DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

7 September, 2012

Regulatory Division

Re: NCIRT Review and USACE Approval of the Jacobs Landing Mitigation Plan (SAW 2012-01006)

Ms. Suzanne Klimek
North Carolina Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

Dear Ms. Klimek:

The purpose of this letter is to provide the North Carolina Ecosystem Enhancement Program (NCEEP) with all comments generated by the North Carolina Interagency Review Team (NCIRT) during the 30-day comment period for the Jacobs Landing Mitigation Plan, which closed on 23 August, 2012. These comments are attached for your review.

Based on our review of these comments, we have determined that no major concerns have been identified with the Draft Mitigation Plan. However, the minor issues with the Draft discussed in the attached comments must be addressed in the Final Mitigation Plan.

The Final Mitigation Plan is to be submitted with the Preconstruction Notification (PCN) Application for Nationwide permit approval of the project along with a copy of this letter and a summation of the comments addressed. If it is determined that the project does not require a Department of the Army permit, you must still provide a copy of the Final Mitigation Plan, along with a copy of this letter, to the appropriate USACE field office at least 30 days in advance of beginning construction of the project. Please note that this approval does not preclude the inclusion of permit conditions in the permit authorization for the project, particularly if issues mentioned above are not satisfactorily addressed. Additionally, this letter provides initial approval for the Mitigation Plan, but this does not guarantee that the project will generate the requested amount of mitigation credit. As you are aware, unforeseen issues may arise during construction or monitoring of the project that may require maintenance or reconstruction that may lead to reduced credit.

Thank you for your prompt attention to this matter, and if you have any questions regarding this letter, the mitigation plan review process, or the requirements of the Mitigation Rule, please call us at 919-846-2564.

Sincerely,

Tyler Crumbley
Regulatory Specialist

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List
CESAW-RG/McLendon
CESAW-RG-A/Kichefski
Michael McDonald, NCEEP
Deborah Daniel, NCEEP

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

CESAW-RG/Crumbley August 24, 2012

MEMORANDUM FOR RECORD

SUBJECT: NCIRT Comments During 30-day Mitigation Plan Review

Purpose: The comments listed below were posted to the NCEEP Mitigation Plan Review Portal during the 30-day comment period in accordance with Section 332.8(g) of the 2008 Mitigation Rule.

NCEEP Project Name: Jacobs Landing Stream Mitigation Site (EEP-IMS# 95024)
USACE AID#: SAW 2012-01006

30-Day Comment Deadline: August 23, 2012

1. 8/22/2012- N.C. Division of Water Quality; Eric Kulz: This project consists of a significant amount of Priority 2 Restoration. Our mitigation study revealed a lot of problems with P2 sites in the Piedmont, specifically related to vegetation survival and growth. The Provider needs to provide more details on topsoil management and addressing potential compaction and fertility/organic matter issues. 2) The plan shows a number of drainage ditches entering the easement from pasture areas. The plan proposes to stabilize with riprap and discharge directly to the stream. These discharges may include cattle waste and have the potential to compromise water quality and reduce the potential for the project to provide uplift. Routing of this runoff to floodplain wetland pools for retention/infiltration should be considered, as NCEEP has been using these on projects for a number of years.

2. 8/22/2012- U.S. Environmental Protection Agency; Jeffrey Garnett: I agree with both points made by Eric Kulz. With the amount of excavation involved with Priority 2 restoration, the Provider should present a soil management plan. This should primarily include the stockpiling of topsoil and redistribution of it on top of other fill. The mixing of soil layers could prove detrimental to vegetative success. Additionally, the plan calls for at least four reconstructed culverted crossings. I request that the Provider submit detailed plans of culvert installations that adequately ensure that passage for aquatic life is achievable. Finally, one of the goals of the project is to "reduce the sediment supply entering Irish Buffalo Creek." Monitoring channel forms over the first five years of the bank only serves as a surrogate that sediment loads are decreasing. The

assumption is being made that improving the channel will reduce sediment loads, but no quantifiable way to test this is being presented. The Provider should develop a quantifiable plan to directly measure success of the project goal. For example, simple turbidity measurements could be taken on a regular basis (during base flows and bank full events) both upstream and downstream of the site. These measurements should be taken before restoration, during restoration, and for a minimum of five years post-restoration in order to document achievement of the goal.

