Riffle Pebble Count

Riffle Pebble Count,

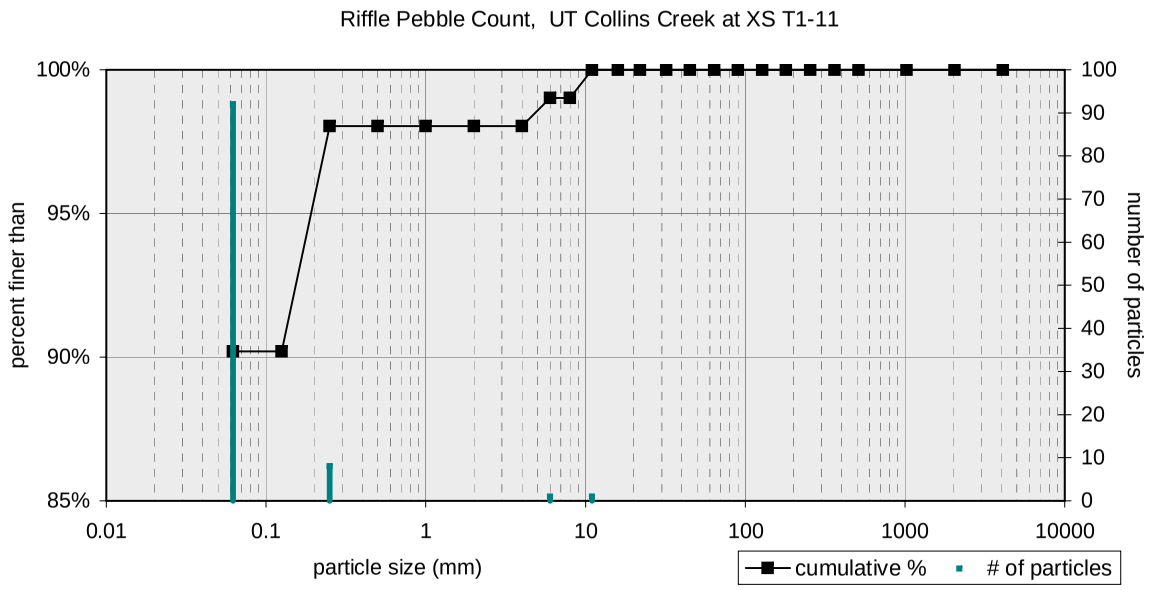
Material	Size Range (mm)		Count
silt/clay	0	0.062	**92**
very fine sand	0.062	0.13	
fine sand	0.13	0.25	**8**
medium sand	0.25	0.5	
coarse sand	0.5	1	
very coarse sand	1	2	
very fine gravel	2	4	
fine gravel	4	6	**1**
fine gravel	6	8	
medium gravel	8	11	**1**
medium gravel	11	16	
coarse gravel	16	22	
coarse gravel	22	32	
very coarse gravel	32	45	
very coarse gravel	45	64	
small cobble	64	90	
medium cobble	90	128	
large cobble	128	180	
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		102

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	102

UT Collins Creek at XS T1-11

Collins Creek- Cape Fear River

Note: **Riffle Pebble Count**



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	0.06	0.1	0	0	0	1.0	0.1	1.0

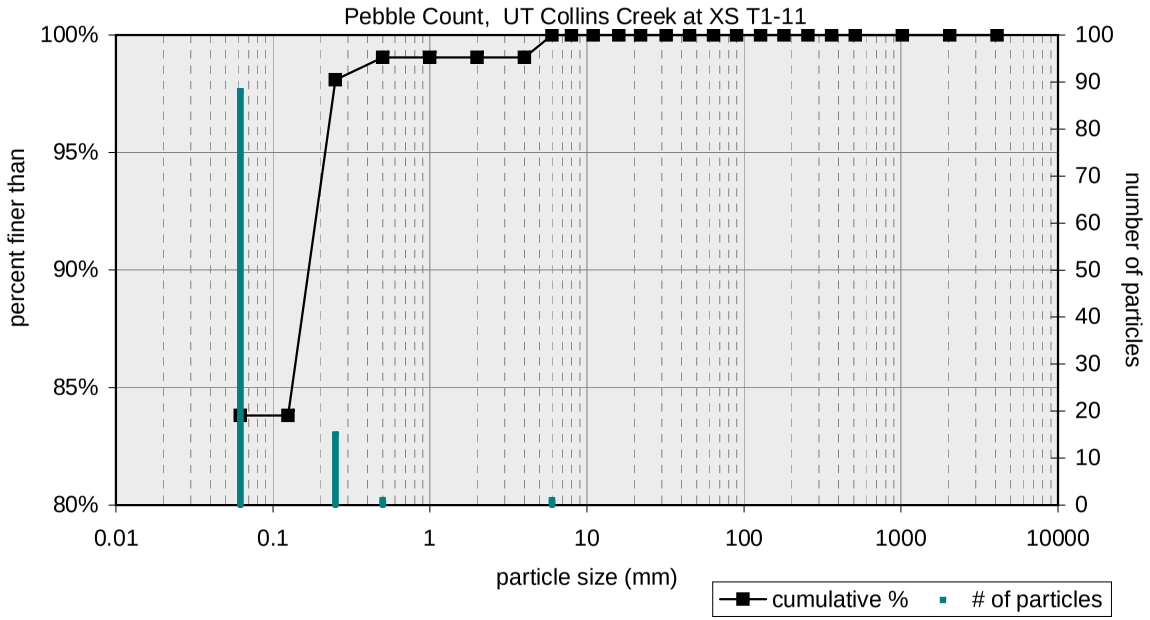
based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	90%	8%	2%	0%	0%	0%	0%	0%	0%

Pebble Count of Channel Reach

Pebble Count,
UT Collins Creek at XS T1-11
Collins Creek- Cape Fear River

Note: **Reach Pebble Count**

Material	Size Range (mm)		Count
silt/clay	0	0.062	**88**
very fine sand	0.062	0.13	
fine sand	0.13	0.25	**15**
medium sand	0.25	0.5	**1**
coarse sand	0.5	1	
very coarse sand	1	2	
very fine gravel	2	4	
fine gravel	4	6	**1**
fine gravel	6	8	
medium gravel	8	11	
medium gravel	11	16	
coarse gravel	16	22	
coarse gravel	22	32	
very coarse gravel	32	45	
very coarse gravel	45	64	
small cobble	64	90	
medium cobble	90	128	
large cobble	128	180	
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		105



bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	105

based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	0.06	0.1	0	0	0	1.5	0.1	1.4

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	84%	15%	1%	0%	0%	0%	0%	0%	0%

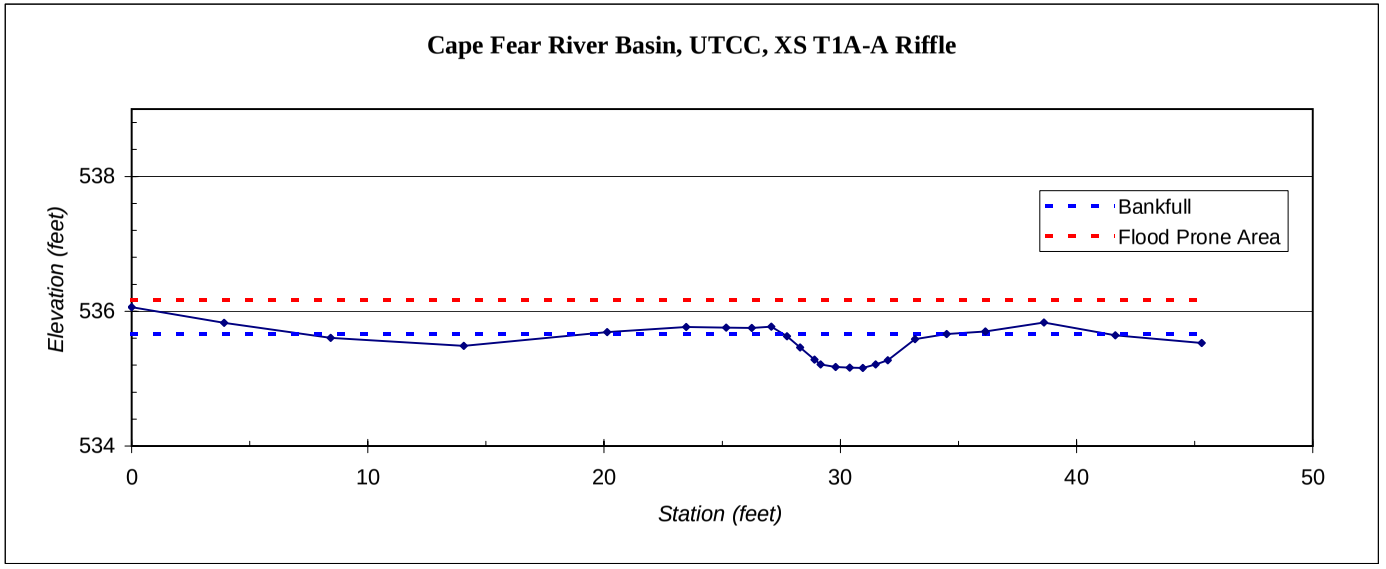
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1A-A Riffle
Drainage Area (sq mi):	0.045
Date:	April 2007
Field Crew:	Knight, Roberts, Helms

Station	Elevation
0.0	536.06
3.9	535.83
8.4	535.60
14.1	535.49
20.1	535.69
23.5	535.77
25.2	535.76
26.3	535.75
27.1	535.77
27.7	535.63
28.3	535.46
28.9	535.28
29.2	535.21
29.8	535.17
30.4	535.16
31.0	535.16
31.5	535.21
32.0	535.27
33.2	535.59
34.5	535.66
36.1	535.70
38.6	535.83
41.6	535.64
45.3	535.53

SUMMARY DATA	
Bankfull Elevation:	535.7
Bankfull Cross-Sectional Area:	2.0
Bankfull Width:	6.8
Flood Prone Area Elevation:	536.2
Flood Prone Width:	45.0
Max Depth at Bankfull:	0.5
Mean Depth at Bankfull:	0.3
W / D Ratio:	23.1
Entrenchment Ratio:	6.6
Bank Height Ratio:	4.6
Slope (ft/ft):	0.017
Discharge (cfs)	6

Stream Type:	C4



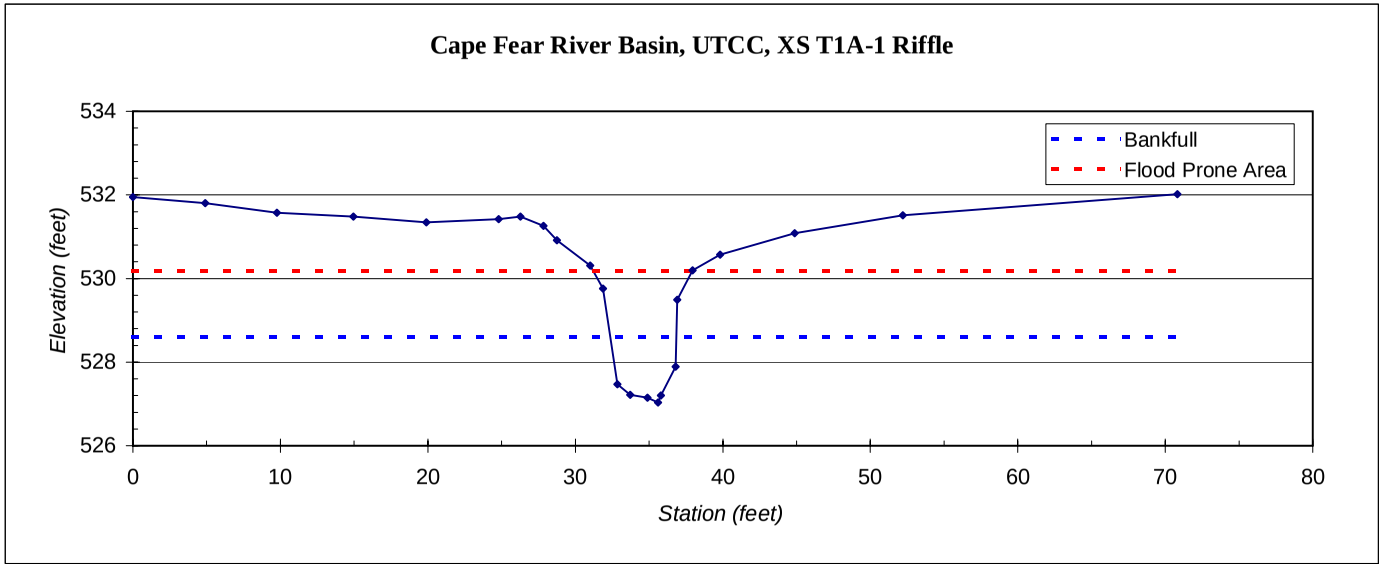
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1A-1 Riffle
Drainage Area (sq mi):	0.045
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

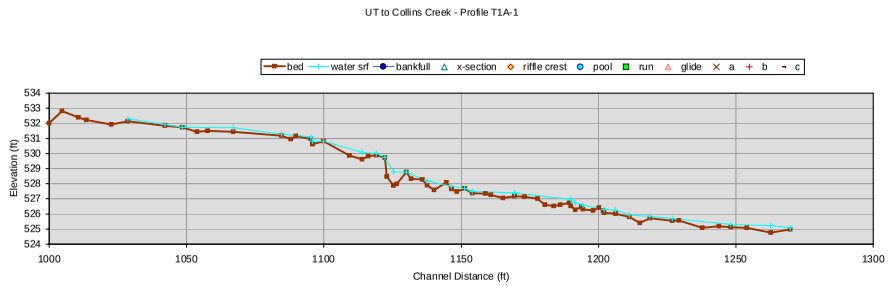
Station	Elevation
0.0	531.94
4.9	531.80
9.8	531.57
15.0	531.48
19.9	531.34
24.8	531.42
26.3	531.48
27.8	531.26
28.8	530.92
31.0	530.31
31.9	529.76
32.8	527.47
33.7	527.22
34.9	527.15
35.6	527.03
35.8	527.20
36.8	527.89
36.9	529.49
38.0	530.19
39.8	530.57
44.9	531.08
52.2	531.51
70.8	532.02

SUMMARY DATA	
Bankfull Elevation:	528.6
Bankfull Cross-Sectional Area:	5.5
Bankfull Width:	4.5
Flood Prone Area Elevation:	530.2
Flood Prone Width:	6.7
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	1.2
W / D Ratio:	3.6
Entrenchment Ratio:	1.5
Bank Height Ratio:	2.3
Slope (ft/ft):	0.021
Discharge (cfs)	36

Stream Type:	G4



Longitudinal Profile



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	---	---	1269.9	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---
	---	---	---	---	---	---

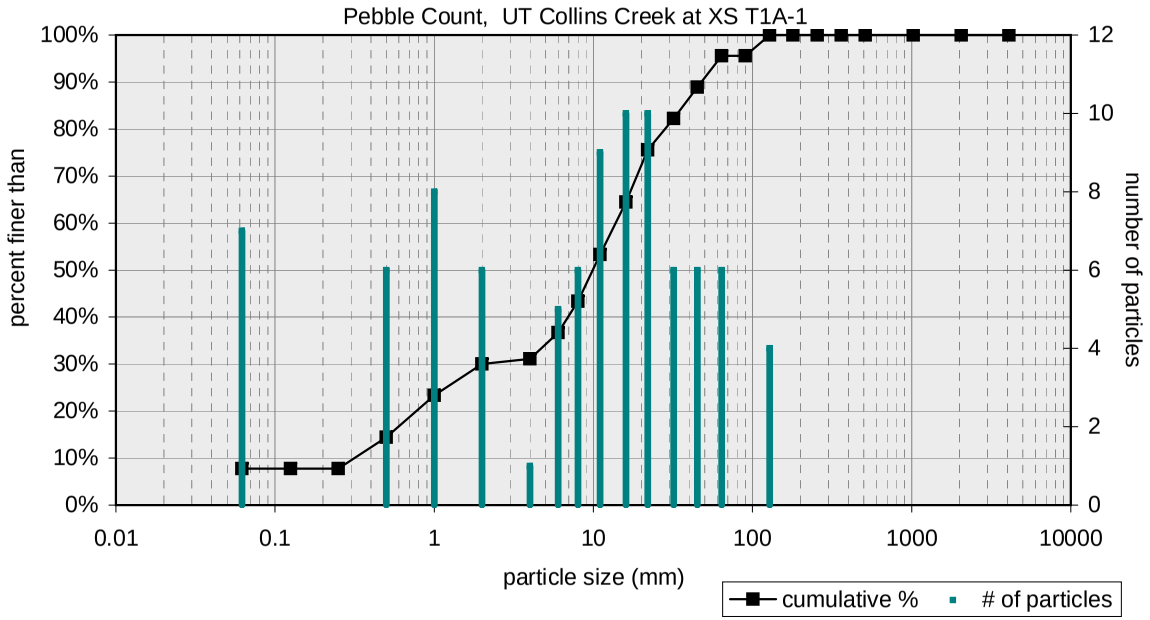
notes	cross section ID	bed feature	BkF channel centerline easting (ft)	northing (ft)	station	ELEV centerline	ELEV thalwag	ELEV water	ELEV bankfull	user defined ELEV a	ELEV b	ELEV c
PIPE INV					1000.00	532.01						
DEBRIS					1004.67	532.82						
					1010.64	532.40						
					1013.47	532.23						
BPO					1022.66	531.93						
BRI					1028.66	532.14		532.30				
RI					1042.19	531.84		531.93				
ERI					1048.41	531.74		531.74				
PO					1053.88	531.44						
EPO					1057.64	531.49						
BRI					1067.04	531.44		531.70				
ERI					1084.58	531.18		531.30				
PO					1087.96	530.96						
					1089.81	531.16						
THC					1095.31	530.94		531.11				
BOTHC					1095.92	530.60		530.82				
TRI=WS					1099.80	530.82		530.82				
BRI					1109.26	529.87						
PO					1113.92	529.60		530.08				
EPO					1116.12	529.82						
BRI					1119.06	529.89		529.99				
ERI=THC					1122.17	529.71		529.75				
BHC					1122.97	528.47						
PO					1125.41	527.87		528.79				
EPO					1126.56	527.97						
BRI=WS					1130.07	528.77		528.77				
ERI=HC					1131.82	528.33						
THC					1135.83	528.27						
BHC					1137.61	527.91		528.20				
PO					1140.14	527.57						
BRI=THC					1144.59	528.08						
ERI=BHC					1146.42	527.64		527.83				
PO					1148.40	527.48						
TRI=WS					1151.17	527.68		527.68				
ERI					1153.96	527.37		527.50				
					1158.78	527.36						
					1160.78	527.26						
PO					1165.17	527.05						
BRI					1169.37	527.18		527.39				
RI					1173.04	527.13						
ERI					1177.78	527.01						
PO					1180.47	526.60						
PO					1183.73	526.51						
EPO					1186.03	526.61						
THC					1189.29	526.73						
BHC					1189.92	526.52		526.97				
					1191.54	526.26		526.73				
					1193.80	526.49						
					1194.31	526.30		526.58				
					1198.08	526.21						
THC					1200.15	526.42						
HC					1201.64	526.20						
BHC					1201.99	526.07		526.28				
BRI					1206.16	526.02		526.26				
ERI					1211.24	525.81		525.94				
PO					1215.09	525.41						
BRI					1218.72	525.71		525.85				
ERI					1226.79	525.55		525.70				
					1229.34	525.57						
					1237.82	525.08						
					1243.81	525.18						
					1248.15	525.11		525.31				
					1253.97	525.09						
					1262.74	524.76		525.22				
PO					1269.88	524.97		525.08				

Pebble Count of Channel Reach

Pebble Count,
UT Collins Creek at XS T1A-1
Collins Creek- Cape Fear River

Note: **Reach Pebble Count**

Material	Size Range (mm)		Count
silt/clay	0	0.062	**7**
very fine sand	0.062	0.13	
fine sand	0.13	0.25	
medium sand	0.25	0.5	**6**
coarse sand	0.5	1	**8**
very coarse sand	1	2	**6**
very fine gravel	2	4	**1**
fine gravel	4	6	**5**
fine gravel	6	8	**6**
medium gravel	8	11	**9**
medium gravel	11	16	**10**
coarse gravel	16	22	**10**
coarse gravel	22	32	**6**
very coarse gravel	32	45	**6**
very coarse gravel	45	64	**6**
small cobble	64	90	
medium cobble	90	128	**4**
large cobble	128	180	
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		90



bedrock			**14**
clay hardpan			
detritus/wood			
artificial			
	total count:		104

based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.564	5.31	9.9	16	35	62	10.5	4.4	7.9

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	7%	19%	57%	4%	0%	13%	0%	0%	0%

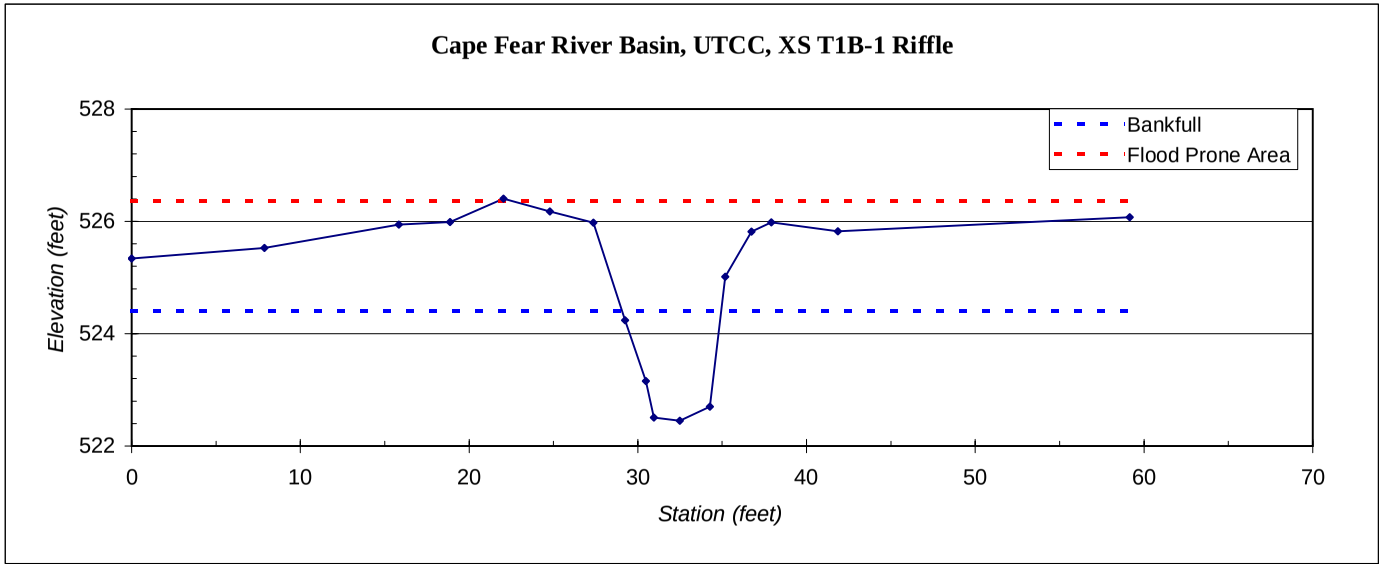
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1B-1 Riffle
Drainage Area (sq mi):	0.24
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

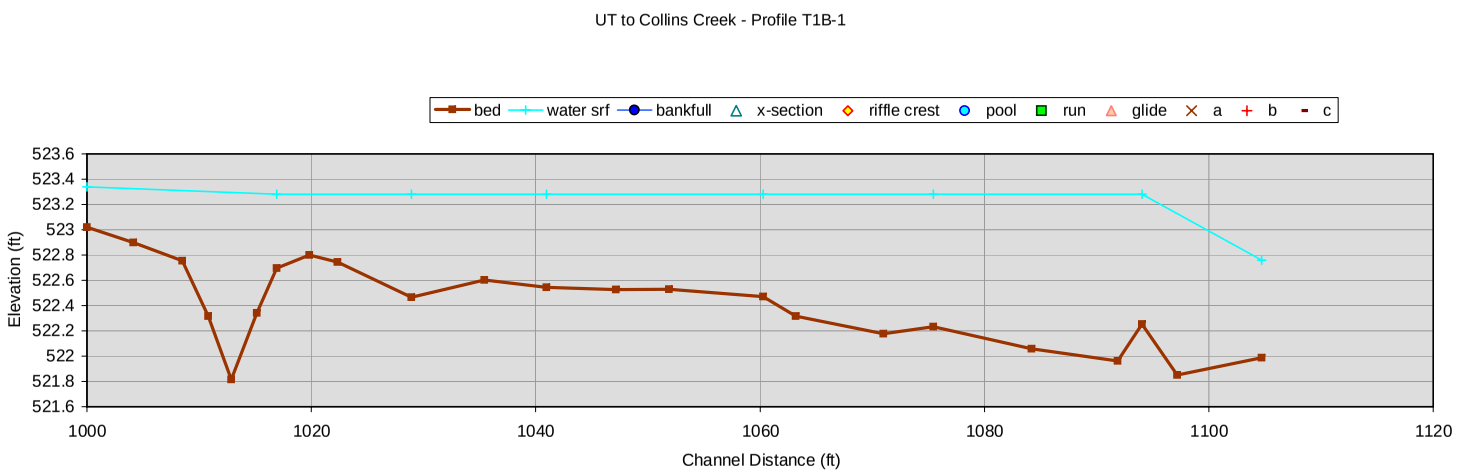
Station	Elevation
0.0	525.34
7.9	525.53
15.8	525.94
18.9	525.99
22.0	526.40
24.8	526.18
27.4	525.98
29.2	524.24
30.5	523.16
30.9	522.51
32.5	522.45
34.3	522.70
35.2	525.01
36.7	525.82
37.9	525.98
41.9	525.82
59.1	526.08

SUMMARY DATA	
Bankfull Elevation:	524.4
Bankfull Cross-Sectional Area:	8.4
Bankfull Width:	5.9
Flood Prone Area Elevation:	526.4
Flood Prone Width:	>40
Max Depth at Bankfull:	2.0
Mean Depth at Bankfull:	1.4
W / D Ratio:	4.1
Entrenchment Ratio:	>6.8
Bank Height Ratio:	1.7
Slope (ft/ft):	0.006
Discharge (cfs)	32

Stream Type:	E4



Longitudinal Profile



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	---	---	1104.7	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---
	---	---	---	---	---	---

notes	cross section ID	bed feature	BkF channel centerline easting (ft)	BkF channel centerline northing (ft)	station	ELEV centerline	ELEV thalwag	ELEV water	ELEV bankfull	user defined ELEV a	user defined ELEV b	user defined ELEV c
TW					1000.00	523.02		523.34				
TW					1004.14	522.90						
TW					1008.50	522.75						
BPO					1010.81	522.32						
PO					1012.87	521.82						
EPO					1015.16	522.34						
BRI					1016.91	522.70		523.28				
RI					1019.83	522.80						
ERI					1022.34	522.74						
TW					1028.92	522.47		523.28				
TW					1035.43	522.60						
TW					1040.95	522.54		523.28				
TW					1047.16	522.53						
TW					1051.90	522.53						
TW					1060.28	522.47		523.28				
TW					1063.17	522.32						
TW					1071.01	522.18						
TW					1075.43	522.23		523.28				
TW					1084.21	522.06						
TW					1091.86	521.96						
TW=DEBRIS_BLO					1094.04	522.25		523.28				
END_DEBRIS					1097.19	521.85						
TW					1104.70	521.99		522.76				

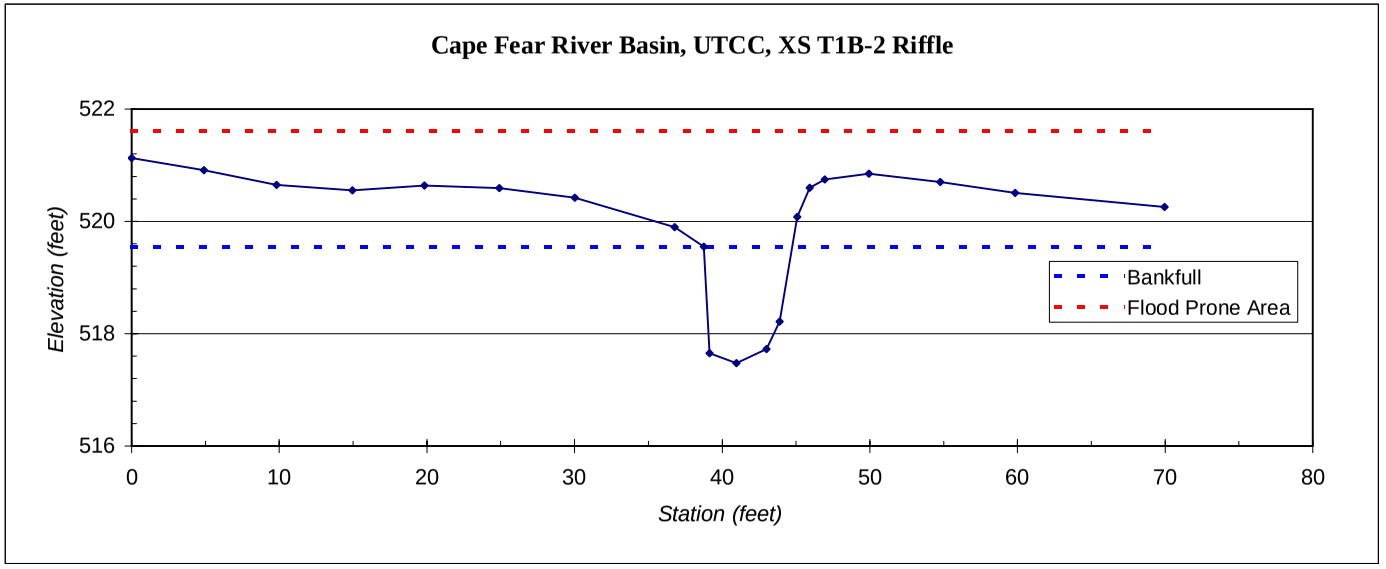
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T1B-2 Riffle
Drainage Area (sq mi):	0.24
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

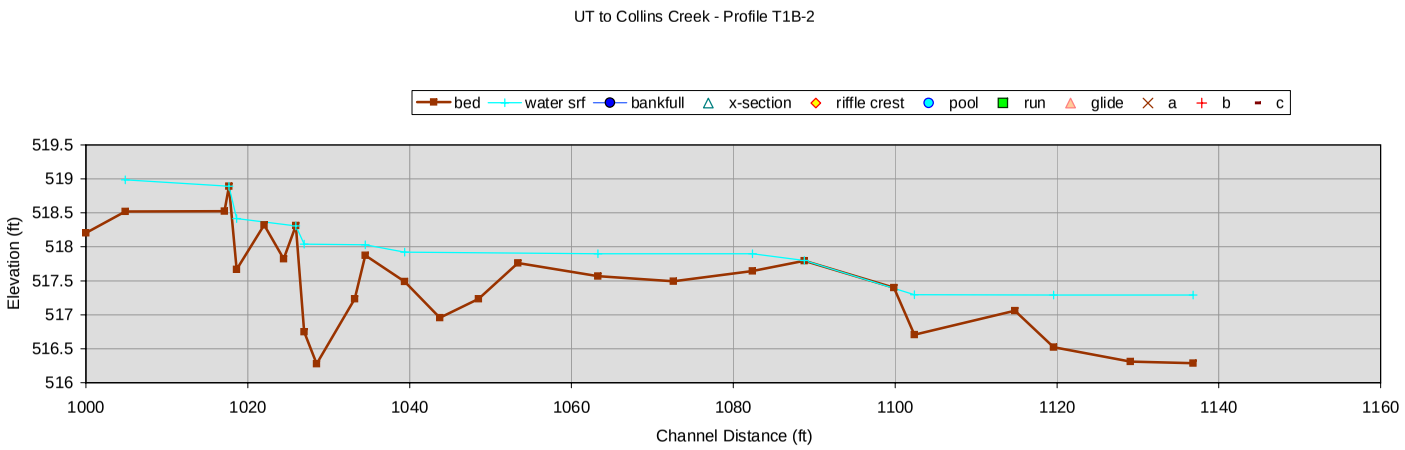
Station	Elevation
0.0	521.13
4.9	520.91
9.8	520.65
14.9	520.55
19.8	520.64
24.9	520.59
30.0	520.42
36.8	519.90
38.7	519.55
39.1	517.65
41.0	517.48
43.0	517.73
43.9	518.21
45.1	520.08
45.9	520.60
46.9	520.75
49.9	520.85
54.8	520.70
59.8	520.51
70.0	520.25

SUMMARY DATA	
Bankfull Elevation:	519.5
Bankfull Cross-Sectional Area:	9.9
Bankfull Width:	6.0
Flood Prone Area Elevation:	521.6
Flood Prone Width:	>70
Max Depth at Bankfull:	2.1
Mean Depth at Bankfull:	1.7
W / D Ratio:	3.6
Entrenchment Ratio:	>11.7
Bank Height Ratio:	1.0
Slope (ft/ft):	0.008
Discharge (cfs)	48

Stream Type:	E4



Longitudinal Profile



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	---	---	1136.8	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---
	---	---	---	---	---	---

