

UNNAMED TRIBUTARY TO CROOKED CREEK MITIGATION REPORT

Franklin County, North Carolina

HUC 03020101

SUBBASIN 03-03-01

Project ID No. 040614801

Ko & Associates, P.C.

Point of Contact: R. Kevin Williams, PE

EEP Project Manager: Tracy Morris

Prepared for:



NCDENR-Ecosystem Enhancement Program

2728 Capital Boulevard, Suite 1H 103

Raleigh, North Carolina 27604

February 20, 2007

EXECUTIVE SUMMARY

Pre-Construction Site Conditions:

The Unnamed Tributary to Crooked Creek (UTCC) – Speas Property project is located northwest of the intersection of NC 98 and Secondary Road 1001 (Pearces Road) in Franklin County, North Carolina. Prior land use practices and straightening have made the 1,976 linear feet of stream, with a drainage area of 380 acres, unstable through the project site. The jurisdictional delineation effort, made during the planning phase of the Shartree sub-division and accepted by the U.S. Army Corps of Engineers (COE), indicates the presence of stream channels and jurisdictional wetlands within the easement area, however, there are no wetland areas within the stream restoration project.

Restoration Plan:

The goal of this project is to provide a natural channel design approach to restoring the stream reach. The proposed adjustments to the dimension, pattern, and profile of the stream reach have been designed to increase long-term stability and create a more functional riparian system. The existing floodplain area consists of both wetland and upland areas. The restoration plan calls for the restoration of the riparian buffer for UTCC, but does not call for any additional wetland monitoring other than the monitoring associated with the riparian buffer. The restored floodplain area has been revegetated with woody stems to promote stability and nutrient removal and herbaceous material to promote sediment removal. Restoration of the riparian buffer along the stream will help to improve aquatic and terrestrial habitats and will promote streambank stability.

Post Construction Site Conditions:

The length of the constructed stream totaled 2,267 linear feet along the main channel, of which 1,867 linear feet is Priority 1 restoration and the remaining 400 linear feet is Priority 2 restoration. There were two (2) perennial tributaries, totaling 155 linear feet, that required channel shaping and stabilization during construction. There was a third tributary, measuring 55 linear feet, which also required some channel shaping and stabilization. A 50-foot riparian buffer was established on both sides of the restored channel. This 4.34-acre buffer restoration was planted with an appropriate mix of bare root and live stake species.

Area	Before	After
EEP Easement Area (acres)	37.95	37.95
Existing Wetland and Stream Area within EEP Easement (acres)	34.41	n/a
Stream Restoration (feet)	1976	2267
Buffer restoration (acres)	n/a	4.34

Stream restoration and buffer restoration techniques will help improve the water quality of the stream by reducing erosion and runoff entering the stream. The stream restoration will improve onsite aquatic habitats and buffer restoration will improve terrestrial habitats and provide a wooded wildlife corridor. Restoring ecological functions at this site will decrease

floodwater levels, improve water quality, increase aquatic and terrestrial habitat and diversity, improve the biological integrity of the system, reduce the amount of sediment and pollutants entering the system, and provide landscape continuity.

Overall, the project will provide a variety of habitats from open water to uplands. The project will greatly increase the future habitat and food sources for a variety of wildlife species. The combination of upland and wetland communities within the UTCC floodplain will encourage greater wildlife utilization by creating different habitats within a relatively small area. Restoration of the stream channel and buffer will help improve the overall water quality within the UTCC watershed and its receiving waters.

Monitoring Plan

Stream Criteria - Eight permanent cross sections were established at an approximate frequency of one per 20 bankfull-width lengths. Since the restored stream section is less than 3,000 linear feet, a longitudinal profile will be conducted on the entire 2,267-foot restoration reach. Channel stability, ecological function, and photo documentation will be used to evaluate stream restoration success. Channel stability will be used to demonstrate any changes from the as-built including: pool/riffle spacing, aggradation/degradation, and to show that the size of the bed material is changing toward a desired composition. Ecological function will be measured by the health and survival of the planted vegetation and how well the restored reach mimics the upstream and/or reference conditions. Photo documentation will be used to measure channel aggradation/degradation, bank erosion, success of riparian vegetation, effectiveness of erosion control measures, and the presence/absence of instream bars.