3. 8/23/2012 - U.S. Army Corps of Engineers; Tyler Crumbley and Todd Tugwell:

    a. Please ensure that the performance standards for channel dimension [(as described in Sections 9 and 10 of the document (pgs. 34-37)], are in accordance with the 2003 Stream Mitigation Guidelines (1 cross-section per 20 bankfull width lengths) and that the performance standard for Bed Materials is instituted to show a change to a pre-determined desired composition, rather than purely an evaluation of sediment transport.
    b. Where possible, easement crossings should be made at a perpendicular angle. Exception 1 on easement B could be modified to reduce loss of the buffer. Additionally, it appears that the dirt path crosses through the conservation easement (Sheet 1 of 1, Final Plat).

FINAL MITIGATION PLAN

Jacob's Landing Stream Restoration Site
Rowan County, North Carolina
EEP Contract 003984

Yadkin-Pee Dee River Basin
Cataloging Unit 03040105

Prepared for:

NC Department of Environment and Natural Resources
Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

September 2012

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Prepared for:

NC Department of Environment and Natural Resources
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1652 Mail Service Center
Raleigh, NC 27699-1652

Prepared by:

KCI Associates of North Carolina, PA
4601 Six Forks Rd, Suite 220
Raleigh, NC 27609
(919) 783-9214

September 2012

EXECUTIVE SUMMARY

This mitigation plan has been written in conformance with the requirements of the following:

- *Federal rule for compensatory mitigation project sites as described in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.8 paragraphs (c)(2) through (c)(14).*
- *NCDENR Ecosystem Enhancement Program In-Lieu Fee Instrument signed and dated July 28, 2010*

These documents govern NCEEP operations and procedures for the delivery of compensatory mitigation.

The Jacob's Landing Stream Restoration Site is a full-delivery mitigation project being developed for the North Carolina Ecosystem Enhancement Program (EEP). The site offers the opportunity to restore and enhance a series of headwater tributaries to Irish Buffalo Creek. This project will return these tributaries to a stable stream ecosystem, lower the sediment supply entering Irish Buffalo Creek, and reduce incoming nutrients from livestock. This project also looks to expand aquatic and terrestrial habitat in the Rocky River Watershed (03040105). The project is located in the Irish Buffalo Creek Drainage (03040105020040), which the EEP has identified as a Targeted Local Watershed.

The project goals address stressors identified in the TLW and include the following:

- Restore a diverse riparian corridor that connects forested stream systems upstream and downstream of the project.
- Reduce the sediment supply entering Irish Buffalo Creek.

The project goals will be addressed through the following objectives:

- Restore stable channel planforms to streams that have been straightened and modified.
- Reshape and stabilize eroding stream banks.
- Plant the site with native trees to help reestablish a diverse riparian corridor.
- Install exclusion fencing and alternative watering options to keep livestock out of the project streams.

The majority of the site is currently used for pasture. Past anthropogenic modifications have involved logging, grazing, and channelization. Four separate streams make up the site: Tributary 1 (T1) begins in the northwestern project corner, Tributary 1A (T1A) flows south to join T1; Tributary 2 (T2) comes onto the site from the northeastern corner; and Tributary 2A (T2A) originates on the property from seep flow to then join T2. T1 and T2 come together just south of the project boundary before joining another tributary to form Irish Buffalo Creek.

The mitigation approach for the Jacob's Landing Stream Restoration Site will focus on repairing isolated sections of bed degradation and bank erosion, and restoring the unstable reaches that have been straightened or severely degraded by cattle. Once site grading is complete, the stream buffers will be planted as Piedmont Alluvial Forest (Schafale and Weakley 1990). The site will be monitored for five years or until the success criteria are met.