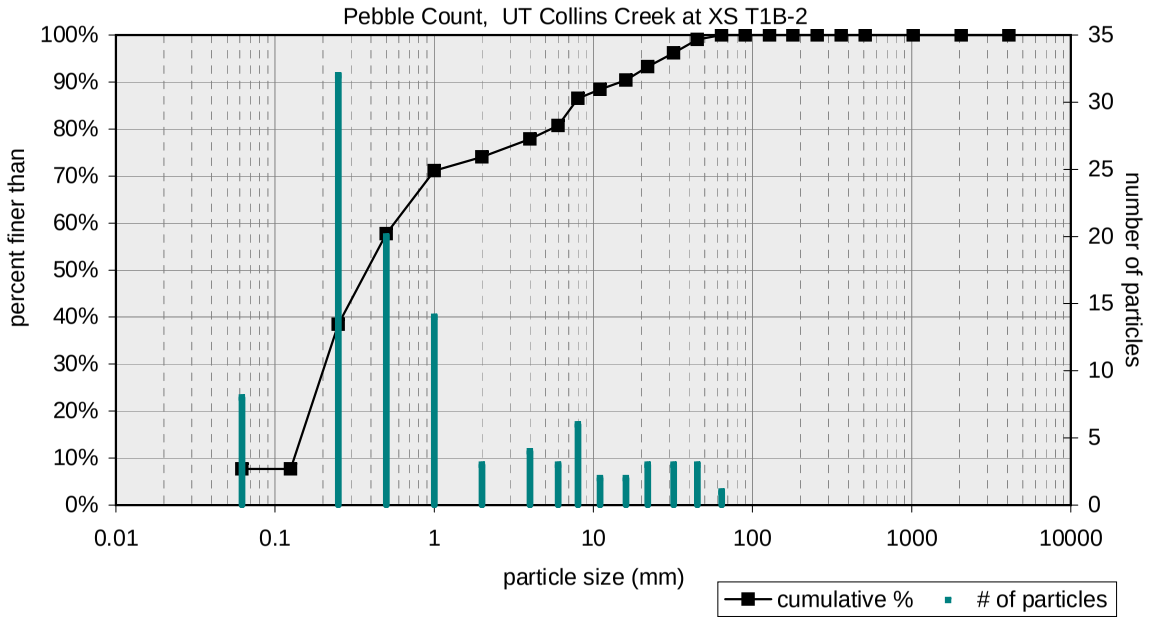
notes	cross section ID	bed feature	BkF channel centerline easting (ft)	BkF channel centerline northing (ft)	station	ELEV centerline	ELEV thalwag	ELEV water	ELEV bankfull	user defined ELEV a	user defined ELEV b	user defined ELEV c
TW_BGL					1000.00	518.20						
TW					1004.87	518.52		518.98				
TW					1017.11	518.53						
BHC=WS					1017.67	518.89		518.89				
EHC					1018.62	517.67		518.42				
WS=BLK					1022.04	518.32						
TW					1024.44	517.82						
HC=WS					1025.94	518.31		518.31				
EHC					1026.95	516.75		518.04				
PO					1028.51	516.28						
EPO					1033.22	517.23						
TW					1034.52	517.88		518.03				
BPO					1039.37	517.49		517.92				
PO					1043.72	516.95						
EPO					1048.51	517.23						
TW					1053.39	517.76						
TW					1063.29	517.57		517.90				
TW					1072.61	517.49						
TW					1082.36	517.64		517.90				
TW_WS					1088.80	517.80		517.80				
BHC					1099.87	517.40						
EHC					1102.37	516.71		517.29				
TW					1114.82	517.06						
TW					1119.58	516.52		517.29				
TW					1129.08	516.31						
TW					1136.81	516.29		517.29				

Pebble Count of Channel Reach

Pebble Count,
UT Collins Creek at XS T1B-2
Collins Creek- Cape Fear River

Note: **Reach Pebble Count**

Material	Size Range (mm)		Count
silt/clay	0	0.062	**8**
very fine sand	0.062	0.13	
fine sand	0.13	0.25	**32**
medium sand	0.25	0.5	**20**
coarse sand	0.5	1	**14**
very coarse sand	1	2	**3**
very fine gravel	2	4	**4**
fine gravel	4	6	**3**
fine gravel	6	8	**6**
medium gravel	8	11	**2**
medium gravel	11	16	**2**
coarse gravel	16	22	**3**
coarse gravel	22	32	**3**
very coarse gravel	32	45	**3**
very coarse gravel	45	64	**1**
small cobble	64	90	
medium cobble	90	128	
large cobble	128	180	
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		104



bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	104

based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.151	0.23	0.4	1	7	28	10.6	1.0	6.8

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	8%	66%	26%	0%	0%	0%	0%	0%	0%

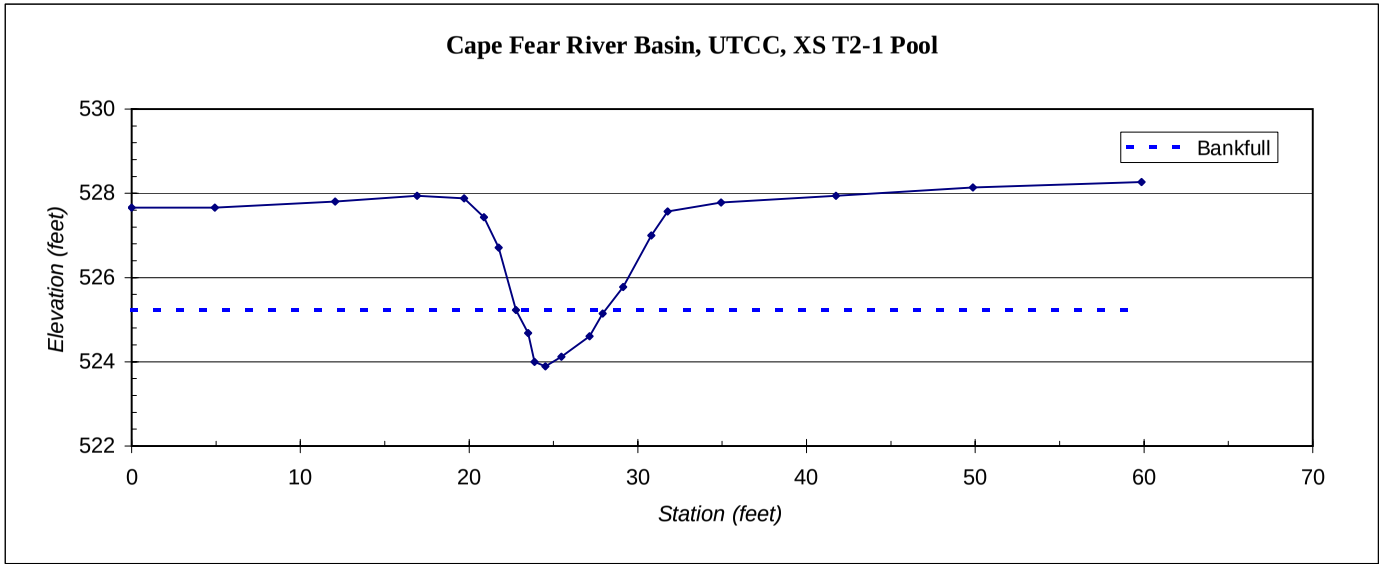
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T2-1 Pool
Drainage Area (sq mi):	0.07
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

Station	Elevation
0.0	527.66
4.9	527.66
12.1	527.80
16.9	527.94
19.7	527.88
20.9	527.43
21.8	526.71
22.8	525.23
23.5	524.68
23.9	524.00
24.5	523.89
25.5	524.12
27.1	524.60
27.9	525.14
29.1	525.78
30.8	527.00
31.8	527.57
34.9	527.78
41.7	527.94
49.9	528.14
59.9	528.27

SUMMARY DATA	
Bankfull Elevation:	525.2
Bankfull Cross-Sectional Area:	4.3
Bankfull Width:	5.3
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.3
Mean Depth at Bankfull:	0.8
W / D Ratio:	6.6
Entrenchment Ratio:	-
Bank Height Ratio:	2.7
Slope (ft/ft):	0.006
Discharge (cfs)	-

Stream Type:	-



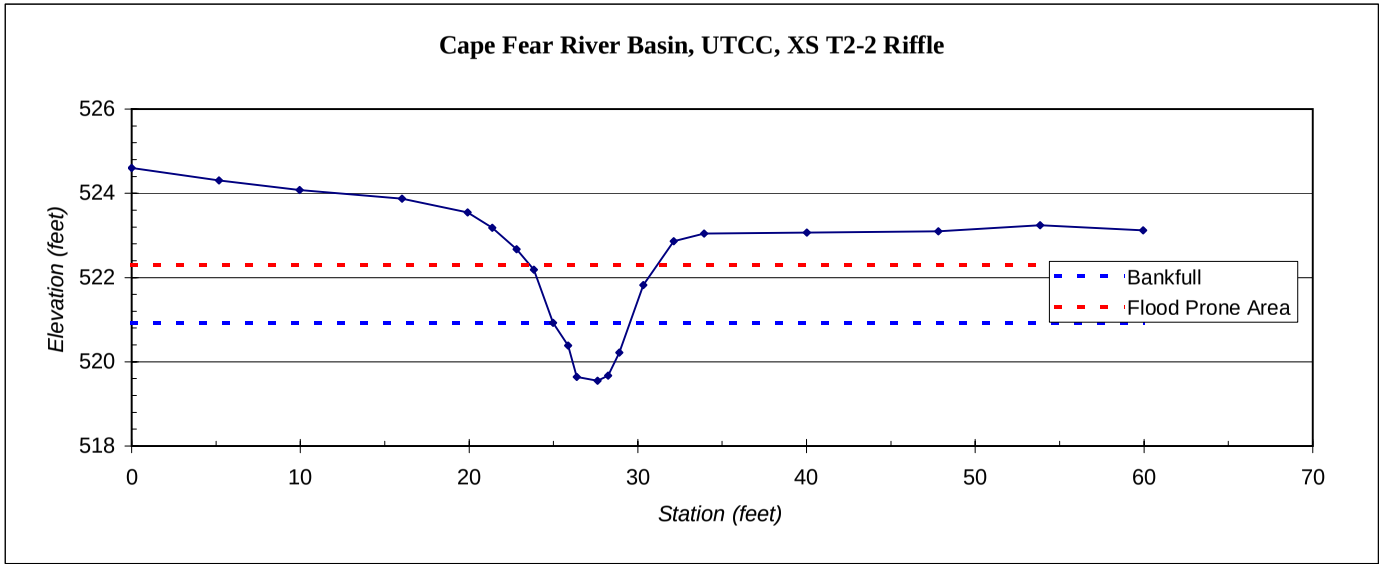
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T2-2 Riffle
Drainage Area (sq mi):	0.07
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

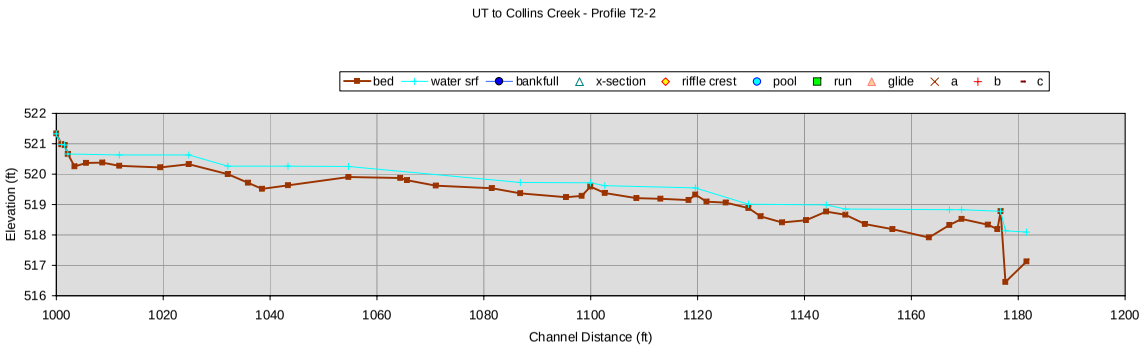
Station	Elevation
0.0	524.60
5.2	524.31
10.0	524.08
16.0	523.87
19.9	523.54
21.4	523.18
22.8	522.67
23.8	522.19
25.0	520.92
25.9	520.39
26.4	519.64
27.6	519.55
28.2	519.67
28.9	520.22
30.3	521.82
32.1	522.86
33.9	523.05
40.0	523.07
47.8	523.10
53.8	523.24
60.0	523.12

SUMMARY DATA	
Bankfull Elevation:	520.9
Bankfull Cross-Sectional Area:	4.0
Bankfull Width:	4.6
Flood Prone Area Elevation:	522.3
Flood Prone Width:	7.5
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	0.9
W / D Ratio:	5.2
Entrenchment Ratio:	1.6
Bank Height Ratio:	2.4
Slope (ft/ft):	0.018
Discharge (cfs)	18

Stream Type:	G4c



Longitudinal Profile



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	---	---	1181.6	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---
	---	---	---	---	---	---

notes	cross section ID	bed feature	BkF channel centerline easting (ft)	BkF channel centerline northing (ft)	BkF channel centerline station	BkF channel centerline ELEV centerline	ELEV thalwag	water	ELEV bankfull	user defined ELEV a	user defined ELEV b	user defined ELEV c
BDRK-STEP=WS					1000.00	521.33		521.33				
BDRK-STEP=WS					1000.94	520.98		520.98				
BDRK-STEP=WS					1001.54	520.96		520.96				
BDRK-STEP=WS					1002.17	520.66		520.66				
BPO					1003.40	520.26						
PO					1005.54	520.37						
PO=BEGDEBRIS					1008.61	520.38						
EPO=END DEBRIS					1011.77	520.27		520.64				
TW					1019.45	520.22						
BRI					1024.78	520.32		520.63				
ERI					1032.09	520.00		520.26				
BOP					1035.85	519.71						
PO					1038.48	519.51						
EPO					1043.35	519.63		520.26				
BRI					1054.69	519.90		520.25				
RI					1064.39	519.88						
RI					1065.65	519.80						
RI					1070.99	519.62						
RI					1081.52	519.54						
ERI					1086.85	519.37		519.73				
TW					1095.41	519.25						
TW					1098.34	519.29						
BRI					1099.96	519.59		519.72				
ERI					1102.63	519.38		519.62				
TW					1108.57	519.21						
TW					1113.08	519.19						
TW					1118.32	519.15						
BRI					1119.60	519.33		519.55				
RI					1121.68	519.10						
RI					1125.25	519.06						
ERI					1129.54	518.88		519.01				
BPO					1131.78	518.61						
PO					1135.82	518.41						
EPO					1140.27	518.48						
BRI					1144.07	518.77		518.99				
ERI					1147.68	518.66		518.86				
BPO					1151.31	518.36						
PO					1156.48	518.19						
PO					1163.31	517.91						
EPO					1167.15	518.32		518.83				
TW					1169.41	518.52		518.83				
TW					1174.30	518.34						
TW					1176.10	518.19						
TLOG=WS=HC					1176.69	518.78		518.78				
BHC					1177.59	516.46		518.14				
CLXCL=EHCPO					1181.55	517.12		518.09				

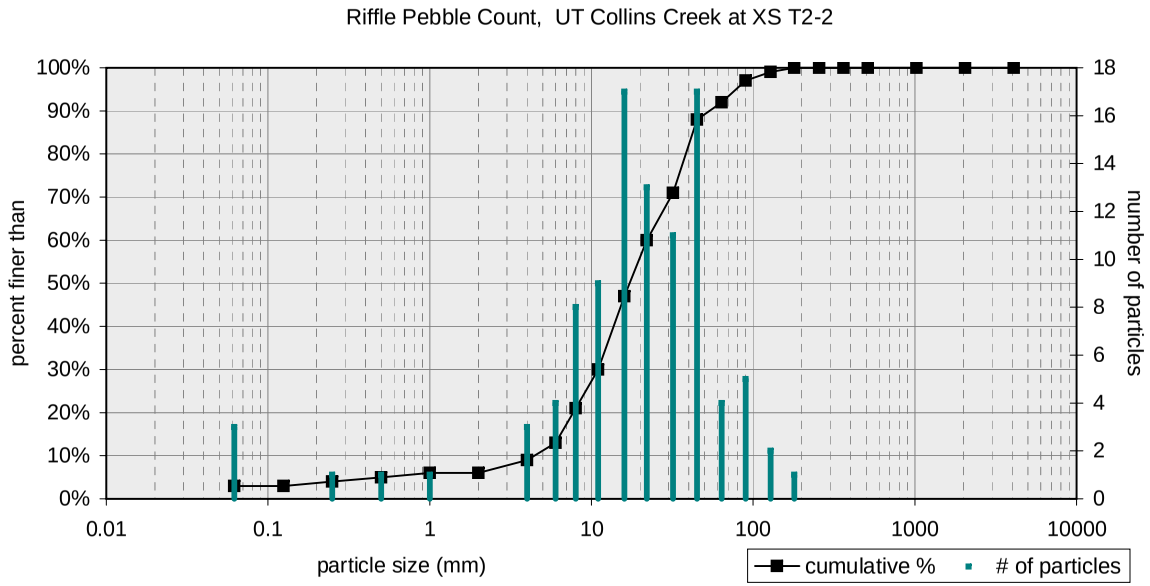
Riffle Pebble Count Riffle Pebble Count,

Material	Size Range (mm)		Count
silt/clay	0	0.062	**3**
very fine sand	0.062	0.13	
fine sand	0.13	0.25	**1**
medium sand	0.25	0.5	**1**
coarse sand	0.5	1	**1**
very coarse sand	1	2	
very fine gravel	2	4	**3**
fine gravel	4	6	**4**
fine gravel	6	8	**8**
medium gravel	8	11	**9**
medium gravel	11	16	**17**
coarse gravel	16	22	**13**
coarse gravel	22	32	**11**
very coarse gravel	32	45	**17**
very coarse gravel	45	64	**4**
small cobble	64	90	**5**
medium cobble	90	128	**2**
large cobble	128	180	**1**
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		100

bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		100

UT Collins Creek at XS T2-2
Collins Creek- Cape Fear River

Note: **Riffle Pebble Count**



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	6.683	12.28	17.2	26	42	79	2.5	16.7	2.5

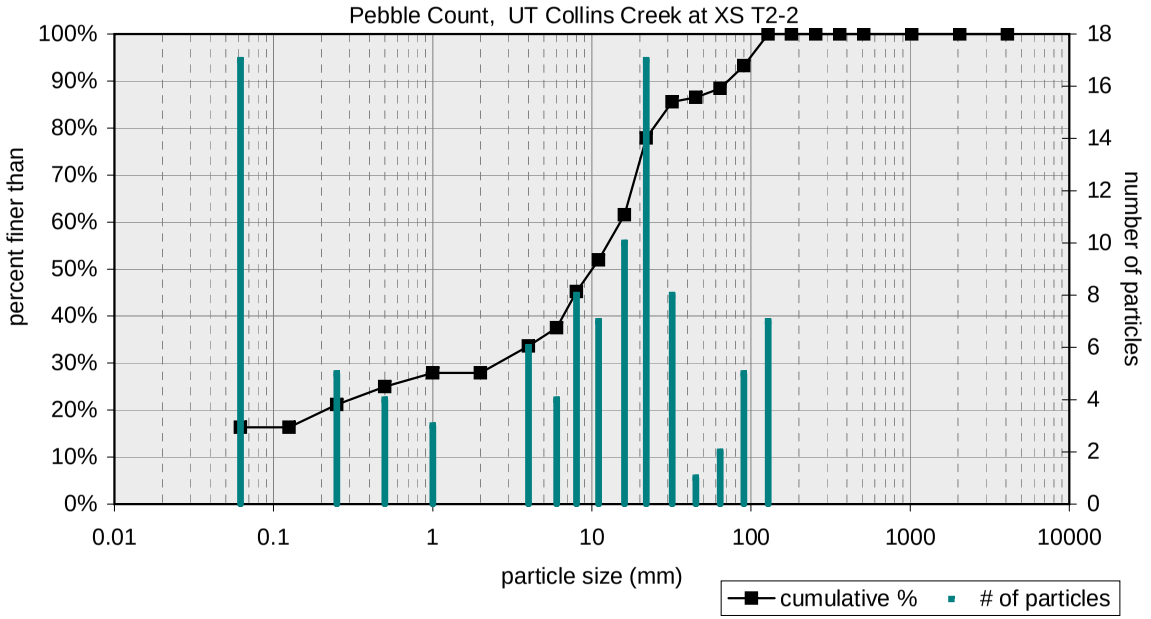
based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	3%	3%	86%	8%	0%	0%	0%	0%	0%

Pebble Count of Channel Reach

Pebble Count,
UT Collins Creek at XS T2-2
Collins Creek- Cape Fear River

Note: **Reach Pebble Count**

Material	Size Range (mm)		Count
silt/clay	0	0.062	**17**
very fine sand	0.062	0.13	
fine sand	0.13	0.25	**5**
medium sand	0.25	0.5	**4**
coarse sand	0.5	1	**3**
very coarse sand	1	2	
very fine gravel	2	4	**6**
fine gravel	4	6	**4**
fine gravel	6	8	**8**
medium gravel	8	11	**7**
medium gravel	11	16	**10**
coarse gravel	16	22	**17**
coarse gravel	22	32	**8**
very coarse gravel	32	45	**1**
very coarse gravel	45	64	**2**
small cobble	64	90	**5**
medium cobble	90	128	**7**
large cobble	128	180	
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		104



bedrock			
clay hardpan			
detritus/wood			
artificial			
	total count:		104

based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	4.61	10.0	17	30	99	82.5	1.4	21.9

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	16%	12%	61%	12%	0%	0%	0%	0%	0%

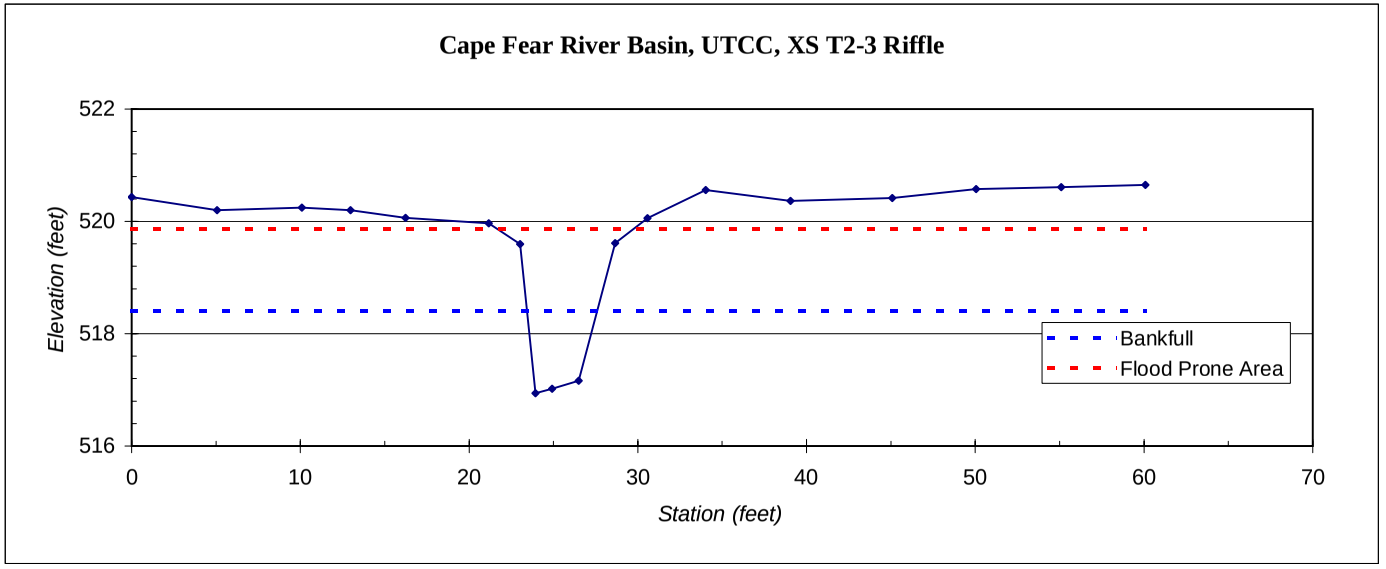
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T2-3 Riffle
Drainage Area (sq mi):	0.07
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

Station	Elevation
0.0	520.43
5.1	520.20
10.1	520.24
13.0	520.20
16.2	520.06
21.2	519.97
23.0	519.59
23.9	516.94
24.9	517.02
26.5	517.16
28.7	519.61
30.6	520.05
34.0	520.56
39.0	520.37
45.1	520.42
50.1	520.58
55.1	520.61
60.1	520.65

SUMMARY DATA	
Bankfull Elevation:	518.4
Bankfull Cross-Sectional Area:	4.5
Bankfull Width:	4.2
Flood Prone Area Elevation:	519.9
Flood Prone Width:	8.0
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	1.1
W / D Ratio:	3.8
Entrenchment Ratio:	1.9
Bank Height Ratio:	2.1
Slope (ft/ft):	0.018
Discharge (cfs)	22

Stream Type:	E4



Riffle Pebble Count

Riffle Pebble Count,

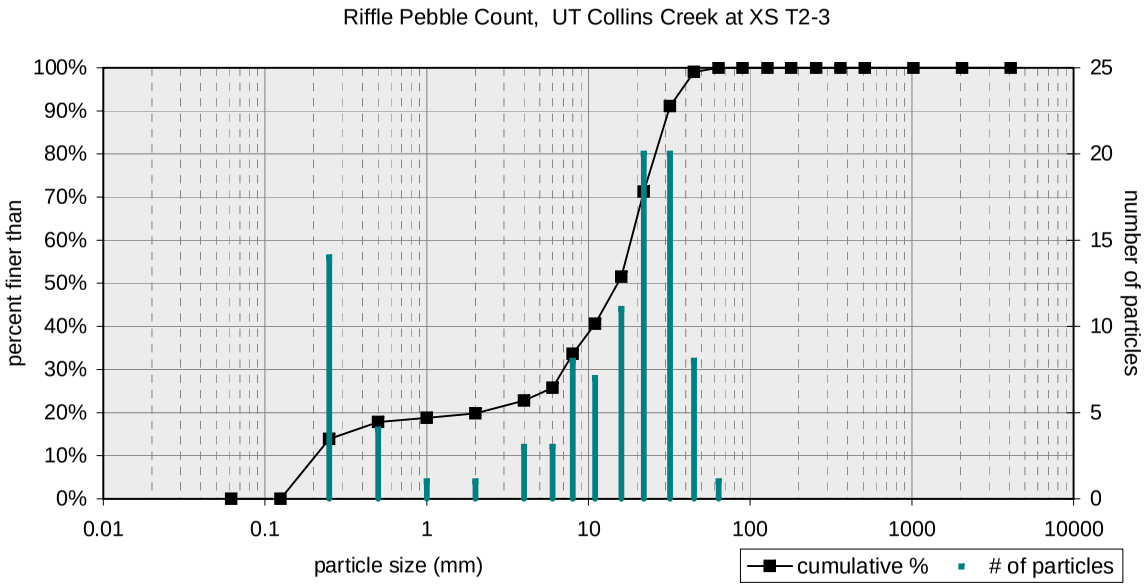
Material	Size Range (mm)		Count
silt/clay	0	0.062	
very fine sand	0.062	0.13	
fine sand	0.13	0.25	**14**
medium sand	0.25	0.5	**4**
coarse sand	0.5	1	**1**
very coarse sand	1	2	**1**
very fine gravel	2	4	**3**
fine gravel	4	6	**3**
fine gravel	6	8	**8**
medium gravel	8	11	**7**
medium gravel	11	16	**11**
coarse gravel	16	22	**20**
coarse gravel	22	32	**20**
very coarse gravel	32	45	**8**
very coarse gravel	45	64	**1**
small cobble	64	90	
medium cobble	90	128	
large cobble	128	180	
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		101

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	101

UT Collins Creek at XS T2-3

Collins Creek- Cape Fear River

Note:



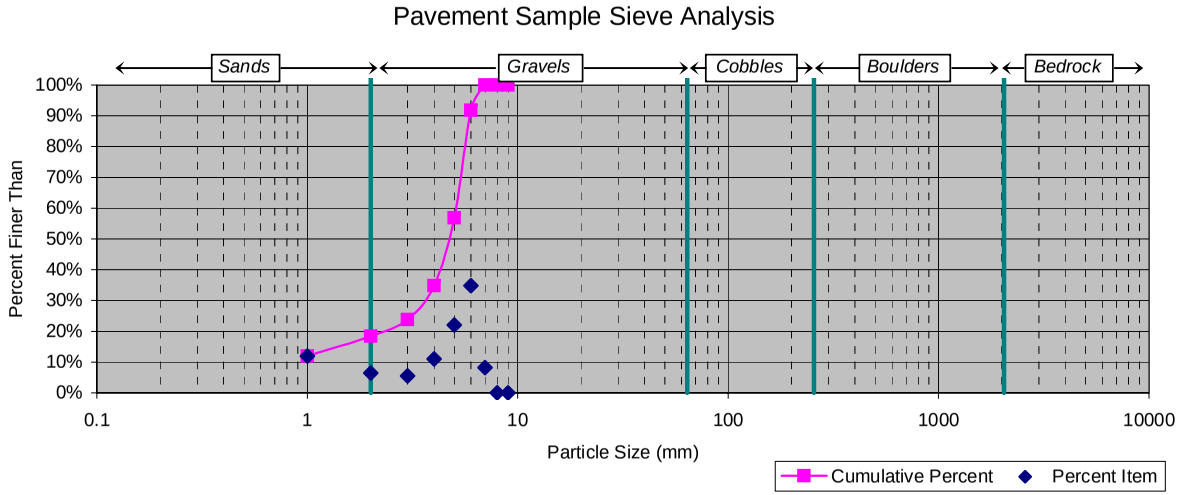
based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.363	8.51	15.2	20	28	38	21.8	3.2	8.8

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	20%	80%	0%	0%	0%	0%	0%	0%

Sample Sieve Analysis

Smallest Sieve Passed (mm)	Weight (oz)	% Item	Percent Finer Than
1.0	6.5	11.9%	11.9%
2.0	3.5	6.4%	18.3%
4.0	3.0	5.5%	23.9%
8.0	6.0	11.0%	34.9%
16.0	12.0	22.0%	56.9%
31.5	19.0	34.9%	91.7%
64.0	4.5	8.3%	100.0%
256.0	0.0	0.0%	100.0%
> 256.0	0.0	0.0%	100.0%
Total:	54.5	100%	

Stream:	Collins Creek - Pavement
Watershed:	Collins Creek - Cape Fear River
Location:	Pavement XS T2-3
Note:	

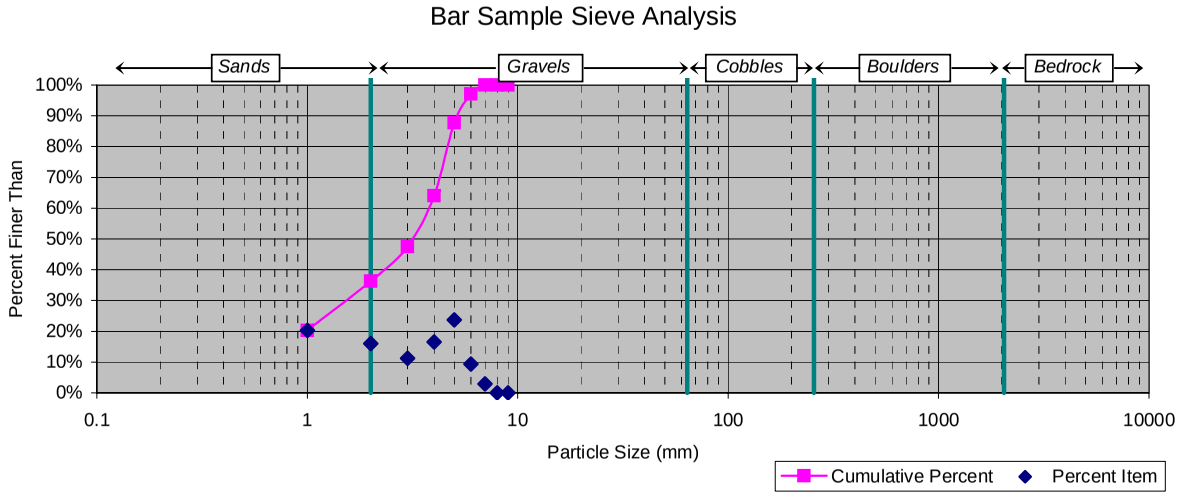


Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
1.6	8.0	12.9	27.1	41.7	0%	18%	82%	0%	---	---

Sample Sieve Analysis

Smallest Sieve Passed (mm)	Weight (oz)	% Item	Percent Finer Than
1.0	38	20.3%	20.3%
2.0	30.0	16.0%	36.3%
4.0	21.0	11.2%	47.5%
8.0	31.0	16.5%	64.0%
16.0	44.5	23.7%	87.7%
31.5	17.5	9.3%	97.1%
64.0	5.5	2.9%	100.0%
256.0	0.0	0.0%	100.0%
> 256.0	0.0	0.0%	100.0%
Total:	187.5	100%	

Stream:	Collins Creek - Sub-Pavement
Watershed:	Collins Creek - Cape Fear River
Location:	Sub-Pavement XS T2-3
Note:	