Wetland Criteria - Wetlands were enhanced through supplemental planting of the buffer and floodplain adjacent to UTCC. No additional hydrologic or vegetative monitoring was required. The only established success criteria is included as part of the riparian buffer success requirements.

Riparian Buffer Criteria – Three permanent vegetation plots were established within the buffer restoration area. Yearly monitoring will be conducted. The sample plot locations were marked and will be monitored based on the Carolina Vegetation Survey guidelines, per recent EEP guidance. Riparian buffer success criteria will be met if sample plots demonstrate that specific tree survival goals are met annually.

Remedial Action – EEP will be notified immediately upon the discovery of any site condition that may compromise the success of the site. In the event that vegetation or stream restoration success criteria are not fulfilled, a mechanism for contingency will be implemented. For vegetation contingency, replanting and extending the monitoring period will be implemented if minimum distribution requirements are not fulfilled. Stream restoration contingency will require EEP and agency consultation. Recommendations for contingency will be implemented until success criteria are achieved or until agency approval is received.

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1.0 NARRATIVE

Introduction:

The Unnamed Tributary to Crooked Creek (UTCC) – Speas Property project is located in Franklin County, North Carolina, northwest of the intersection of NC Highway 98 and Secondary Road 1001 (Pearces Road) (Figure 1). The project study area includes the UTCC and portions of three smaller tributaries located on the proposed Shartree sub-division development site. The project will focus on the UTCC with minor work along on the other tributaries. The project will include the restoration of 2,267 linear feet of the UTCC. This project was identified as a potential stream restoration opportunity by the North Carolina Department of Natural Resources (DENR) Ecosystem Enhancement Program (EEP) based on an evaluation by EEP staff.

The UTCC is within subbasin 03-03-01 of the Tar-Pamlico River Drainage Basin (DENR 2004) and is part of the USGS Hydrologic Unit (HUC) 03020101 (USGS 1974). The channel reaches within the project study area are currently subject to the Tar-Pamlico Riparian Buffer Rules. The Tar-Pamlico Riparian Buffer rules place limits on what activities can take place within 50 feet of any water feature which is depicted as either a blue-line stream or open water feature on either the most recent version of the USGS 7.5-minute topographic quadrangle or the Natural Resource Conservation Service (NRCS) Soil Survey.

The watershed above UTCC is approximately 380 acres in area. Elevations range from a topographic high of approximately 316 feet above mean sea level to a topographic low of 210 feet above mean sea level at the lower portion of the project study area (Figure 2.1.1). Current land use within the watershed is generally rural in nature, containing several small farms and private residences (Figure 2.1.2). Relief within the watershed is gently sloping.

Future land use within the watershed includes the development of at least one sub-division, the Shartree development, which is currently surrounding the areas immediately adjacent to UTCC within the project study area.

The project study area was subjected to a jurisdictional delineation effort during the planning phase of the Shartree Subdivision design process. The delineation effort, which was accepted by the U.S. Army Corps of Engineers (COE), indicates the presence of stream channels and jurisdictional wetlands within the project study area. Jurisdictional wetland areas within the project study area include forested wetlands along with shrub-scrub and herbaceous assemblages.

The majority of wetlands within the project study area affected by this project can be described as shrub-scrub and the herbaceous assemblages. Vegetation within the jurisdictional herbaceous assemblages includes soft rush (*Juncus effusus*), black willow (*Salix nigra*), and blackberry (*Rubus* sp.).

A. Restoration Summary

The goal of this project is to restore a stable channel to the UTCC and establish a vegetated riparian floodplain at the bankfull discharge elevation. The proposed adjustments to the dimension, pattern, and profile of the UTCC have been designed to ensure long-term channel stability and enhance aquatic habitat. The design has adjusted the stream's geomorphic features, including dimension, pattern, and profile. The adjustments reflect stable conditions and geomorphic features of reference stream reaches. The vegetated riparian floodplain/buffers are similar in composition to other natural riparian buffers commonly occurring within the same physiographic region.

The UTCC was designed as a low width-to-depth ratio (W/D) C5 type channel. It is expected that the channel's W/D may decrease over time and ultimately evolve into a lower W/D E5 type channel. The channel was designed as a meandering stream with riffles through straight sections and pools through meander bends and structures. Pools are used to dissipate flow energy and decrease stress on the channel banks.