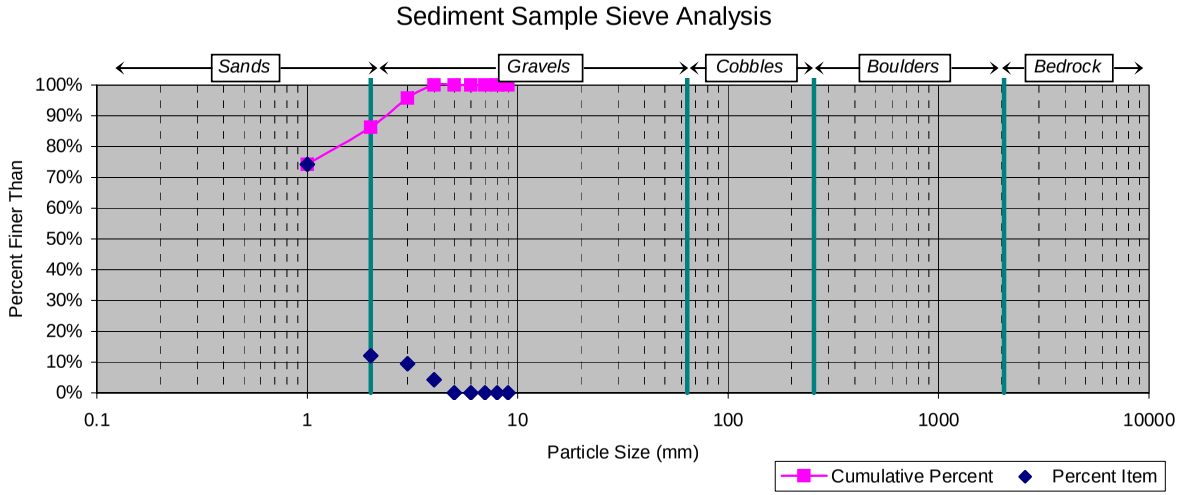


Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
1.9	1.9	4.4	14.3	27.1	0%	36%	64%	0%	---	---

Bar Sample Sieve Analysis

Smallest Sieve Passed (mm)	Weight (oz)	% Item	Percent Finer Than
1.0	70.5	74.2%	74.2%
2.0	11.5	12.1%	86.3%
4.0	9.0	9.5%	95.8%
8.0	4.0	4.2%	100.0%
16.0	0.0	0.0%	100.0%
31.5	0.0	0.0%	100.0%
64.0	0.0	0.0%	100.0%
128.0	0.0	0.0%	100.0%
> 256.0	0.0	0.0%	100.0%
Total:	95.0	100%	

Stream:	UT Collins Creek
Watershed:	Collins Creek - Cape Fear River
Location:	Bar XS T2-3
Note:	



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
1.8	1.8	1.8	1.8	3.8	0%	86%	14%	0%	---	---

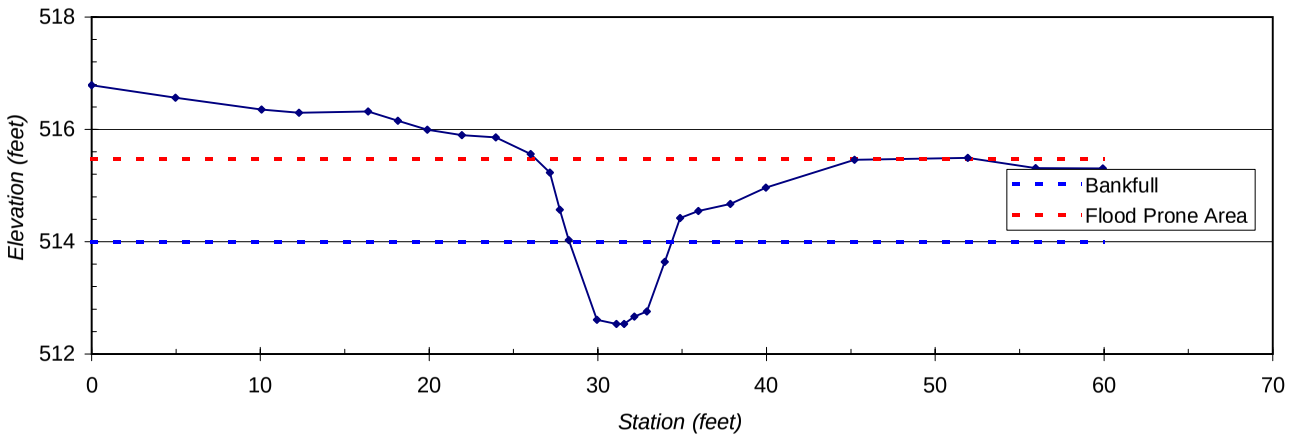
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T2-4 Riffle
Drainage Area (sq mi):	0.07
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

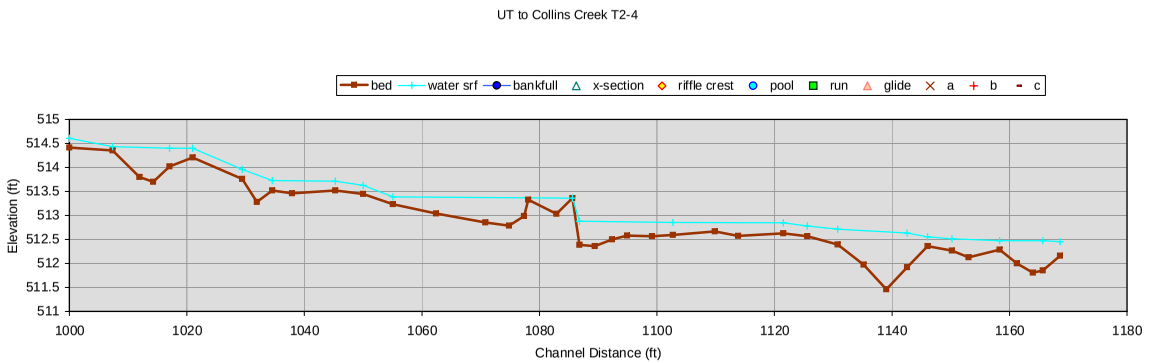
Station	Elevation
0.0	516.79
5.0	516.56
10.1	516.35
12.3	516.30
16.4	516.32
18.1	516.16
19.9	516.00
21.9	515.90
24.0	515.86
26.0	515.56
27.2	515.23
27.7	514.57
28.3	514.03
29.9	512.61
31.1	512.53
31.6	512.54
32.2	512.66
32.9	512.76
34.0	513.64
34.9	514.42
36.0	514.55
37.8	514.67
40.0	514.96
45.2	515.46
51.9	515.49
55.9	515.31
59.9	515.30

SUMMARY DATA	
Bankfull Elevation:	514.0
Bankfull Cross-Sectional Area:	6.2
Bankfull Width:	6.1
Flood Prone Area Elevation:	515.5
Flood Prone Width:	28.1
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	1.0
W / D Ratio:	6.0
Entrenchment Ratio:	4.6
Bank Height Ratio:	1.3
Slope (ft/ft):	0.013
Discharge (cfs)	27

Stream Type:	E4



Longitudinal Profile



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	---	---	1168.6	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---
	---	---	---	---	---	---

notes	cross section ID	bed feature	BkF channel centerline easting (ft)	BkF channel centerline northing (ft)	station	ELEV centerline	ELEV thalwag	water	ELEV bankfull	user defined ELEV a	user defined ELEV b	user defined ELEV c
BRI					1000.00	514.41		514.61				
BERI					1007.36	514.35		514.43				
BPO					1011.94	513.80						
PO					1014.26	513.70						
EPO					1017.04	514.02		514.40				
BRI					1020.96	514.21		514.40				
ERI					1029.40	513.76		513.96				
BPO					1031.89	513.28						
EPO					1034.51	513.52		513.72				
TW					1037.92	513.46						
BRI					1045.26	513.52		513.71				
RI					1049.98	513.45		513.63				
ERI					1055.08	513.23		513.39				
TW					1062.39	513.04						
BPO					1070.78	512.85						
PO					1074.81	512.78						
EPO					1077.38	512.99						
EPO					1078.08	513.33						
TW					1082.89	513.03						
BLDR_STEP					1085.63	513.36		513.36				
BPO					1086.83	512.38		512.88				
PO					1089.45	512.36						
EPO					1092.37	512.50						
TW					1094.94	512.58						
TW					1099.18	512.57						
TW					1102.73	512.59		512.85				
TW					1109.87	512.67						
TW					1113.81	512.57						
BRI					1121.49	512.63		512.85				
RI					1125.58	512.57		512.78				
ERI					1130.79	512.39		512.72				
BPO					1135.19	511.97						
PO					1139.03	511.46						
EPO					1142.60	511.92		512.63				
BRI					1146.06	512.36		512.55				
ERI					1150.19	512.27		512.52				
TW					1153.03	512.12						
TW					1158.32	512.28		512.47				
BPO					1161.25	512.00						
PO					1163.97	511.80						
EPO					1165.69	511.85		512.47				
BRI					1168.64	512.16		512.45				

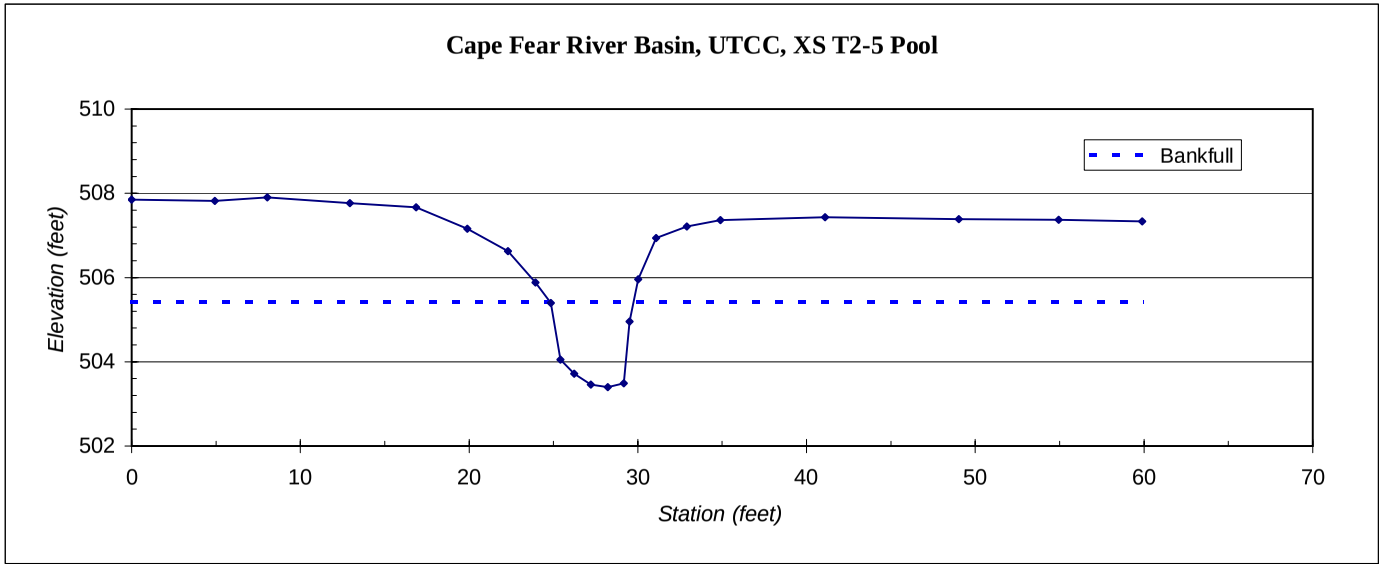
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T2-5 Pool
Drainage Area (sq mi):	0.07
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

Station	Elevation
0.0	507.85
4.9	507.82
8.0	507.91
12.9	507.76
16.9	507.67
19.9	507.16
22.3	506.63
23.9	505.88
24.9	505.40
25.4	504.05
26.2	503.72
27.2	503.46
28.2	503.40
29.2	503.49
29.5	504.96
30.0	505.96
31.1	506.94
32.9	507.21
34.9	507.37
41.1	507.43
49.0	507.39
54.9	507.37
59.9	507.33

SUMMARY DATA	
Bankfull Elevation:	505.4
Bankfull Cross-Sectional Area:	7.7
Bankfull Width:	4.9
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.0
Mean Depth at Bankfull:	1.6
W / D Ratio:	3.1
Entrenchment Ratio:	-
Bank Height Ratio:	2.0
Slope (ft/ft):	0.014
Discharge (cfs)	-

Stream Type:	-



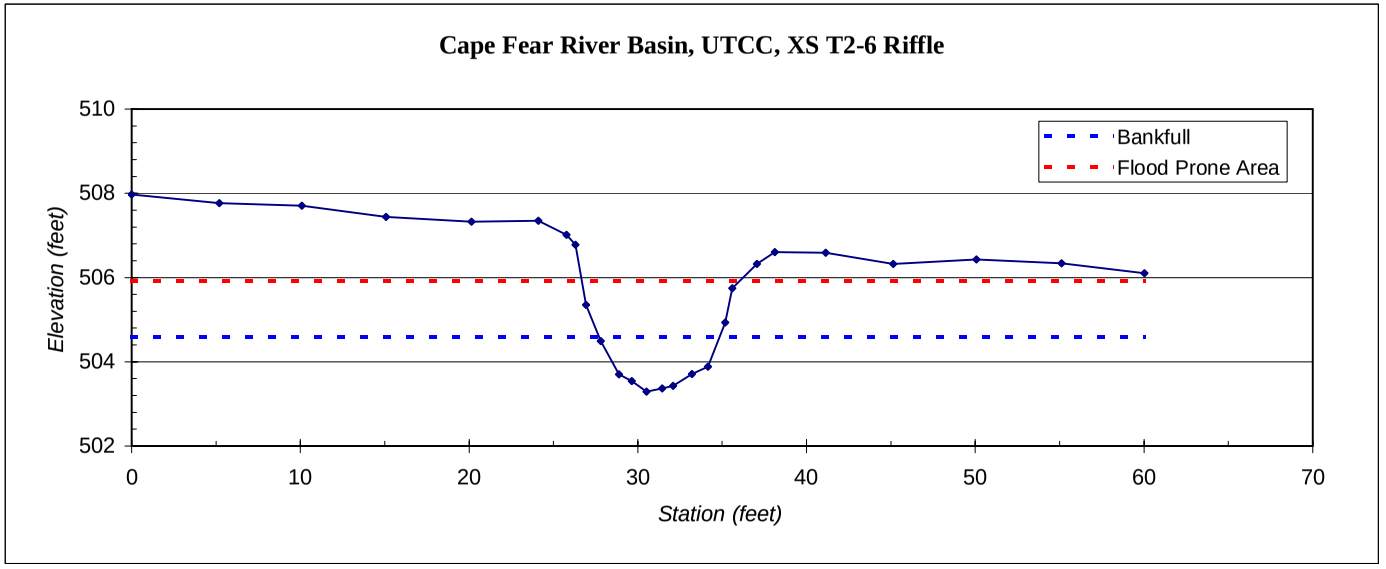
Collins Creek Restoration Plan
Existing Conditions

River Basin:	Cape Fear
Watershed:	UTCC
XS ID	XS T2-6 Riffle
Drainage Area (sq mi):	0.07
Date:	February 2006
Field Crew:	Mryncza, Helms, Hayes, Spiller, French

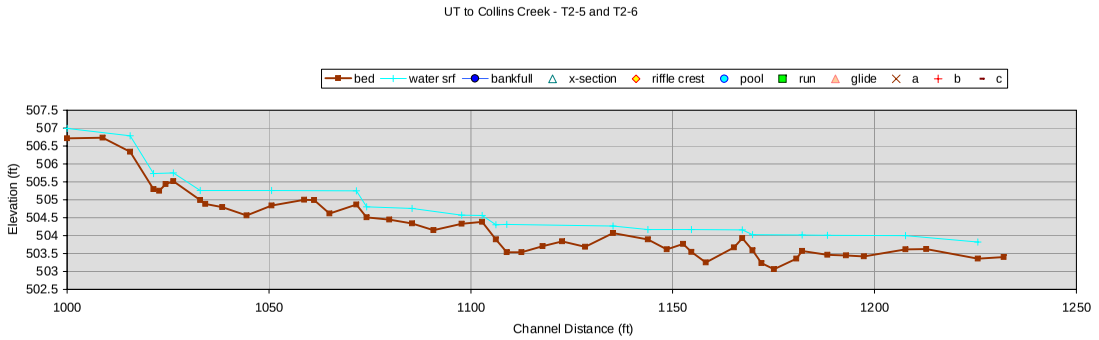
Station	Elevation
0.0	507.97
5.2	507.77
10.1	507.71
15.1	507.44
20.1	507.33
24.1	507.35
25.8	507.02
26.3	506.78
26.9	505.35
27.8	504.49
28.9	503.71
29.6	503.54
30.5	503.29
31.4	503.37
32.1	503.43
33.2	503.71
34.2	503.89
35.2	504.93
35.6	505.75
37.1	506.32
38.1	506.61
41.1	506.59
45.1	506.32
50.1	506.43
55.1	506.34
60.0	506.11

SUMMARY DATA	
Bankfull Elevation:	504.6
Bankfull Cross-Sectional Area:	6.4
Bankfull Width:	7.2
Flood Prone Area Elevation:	505.9
Flood Prone Width:	9.3
Max Depth at Bankfull:	1.3
Mean Depth at Bankfull:	0.9
W / D Ratio:	8.0
Entrenchment Ratio:	1.3
Bank Height Ratio:	2.5
Slope (ft/ft):	0.014
Discharge (cfs)	28

Stream Type:	G4c



Longitudinal Profile



	slope (%)	slope ratio	length (ft)	length ratio	pool-pool spacing (ft)	p-p ratio
reach	---	---	1232.0	---	---	---
riffle	---	---	---	---	---	---
pool	---	---	---	---	---	---
	---	---	---	---	---	---
	---	---	---	---	---	---

notes	cross section ID	bed feature	BkF channel centerline easting (ft)	BkF channel centerline northing (ft)	station	ELEV centerline	ELEV thalwag	water	ELEV bankfull	user defined ELEV a	user defined ELEV b	user defined ELEV c
BRI					1000.00	506.72		506.99				
RI					1008.78	506.73						
ERI=BLDRS					1015.62	506.34		506.79				
EBLDRS=BPO					1021.43	505.29		505.73				
PO					1022.85	505.25						
EPO					1024.41	505.44						
BRI					1026.28	505.52		505.75				
ERI					1032.98	504.99		505.26				
BPO					1034.24	504.89						
PO					1038.47	504.79						
PO					1044.49	504.56						
EPO					1050.68	504.84		505.26				
TW=BDRK					1058.73	505.00						
TW=BDRK					1061.22	504.99						
TW=BDRK					1065.01	504.61						
TW=BDRKSTEP					1071.68	504.87		505.25				
TW=EBDRKSTEP					1074.16	504.51		504.81				
TW=BDRK					1079.82	504.45						
TW					1085.45	504.34		504.76				
TW					1090.79	504.15						
TW					1097.74	504.33		504.58				
BRI					1102.77	504.39		504.56				
ERI					1106.19	503.89		504.31				
BPO					1108.88	503.53		504.31				
PO					1112.58	503.53						
EPO					1117.81	503.71						
TW					1122.66	503.84						
TW					1128.36	503.69						
BRI					1135.20	504.07		504.27				
ERI					1143.86	503.89		504.17				
TW					1148.57	503.61						
TW					1152.55	503.77						
BPO					1154.62	503.55		504.17				
PO					1158.23	503.25						
EPO					1165.15	503.67						
BRI					1167.23	503.93		504.16				
ERI					1169.77	503.59		504.03				
BPO					1172.01	503.23						
PO					1175.10	503.07						
EPO					1180.66	503.36						
BRI					1182.11	503.57		504.01				
ERI					1188.34	503.46		504.01				
TW					1192.95	503.45						
TW					1197.37	503.42						
BRI					1207.70	503.62		504.00				
RI					1212.82	503.62						
ERI					1225.60	503.35		503.82				
TW=DEBRIS					1232.02	503.40						

Riffle Pebble Count

Riffle Pebble Count,

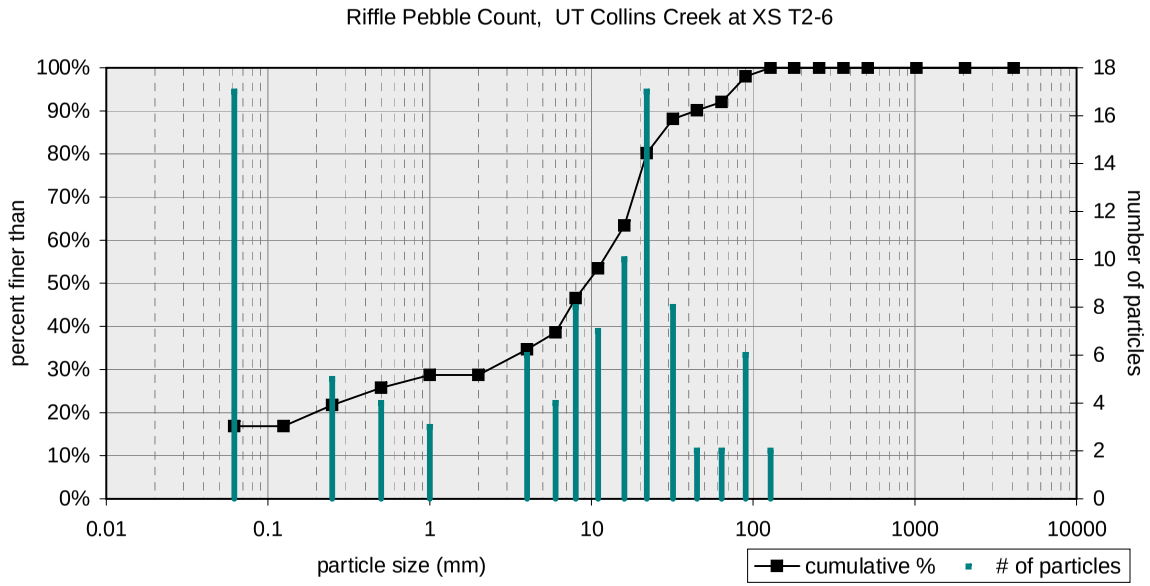
Material	Size Range (mm)		Count
silt/clay	0	0.062	**17**
very fine sand	0.062	0.13	
fine sand	0.13	0.25	**5**
medium sand	0.25	0.5	**4**
coarse sand	0.5	1	**3**
very coarse sand	1	2	
very fine gravel	2	4	**6**
fine gravel	4	6	**4**
fine gravel	6	8	**8**
medium gravel	8	11	**7**
medium gravel	11	16	**10**
coarse gravel	16	22	**17**
coarse gravel	22	32	**8**
very coarse gravel	32	45	**2**
very coarse gravel	45	64	**2**
small cobble	64	90	**6**
medium cobble	90	128	**2**
large cobble	128	180	
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		101

bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		101

UT Collins Creek at XS T2-6

Collins Creek- Cape Fear River

Note: **Riffle Pebble Count**



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	4.14	9.4	17	26	76	77.1	1.3	20.6

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	17%	12%	63%	8%	0%	0%	0%	0%	0%

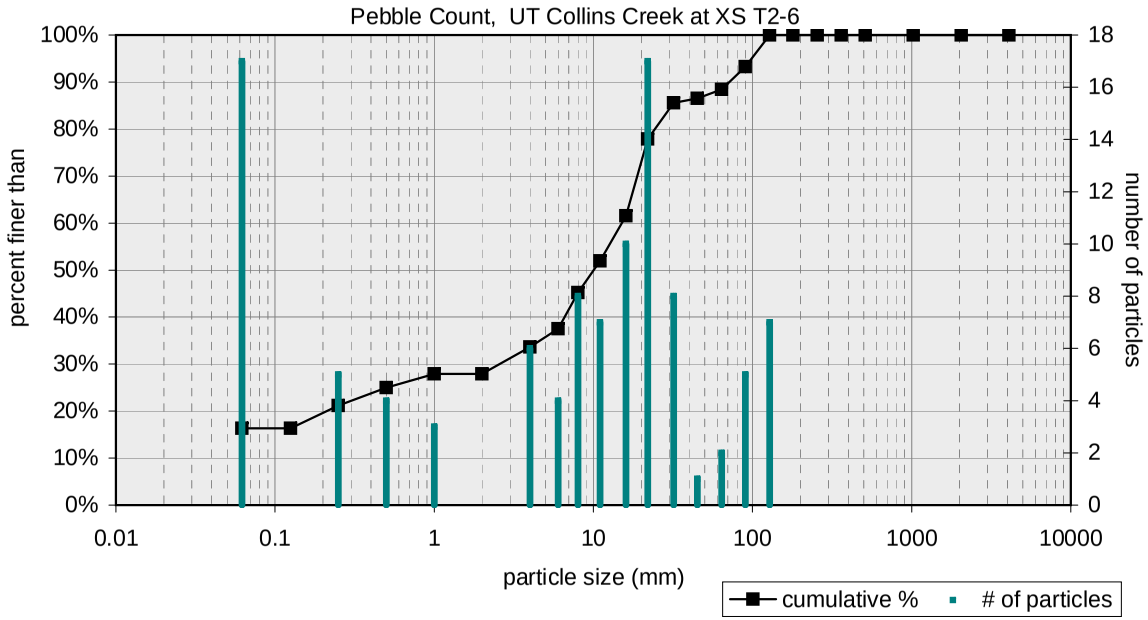
Pebble Count of Channel Reach

Material	Size Range (mm)		Count
silt/clay	0	0.062	**17**
very fine sand	0.062	0.13	
fine sand	0.13	0.25	**5**
medium sand	0.25	0.5	**4**
coarse sand	0.5	1	**3**
very coarse sand	1	2	
very fine gravel	2	4	**6**
fine gravel	4	6	**4**
fine gravel	6	8	**8**
medium gravel	8	11	**7**
medium gravel	11	16	**10**
coarse gravel	16	22	**17**
coarse gravel	22	32	**8**
very coarse gravel	32	45	**1**
very coarse gravel	45	64	**2**
small cobble	64	90	**5**
medium cobble	90	128	**7**
large cobble	128	180	
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
	total particle count:		104

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	104

Pebble Count,
UT Collins Creek at XS T2-6
Collins Creek- Cape Fear River

Note: **Reach Pebble Count**



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	4.61	10.0	17	30	99	82.5	1.4	21.9

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	16%	12%	61%	12%	0%	0%	0%	0%	0%

Appendix F
Reference Reach Data

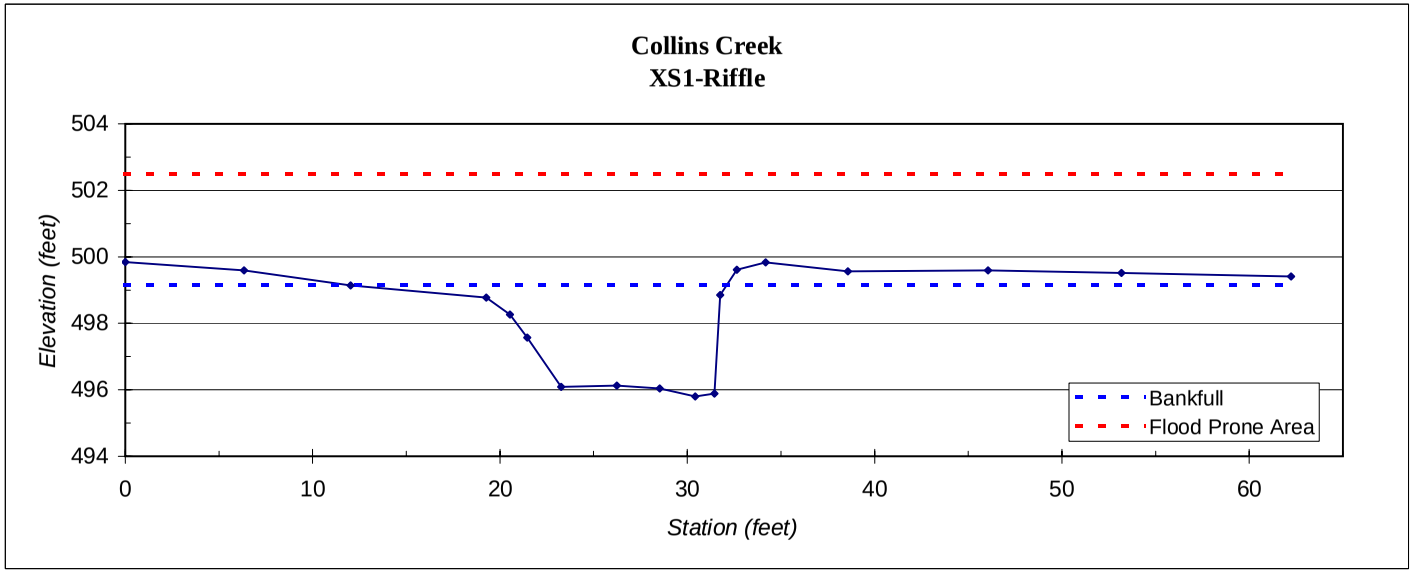
Collins Creek
Reference Reach

River Basin:	Cape Fear
Watershed:	Collins Creek
XS ID	XS1 Riffle
Drainage Area (sq mi):	
Date:	12/27/2006
Field Crew:	A. Helms, A. Spiller, B. Roberts

Station	Elevation
0.0	499.84
6.3	499.59
12.0	499.14
19.3	498.78
20.5	498.26
21.5	497.58
23.3	496.09
26.2	496.12
28.5	496.04
30.4	495.80
31.4	495.89
31.8	498.85
32.6	499.61
34.2	499.83
38.6	499.57
46.1	499.59
53.2	499.52
62.2	499.41

SUMMARY DATA	
Bankfull Elevation:	499.14
Bankfull Cross-Sectional Area:	33.4
Bankfull Width:	20.1
Flood Prone Area Elevation:	502.48
Flood Prone Width:	>60
Max Depth at Bankfull:	3.34
Mean Depth at Bankfull:	1.66
W / D Ratio:	12.1
Entrenchment Ratio:	3.0
Bank Height Ratio:	0.89
Slope (ft/ft):	0.003
Discharge (cfs)	114

Stream Type:	E4

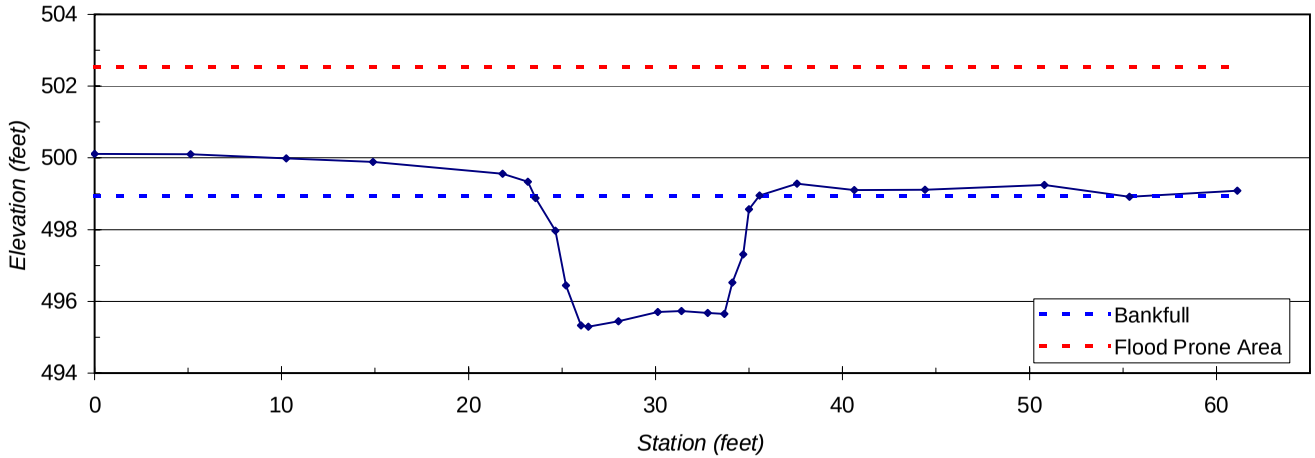


River Basin:	Cape Fear
Watershed:	Collins Creek
XS ID	XS2 Riffle
Drainage Area (sq mi):	
Date:	12/27/2006
Field Crew:	A. Helms, A. Spiller, B. Roberts

Station	Elevation
0.0	500.11
5.1	500.11
10.2	499.99
14.9	499.88
21.8	499.55
23.2	499.33
23.6	498.88
24.6	497.97
25.2	496.44
26.0	495.33
26.4	495.30
28.0	495.44
30.1	495.70
31.4	495.73
32.8	495.68
33.7	495.65
34.1	496.53
34.7	497.31
35.0	498.56
35.6	498.95
37.6	499.28
40.6	499.10
44.4	499.11
50.79	499.25
55.34	498.92
61.12	499.09

SUMMARY DATA	
Bankfull Elevation:	498.92
Bankfull Cross-Sectional Area:	32.4
Bankfull Width:	11.9
Flood Prone Area Elevation:	502.54
Flood Prone Width:	>60
Max Depth at Bankfull:	3.62
Mean Depth at Bankfull:	2.72
W / D Ratio:	4.4
Entrenchment Ratio:	5.0
Bank Height Ratio:	1.10
Slope (ft/ft):	0.003
Discharge (cfs)	141

Stream Type:	E4

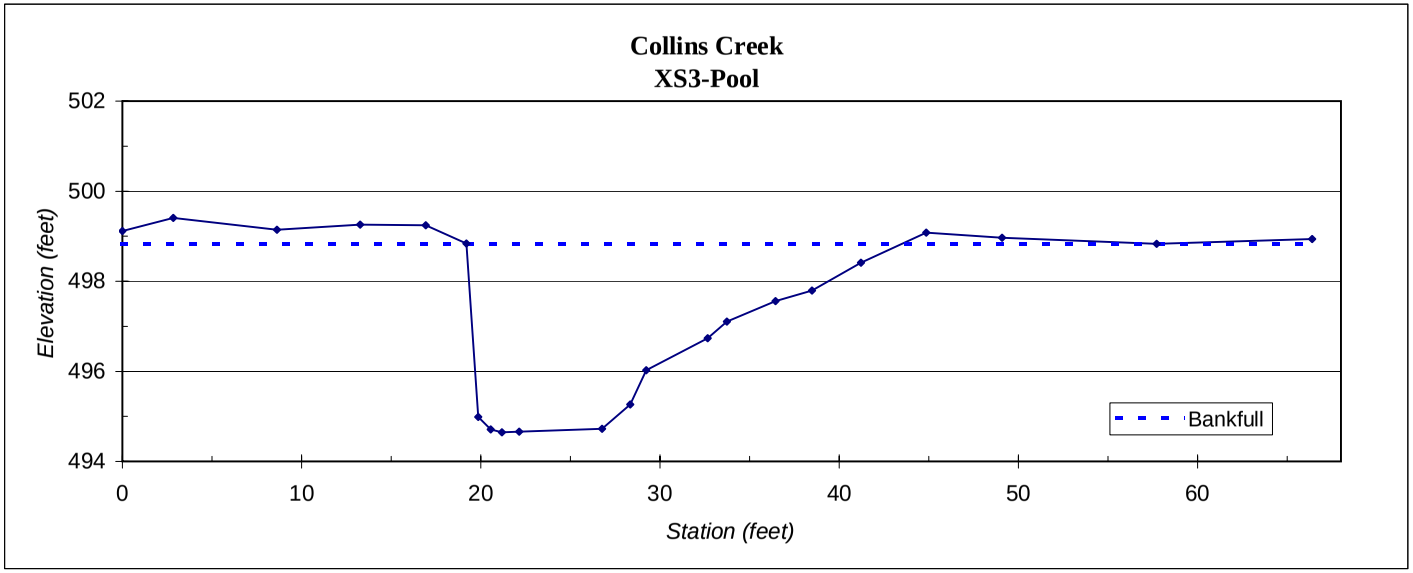


River Basin:	Cape Fear
Watershed:	Collins Creek
XS ID	XS3 Pool
Drainage Area (sq mi):	
Date:	12/27/2006
Field Crew:	A. Helms, A. Spiller, B. Roberts

Station	Elevation
0.0	499.12
2.8	499.40
8.6	499.14
13.3	499.26
16.9	499.24
19.2	498.84
19.9	494.99
20.5	494.71
21.2	494.64
22.1	494.66
26.8	494.72
28.3	495.26
29.2	496.02
32.7	496.74
33.7	497.11
36.4	497.56
38.5	497.79
41.2	498.41
44.9	499.08
49.1	498.97
57.7	498.83
66.4	498.94

SUMMARY DATA	
Bankfull Elevation:	498.83
Bankfull Cross-Sectional Area:	57.9
Bankfull Width:	24.3
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	4.19
Mean Depth at Bankfull:	2.4
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-
Slope (ft/ft):	0.003
Discharge (cfs)	

Stream Type:	E4



Riffle Pebble Count

Riffle Pebble Count,

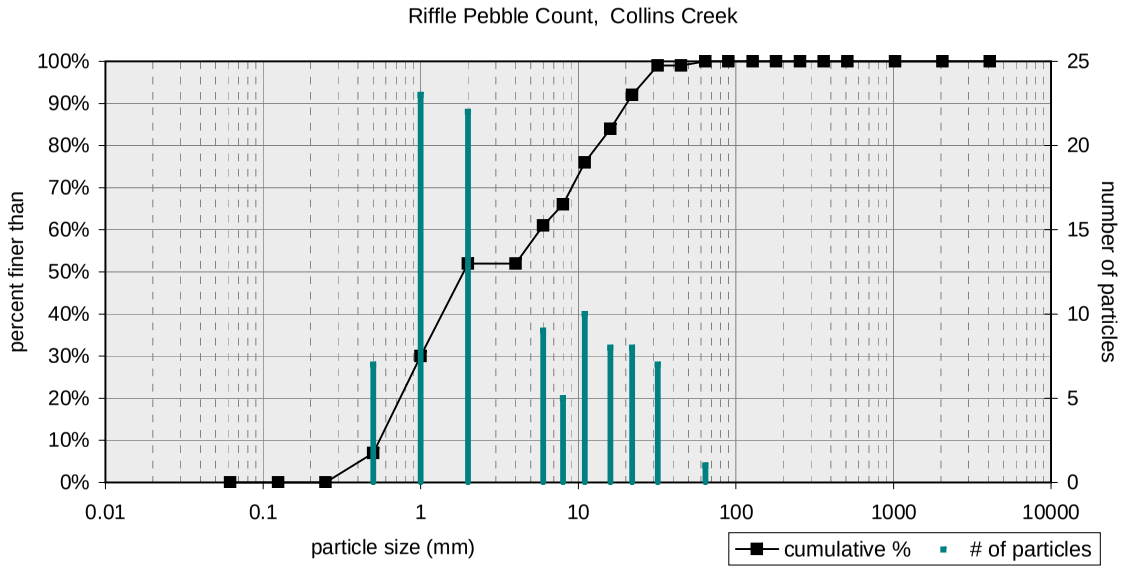
Collins Creek

Cape Fear

Note: **Riffle XS2**

Material	Size Range (mm)		Count	
silt/clay	0	0.062		#
very fine sand	0.062	0.13		#
fine sand	0.13	0.25		#
medium sand	0.25	0.5	**7**	#
coarse sand	0.5	1	**23**	#
very coarse sand	1	2	**22**	#
very fine gravel	2	4		#
fine gravel	4	6	**9**	#
fine gravel	6	8	**5**	#
medium gravel	8	11	**10**	#
medium gravel	11	16	**8**	#
coarse gravel	16	22	**8**	#
coarse gravel	22	32	**7**	#
very coarse gravel	32	45		#
very coarse gravel	45	64	**1**	#
small cobble	64	90		#
medium cobble	90	128		#
large cobble	128	180		#
very large cobble	180	256		#
small boulder	256	362		#
small boulder	362	512		#
medium boulder	512	1024		#
large boulder	1024	2048		#
very large boulder	2048	4096		#
		total particle count:	100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
	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
	0.656	1.17	1.9	8	16	26	5.7	3.2	4.9

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	52%	48%	0%	0%	0%	0%	0%	0%

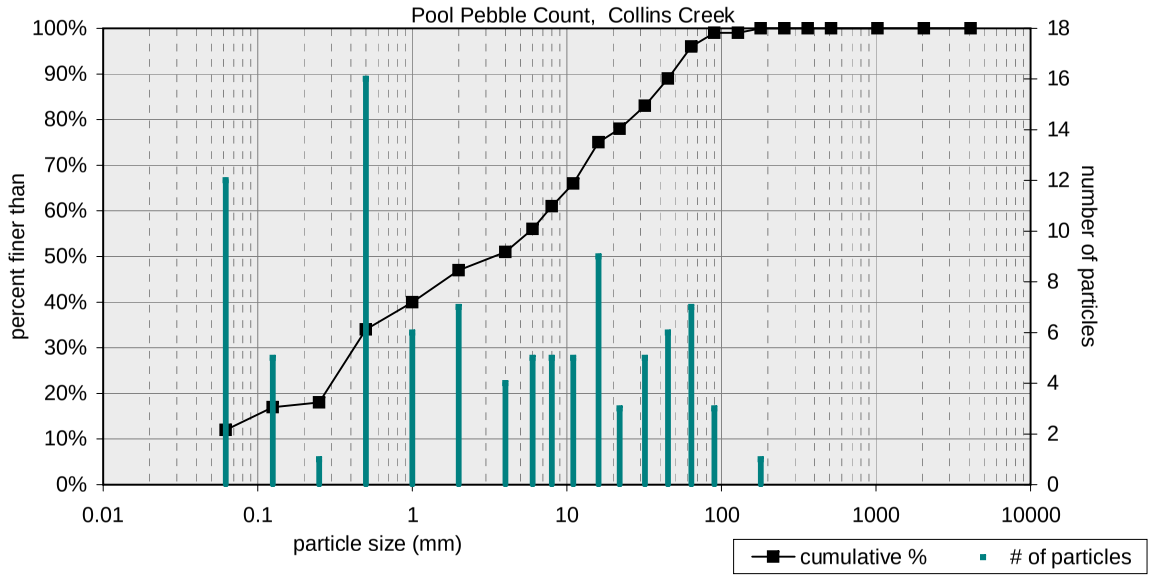
Pool Pebble Count

Pool Pebble Count,

Material	Size Range (mm)		Count	
silt/clay	0	0.062	**12**	#
very fine sand	0.062	0.13	**5**	#
fine sand	0.13	0.25	**1**	#
medium sand	0.25	0.5	**16**	#
coarse sand	0.5	1	**6**	#
very coarse sand	1	2	**7**	#
very fine gravel	2	4	**4**	#
fine gravel	4	6	**5**	#
fine gravel	6	8	**5**	#
medium gravel	8	11	**5**	#
medium gravel	11	16	**9**	#
coarse gravel	16	22	**3**	#
coarse gravel	22	32	**5**	#
very coarse gravel	32	45	**6**	#
very coarse gravel	45	64	**7**	#
small cobble	64	90	**3**	#
medium cobble	90	128		#
large cobble	128	180	**1**	#
very large cobble	180	256		#
small boulder	256	362		#
small boulder	362	512		#
medium boulder	512	1024		#
large boulder	1024	2048		#
very large boulder	2048	4096		#
		total particle count:	100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100

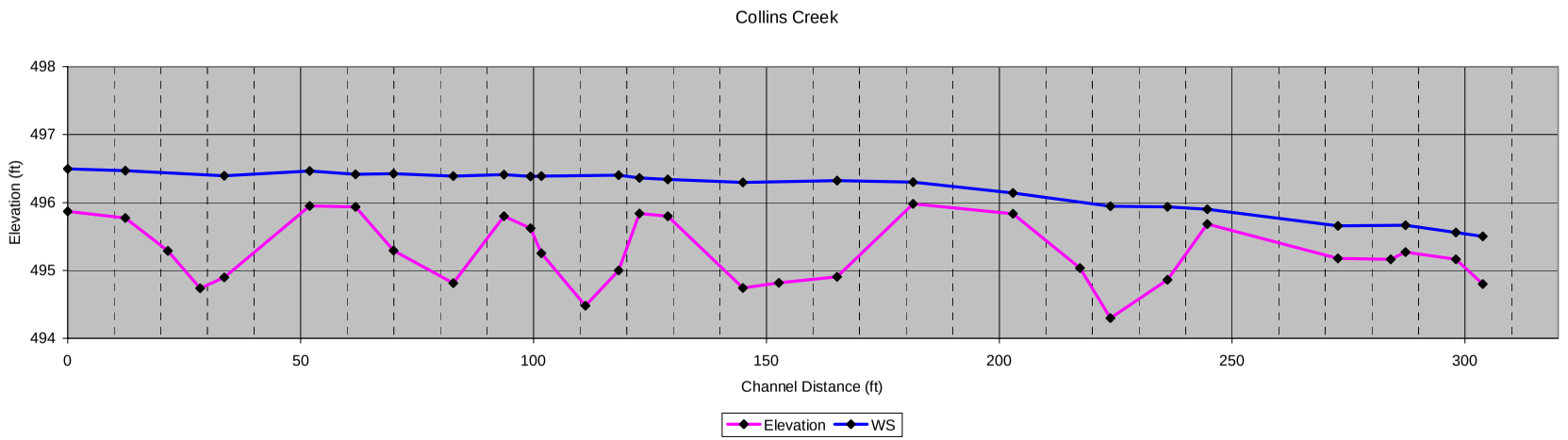
	Collins Creek
	Cape Fear
Note:	



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.109	0.56	3.4	10	34	61	20.5	1.9	17.7

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	12%	35%	49%	4%	0%	0%	0%	0%	0%

Slope Profile



Elevation BM: 100

notes	inc distance	station	BS 0	HI 100	FS TP	FS bed	depth water	FS LB	FS RB	FS BKF	FS WS	AZ azimuth	ELEV bed	ELEV water srf	ELEV LF	ELEV RB	ELEV BKF	ELEV WS
		0.0		100									495.8693					496.4937
Begin Pool	12.4	12.4		100									495.772					496.4671
	9.1	21.5		100									495.2886					
	6.9	28.4		100									494.7391					
End Pool	5.2	33.6		100									494.895					496.3907
Begin Riffle	18.3	52.0		100									495.9509					496.4619
End Riffle	9.8	61.8		100									495.9354					496.4138
Begin Pool	8.1	69.9		100									495.2926					496.426
End Pool	12.8	82.8		100									494.812					496.3869
Begin Riffle	10.9	93.6		100									495.7976					496.4113
End Riffle	5.7	99.3		100									495.6188					496.3838
Begin Pool	2.3	101.7		100									495.251					496.3891
	9.5	111.2		100									494.4782					
End Pool	7.1	118.3		100									495.0004					496.4004
Begin Riffle	4.5	122.8		100									495.8361					496.3606
End Riffle	6.1	128.9		100									495.7999					496.3401
Begin Pool	16.1	145.0		100									494.7427					496.2961
	7.7	152.7		100									494.8161					
End Pool	12.5	165.2		100									494.9066					496.3209
Begin Riffle	16.4	181.5		100									495.9798					496.2985
End Riffle	21.4	202.9		100									495.8352					496.1402
	14.4	217.3		100									495.0338					
Begin Pool	6.6	223.9		100									494.2961					495.9434
End Pool	12.2	236.1		100									494.8633					495.9376
Begin Riffle	8.6	244.7		100									495.6824					495.9015
End Riffle	28.0	272.7		100									495.1772					495.6558
	11.4	284.0		100									495.1644					
Begin Riffle	3.2	287.2		100									495.2709					495.6652
End Riffle	10.8	298.0		100									495.1633					495.5587
Begin Pool	5.8	303.8		100									494.7974					495.5013

UT to Back Creek
Reference Reach

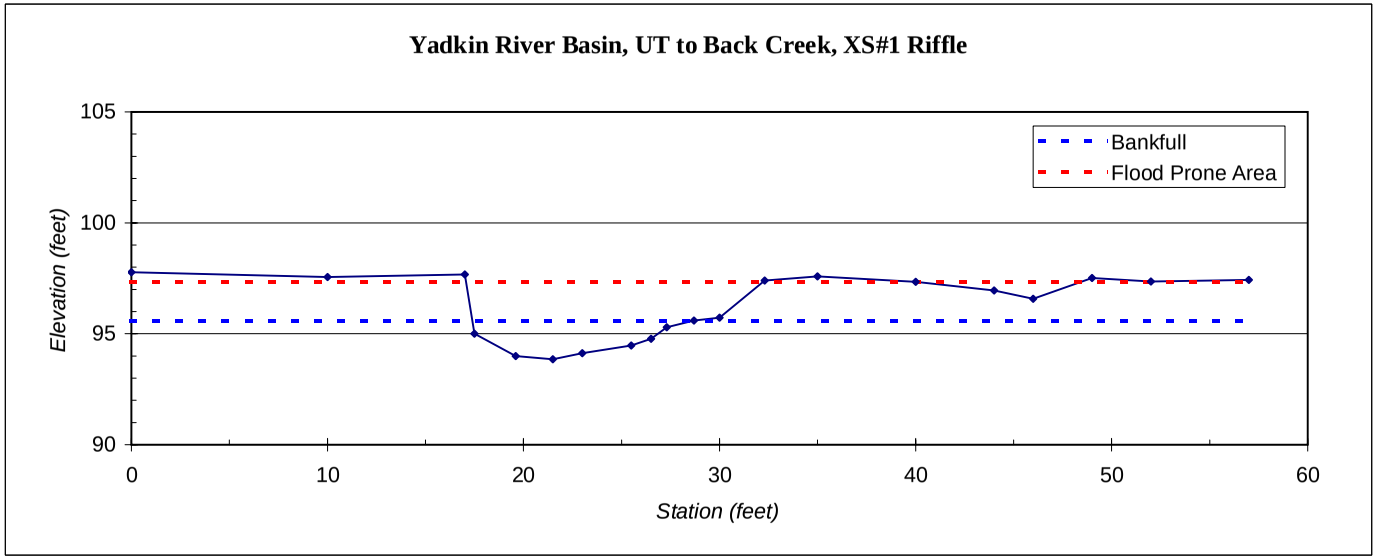
River Basin:	Yadkin
Watershed:	UT to Back Creek
XS ID	XS#1 Riffle
Drainage Area (sq mi):	0.63
Date:	-
Field Crew:	A. Schlindwein, M. Schlegel

Station	Rod Ht.	Elevation
0	2.23	97.77
10	2.44	97.56
17	2.33	97.67
17.5	5	95.00
19.6	6.01	93.99
21.5	6.15	93.85
23	5.87	94.13
25.5	5.53	94.47
26.5	5.23	94.77
27.3	4.71	95.29
28.7	4.41	95.59
30	4.28	95.72
32.3	2.6	97.40
35	2.41	97.59
40	2.66	97.34
44	3.05	96.95
46	3.42	96.58
49	2.48	97.52
52	2.64	97.36
57	2.57	97.43

SUMMARY DATA	
Bankfull Elevation:	95.59
Bankfull Cross-Sectional Area:	12.50
Bankfull Width:	10.40
Flood Prone Area Elevation:	97.33
Flood Prone Width:	150.00
Max Depth at Bankfull:	1.74
Mean Depth at Bankfull:	1.20
W / D Ratio:	8.7
Entrenchment Ratio:	14.40
Bank Height Ratio:	-
Slope (ft/ft):	0.014
Discharge (cfs)	63

No Photo

Stream Type:	E4/C4



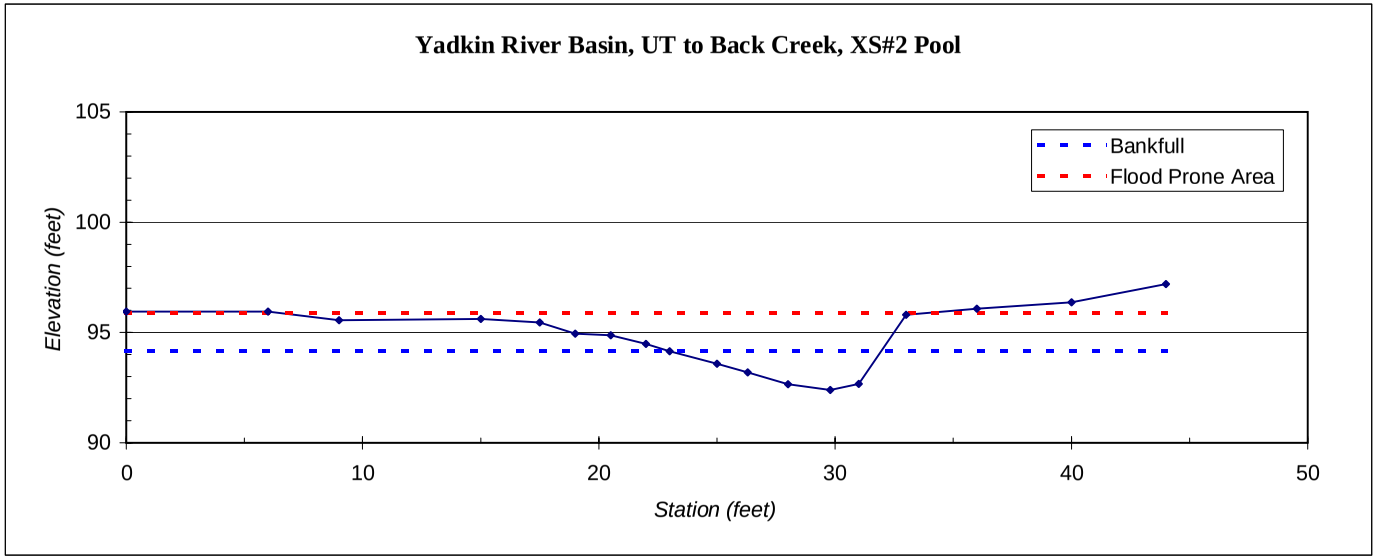
River Basin:	Yadkin
Watershed:	UT to Back Creek
XS ID	XS#2 Pool
Drainage Area (sq mi):	0.63
Date:	-
Field Crew:	A. Schlindwein, M. Schlegel

Station	Rod Ht.	Elevation
0	4.05	95.95
6	4.05	95.95
9	4.44	95.56
15	4.39	95.61
17.5	4.55	95.45
19	5.05	94.95
20.5	5.13	94.87
22	5.52	94.48
23	5.85	94.15
25	6.41	93.59
26.3	6.81	93.19
28	7.34	92.66
29.8	7.61	92.39
31	7.33	92.67
33	4.2	95.80
36	3.92	96.08
40	3.63	96.37
44	2.8	97.20

SUMMARY DATA	
Bankfull Elevation:	94.15
Bankfull Cross-Sectional Area:	10.40
Bankfull Width:	10.10
Flood Prone Area Elevation:	95.91
Flood Prone Width:	-
Max Depth at Bankfull:	1.76
Mean Depth at Bankfull:	1.03
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-
Slope (ft/ft):	0.001
Discharge (cfs)	-

No Photo

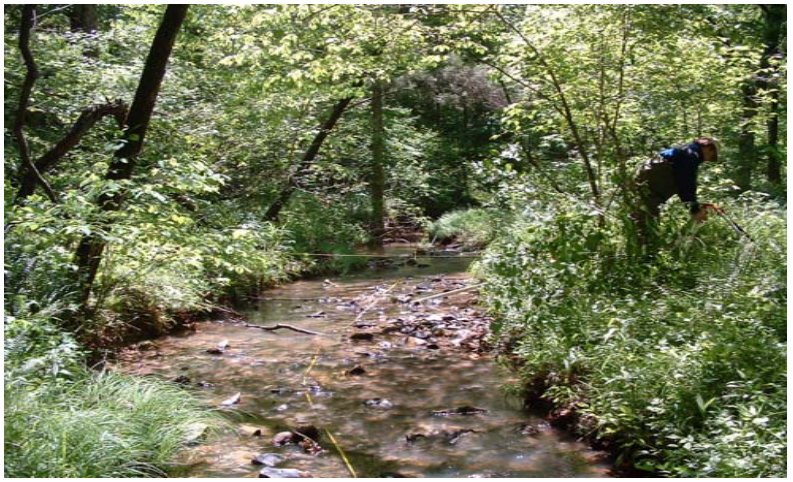
Stream Type:	C4



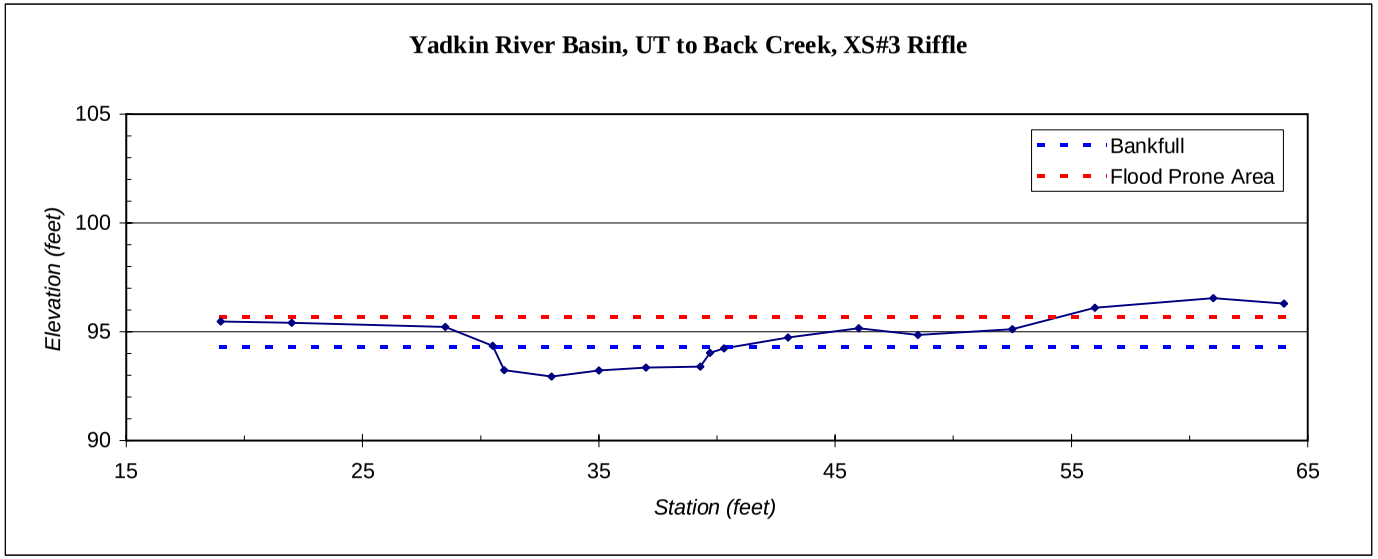
River Basin:	Yadkin
Watershed:	UT to Back Creek
XS ID	XS#3 Riffle
Drainage Area (sq mi):	0.63
Date:	-
Field Crew:	A. Schlindwein, M. Schlegel

Station	Rod Ht.	Elevation
19	4.53	95.47
22	4.59	95.41
28.5	4.78	95.22
30.5	5.64	94.36
31	6.77	93.23
33	7.06	92.94
35	6.78	93.22
37	6.65	93.35
39.3	6.6	93.40
39.7	5.97	94.03
40.3	5.76	94.24
43	5.27	94.73
46	4.84	95.16
48.5	5.15	94.85
52.5	4.88	95.12
56	3.9	96.10
61	3.45	96.55
64	3.7	96.30

SUMMARY DATA	
Bankfull Elevation:	94.30
Bankfull Cross-Sectional Area:	14.40
Bankfull Width:	16.10
Flood Prone Area Elevation:	95.66
Flood Prone Width:	150.00
Max Depth at Bankfull:	1.36
Mean Depth at Bankfull:	0.89
W / D Ratio:	18.0
Entrenchment Ratio:	9.30
Bank Height Ratio:	-
Slope (ft/ft):	0.014
Discharge (cfs)	63



Stream Type:	C4

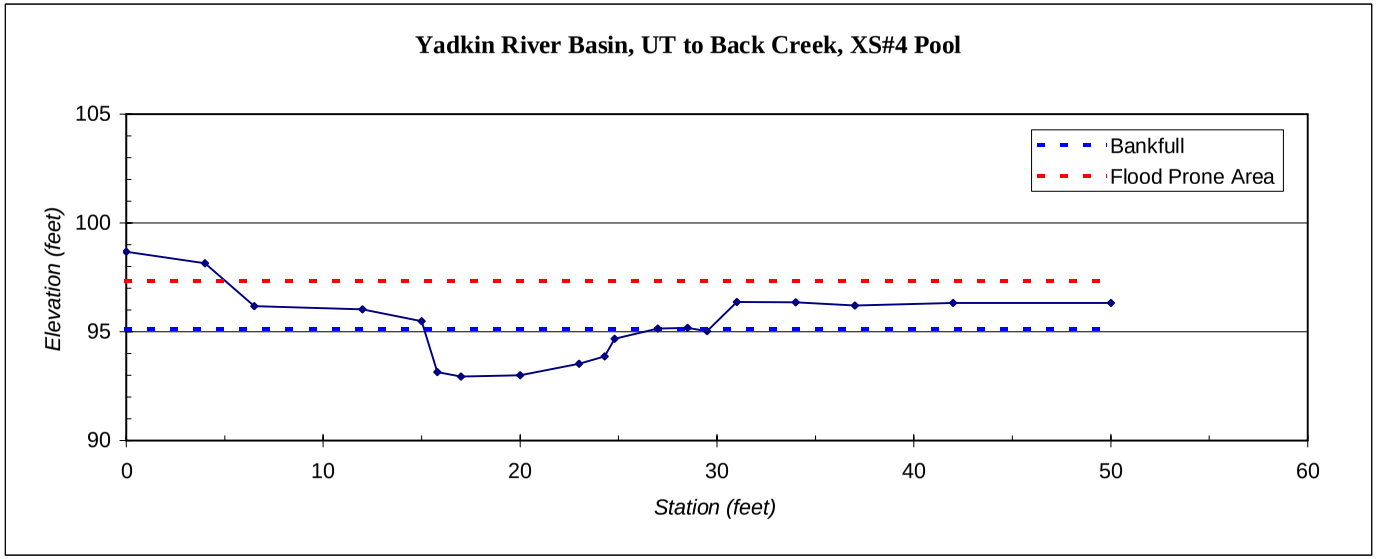


River Basin:	Yadkin
Watershed:	UT to Back Creek
XS ID	XS#4 Pool
Drainage Area (sq mi):	0.63
Date:	-
Field Crew:	A. Schlindwein, M. Schlegel

Station	Rod Ht.	Elevation
0	1.33	98.67
4	1.85	98.15
6.5	3.83	96.17
12	3.97	96.03
15	4.52	95.48
15.8	6.85	93.15
17	7.06	92.94
20	7	93.00
23	6.47	93.53
24.3	6.13	93.87
24.8	5.32	94.68
27	4.86	95.14
28.5	4.83	95.17
29.5	4.97	95.03
31	3.63	96.37
34	3.64	96.36
37	3.79	96.21
42	3.68	96.32
50	3.67	96.33

SUMMARY DATA	
Bankfull Elevation:	95.14
Bankfull Cross-Sectional Area:	19.30
Bankfull Width:	13.00
Flood Prone Area Elevation:	97.34
Flood Prone Width:	-
Max Depth at Bankfull:	2.20
Mean Depth at Bankfull:	1.48
W / D Ratio:	8.8
Entrenchment Ratio:	-
Bank Height Ratio:	-
Slope (ft/ft):	0.001
Discharge (cfs)	-

Stream Type:	C4

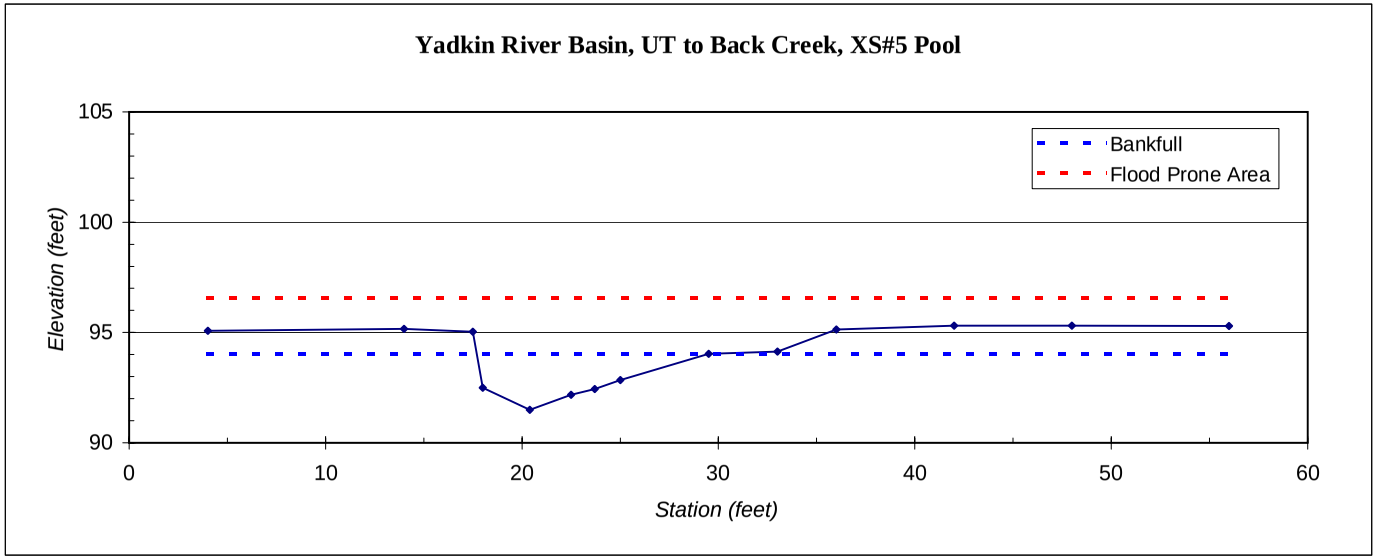


River Basin:	Yadkin
Watershed:	UT to Back Creek
XS ID	XS#5 Pool
Drainage Area (sq mi):	0.63
Date:	-
Field Crew:	A. Schlindwein, M. Schlegel

Station	Rod Ht.	Elevation
4	4.92	95.08
14	4.84	95.16
17.5	4.97	95.03
18	7.5	92.50
20.4	8.5	91.50
22.5	7.82	92.18
23.7	7.57	92.43
25	7.15	92.85
29.5	5.96	94.04
33	5.86	94.14
36	4.86	95.14
42	4.69	95.31
48	4.69	95.31
56	4.71	95.29

SUMMARY DATA	
Bankfull Elevation:	94.04
Bankfull Cross-Sectional Area:	18.00
Bankfull Width:	13.00
Flood Prone Area Elevation:	96.58
Flood Prone Width:	-
Max Depth at Bankfull:	2.54
Mean Depth at Bankfull:	1.38
W / D Ratio:	9.4
Entrenchment Ratio:	-
Bank Height Ratio:	-
Slope (ft/ft):	<0.001
Discharge (cfs)	-