The project was constructed as a combination of a Priority I and Priority II restoration. A Priority I restoration requires a bankfull channel to be excavated where bankfull and higher discharges flow onto the existing floodplain/top of ground. A Priority II restoration requires a bankfull channel and floodplain to be excavated where bankfull and higher discharges flow onto the excavated floodplain. The middle third of the project was constructed as a Priority I restoration. The upper and lower third of the project were constructed as a Priority II restoration.

A number of different structures were used to control grade, decrease stress on the channel banks, and provide habitat and foraging opportunities for aquatic fauna. These structures include: rock cross-vanes, log cross-vanes, log/rock cross-vane combinations, log vanes with rock sill, log vanes with log sills, rootwads, floodplain interceptors, matting, transplants and vegetative plantings (bare roots and live stakes).

A vegetated floodplain has been established at the bankfull discharge elevation adjacent to the UTCC. This feature will allow for a more natural channel and riparian function, by reducing channel stress and sediment loss during high flow events, and subsequently improving aquatic and terrestrial habitat. To ensure the long term stability of the vegetative communities within the project study area, only native species were used to revegetate the area.

B. Project Map

See As-Built plans for Project Map

C. Summary Table

	UTCC UPPER REACH	UTCC LOWER REACH
EXISTING LENGTH (FT)	986	990
RESTORED LENGTH (FT)	1,334	1,133
LEVEL OF RESTORATION	Restoration	Restoration
CREDIT RATIO	1.0 to 1.0	1.0 to 1.0
SMU	1,334	1,133

2.0 AS-BUILTS

As-Built Vegetation Data

The mitigation plan called for six planting zones, A-F. Zone A is a streambank zone which was planted using live stake material. Zone B is a floodplain forest zone which was planted using bare root material. Zones C, E, and F are riparian buffer zones which were planted using bare root material. Zone D is a riparian buffer zone which received no plantings.

Bare root seedlings were planted on 8-foot centers. This spacing is based on an initial density of 680 stems per acre. One row of live stakes was planted on 3-foot centers directly adjacent to the stream.

The table below summarizes the species and abundance planted in each zone.

Planting Plan Summary Table for UTCC

Zone A: Streambank Zone (Live Staking)	Zone B: Floodplain Forest (Bare Roots)
25% Silky dogwood (<i>Cornus amonum</i>)	15% Tulip poplar (<i>Liriodendron tulipifera</i>)
25% Tag alder (<i>Alnus serrulata</i>)*	20 %River birch (<i>Betual nigra</i>)
25% Virginia willow (<i>Itea virginica</i>)	20% Swamp chestnut oak (<i>Quercus michauxii</i>)
25% Black willow (<i>Salix nigra</i>)	15% Black willow (<i>Salix nigra</i>)*
25% Buttonbush (<i>Cephalanthus occidentalis</i>)	15% Soft rush (<i>Juncus effuses</i>)
	15% Tag alder (<i>Alnus serrulata</i>)
Zone C: Riparian Buffer (Bare Roots)	Zone D: Riparian Buffer (no planting here)
25% White oak (<i>Quercus alba</i>)	
25% Willow oak (<i>Quercus phellos</i>)	
25% Shortleaf pine (<i>Pinus echinata</i>)	
25% Flowering dogwood (<i>Cornus florida</i>)	
Zone E: Riparian Buffer (heavy) (Bare Roots)	Zone F: Riparian Buffer (Bare Roots)
33% Flowering dogwood (<i>Cornus florida</i>)	25% Cherrybark oak (<i>Quercus pagodafolia</i>)
33% American beech (<i>Fagus grandiflora</i>)	25% Loblolly pine (<i>Pinus taeda</i>)
33% Loblolly pine (<i>Pinus taeda</i>)	25% Tulip poplar (<i>Liriodendron tulipifera</i>)
	25% Willow oak (<i>Quercus phellos</i>)

*Per email on September 26, 2006, we allowed the following changes:

Zone A- cottonwood or silky willow acceptable to replace tag alder as live stakes.

Zone B- Green ash and swamp blackgum acceptable to replace black willow bare roots.