Stream Type:	C4

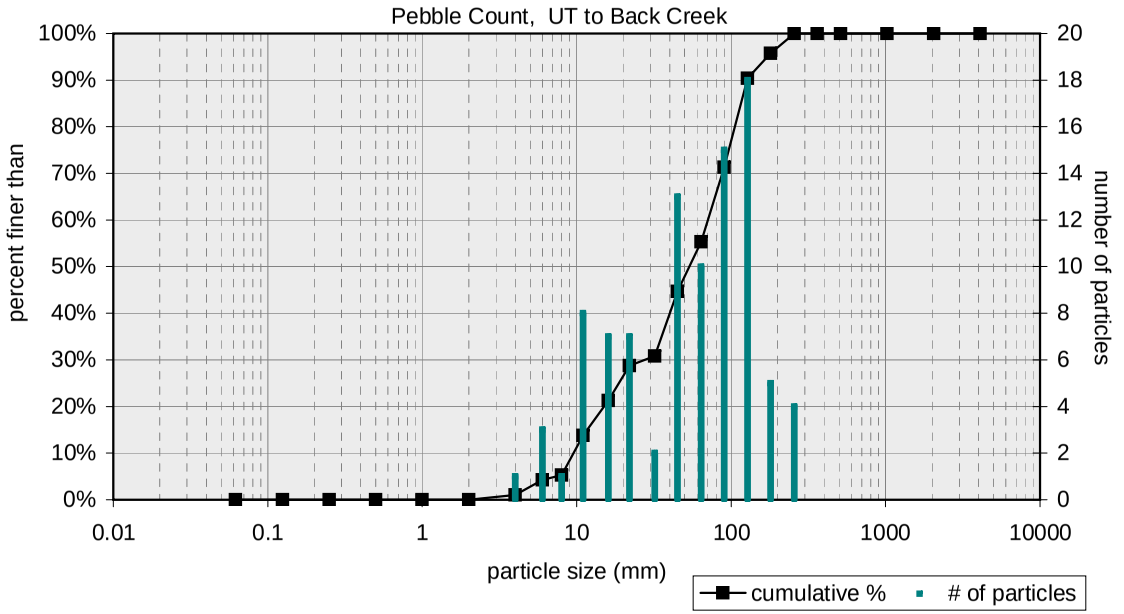


Pebble Count of Channel Reach

Material	Size Range (mm)		Count	
silt/clay	0	0.062		##
very fine sand	0.062	0.13		##
fine sand	0.13	0.25		##
medium sand	0.25	0.5		##
coarse sand	0.5	1		##
very coarse sand	1	2		##
very fine gravel	2	4	**1**	##
fine gravel	4	6	**3**	##
fine gravel	6	8	**1**	##
medium gravel	8	11	**8**	##
medium gravel	11	16	**7**	##
coarse gravel	16	22	**7**	##
coarse gravel	22	32	**2**	##
very coarse gravel	32	45	**13**	##
very coarse gravel	45	64	**10**	##
small cobble	64	90	**15**	##
medium cobble	90	128	**18**	##
large cobble	128	180	**5**	##
very large cobble	180	256	**4**	##
small boulder	256	362		##
small boulder	362	512		##
medium boulder	512	1024		##
large boulder	1024	2048		##
very large boulder	2048	4096		##
		total particle count:	94	

bedrock		**6**
clay hardpan		
detritus/wood		
artificial		
	total count:	100

Pebble Count,
UT to Back Creek
Yadkin Basin
Profile Station 0+00 to 1+32
Note: **Composite Sample - 70% Riffle; 30% Pool**



based on sediment particles only	size percent less than (mm) D16	D35	D50	D65	D84	D95	particle size distribution gradation	geo mean	std dev
	12.269	35.45	53.7	79	114	172	3.2	37.4	3.0

based on total count	percent by substrate type silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	0%	52%	42%	0%	6%	0%	0%	0%

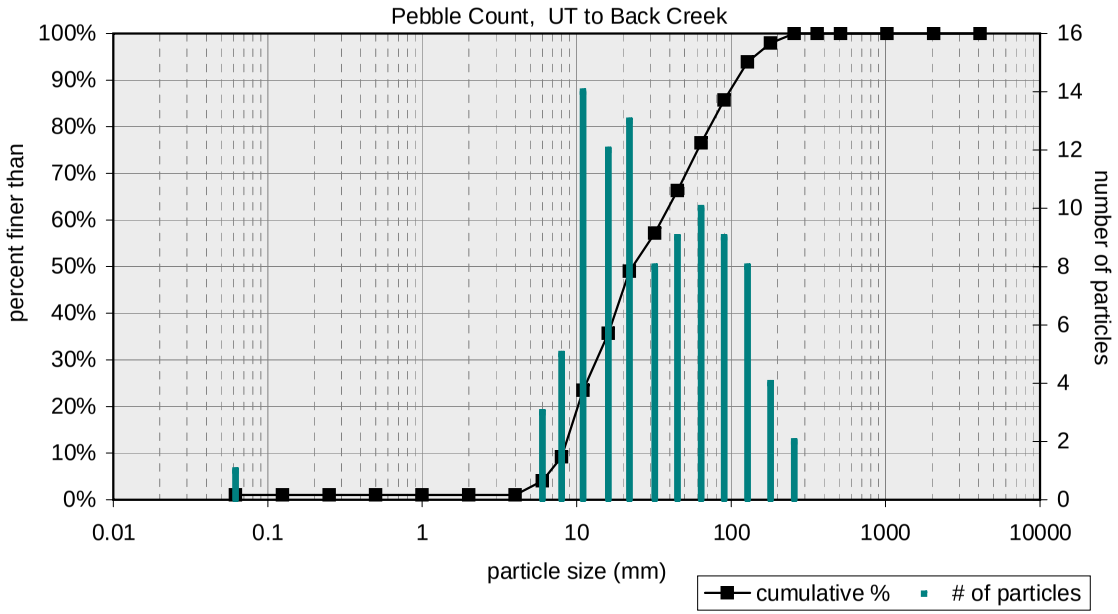
Pebble Count of Channel Reach

Material	Size Range (mm)		Count	
silt/clay	0	0.062	**1**	##
very fine sand	0.062	0.13		##
fine sand	0.13	0.25		##
medium sand	0.25	0.5		##
coarse sand	0.5	1		##
very coarse sand	1	2		##
very fine gravel	2	4		##
fine gravel	4	6	**3**	##
fine gravel	6	8	**5**	##
medium gravel	8	11	**14**	##
medium gravel	11	16	**12**	##
coarse gravel	16	22	**13**	##
coarse gravel	22	32	**8**	##
very coarse gravel	32	45	**9**	##
very coarse gravel	45	64	**10**	##
small cobble	64	90	**9**	##
medium cobble	90	128	**8**	##
large cobble	128	180	**4**	##
very large cobble	180	256	**2**	##
small boulder	256	362		##
small boulder	362	512		##
medium boulder	512	1024		##
large boulder	1024	2048		##
very large boulder	2048	4096		##
	total particle count:		98	

bedrock		**2**
clay hardpan		
detritus/wood		
artificial		
	total count:	100

Pebble Count,

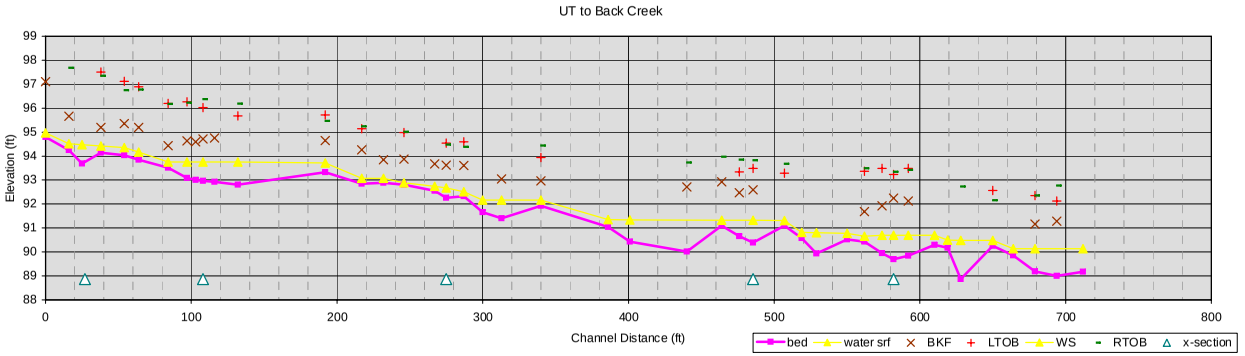
	UT to Back Creek
	Yadkin Basin
	Profile Station 1+92 to 7+12
Note:	**Composite Sample - 50% Riffle; 50% Pool**



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	9.313	15.65	23.1	43	84	141	3.1	28.0	3.0

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	1%	0%	74%	23%	0%	2%	0%	0%	0%

Longitudinal Profile | Hints | Stream: UT to Back Creek | Location:
Watershed: Yadkin | Date:



100 :Elevation BM

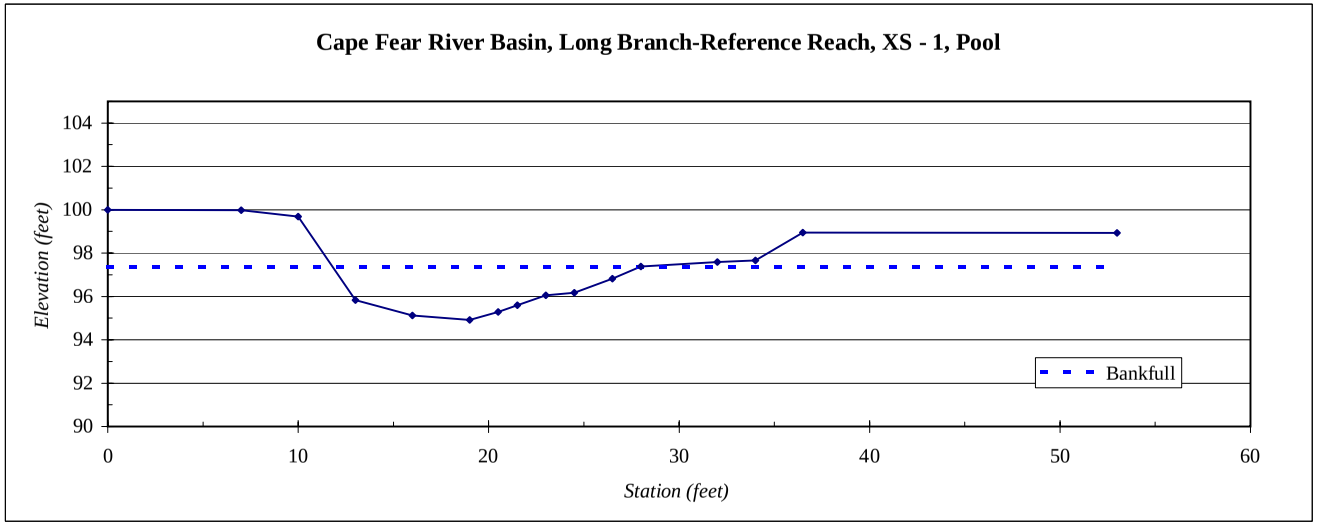
notes	cross section	station		BS	HI	FS TP	FS bed	depth water	FS WS	FS BKF	FS LTOB	FS RTOB	AZ azimuth	ELEV bed	ELEV water srf	ELEV WS	ELEV BKF	ELEV LTOB	ELEV RTOB
HOR		0			100		5.21		5.03	2.89				94.79		94.97	97.11		
HOP		16			100		5.75		5.48	4.34		2.32	225	94.25		94.52	95.66		97.68
MP		25			100		6.31		5.53				225	93.69		94.47			
Riffle	XS 1	27			100								225						
Glide		38			100		5.86		5.58	4.81	2.49	2.65	225	94.14		94.42	95.19	97.51	97.35
Riffle		54			100		5.96		5.65	4.64	2.88	3.25	225	94.04		94.35	95.36	97.12	96.75
Riffle		64			100		6.15		5.83	4.81	3.11	3.23	225	93.85		94.17	95.19	96.89	96.77
TP 1					100	4.97													
				5.54	100.57										N/A	N/A	N/A	N/A	N/A
TR		84			100.57		7.06		6.81	6.13	4.38	4.4	225	93.51		93.76	94.44	96.19	96.17
Run		97			100.57		7.49		6.81	5.94	4.31	4.35		93.08		93.76	94.63	96.26	96.22
Pool		103			100.57		7.57			5.98				93			94.59		
Pool	XS 2	108			100.57		7.61		6.81	5.85	4.55	4.2		92.96		93.76	94.72	96.02	96.37
MP		116			100.57		7.65			5.81			135	92.92			94.76		
Pool		132			100.57		7.77		6.82		4.89	4.39	135	92.8		93.75		95.68	96.18
TP 2					100.57	6.87													
				5.62	99.32										N/A	N/A	N/A	N/A	N/A
Glide		192			99.32		5.99		5.61	4.67	3.61	3.86	180	93.33		93.71	94.65	95.71	95.46
TR		217			99.32		6.47		6.25	5.06	4.18	4.09	180	92.85		93.07	94.26	95.14	95.23
HOR/BR		232			99.32		6.44		6.25	5.47			180	92.88		93.07	93.85		
BR		246			99.32		6.52		6.43	5.45	4.34	4.31	157.5	92.8		92.89	93.87	94.98	95.01
Riffle		267			99.32		6.77		6.58	5.65			157.5	92.55		92.74	93.67		
Riffle	XS 3	275			99.32		7.06		6.65	5.7	4.78	4.84	180	92.26		92.67	93.62	94.54	94.48
Riffle		287			99.32		6.99		6.81	5.71	4.72	4.94	180	92.33		92.51	93.61	94.6	94.38
Crossover Bar		300			99.32		7.66		7.16				180	91.66		92.16			
HOR		313			99.32		7.91		7.16	6.28			180	91.41		92.16	93.04		
HOR		340			99.32		7.4		7.16	6.36	5.38	4.89	180	91.92		92.16	92.96	93.94	94.43
TP 3					99.32	7.48													
				5.61	97.45										N/A	N/A	N/A	N/A	N/A
HOP		386			97.45		6.41		6.1				225	91.04		91.35			
Pool		401			97.45		7.02		6.11				225	90.43		91.34			
Pool		440			97.45		7.43			4.74		3.72	225	90.02			92.71		93.73
Pool		464			97.45		6.35		6.12	4.52		3.48	225	91.1		91.33	92.93		93.97
		476			97.45		6.8			4.98	4.11	3.6	225	90.65			92.47	93.34	93.85
Pool	XS 4	485.5			97.45		7.06		6.13	4.86	3.97	3.63	225	90.39		91.32	92.59	93.48	93.82
HOR		507			97.45		6.35		6.14		4.17	3.78	202.5	91.1		91.31		93.28	93.67
HOP		519			97.45		6.88		6.63				202.5	90.57		90.82			
Pool		529			97.45		7.52		6.64				180	89.93		90.81			
		550			97.45		6.93		6.67				180	90.52		90.78			
HOP		562			97.45		7.02		6.79		4.08		225	90.43		90.66		93.37	
TP 4					97.45	6.47													
				7.22	98.2										N/A	N/A	N/A	N/A	N/A
		562			98.2					6.51		4.72	225				91.69		93.48
Pool		574			98.2		8.25		7.5	6.27	4.71		225	89.95		90.7	91.93	93.49	
Pool	XS 5	582			98.2		8.5		7.5	5.96	4.97	4.86	225	89.7		90.7	92.24	93.23	93.34
Pool		592			98.2		8.36		7.5	6.07	4.71	4.78	315	89.84		90.7	92.13	93.49	93.42
HOR		610			98.2		7.9		7.5				315	90.3		90.7			
HOP		619			98.2		8.02		7.71				315	90.18		90.49			
MP		628			98.2		9.33		7.72			5.48	315	88.87		90.48			92.72
HOR		650			98.2		7.94		7.72		5.63	6.05	315	90.26		90.48		92.57	92.15
HOP		664			98.2		8.34		8.07				315	89.86		90.13			
Pool		679			98.2		9.01		8.07	7.04	5.85	5.85	270	89.19		90.13	91.16	92.35	92.35
Pool		694			98.2		9.2			6.91	6.07	5.43	270	89			91.29	92.13	92.77
Glide		712			98.2		9.02		8.07				270	89.18		90.13			

Long Branch
Reference Reach

River Basin:	Cape Fear
Watershed:	Long Branch-Reference Reach
XS ID	XS - 1, Pool
Drainage Area (sq mi):	1.49
Date:	
Field Crew:	A. Helms, A. French, A. Spiller, G. Mrynzca

Station	Elevation
0	100.00
7	99.98
10	99.69
13	95.83
16	95.12
19	94.91
20.5	95.29
21.5	95.60
23	96.05
24.5	96.17
26.5	96.82
28	97.38
32	97.59
34	97.66
36.5	98.94
53	98.93

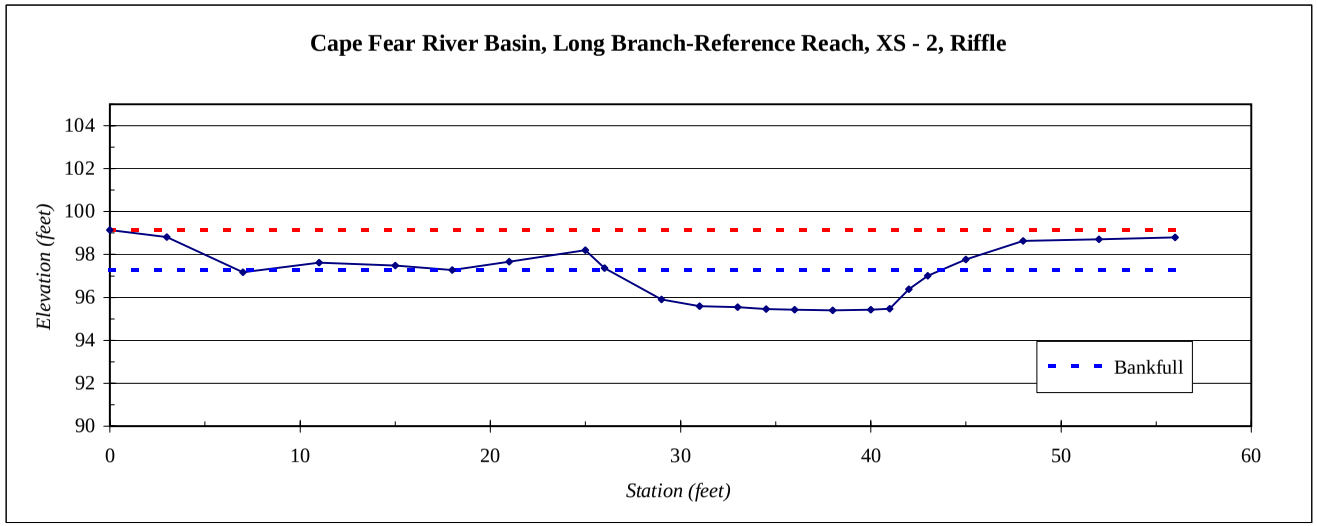
SUMMARY DATA	
Bankfull Elevation:	97.4
Bankfull Cross-Sectional Area:	25.5
Bankfull Width:	16.2
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.5
Mean Depth at Bankfull:	1.6
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-
Water Surface Slope (ft/ft):	0.004



River Basin:	Cape Fear
Watershed:	Long Branch-Reference Reach
XS ID	XS - 2, Riffle
Drainage Area (sq mi):	1.49
Date:	
Field Crew:	A. Helms, A. French, A. Spiller, G. Mrynzca

Station	Elevation
0	99.15
3	98.81
7	97.17
11	97.62
15	97.48
18	97.27
21	97.66
25	98.20
26	97.37
29	95.90
31	95.59
33	95.55
34.5	95.46
36	95.42
38	95.40
40	95.43
41	95.48
42	96.38
43	97.00
45	97.76
48	98.64
52	98.71
56	98.79

SUMMARY DATA	
Bankfull Elevation:	97.3
Bankfull Cross-Sectional Area:	25.1
Bankfull Width:	18.6
Flood Prone Area Elevation:	99.1
Flood Prone Width:	>55
Max Depth at Bankfull:	1.9
Mean Depth at Bankfull:	1.3
W / D Ratio:	13.8
Entrenchment Ratio:	>2.5
Bank Height Ratio:	1.5
Water Surface Slope (ft/ft):	0.004



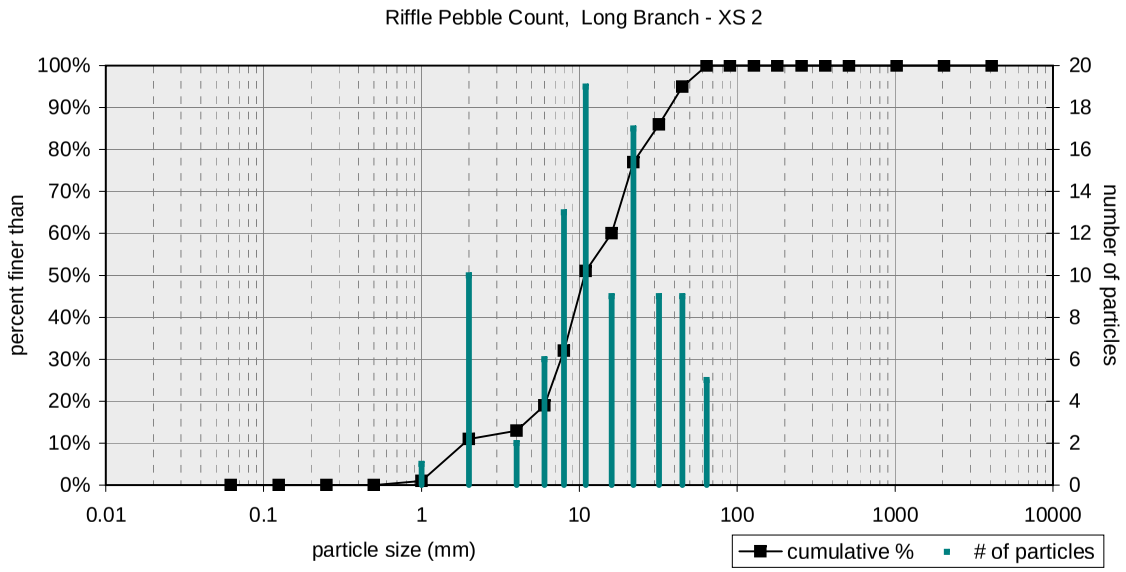
Riffle Pebble Count

Material	Size Range (mm)		Count	
silt/clay	0	0.062		#
very fine sand	0.062	0.13		#
fine sand	0.13	0.25		#
medium sand	0.25	0.5		#
coarse sand	0.5	1	**1**	#
very coarse sand	1	2	**10**	#
very fine gravel	2	4	**2**	#
fine gravel	4	6	**6**	#
fine gravel	6	8	**13**	#
medium gravel	8	11	**19**	#
medium gravel	11	16	**9**	#
coarse gravel	16	22	**17**	#
coarse gravel	22	32	**9**	#
very coarse gravel	32	45	**9**	#
very coarse gravel	45	64	**5**	#
small cobble	64	90		#
medium cobble	90	128		#
large cobble	128	180		#
very large cobble	180	256		#
small boulder	256	362		#
small boulder	362	512		#
medium boulder	512	1024		#
large boulder	1024	2048		#
very large boulder	2048	4096		#
		total particle count:	100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100

Riffle Pebble Count,

	Long Branch - XS 2
	Cape Fear
	Orange County
Note:	**XS 2**



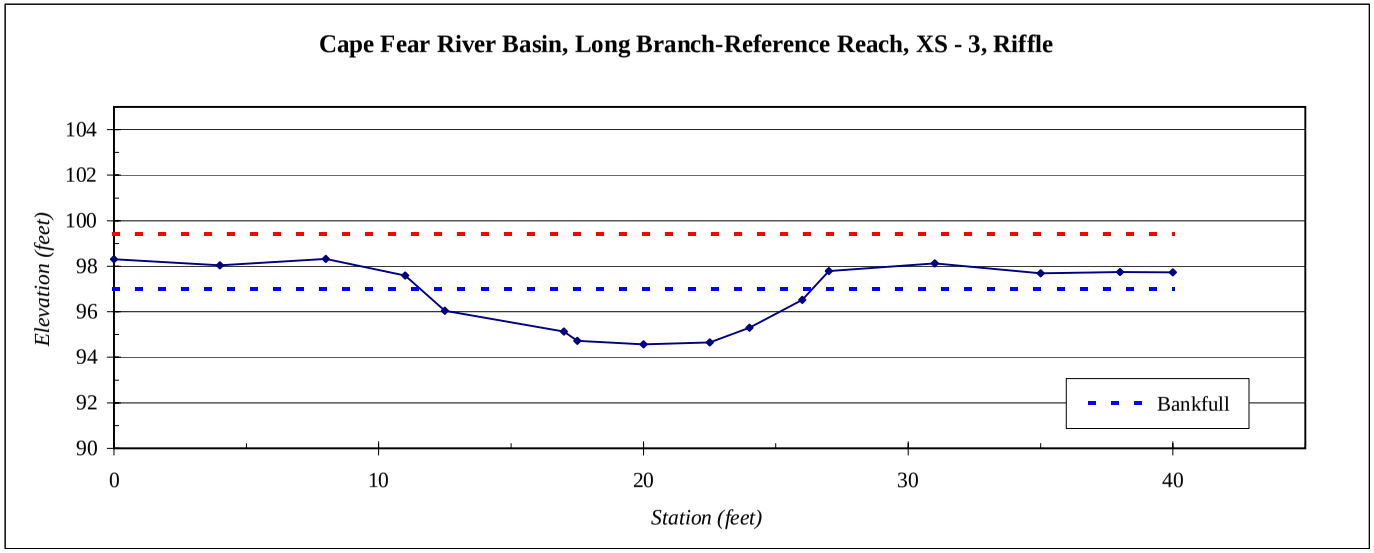
based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	4.899	8.41	10.8	18	29	45	2.5	12.0	2.5

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	11%	89%	0%	0%	0%	0%	0%	0%

River Basin:	Cape Fear
Watershed:	Long Branch-Reference Reach
XS ID	XS - 3, Riffle
Drainage Area (sq mi):	1.49
Date:	
Field Crew:	A. Helms, A. French, A. Spiller, G. Mrynzca

Station	Elevation
0	98.31
4	98.04
8	98.32
11	97.59
12.5	96.05
17	95.13
17.5	94.73
20	94.57
22.5	94.66
24	95.29
26	96.52
27	97.79
31	98.12
35	97.68
38	97.75
40	97.73

SUMMARY DATA	
Bankfull Elevation:	97.0
Bankfull Cross-Sectional Area:	25.0
Bankfull Width:	14.8
Flood Prone Area Elevation:	99.4
Flood Prone Width:	>40
Max Depth at Bankfull:	2.4
Mean Depth at Bankfull:	1.7
W / D Ratio:	8.8
Entrenchment Ratio:	>2.5
Bank Height Ratio:	1.2
Water Surface Slope (ft/ft):	0.004



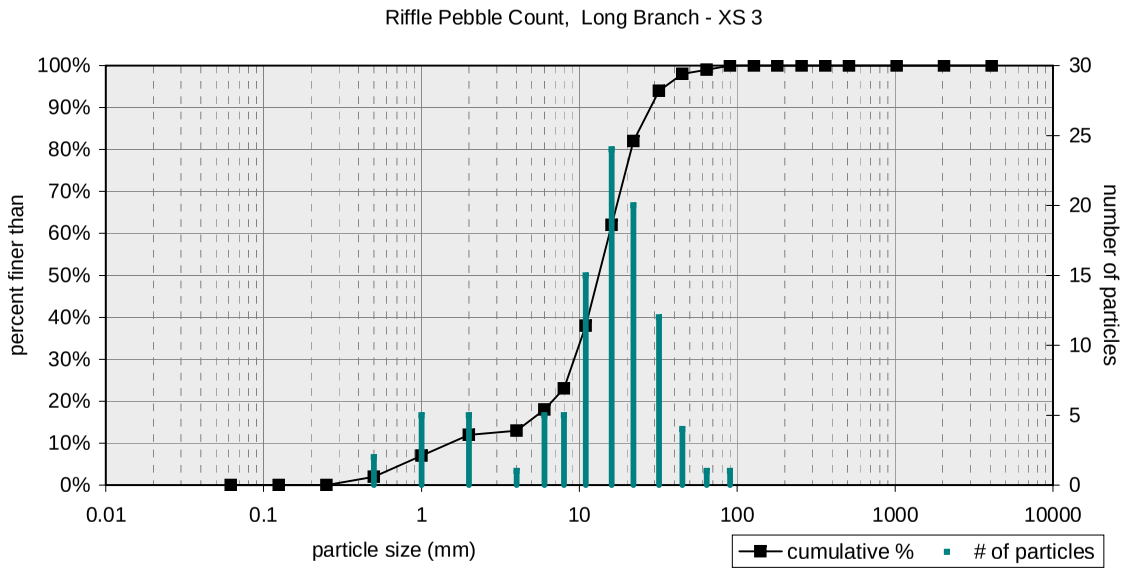
Riffle Pebble Count

Material	Size Range (mm)		Count	
silt/clay	0	0.062		#
very fine sand	0.062	0.13		#
fine sand	0.13	0.25		#
medium sand	0.25	0.5	**2**	#
coarse sand	0.5	1	**5**	#
very coarse sand	1	2	**5**	#
very fine gravel	2	4	**1**	#
fine gravel	4	6	**5**	#
fine gravel	6	8	**5**	#
medium gravel	8	11	**15**	#
medium gravel	11	16	**24**	#
coarse gravel	16	22	**20**	#
coarse gravel	22	32	**12**	#
very coarse gravel	32	45	**4**	#
very coarse gravel	45	64	**1**	#
small cobble	64	90	**1**	#
medium cobble	90	128		#
large cobble	128	180		#
very large cobble	180	256		#
small boulder	256	362		#
small boulder	362	512		#
medium boulder	512	1024		#
large boulder	1024	2048		#
very large boulder	2048	4096		#
		total particle count:	100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100

Riffle Pebble Count,

	Long Branch - XS 3
	Cape Fear
	Orange County
Note:	**XS 3**



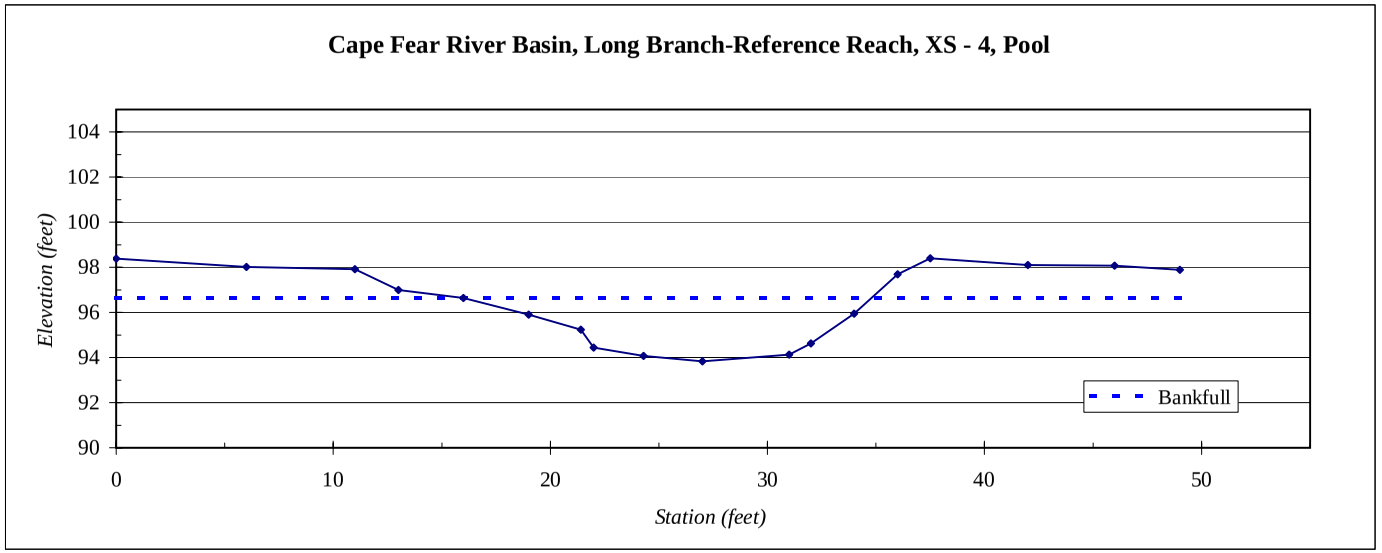
based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	5.102	10.32	13.3	17	23	35	2.2	10.9	2.1

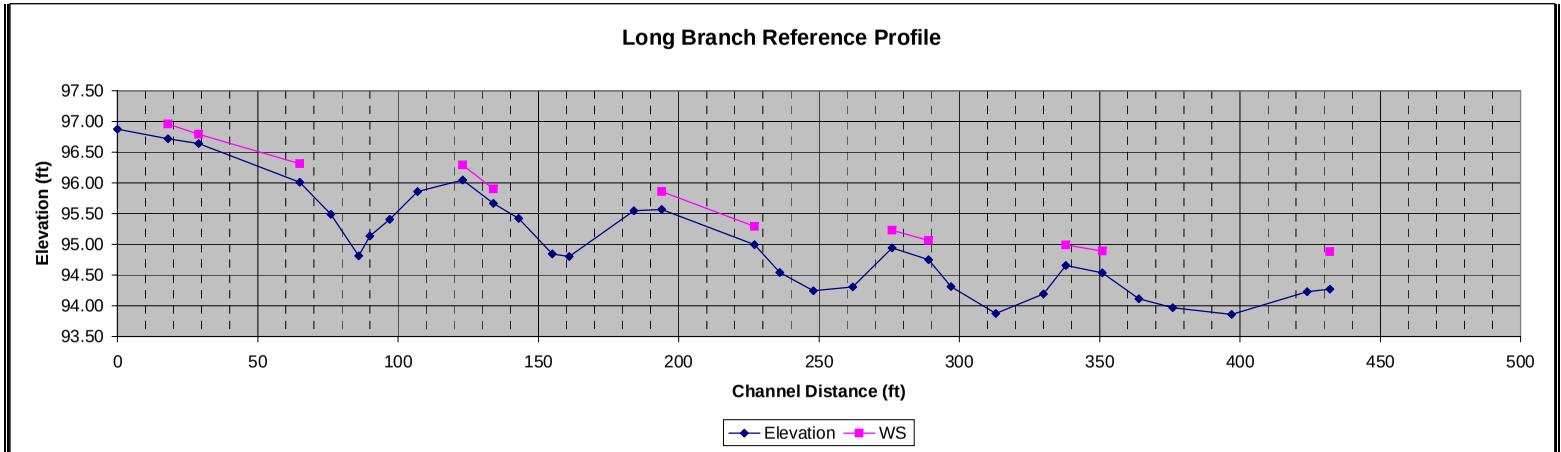
based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	12%	87%	1%	0%	0%	0%	0%	0%

River Basin:	Cape Fear
Watershed:	Long Branch-Reference Reach
XS ID	XS - 4, Pool
Drainage Area (sq mi):	1.49
Date:	
Field Crew:	A. Helms, A. French, A. Spiller, G. Mrynzca

Station	Elevation
0	98.38
6	98.02
11	97.91
13	97.00
16	96.64
19	95.91
21.4	95.23
22	94.45
24.3	94.07
27	93.84
31	94.13
32	94.62
34	95.94
36	97.69
37.5	98.40
42	98.11
46	98.07
49	97.89

SUMMARY DATA	
Bankfull Elevation:	96.6
Bankfull Cross-Sectional Area:	33.4
Bankfull Width:	18.8
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.8
Mean Depth at Bankfull:	1.8
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-
Water Surface Slope (ft/ft):	0.004





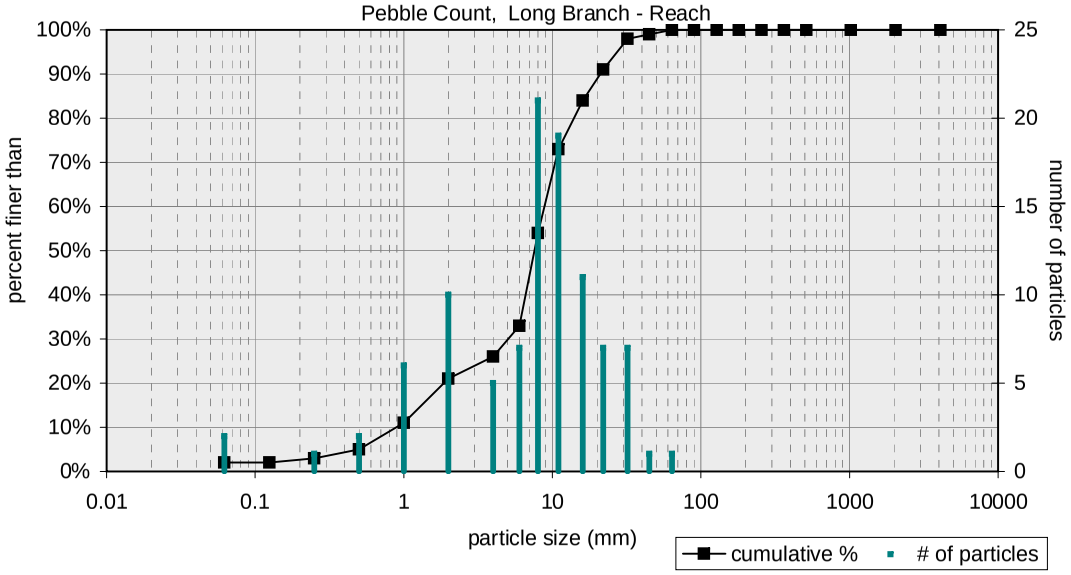
				Elevation BM:	100													
notes	inc distance	station	BS	HI	FS TP	FS bed	depth water	FS LB	FS RB	FS BKF	FS WS	AZ azimuth	ELEV bed	ELEV water srf	ELEV LF	ELEV RB	ELEV BKF	ELEV WS
			0	100														
TW	0	0		100									96.87					96.96
TW_ERI	18	18		100									96.72					96.79
TW_BRI	11	29		100									96.64					96.31
TW_ERI	36	65		100									96.01					
TW_BPO	11	76		100									95.49					
TW_PO	10	86		100									94.81					
TW_EPO	4	90		100									95.14					
TW_GL	7	97		100									95.40					
TW_GL	10	107		100									95.86					96.29
TW_BRI	16	123		100									96.05					95.9
TW_ERI	11	134		100									95.67					
TW_BPO	9	143		100									95.42					
TW_PO	12	155		100									94.84					
TW_EPO	6	161		100									94.80					
TW_GL	23	184		100									95.55					95.86
TW_BRI	10	194		100									95.57					95.29
TW_ERI	33	227		100									94.99					
TW_ERU	9	236		100									94.54					
TW_POOL	12	248		100									94.25					
TW_EPO	14	262		100									94.31					95.23
TW_BRI	14	276		100									94.94					95.06
TW_ERI	13	289		100									94.75					
TW_BPO	8	297		100									94.31					
TW_POOL	16	313		100									93.88					
TW_EPO	17	330		100									94.19					94.99
TW_BRI	8	338		100									94.65					94.89
TW_ERI	13	351		100									94.54					
TW_BPO	13	364		100									94.12					
TW_PO	12	376		100									93.97					
TW_EPO	21	397		100									93.86					
TW_GL	27	424		100									94.23					94.88
TW_BRI	8	432		100									94.27					

Pebble Count of Channel Reach

Material	Size Range (mm)		Count	
silt/clay	0	0.062	**2**	##
very fine sand	0.062	0.13		##
fine sand	0.13	0.25	**1**	##
medium sand	0.25	0.5	**2**	##
coarse sand	0.5	1	**6**	##
very coarse sand	1	2	**10**	##
very fine gravel	2	4	**5**	##
fine gravel	4	6	**7**	##
fine gravel	6	8	**21**	##
medium gravel	8	11	**19**	##
medium gravel	11	16	**11**	##
coarse gravel	16	22	**7**	##
coarse gravel	22	32	**7**	##
very coarse gravel	32	45	**1**	##
very coarse gravel	45	64	**1**	##
small cobble	64	90		##
medium cobble	90	128		##
large cobble	128	180		##
very large cobble	180	256		##
small boulder	256	362		##
small boulder	362	512		##
medium boulder	512	1024		##
large boulder	1024	2048		##
very large boulder	2048	4096		##
		total particle count:	100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100

Pebble Count,
Long Branch - Reach
Cape Fear
Orange County
Note: **Reach**



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	1.414	6.17	7.6	10	16	27	3.7	4.8	3.4

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	2%	19%	79%	0%	0%	0%	0%	0%	0%

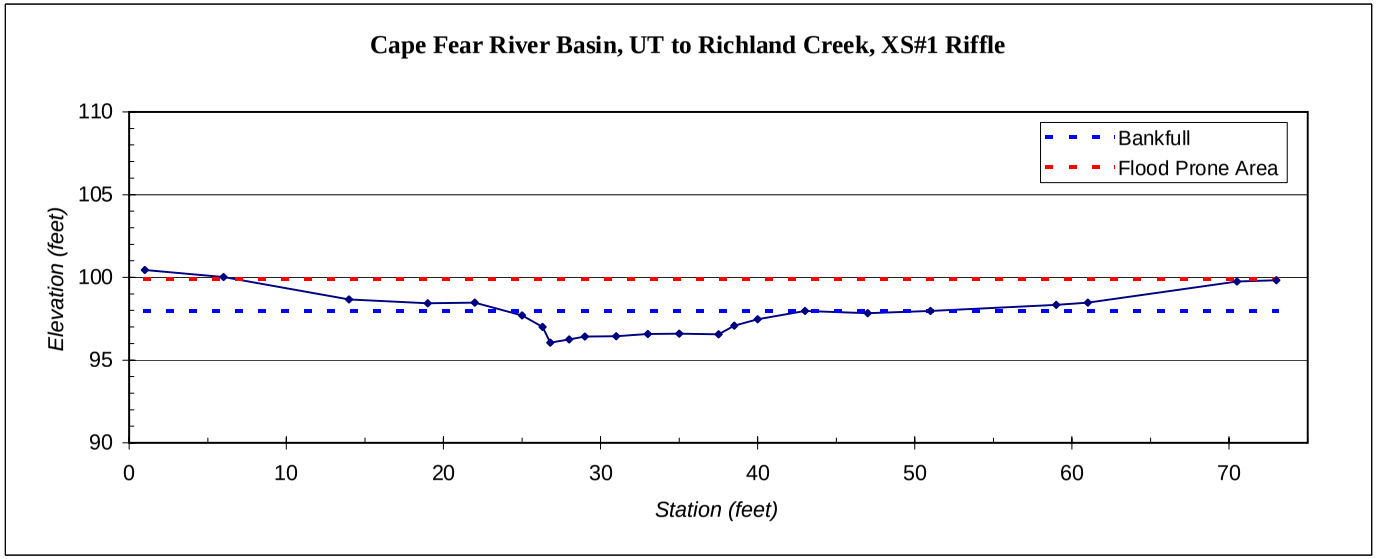
Richland Creek
Reference Reach

River Basin:	Cape Fear
Watershed:	UT to Richland Creek
XS ID	XS#1 Riffle
Drainage Area (sq mi):	0.9
Date:	
Field Crew:	A. Schlindwein, M. Schlegel

Station	Rod Ht.	Elevation
1	1.75	100.45
6	2.19	100.01
14	3.54	98.66
19	3.76	98.44
22	3.73	98.47
25	4.51	97.69
26.3	5.2	97.00
26.8	6.15	96.05
28	5.95	96.25
29	5.78	96.42
31	5.75	96.45
33	5.62	96.58
35	5.61	96.59
37.5	5.65	96.55
38.5	5.12	97.08
40	4.73	97.47
43	4.23	97.97
47	4.36	97.84
51	4.23	97.97
59	3.87	98.33
61	3.72	98.48
70.5	2.46	99.74
73	2.38	99.82

SUMMARY DATA	
Bankfull Elevation:	97.97
Bankfull Cross-Sectional Area:	21.20
Bankfull Width:	18.00
Flood Prone Area Elevation:	99.89
Flood Prone Width:	200.00
Max Depth at Bankfull:	1.92
Mean Depth at Bankfull:	1.18
W / D Ratio:	15.3
Entrenchment Ratio:	7.40
Bank Height Ratio:	-
Slope (ft/ft):	0.030
Discharge (cfs)	123

Stream Type:	C3/C4

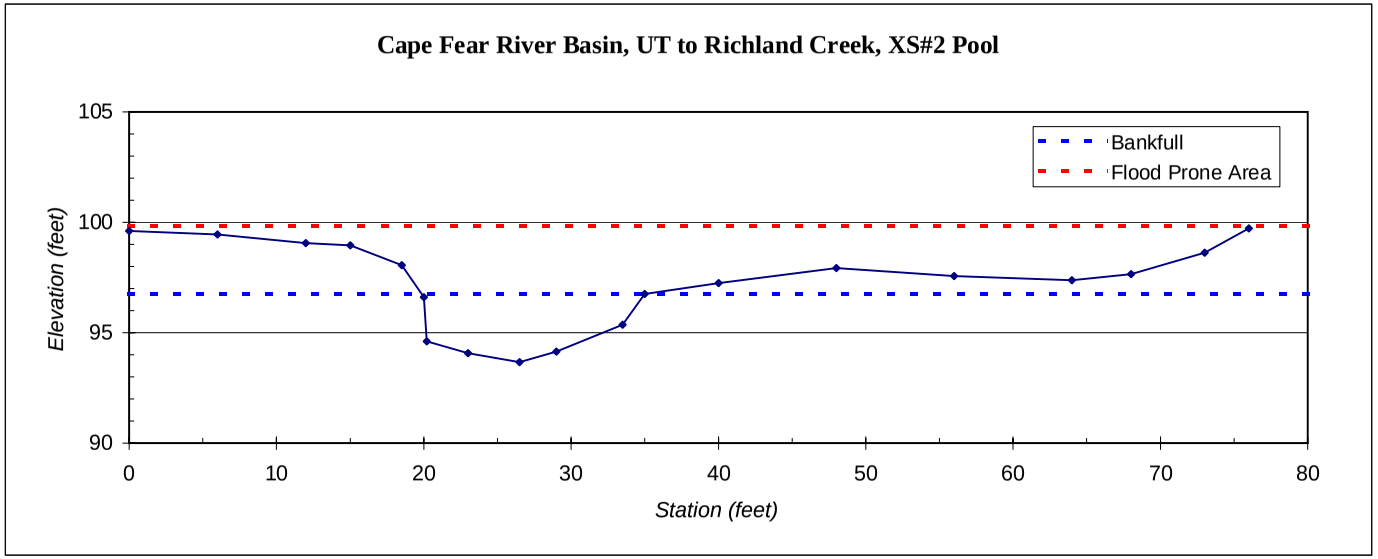


River Basin:	Cape Fear
Watershed:	UT to Richland Creek
XS ID	XS#2 Pool
Drainage Area (sq mi):	0.9
Date:	
Field Crew:	A. Schlindwein, M. Schlegel

Station	Rod Ht.	Elevation
0	2.59	99.61
6	2.75	99.45
12	3.14	99.06
15	3.24	98.96
18.5	4.14	98.06
20	5.59	96.61
20.2	7.59	94.61
23	8.13	94.07
26.5	8.53	93.67
29	8.05	94.15
33.5	6.84	95.36
35	5.44	96.76
40	4.95	97.25
48	4.27	97.93
56	4.64	97.56
64	4.82	97.38
68	4.55	97.65
73	3.58	98.62
76	2.48	99.72

SUMMARY DATA	
Bankfull Elevation:	96.76
Bankfull Cross-Sectional Area:	35.60
Bankfull Width:	15.20
Flood Prone Area Elevation:	99.85
Flood Prone Width:	-
Max Depth at Bankfull:	3.09
Mean Depth at Bankfull:	2.34
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-
Slope (ft/ft):	-
Discharge (cfs)	-

Stream Type:	C3/C4

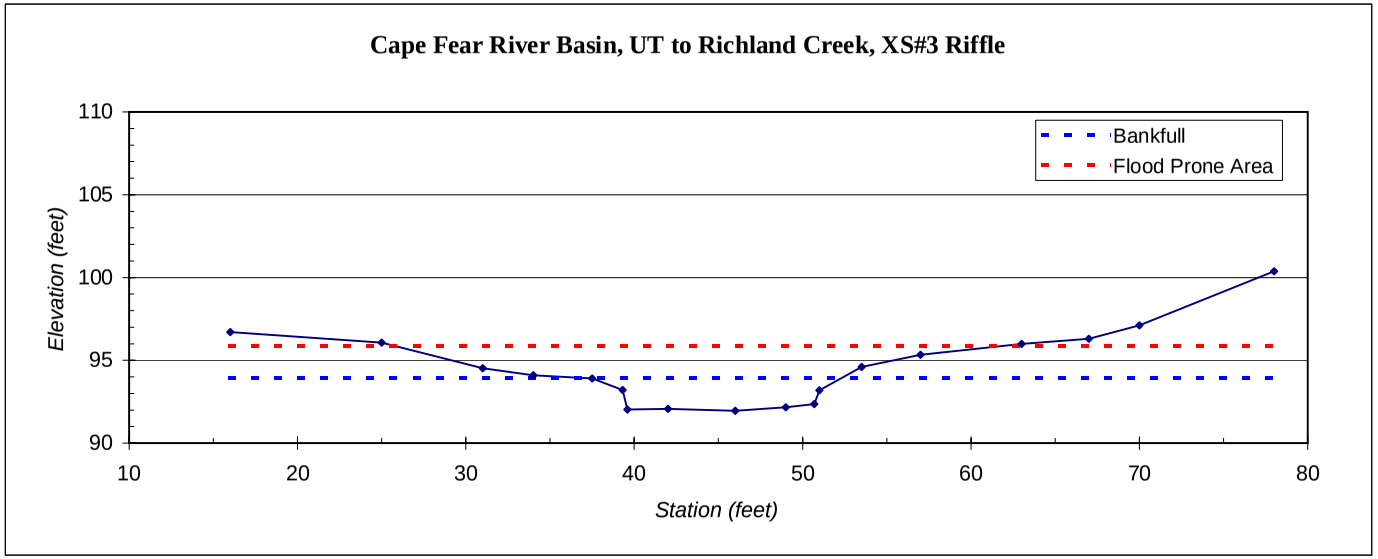


River Basin:	Cape Fear
Watershed:	UT to Richland Creek
XS ID	XS#3 Riffle
Drainage Area (sq mi):	0.9
Date:	
Field Crew:	A. Schlindwein, M. Schlegel

Station	Rod Ht.	Elevation
16	4.57	96.71
25	5.22	96.06
31	6.75	94.53
34	7.19	94.09
37.5	7.37	93.91
39.3	8.07	93.21
39.6	9.25	92.03
42	9.22	92.06
46	9.33	91.95
49	9.12	92.16
50.7	8.93	92.35
51	8.09	93.19
53.5	6.69	94.59
57	5.94	95.34
63	5.29	95.99
67	4.99	96.29
70	4.17	97.11
78	0.9	100.38

SUMMARY DATA	
Bankfull Elevation:	93.91
Bankfull Cross-Sectional Area:	22.30
Bankfull Width:	14.80
Flood Prone Area Elevation:	95.87
Flood Prone Width:	150.00
Max Depth at Bankfull:	1.96
Mean Depth at Bankfull:	1.51
W / D Ratio:	9.8
Entrenchment Ratio:	10.10
Bank Height Ratio:	-
Slope (ft/ft):	0.017
Discharge (cfs)	151

Stream Type:	C3/C4



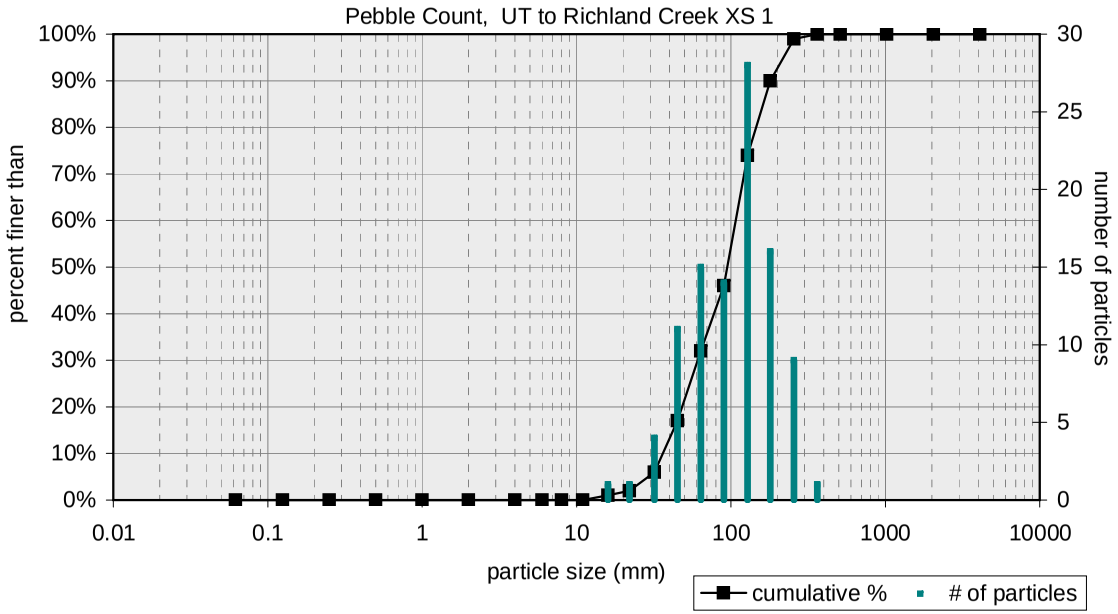
Pebble Count of Channel Reach

Material	Size Range (mm)		Count	
silt/clay	0	0.062		##
very fine sand	0.062	0.13		##
fine sand	0.13	0.25		##
medium sand	0.25	0.5		##
coarse sand	0.5	1		##
very coarse sand	1	2		##
very fine gravel	2	4		##
fine gravel	4	6		##
fine gravel	6	8		##
medium gravel	8	11		##
medium gravel	11	16	**1**	##
coarse gravel	16	22	**1**	##
coarse gravel	22	32	**4**	##
very coarse gravel	32	45	**11**	##
very coarse gravel	45	64	**15**	##
small cobble	64	90	**14**	##
medium cobble	90	128	**28**	##
large cobble	128	180	**16**	##
very large cobble	180	256	**9**	##
small boulder	256	362	**1**	##
small boulder	362	512		##
medium boulder	512	1024		##
large boulder	1024	2048		##
very large boulder	2048	4096		##
	total particle count:		100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		100

Pebble Count,
UT to Richland Creek XS 1
Cape Fear Basin

Note: **UT to Richland Creek XS 1 Riffle**



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	43.627	68.85	94.6	114	158	219	1.9	83.1	1.9

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	0%	32%	67%	1%	0%	0%	0%	0%

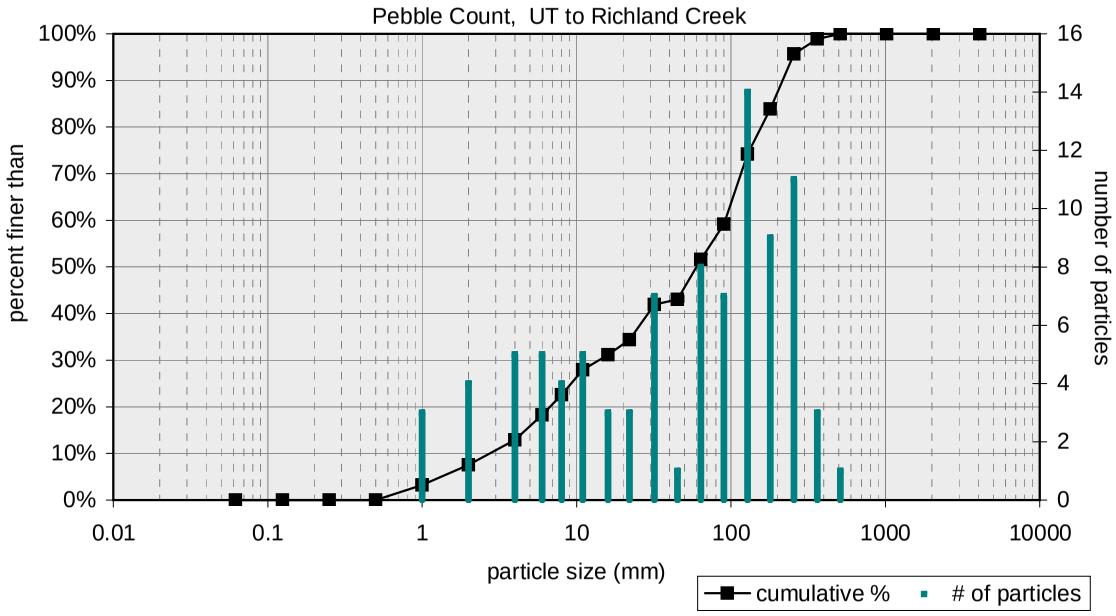
Pebble Count of Channel Reach

Pebble Count,
UT to Richland Creek
Cape Fear Basin

Note: **UT to Richland Creek XS 2 Pool**

Material	Size Range (mm)		Count	
silt/clay	0	0.062		##
very fine sand	0.062	0.13		##
fine sand	0.13	0.25		##
medium sand	0.25	0.5		##
coarse sand	0.5	1	**3**	##
very coarse sand	1	2	**4**	##
very fine gravel	2	4	**5**	##
fine gravel	4	6	**5**	##
fine gravel	6	8	**4**	##
medium gravel	8	11	**5**	##
medium gravel	11	16	**3**	##
coarse gravel	16	22	**3**	##
coarse gravel	22	32	**7**	##
very coarse gravel	32	45	**1**	##
very coarse gravel	45	64	**8**	##
small cobble	64	90	**7**	##
medium cobble	90	128	**14**	##
large cobble	128	180	**9**	##
very large cobble	180	256	**11**	##
small boulder	256	362	**3**	##
small boulder	362	512	**1**	##
medium boulder	512	1024		##
large boulder	1024	2048		##
very large boulder	2048	4096		##
	total particle count:		93	

bedrock		**10**
clay hardpan		
detritus/wood		
artificial		
	total count:	103



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	5.052	22.66	59.9	103	181	251	7.4	30.2	6.0

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	7%	40%	40%	4%	10%	0%	0%	0%

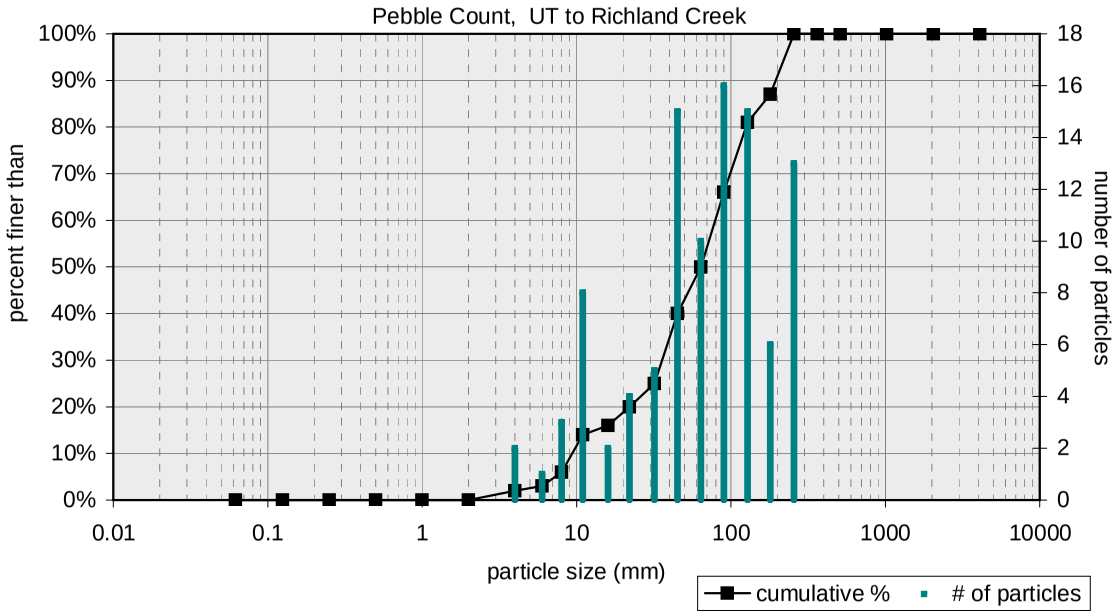
Pebble Count of Channel Reach

Pebble Count,
UT to Richland Creek
Cape Fear Basin

Note: **UT to Richland Creek XS 3 Riffle**

Material	Size Range (mm)		Count	
silt/clay	0	0.062		##
very fine sand	0.062	0.13		##
fine sand	0.13	0.25		##
medium sand	0.25	0.5		##
coarse sand	0.5	1		##
very coarse sand	1	2		##
very fine gravel	2	4	**2**	##
fine gravel	4	6	**1**	##
fine gravel	6	8	**3**	##
medium gravel	8	11	**8**	##
medium gravel	11	16	**2**	##
coarse gravel	16	22	**4**	##
coarse gravel	22	32	**5**	##
very coarse gravel	32	45	**15**	##
very coarse gravel	45	64	**10**	##
small cobble	64	90	**16**	##
medium cobble	90	128	**15**	##
large cobble	128	180	**6**	##
very large cobble	180	256	**13**	##
small boulder	256	362		##
small boulder	362	512		##
medium boulder	512	1024		##
large boulder	1024	2048		##
very large boulder	2048	4096		##
		total particle count:	100	

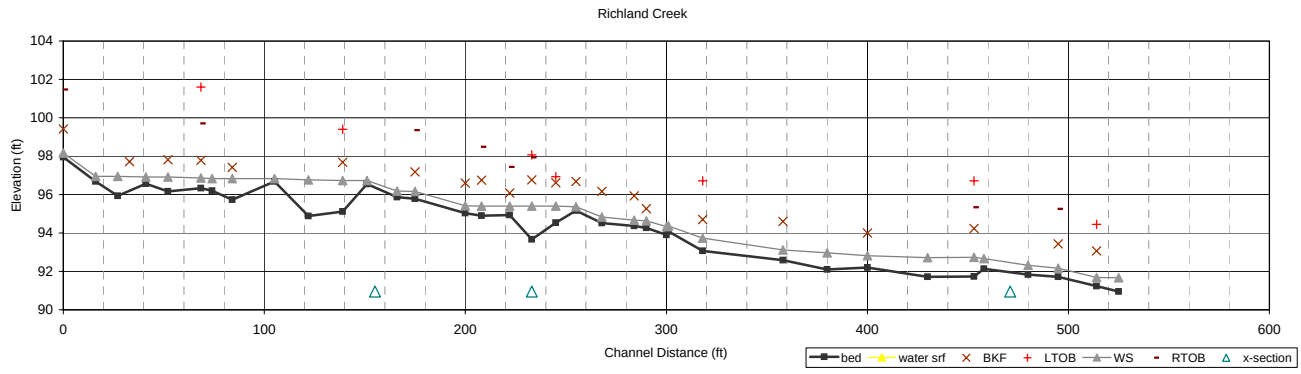
bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	16.000	40.17	64.0	88	152	224	3.2	49.3	3.1

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	0%	50%	50%	0%	0%	0%	0%	0%

Longitudinal Profile | Hints | Stream: **Richland Creek** | Watershed: **Cape Fear** | Location: | Date:



105.28 :Elevation BM

notes	cross section	station		BS	HI	FS TP	FS bed	depth water	FS WS	FS BKF	FS LTOB	FS RTOB	AZ azimuth	ELEV bed	ELEV water srf	ELEV WS	ELEV BKF	ELEV LTOB	ELEV RTOB
HOR		0			105.28		7.33		7.12	5.86		3.81		97.95		98.16	99.42		101.47
HOP		16			105.28		8.6		8.33					96.68		96.95			
MP		27			105.28		9.35		8.33					95.93		96.95			
		33			105.28					7.56							97.72		
Glide		41			105.28		8.71		8.37					96.57		96.91			
Glide		52			105.28		9.11		8.37	7.47				96.17		96.91	97.81		
HOR		68.5			105.28		8.95		8.42	7.49	3.68	5.58		96.33		96.86	97.79	101.6	99.7
Hop		74			105.28		9.08		8.44					96.2		96.84			
Pool		84			105.28		9.54		8.44	7.86				95.74		96.84	97.42		
HOP/BR		105			105.28		8.6		8.45					96.68		96.83			
Pool		122			105.28		10.39		8.51					94.89		96.77			
Pool		139			105.28		10.16		8.55	7.59	5.88			95.12		96.73	97.69	99.4	
HOR		151			105.28		8.73		8.54					96.55		96.74			
Riffle	XS 1	155			105.28														
TR		166			105.28		9.41		9.1					95.87		96.18			
Run		175			105.28		9.49		9.12	8.09		5.93		95.79		96.16	97.19		99.35
HOP		200			105.28		10.24		9.86	8.68				95.04		95.42	96.6		
TP 1					105.28	9.54													
				6.46	102.2														
Run		208			102.2		7.3		6.8	5.45		3.71		94.9		95.4	96.75		98.49
HOP		222			102.2		7.26		6.8	6.11		4.76		94.94		95.4	96.09		97.44
MP	XS 2	233			102.2		8.53		6.8	5.44	4.14	4.27		93.67		95.4	96.76	98.06	97.93
Glide		245			102.2		7.66		6.8	5.59	5.26			94.54		95.4	96.61	96.94	
HOR		255			102.2		7.04		6.83	5.51				95.16		95.37	96.69		
Riffle		268			102.2		7.68		7.36	6.03				94.52		94.84	96.17		
		284			102.2		7.84		7.54	6.26				94.36		94.66	95.94		
Run		290			102.2		7.94		7.57	6.93				94.26		94.63	95.27		
		300			102.2		8.3		7.86					93.9		94.34			
TP 2					102.2	7.2													
				4.66	99.66														
Riffle		301			99.66		5.58		5.3					94.08		94.36			
Pool		318			99.66		6.59		5.93	4.96	2.95			93.07		93.73	94.7	96.71	
iffle/Run/BR		358			99.66		7.07		6.54	5.06				92.59		93.12	94.6		
Pool		380			99.66		7.56		6.7					92.1		92.96			
Riffle		400			99.66		7.46		6.85	5.66				92.2		92.81	94		
HOP		430			99.66		7.94		6.94					91.72		92.72			
Pool		453			99.66		7.92		6.92	5.43	2.95	4.32		91.74		92.74	94.23	96.71	95.34
HOR		458			99.66		7.53		7					92.13		92.66			
Riffle	XS 3	471			99.66														
Riffle		480			99.66		7.82		7.34					91.84		92.32			
Riffle		495			99.66		7.95		7.49	6.22		4.41		91.71		92.17	93.44		95.25
TR		514			99.66		8.42		7.97	6.6	5.21			91.24		91.69	93.06	94.45	
Small Bend		525			99.66		8.71		7.99					90.95		91.67			
					99.66	6.81													
				8.43	101.28														
					101.28														