3.0 MONITORING PLAN

Stream Monitoring and Success Criteria

Eight permanent cross sections were established at an approximate frequency of one per 20 bankfull-width lengths.

Since the restored streams section is less than 3,000 linear feet, a longitudinal profile will be conducted on the entire 2,267-foot restoration reach.

Permanent photo-reference points were established at each of the cross sections to give visual documentation of success over time. This documentation will be used to determine the extent of any aggradation/degradation of the stream channel, bank erosion, and formation of any in-stream bars.

As required by the Stream Mitigation Guidelines (ACOE, 2003), the required monitoring shall be performed each year for the 5-year monitoring period and, no less than two bankfull events must be documented through the monitoring period. If less than two bankfull events occur during the first 5 years, monitoring will continue until the second bankfull event is documented. The bankfull events must occur during separate monitoring years. In the event that the required bankfull events do not occur during the five-year monitoring period, the Corps and DWQ, in consultation with the resource agencies, may determine that further monitoring is not required. Monitoring data should include the following: reference photos, plant survival analysis, and channel stability analysis. At the request of EEP, macrobenthos monitoring will not be undertaken as part of this monitoring effort.

Stream restoration success criteria will be used to evaluate success by considering the following:

Photo documentation

- Channel aggradation/degradation
- Bank erosion
- Success of riparian vegetation
- Effectiveness of erosion control measures
- Presence or absence of developing instream bars

Ecological Function

- Health and survival of vegetation (80% survival of planted species after 5 years)
- Restoration reach should mimic upstream conditions (or reference reach when applicable)

Channel Stability

- Should be insignificant change from as-built dimension
- Do changes represent a movement in the direction of instability or are changes minor and represent an increase in stability
- Should be little change from the as-built longitudinal profile
- Pool/riffle spacing should remain fairly constant
- Pools should not be filling in (aggradation) or riffles starting to change to pools (degradation)
- Pebble count should show a change in the size of bed material toward a desired composition

Riparian Buffer Monitoring and Success Criteria

As defined in the approved restoration plan dated April 2005; three permanent vegetation plots were established within the buffer restoration area. Yearly monitoring will be conducted. The sample plot locations were marked and will be monitored based on the Carolina Vegetation Survey guidelines, per EEP guidance. Permanent photo stations were established in the southwest corner of each vegetation plot. These photo stations will be used to document changes throughout the monitoring period. No hydrologic monitoring is proposed within the riparian buffer restoration areas.

Jurisdictional wetlands associated with UTCC occur on both sides of the restored channel both inside and outside of the restoration construction limits. Portions of these wetlands lie within the limits of the 50-foot riparian buffer adjacent to UTCC. These wetlands were enhanced through supplemental planting of the buffer and floodplain adjacent to UTCC. The only established success criteria is included as part of the riparian buffer success requirements.

Riparian buffer success criteria will be met if sample plots demonstrate that specific tree survival goals are met annually.

- For each of the first three complete years of monitoring, 320 stems per acre must have survived such that at the end of three years, 320 three-year old characteristic stems per acre have survived in the planted areas.
- In years four and five, 288 and 260 characteristic stems per acre, respectively, must have survived on the site, such that at the end of year five, the site contains 260 characteristic stems five years of age.
- No quantitative sampling requirements are proposed for herb and shrub assemblages as part of the vegetation success criteria; however, they will be assessed for growth patterns and vigor.

Baseline data was collected to document the number of planted stems within each of the sample plots. The first annual monitoring event will occur after one complete growing season. The results of the first annual monitoring event will be compiled into a report suitable for

submittal to EEP. Subsequent annual monitoring reports will be conducted at approximately the same time each year to provide consistency in data collection and reporting.

4.0 MAINTENANCE AND CONTINGENCY PLAN

EEP will be notified immediately upon the discovery of any site condition that may compromise the success of the site.

In the event that vegetation or stream restoration success criteria are not fulfilled, a mechanism for contingency will be implemented. For vegetation contingency, replanting and extending the monitoring period will be implemented if minimum distribution requirements are not fulfilled. Stream restoration contingency will require EEP and agency consultation. Recommendations for contingency will be implemented until success criteria are achieved or until agency approval is received.

5.0 REFERENCES

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