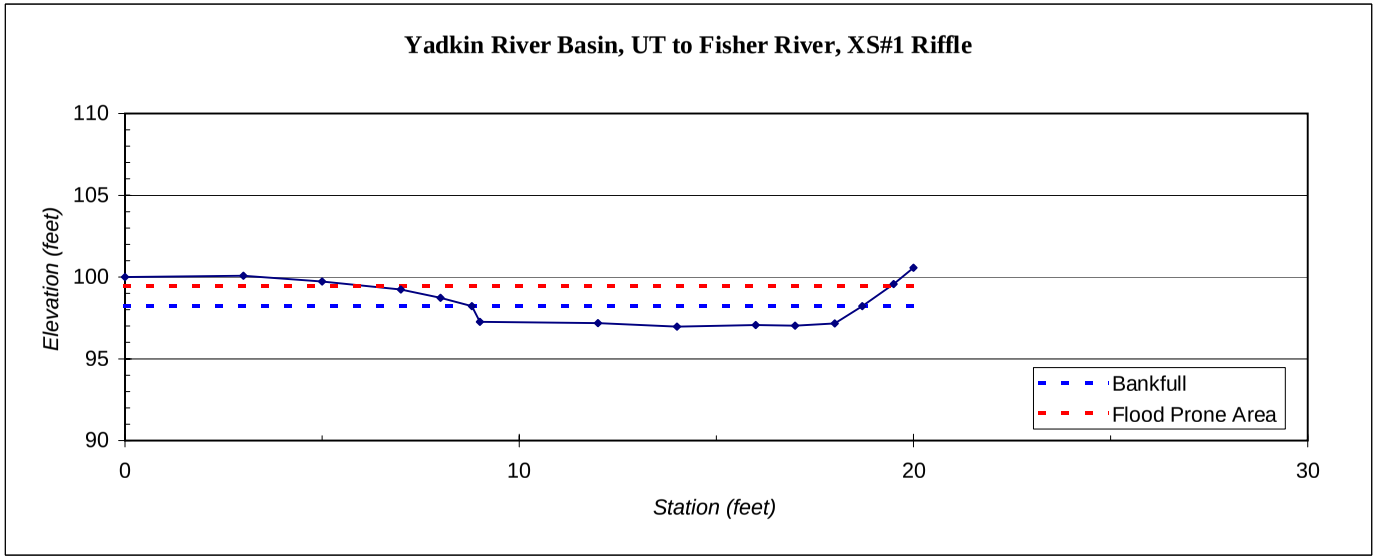
UT to Fisher River

River Basin:	Yadkin
Watershed:	UT to Fisher River
XS ID	XS#1 Riffle
Drainage Area (sq mi):	0.38
Date:	6/9/2005
Field Crew:	G. Mryncza, A. Spiller

Station	Rod Ht.	Elevation
0.0	2.22	100.00
3.0	2.15	100.07
5.0	2.50	99.72
7.0	2.98	99.24
8.0	3.49	98.73
8.8	4.00	98.22
9.0	4.96	97.26
12.0	5.03	97.19
14.0	5.25	96.97
16.0	5.16	97.06
17.0	5.20	97.02
18.0	5.06	97.16
18.7	4.00	98.22
19.5	2.65	99.57
20.0	1.66	100.56

SUMMARY DATA	
Bankfull Elevation:	98.22
Bankfull Cross-Sectional Area:	10.40
Bankfull Width:	10.00
Flood Prone Area Elevation:	99.47
Flood Prone Width:	13.10
Max Depth at Bankfull:	1.25
Mean Depth at Bankfull:	1.04
W / D Ratio:	9.6
Entrenchment Ratio:	1.30
Bank Height Ratio:	2.08
Slope (ft/ft):	0.013
Discharge (cfs)	42

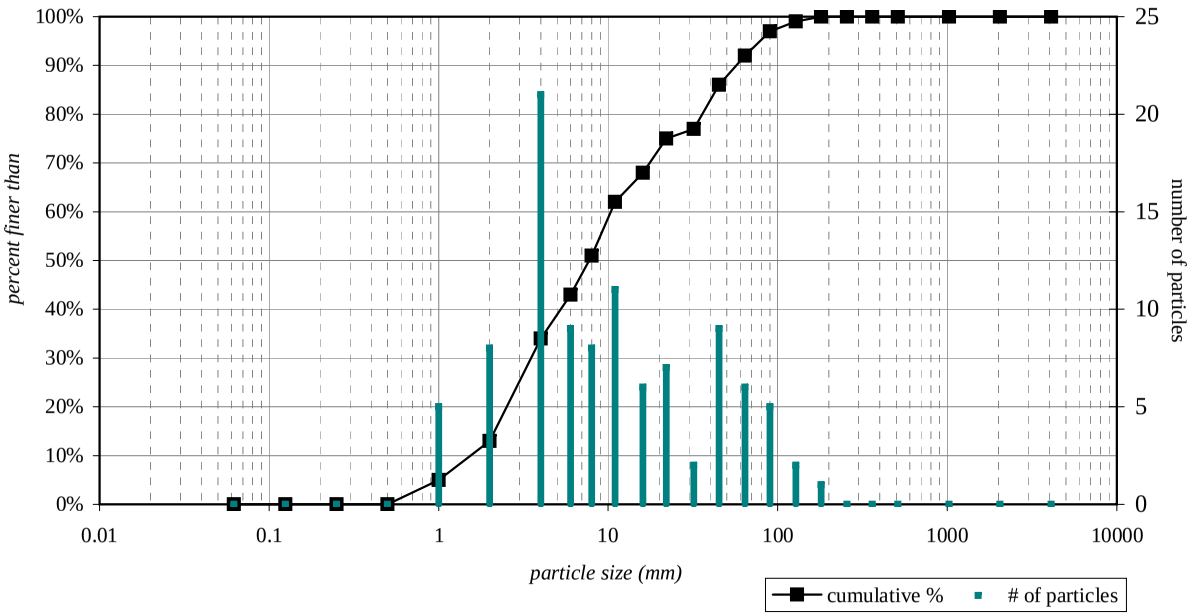
Stream Type:	B4c



Pebble Count

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	**0**
medium sand	0.25	0.5	**0**
coarse sand	0.5	1	**5**
very coarse sand	1	2	**8**
very fine gravel	2	4	**21**
fine gravel	4	6	**9**
fine gravel	6	8	**8**
medium gravel	8	11	**11**
medium gravel	11	16	**6**
coarse gravel	16	22	**7**
coarse gravel	22	32	**2**
very coarse gravel	32	45	**9**
very coarse gravel	45	64	**6**
small cobble	64	90	**5**
medium cobble	90	128	**2**
large cobble	128	180	**1**
very large cobble	180	256	**0**
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:	100

	UT to Fsher River
	Surry County, NC
	Riffle #1 (Sta. 01+00)
Note:	



bedrock			
clay hardpan			
detritus/wood			
artificial			
	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
	2.208	4.18	7.7	13	42	79	4.5	9.6	4.3

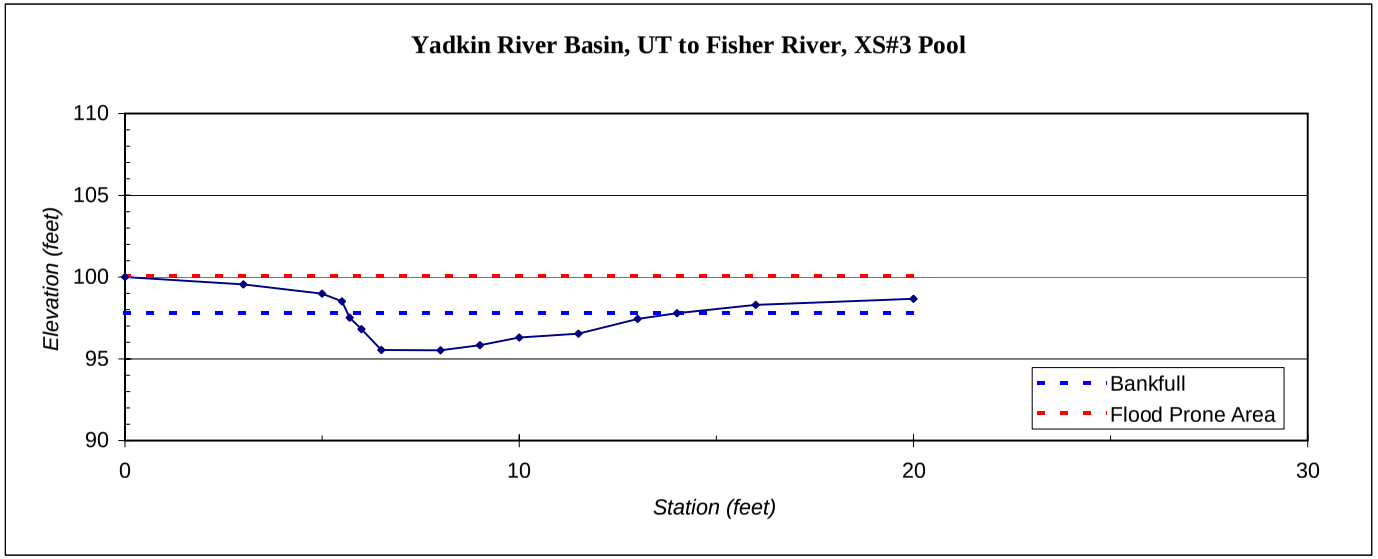
based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	13%	79%	8%	0%	0%	0%	0%	0%

River Basin:	Yadkin
Watershed:	UT to Fisher River
XS ID	XS#3 Pool
Drainage Area (sq mi):	0.38
Date:	6/9/2005
Field Crew:	G. Mryncza, A. Spiller

Station	Rod Ht.	Elevation
0.0	1.33	100.00
3.0	1.78	99.55
5.0	2.35	98.98
5.5	2.82	98.51
5.7	3.81	97.52
6.0	4.52	96.81
6.5	5.79	95.54
8.0	5.82	95.51
9.0	5.50	95.83
10.0	5.02	96.31
11.5	4.80	96.53
13.0	3.90	97.43
14.0	3.55	97.78
16.0	3.03	98.30
20.0	2.66	98.67

SUMMARY DATA	
Bankfull Elevation:	97.78
Bankfull Cross-Sectional Area:	11.60
Bankfull Width:	8.35
Flood Prone Area Elevation:	100.05
Flood Prone Width:	
Max Depth at Bankfull:	2.27
Mean Depth at Bankfull:	1.39
W / D Ratio:	6.0
Entrenchment Ratio:	
Bank Height Ratio:	0.85
Slope (ft/ft):	0.001
Discharge (cfs)	52

Stream Type:	B4c

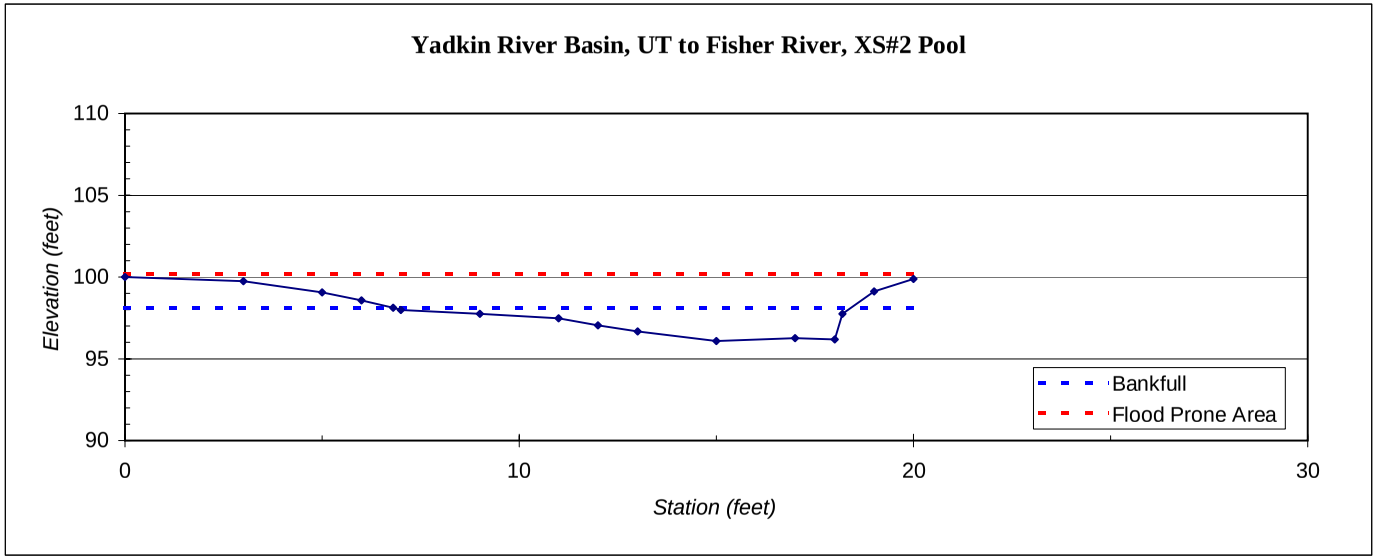


River Basin:	Yadkin
Watershed:	UT to Fisher River
XS ID	XS#2 Pool
Drainage Area (sq mi):	0.38
Date:	6/9/2005
Field Crew:	G. Mryncza, A. Spiller

Station	Rod Ht.	Elevation
0.0	2.68	100.00
3.0	2.94	99.74
5.0	3.61	99.07
6.0	4.10	98.58
6.8	4.56	98.12
7.0	4.70	97.98
9.0	4.94	97.74
11.0	5.21	97.47
12.0	5.64	97.04
13.0	6.00	96.68
15.0	6.59	96.09
17.0	6.42	96.26
18.0	6.50	96.18
18.2	4.93	97.75
19.0	3.56	99.12
20.0	2.80	99.88

SUMMARY DATA	
Bankfull Elevation:	98.12
Bankfull Cross-Sectional Area:	13.40
Bankfull Width:	11.62
Flood Prone Area Elevation:	100.15
Flood Prone Width:	
Max Depth at Bankfull:	2.03
Mean Depth at Bankfull:	1.15
W / D Ratio:	10.1
Entrenchment Ratio:	
Bank Height Ratio:	0.81
Slope (ft/ft):	0.001
Discharge (cfs)	56

Stream Type:	B4c

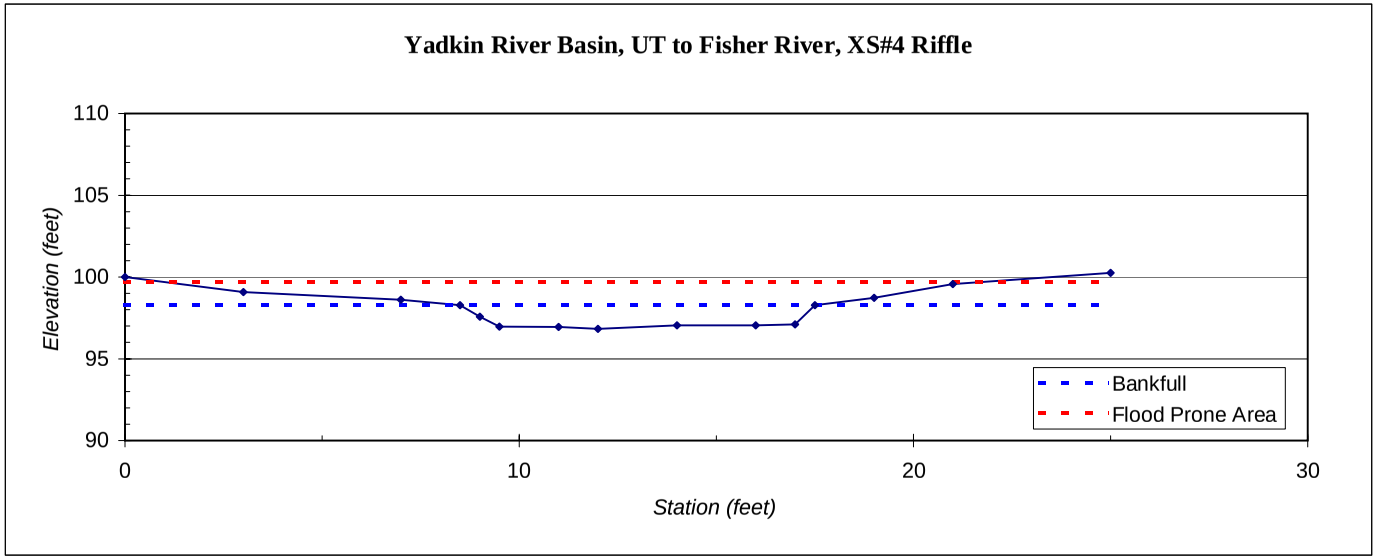


River Basin:	Yadkin
Watershed:	UT to Fisher River
XS ID	XS#4 Riffle
Drainage Area (sq mi):	0.38
Date:	6/9/2005
Field Crew:	G. Mryncza, A. Spiller

Station	Rod Ht.	Elevation
0.0	4.62	100.00
3.0	5.54	99.08
7.0	6.01	98.61
8.5	6.34	98.28
9.0	7.04	97.58
9.5	7.66	96.96
11.0	7.67	96.95
12.0	7.79	96.83
14.0	7.58	97.04
16.0	7.57	97.05
17.0	7.51	97.11
17.5	6.34	98.28
19.0	5.90	98.72
21.0	5.06	99.56
25.0	4.37	100.25

SUMMARY DATA	
Bankfull Elevation:	98.28
Bankfull Cross-Sectional Area:	10.70
Bankfull Width:	9.00
Flood Prone Area Elevation:	99.73
Flood Prone Width:	20.50
Max Depth at Bankfull:	1.45
Mean Depth at Bankfull:	1.19
W / D Ratio:	7.6
Entrenchment Ratio:	2.30
Bank Height Ratio:	1.00
Slope (ft/ft):	0.013
Discharge (cfs)	46

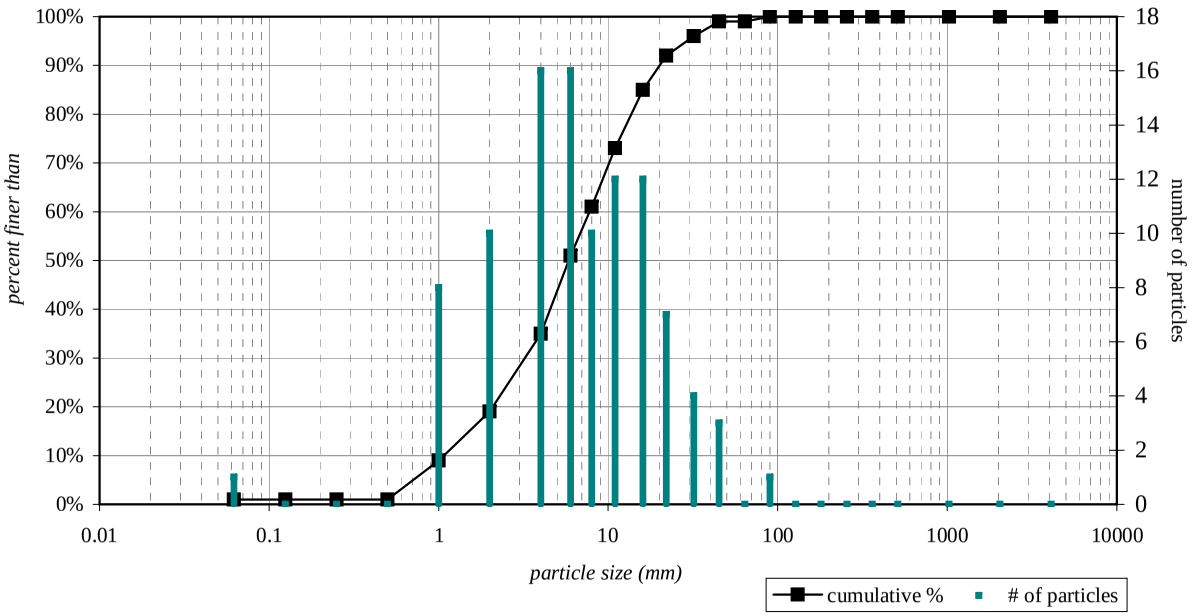
Stream Type:	B4c



Pebble Count

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	**0**
medium sand	0.25	0.5	**0**
coarse sand	0.5	1	**8**
very coarse sand	1	2	**10**
very fine gravel	2	4	**16**
fine gravel	4	6	**16**
fine gravel	6	8	**10**
medium gravel	8	11	**12**
medium gravel	11	16	**12**
coarse gravel	16	22	**7**
coarse gravel	22	32	**4**
very coarse gravel	32	45	**3**
very coarse gravel	45	64	**0**
small cobble	64	90	**1**
medium cobble	90	128	**0**
large cobble	128	180	**0**
very large cobble	180	256	**0**
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:		100

UT to Fsher River
Surry County, NC
Riffle #2 (Sta. 02+55)
Note:



bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		100

based on	size percent less than (mm)						particle size distribution		
sediment	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
particles only	1.625	4.00	5.8	9	16	29	3.1	5.0	3.1

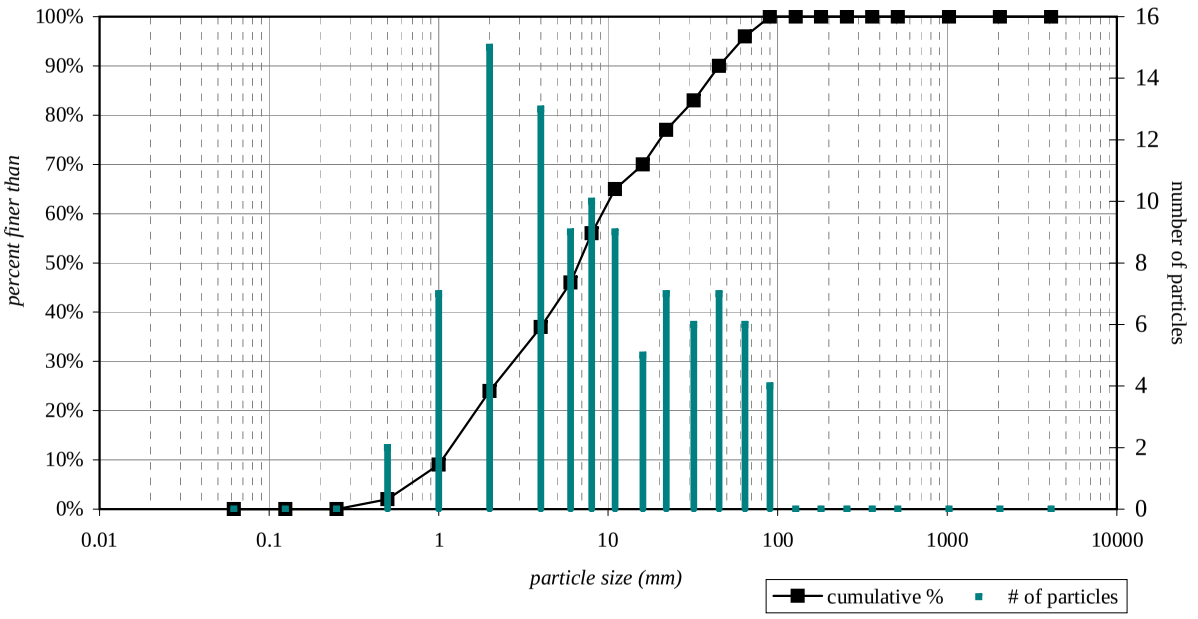
based on	percent by substrate type								
total count	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	1%	18%	80%	1%	0%	0%	0%	0%	0%

Pebble Count

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	**0**
medium sand	0.25	0.5	**2**
coarse sand	0.5	1	**7**
very coarse sand	1	2	**15**
very fine gravel	2	4	**13**
fine gravel	4	6	**9**
fine gravel	6	8	**10**
medium gravel	8	11	**9**
medium gravel	11	16	**5**
coarse gravel	16	22	**7**
coarse gravel	22	32	**6**
very coarse gravel	32	45	**7**
very coarse gravel	45	64	**6**
small cobble	64	90	**4**
medium cobble	90	128	**0**
large cobble	128	180	**0**
very large cobble	180	256	**0**
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:		100

UT to Fsher River
Surry County, NC

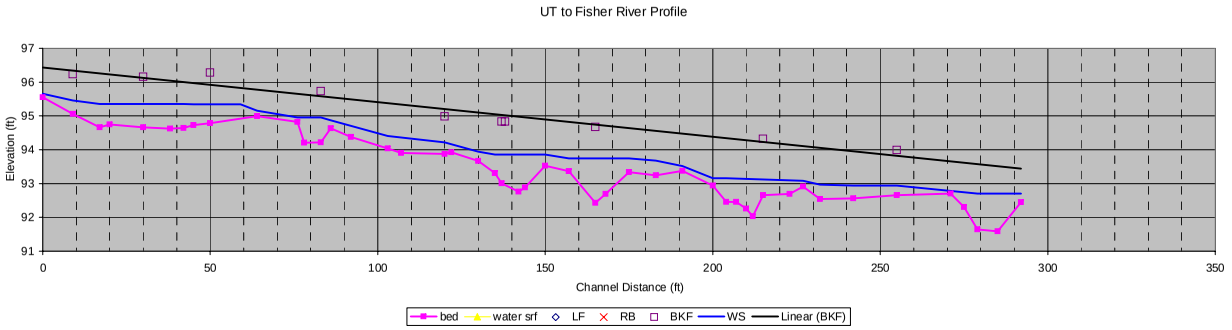
Note: **Reach Pebble Count**



bedrock			
clay hardpan			
detritus/wood			
artificial			
	total count:		100

based on	size percent less than (mm)						particle size distribution		
sediment	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
particles only	1.382	3.60	6.7	11	34	60	4.9	6.8	4.9

based on	percent by substrate type								
total count	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	24%	72%	4%	0%	0%	0%	0%	0%



Elevation BM: 100

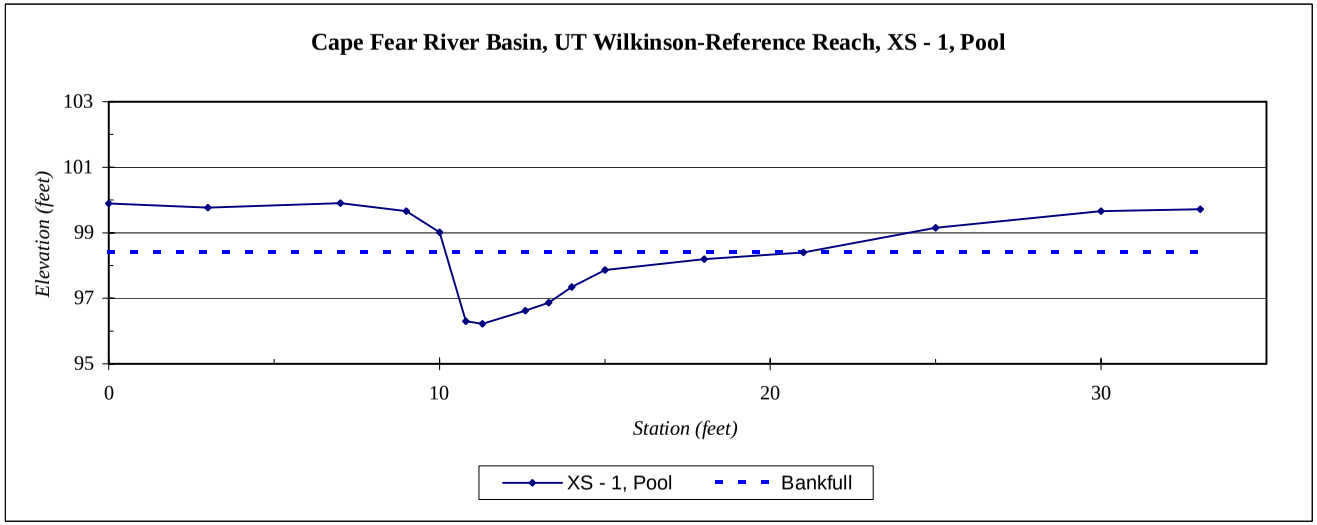
notes	inc distance	station	BS	HI	FS TP	FS bed	depth water	FS LB	FS RB	FS BKF	FS WS	AZ azimuth	ELEV bed	ELEV water srf	ELEV LF	ELEV RB	ELEV BKF	ELEV WS
		5	0	100		4.45					4.34		95.55					95.66
	9	14		100		4.94				3.77	4.54		95.06				96.23	95.46
	8	22		100		5.34					4.65		94.66					95.35
	3	25		100		5.25							94.75					
	10	35		100		5.34				3.84	4.65		94.66				96.16	95.35
	8	43		100		5.38							94.62					
	4	47		100		5.36					4.65		94.64					95.35
	3	50		100		5.27					4.66		94.73					95.34
	5	55		100		5.21				3.72			94.79				96.28	
	9	64		100							4.66							95.34
	5	69	-0.53	99.47		4.48					4.32		94.99					95.15
	12	81		99.47		4.65					4.51		94.82					94.96
	2	83		99.47		5.26							94.21					
	5	88		99.47		5.25				3.74	4.51		94.22				95.73	94.96
	3	91		99.47		4.84					4.6		94.63					94.87
	6	97		99.47		5.09							94.38					
	11	108		99.47		5.43					5.06		94.04					94.41
	4	112		99.47		5.56							93.91					
	13	125		99.47		5.59				4.49	5.25		93.88				94.98	94.22
	18	143		99.47						4.64							94.83	
	-16	127		99.47		5.55							93.92					
	8	135		99.47		5.8					5.53		93.67					93.94
	5	140		99.47		6.16					5.61		93.31					93.86
	2	142		99.47		6.46				4.64			93.01				94.83	
	5	147		99.47		6.71							92.76					
	2	149		99.47		6.59					5.61		92.88					93.86
	6	155		99.47		5.94					5.61		93.53					93.86
	7	162		99.47		6.1					5.73		93.37					93.74
	8	170		99.47		7.04				4.8	5.73		92.43				94.67	93.74
	3	173		99.47		6.78							92.69					
	7	180		99.47		6.13					5.73		93.34					93.74
	8	188	-1.56	97.91		4.67					4.23		93.24					93.68
	8	196		97.91		4.53					4.39		93.38					93.52
	9	205		97.91		4.97					4.75		92.94					93.16
	4	209		97.91		5.45					4.75		92.46					93.16
	3	212		97.91		5.45							92.46					
	3	215		97.91		5.65							92.26					
	2	217		97.91		5.88							92.03					
	3	220		97.91		5.25				3.59			92.66				94.32	
	8	228		97.91		5.22							92.69					
	4	232		97.91		5					4.83		92.91					93.08
	5	237		97.91		5.37					4.94		92.54					92.97
	10	247		97.91		5.35					4.97		92.56					92.94
	13	260	2.46	100.37		7.71				6.38	7.43		92.66				93.99	92.94
	16	276		100.37		7.67							92.7					
	4	280		100.37		8.06							92.31					
	4	284		100.37		8.73					7.67		91.64					92.7
	6	290		100.37		8.78					7.67		91.59					92.7
	7	297		100.37		7.92					7.67		92.45					92.7

UT to Wilkinson Creek
Reference Reach

River Basin:	Cape Fear
Watershed:	UT Wilkinson-Reference Reach
XS ID	XS - 1, Pool
Drainage Area (sq mi):	0.145
Date:	5/9/2006
Field Crew:	A. Helms, A. French

Station	Elevation
0	99.89
3	99.77
7	99.90
9	99.66
10	99.01
10.8	96.30
11.3	96.22
12.6	96.62
13.3	96.87
14	97.34
15	97.86
18	98.19
21	98.40
25	99.15
30	99.66
33	99.72

SUMMARY DATA	
Bankfull Elevation:	98.4
Bankfull Cross-Sectional Area:	8.6
Bankfull Width:	10.8
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.2
Mean Depth at Bankfull:	0.8
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-
Water Surface Slope (ft/ft):	0.018



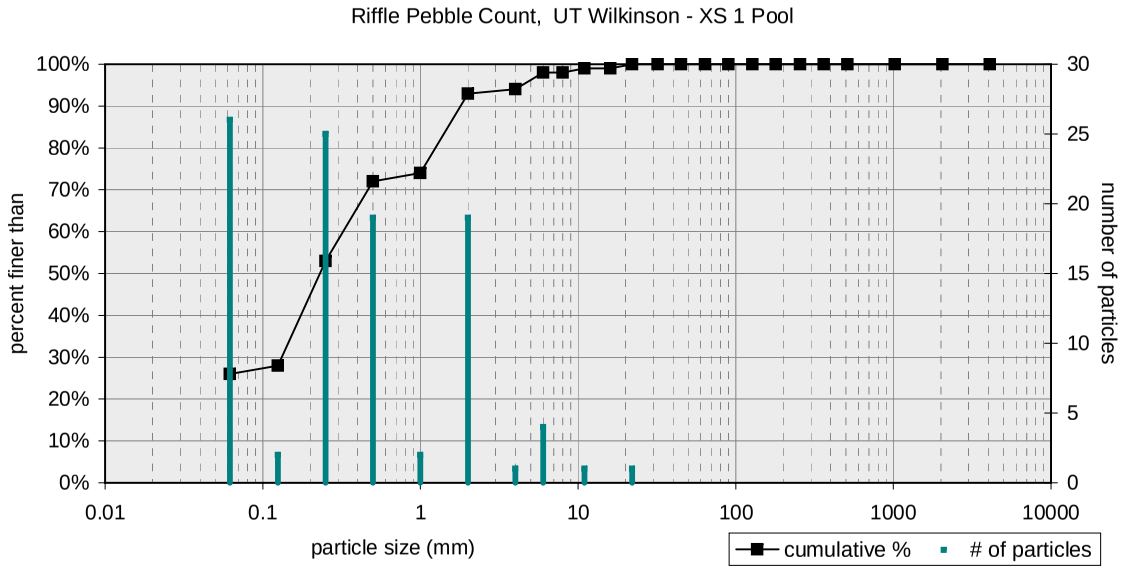
Riffle Pebble Count

Riffle Pebble Count,

Material	Size Range (mm)		Count	
silt/clay	0	0.062	**26**	#
very fine sand	0.062	0.13	**2**	#
fine sand	0.13	0.25	**25**	#
medium sand	0.25	0.5	**19**	#
coarse sand	0.5	1	**2**	#
very coarse sand	1	2	**19**	#
very fine gravel	2	4	**1**	#
fine gravel	4	6	**4**	#
fine gravel	6	8		#
medium gravel	8	11	**1**	#
medium gravel	11	16		#
coarse gravel	16	22	**1**	#
coarse gravel	22	32		#
very coarse gravel	32	45		#
very coarse gravel	45	64		#
small cobble	64	90		#
medium cobble	90	128		#
large cobble	128	180		#
very large cobble	180	256		#
small boulder	256	362		#
small boulder	362	512		#
medium boulder	512	1024		#
large boulder	1024	2048		#
very large boulder	2048	4096		#
		total particle count:	100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100

	UT Wilkinson - XS 1 Pool
	Cape Fear
Note:	**XS 1**



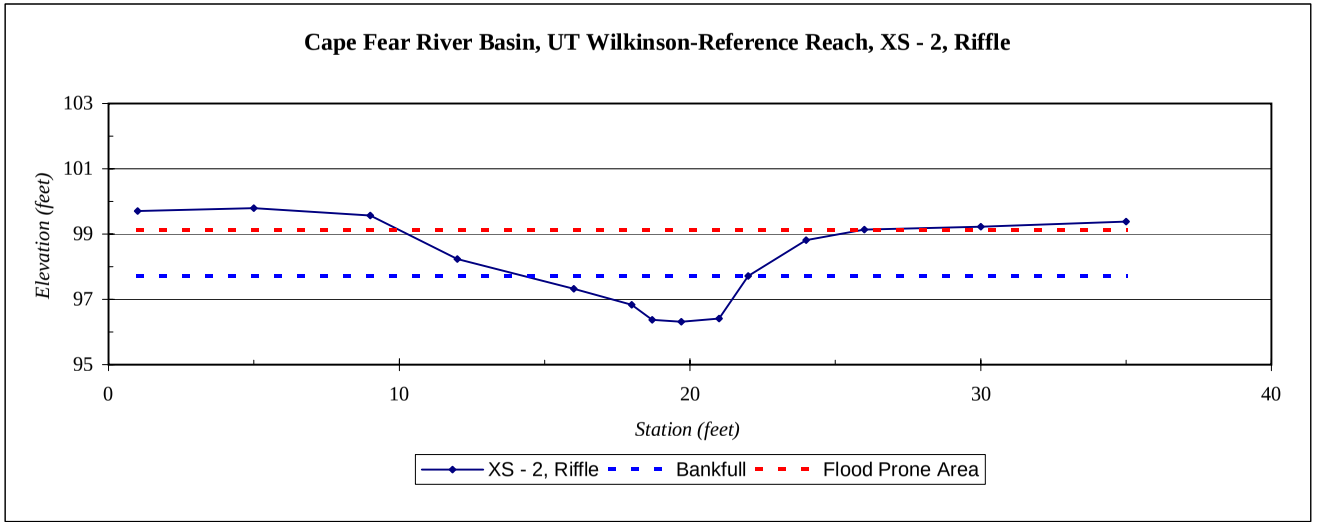
based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	0.062	0.15	0.2	0	1	4	5.0	0.3	4.8

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	26%	67%	7%	0%	0%	0%	0%	0%	0%

River Basin:	Cape Fear
Watershed:	UT Wilkinson-Reference Reach
XS ID	XS - 2, Riffle
Drainage Area (sq mi):	0.145
Date:	5/9/2006
Field Crew:	A. Helms, A. French

Station	Elevation
1	99.70
5	99.80
9	99.57
12	98.23
16	97.33
18	96.84
18.7	96.37
19.7	96.32
21	96.41
22	97.72
24	98.81
26	99.13
30	99.22
35	99.38

SUMMARY DATA	
Bankfull Elevation:	97.7
Bankfull Cross-Sectional Area:	6.2
Bankfull Width:	7.7
Flood Prone Area Elevation:	99.1
Flood Prone Width:	16.0
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	0.8
W / D Ratio:	9.6
Entrenchment Ratio:	2.1
Bank Height Ratio:	2.0
Water Surface Slope (ft/ft):	0.018



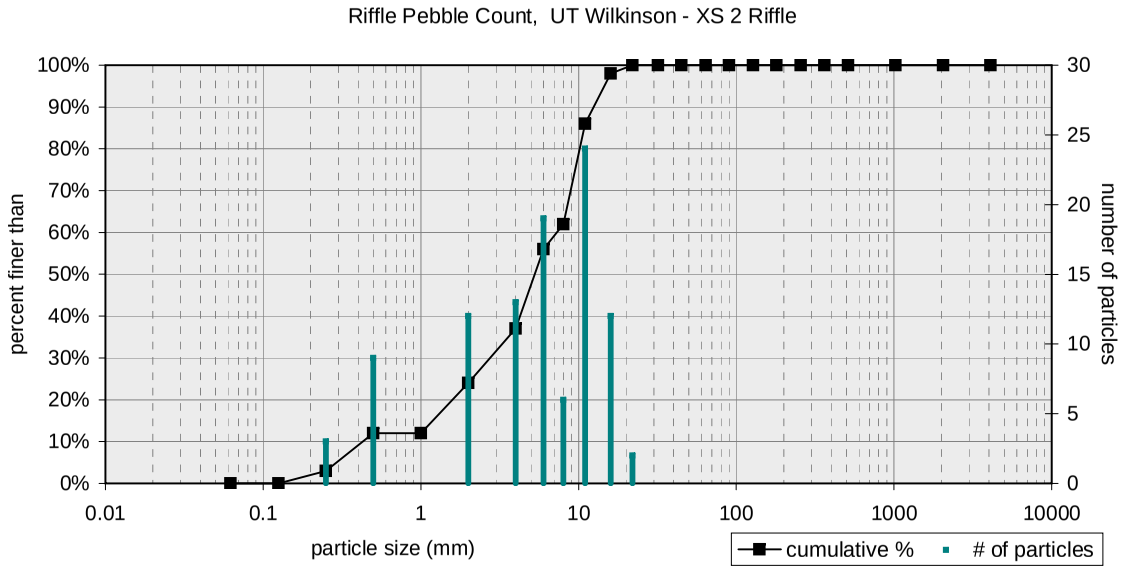
Riffle Pebble Count

Riffle Pebble Count,

Material	Size Range (mm)		Count	
silt/clay	0	0.062		#
very fine sand	0.062	0.13		#
fine sand	0.13	0.25	**3**	#
medium sand	0.25	0.5	**9**	#
coarse sand	0.5	1		#
very coarse sand	1	2	**12**	#
very fine gravel	2	4	**13**	#
fine gravel	4	6	**19**	#
fine gravel	6	8	**6**	#
medium gravel	8	11	**24**	#
medium gravel	11	16	**12**	#
coarse gravel	16	22	**2**	#
coarse gravel	22	32		#
very coarse gravel	32	45		#
very coarse gravel	45	64		#
small cobble	64	90		#
medium cobble	90	128		#
large cobble	128	180		#
very large cobble	180	256		#
small boulder	256	362		#
small boulder	362	512		#
medium boulder	512	1024		#
large boulder	1024	2048		#
very large boulder	2048	4096		#
		total particle count:	100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100

	UT Wilkinson - XS 2 Riffle
	Cape Fear
Note:	**XS 2**



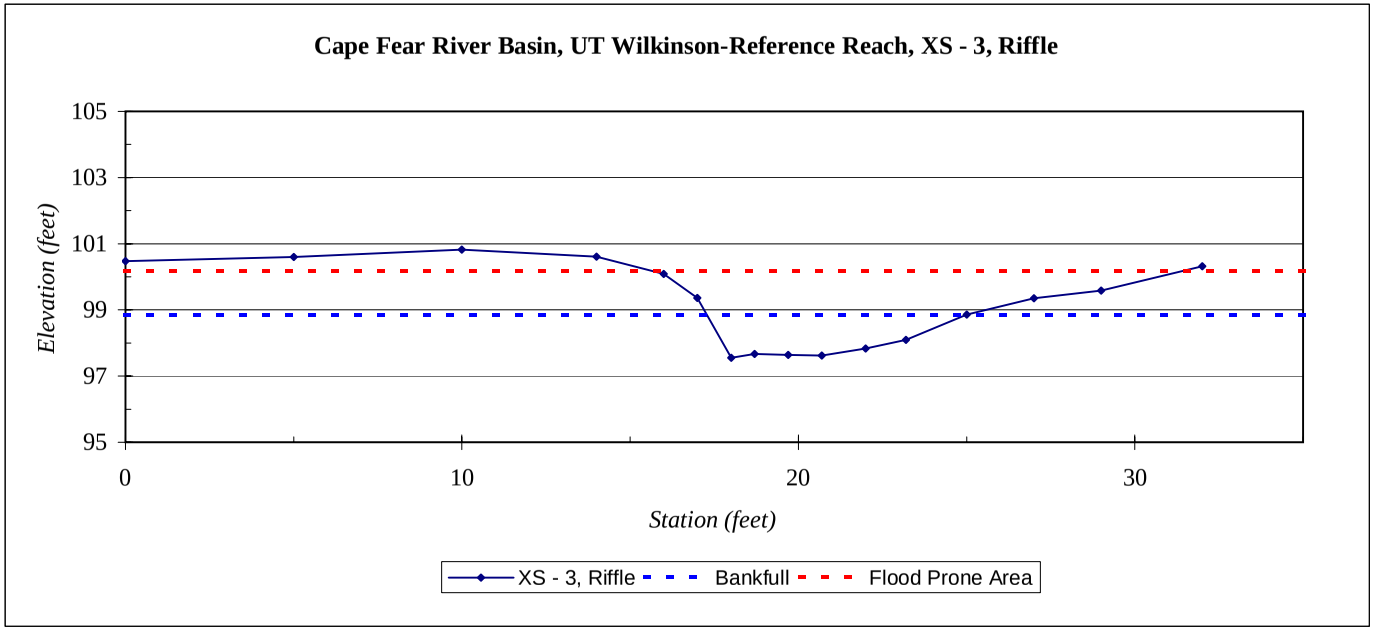
based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	1.260	3.60	5.3	8	11	15	3.1	3.7	2.9

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	24%	76%	0%	0%	0%	0%	0%	0%

River Basin:	Cape Fear
Watershed:	UT Wilkinson-Reference Reach
XS ID	XS - 3, Riffle
Drainage Area (sq mi):	0.145
Date:	5/9/2006
Field Crew:	A. Helms, A. French

Station	Elevation
0	100.47
5	100.60
10	100.82
14	100.61
16	100.09
17	99.36
18	97.56
18.7	97.67
19.7	97.64
20.7	97.63
22	97.83
23.2	98.10
25	98.86
27	99.35
29	99.59
32	100.32
35	100.97
39	101.20

SUMMARY DATA	
Bankfull Elevation:	98.9
Bankfull Cross-Sectional Area:	7.0
Bankfull Width:	7.7
Flood Prone Area Elevation:	100.2
Flood Prone Width:	16.0
Max Depth at Bankfull:	1.3
Mean Depth at Bankfull:	0.9
W / D Ratio:	8.5
Entrenchment Ratio:	2.1
Bank Height Ratio:	2.3
Water Surface Slope (ft/ft):	0.018

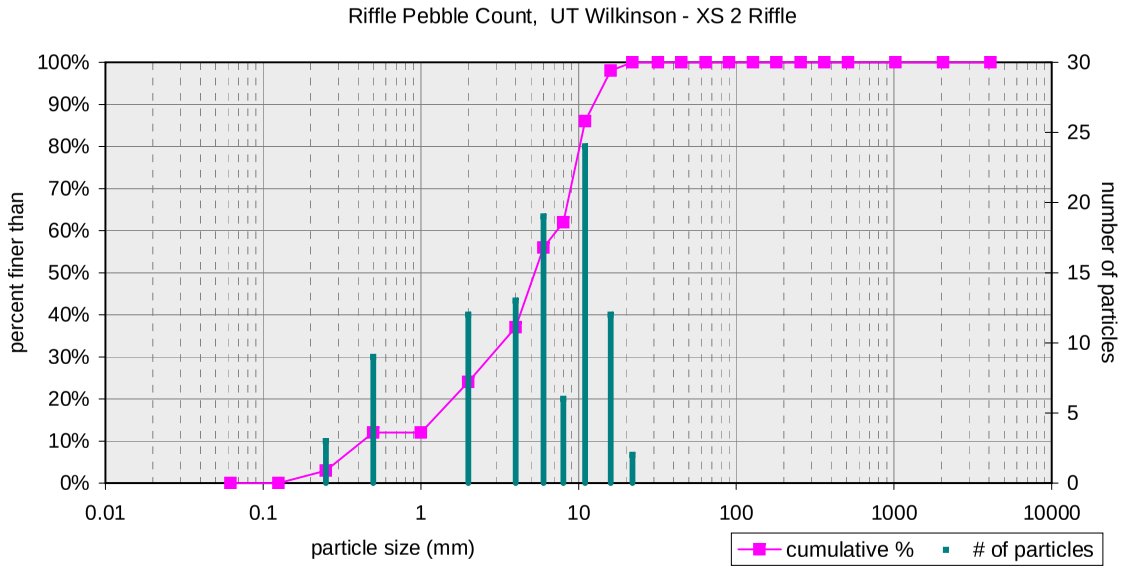


Riffle Pebble Count

Material	Size Range (mm)		Count
silt/clay	0	0.062	3
very fine sand	0.062	0.13	1
fine sand	0.13	0.25	4
medium sand	0.25	0.5	
coarse sand	0.5	1	1
very coarse sand	1	2	
very fine gravel	2	4	10
fine gravel	4	6	10
fine gravel	6	8	7
medium gravel	8	11	22
medium gravel	11	16	22
coarse gravel	16	22	16
coarse gravel	22	32	4
very coarse gravel	32	45	
very coarse gravel	45	64	
small cobble	64	90	
medium cobble	90	128	
large cobble	128	180	
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
		total particle count:	100

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100

	UT Wilkinson - XS 3 Riffle
	Cape Fear
Note:	XS 3



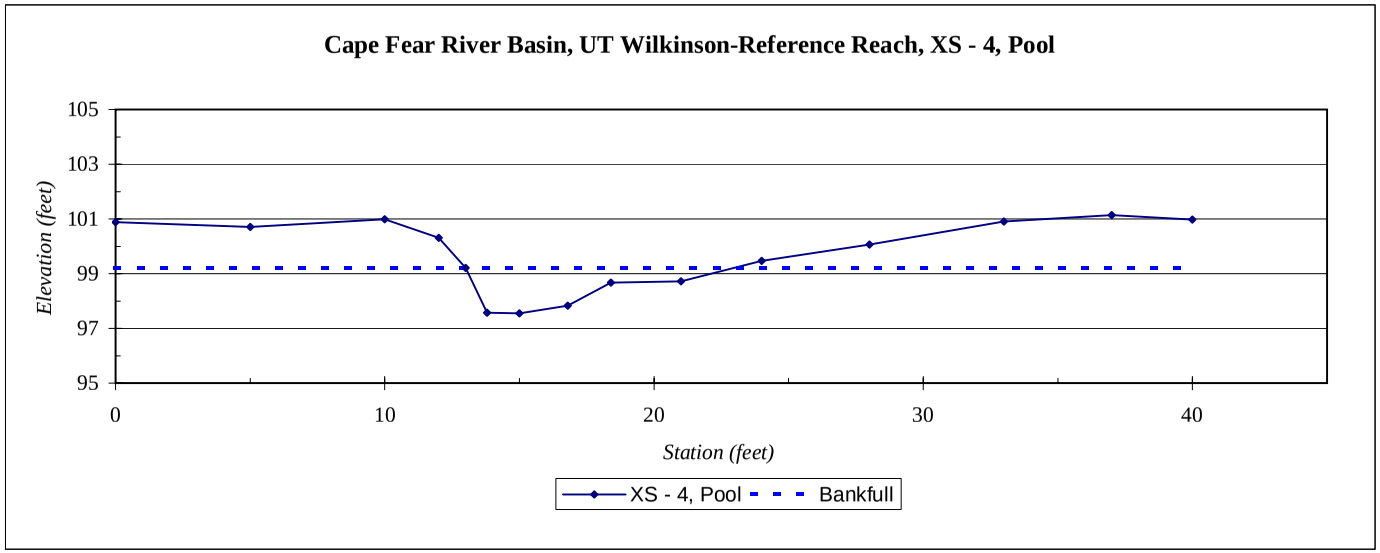
based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	5.102	10.32	13.3	17	23	35	2.2	10.9	2.1

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	12%	87%	1%	0%	0%	0%	0%	0%

River Basin:	Cape Fear
Watershed:	UT Wilkinson-Reference Reach
XS ID	XS - 4, Pool
Drainage Area (sq mi):	0.145
Date:	5/9/2006
Field Crew:	A. Helms, A. French

Station	Elevation
0	100.88
5	100.71
10	100.98
12	100.31
13	99.22
13.8	97.58
15	97.55
16.8	97.84
18.4	98.67
21	98.72
24	99.47
28	100.07
33	100.90
37	101.15
40	100.98

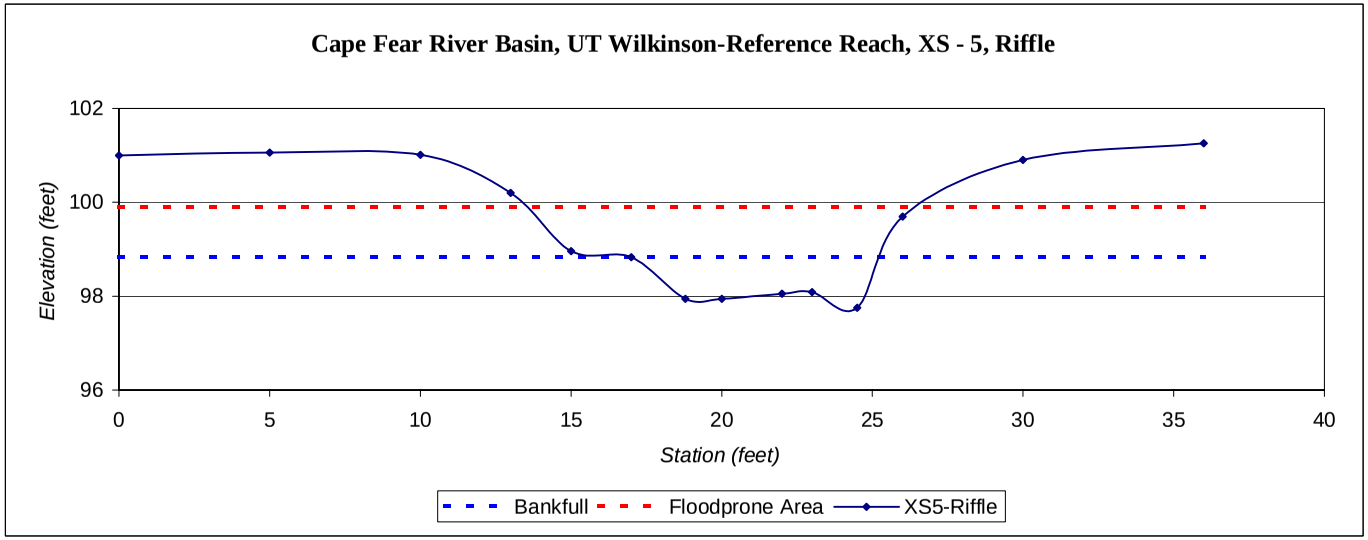
SUMMARY DATA	
Bankfull Elevation:	99.2
Bankfull Cross-Sectional Area:	8.8
Bankfull Width:	10.0
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.7
Mean Depth at Bankfull:	0.9
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-
Water Surface Slope (ft/ft):	0.018



River Basin:	Cape Fear
Watershed:	UT Wilkinson-Reference Reach
XS ID	XS - 5, Riffle
Drainage Area (sq mi):	0.145
Date:	5/9/2006
Field Crew:	A. Helms, A. French

Station	Elevation
0.00	101.00
5.00	101.06
10.00	101.01
13.00	100.20
15.00	98.96
17.00	98.83
18.80	97.94
20.00	97.94
22.00	98.05
23.00	98.08
24.50	97.75
26.00	99.70
30.00	100.90
36.00	101.26

SUMMARY DATA	
Bankfull Elevation:	98.8
Bankfull Cross-Sectional Area:	6.1
Bankfull Width:	8.3
Flood Prone Area Elevation:	99.9
Flood Prone Width:	13.0
Max Depth at Bankfull:	1.1
Mean Depth at Bankfull:	0.7
W / D Ratio:	11.4
Entrenchment Ratio:	1.6
Bank Height Ratio:	2.7
Water Surface Slope (ft/ft):	0.018



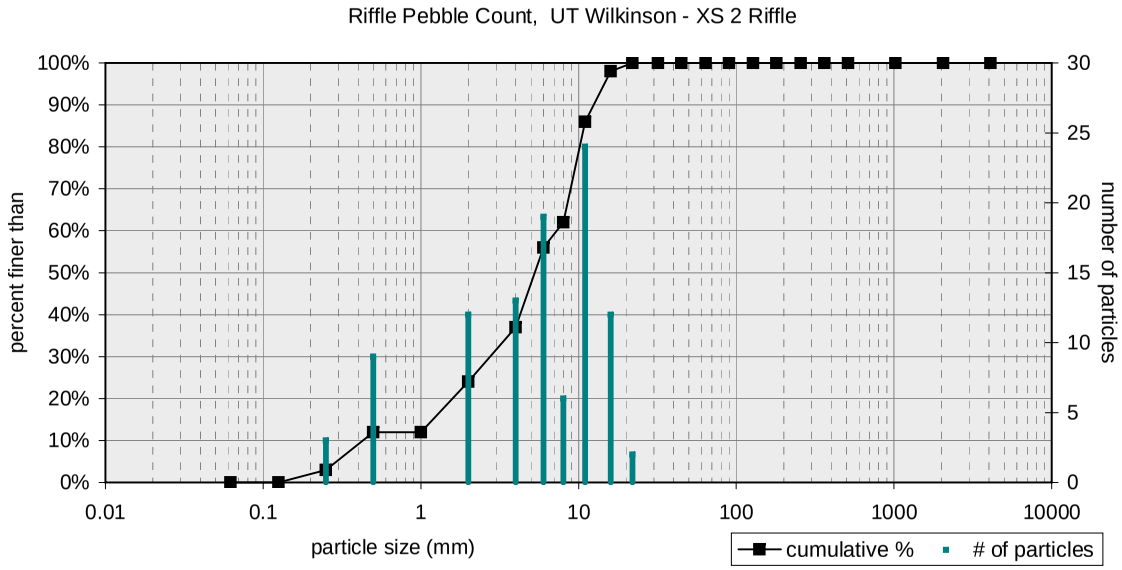
Riffle Pebble Count

Material	Size Range (mm)		Count	
silt/clay	0	0.062		#
very fine sand	0.062	0.13	**10**	#
fine sand	0.13	0.25	**17**	#
medium sand	0.25	0.5	**8**	#
coarse sand	0.5	1	**7**	#
very coarse sand	1	2	**9**	#
very fine gravel	2	4	**8**	#
fine gravel	4	6	**4**	#
fine gravel	6	8	**3**	#
medium gravel	8	11	**5**	#
medium gravel	11	16	**2**	#
coarse gravel	16	22	**4**	#
coarse gravel	22	32		#
very coarse gravel	32	45		#
very coarse gravel	45	64		#
small cobble	64	90	**1**	#
medium cobble	90	128	**3**	#
large cobble	128	180	**10**	#
very large cobble	180	256	**5**	#
small boulder	256	362	**4**	#
small boulder	362	512		#
medium boulder	512	1024		#
large boulder	1024	2048		#
very large boulder	2048	4096		#
		total particle count:	100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100

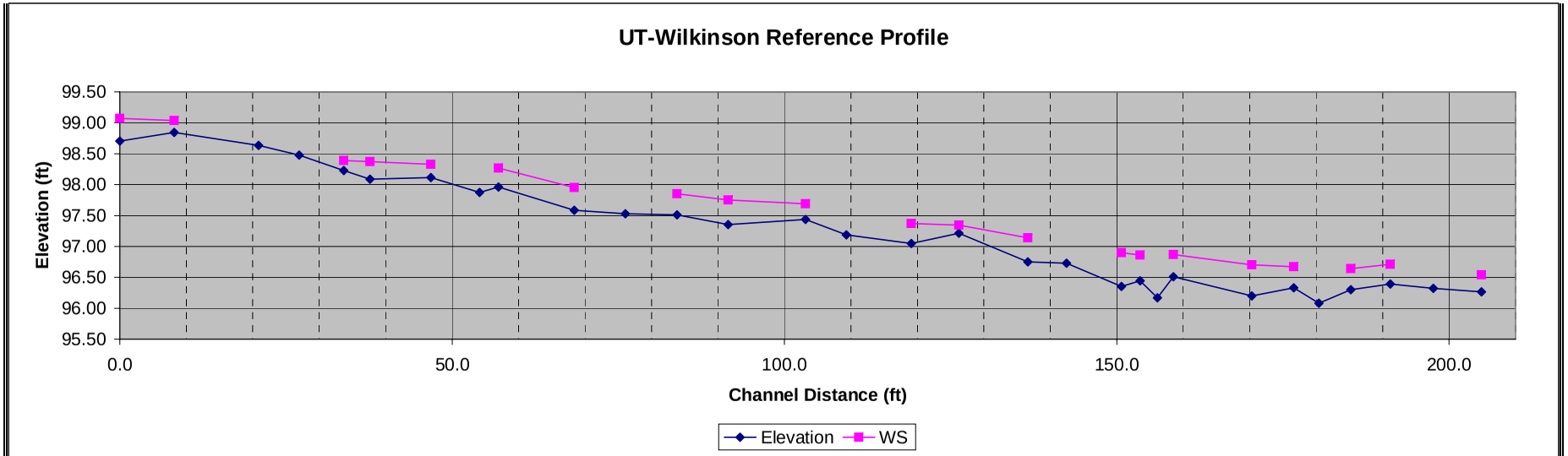
Riffle Pebble Count,

	UT Wilkinson - XS 5 Riffle
	Cape Fear
Note:	**XS 5**



based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	5.102	10.32	13.3	17	23	35	2.2	10.9	2.1

based on total count	percent by substrate type								
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	0%	12%	87%	1%	0%	0%	0%	0%	0%



				Elevation BM:	100													
notes	inc distance	station	BS 0	HI 100	FS TP	FS bed	depth water	FS LB	FS RB	FS BKF	FS WS	AZ azimuth	ELEV bed	ELEV water srf	ELEV LF	ELEV RB	ELEV BKF	ELEV WS
				100														
TW	0	0.0		100									98.70					99.07
RIFF-start	8.18	8.2		100									98.85					99.04
RI	12.69	20.9		100									98.63					
RI	6.10	27.0		100									98.48					
RIFF-end	6.72	33.7		100									98.23					98.39
TW	3.93	37.6		100									98.09					98.37
TW	9.17	46.8		100									98.12					98.33
TW	7.32	54.1		100									97.87					
RIFF-start	2.85	57.0		100									97.96					98.27
RIFF-end	11.38	68.4		100									97.59					97.95
TW	7.69	76.0		100									97.53					
TW	7.78	83.8		100									97.51					97.85
TW	7.69	91.5		100									97.36					97.75
TW	11.66	103.2		100									97.44					97.69
TW	6.14	109.3		100									97.19					
TW	9.79	119.1		100									97.05					97.37
RIFF-start	7.15	126.2		100									97.21					97.34
RIFF-end	10.36	136.6		100									96.75					97.14
TW	5.82	142.4		100									96.73					
TW	8.26	150.7		100									96.35					96.90
POOL-start	2.81	153.5		100									96.45					96.86
POOL	2.63	156.1		100									96.17					
POOL-end	2.41	158.5		100									96.51					96.87
TW	11.78	170.3		100									96.20					96.70
POOL-start	6.31	176.6		100									96.33					96.67
POOL	3.81	180.4		100									96.08					
POOL-end	4.80	185.2		100									96.30					96.64
RIFF-start	5.96	191.2		100									96.39					96.71
RI	6.43	197.6		100									96.32					
RIFF-end	7.27	204.9		100									96.27					96.54

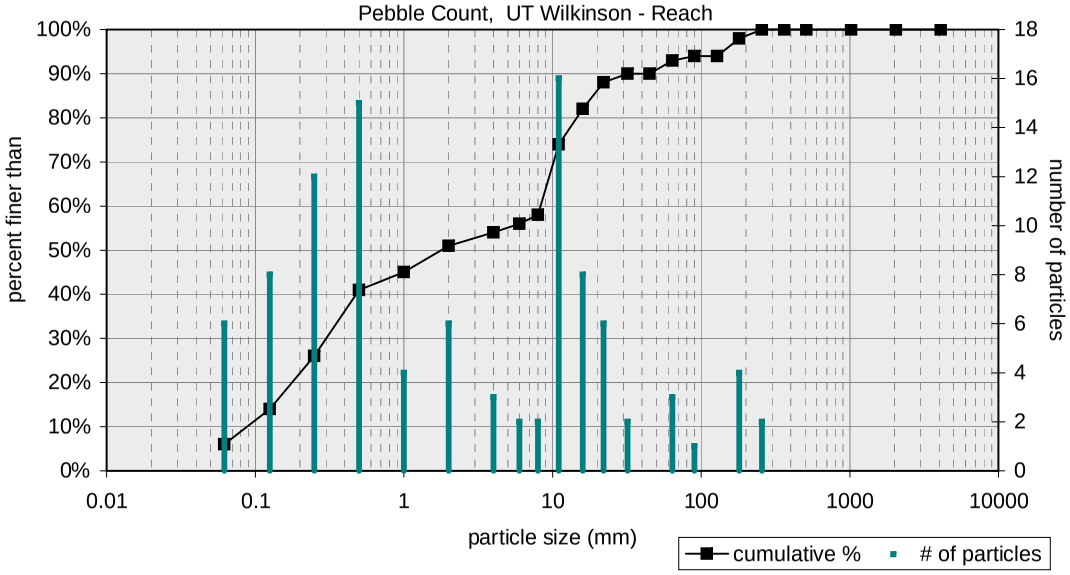
Pebble Count of Channel Reach

Material	Size Range (mm)		Count	
silt/clay	0	0.062	**6**	##
very fine sand	0.062	0.13	**8**	##
fine sand	0.13	0.25	**12**	##
medium sand	0.25	0.5	**15**	##
coarse sand	0.5	1	**4**	##
very coarse sand	1	2	**6**	##
very fine gravel	2	4	**3**	##
fine gravel	4	6	**2**	##
fine gravel	6	8	**2**	##
medium gravel	8	11	**16**	##
medium gravel	11	16	**8**	##
coarse gravel	16	22	**6**	##
coarse gravel	22	32	**2**	##
very coarse gravel	32	45		##
very coarse gravel	45	64	**3**	##
small cobble	64	90	**1**	##
medium cobble	90	128		##
large cobble	128	180	**4**	##
very large cobble	180	256	**2**	##
small boulder	256	362		##
small boulder	362	512		##
medium boulder	512	1024		##
large boulder	1024	2048		##
very large boulder	2048	4096		##
		total particle count:	100	

bedrock		
clay hardpan		
detritus/wood		
artificial		
	total count:	100

Pebble Count,
UT Wilkinson - Reach
Cape Fear

Note: **Reach**



based on sediment particles only	size percent less than (mm) D16	D35	D50	D65	D84	D95	particle size distribution gradation	geo mean	std dev
	0.140	0.38	1.8	9	18	139	11.3	1.6	11.3

based on total count	percent by substrate type silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	6%	45%	42%	7%	0%	0%	0%	0%	0%