Table 1. Jacob's Landing Stream Restoration Site - Mitigation Summary

Reach	Mitigation Type	Priority Approach	Existing Linear Footage	Designed Linear Footage	Mitigation Units
T1-1	Restoration	P2	326	303	303
T1-2	Enhancement II	-	158	109*	44
T1-3	Restoration	P2	846	893	893
T1A	Restoration	P2	294	178	178
T2-1	Restoration	P2	1,800	1,581*	1,581
T2-2	Restoration	P2	1,135	1,060*	1,060
T2A	Enhancement I	-	465	465	310
Total Stream Enhancement I			465	465	310
Total Stream Enhancement II			158	109	44
Total Stream Restoration			4,401	4,015	4,015
Total Mitigation Units					4,369

*Mitigation units have been calculated to exclude the easement exceptions and water utility easements.

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TABLES

APPENDICES

1.0 RESTORATION PROJECT GOALS AND OBJECTIVES

EEP develops River Basin Restoration Priorities (RBRPs) to guide its restoration activities within each of the state's 54 Cataloging Units (CUs). RBRPs delineate specific watersheds that exhibit both the need and opportunity for wetland, stream and riparian buffer restoration. These watersheds are called Targeted Local Watersheds (TLWs) and receive priority for EEP planning and restoration project funds.

The 2009 Lower Yadkin Pee-Dee RBRP identified population growth, urban stormwater and agricultural activities as major stressors within the 8-digit Cataloging Unit (03040105). Overall watershed restoration goals for this CU include management of stormwater runoff and protection of aquatic habitat for rare species (NCDENR, EEP 2009).

The 2009 Lower Yadkin Pee-Dee RBRP identified HUC 03040105020040 (Irish Buffalo Creek) as a Targeted Local Watershed. Major stressors identified within the 46-square mile Irish Buffalo Creek TLW include animal operations and impervious cover. Reduction of sediment inputs and protection of Water Supply Waters serving the City of Kannapolis are primary goals of any stream restoration efforts undertaken within this TLW (NCDENR. EEP 2009). The Jacob's Landing Stream Restoration Site was identified as a stream restoration opportunity to restore and enhance headwater streams within the TLW by addressing some of the local watershed stressors.

The project goals address stressors identified in the TLW and include the following:

- Restore a diverse riparian corridor that connects forested stream systems upstream and downstream of the project.
- Reduce the sediment supply entering Irish Buffalo Creek.

The project goals will be addressed through the following objectives:

- Restore stable channel planforms to streams that have been straightened and modified.
- Reshape and stabilize eroding stream banks.
- Plant the site with native trees to help reestablish a diverse riparian corridor.
- Install exclusion fencing and alternative watering options to keep livestock out of the project streams.

2.0 SITE SELECTION

2.1 Directions

The Jacob's Landing Stream Restoration Site is west of China Grove and north of Kannapolis, located off of Saw Road. To reach the site from Raleigh: proceed west on I-40 for approximately 62 miles. Then travel on I-85 south toward High Point/Charlotte for approximately 50 miles. Take Exit 68 toward China Grove on US-29 south. Turn right on NC-152 on East Church Street for approximately 5 miles and then turn left onto Saw Road. The site is located approximately 0.3 mile south on Saw Road (See 2.3 Vicinity Map).

2.2 Site Selection

The site is part of the 03040105 Watershed Cataloging Unit (Rocky River). The Rocky River Watershed as a whole is experiencing a large amount of habitat alteration due to population growth from Charlotte and its surrounding metropolitan area. The drainage is expected to gain an estimated 950,000 new residents by 2030 (NCDENR, EEP 2009). As a result, the focus in this watershed is on mitigating impacts from stormwater and protecting existing habitat (NCDENR, EEP 2009).

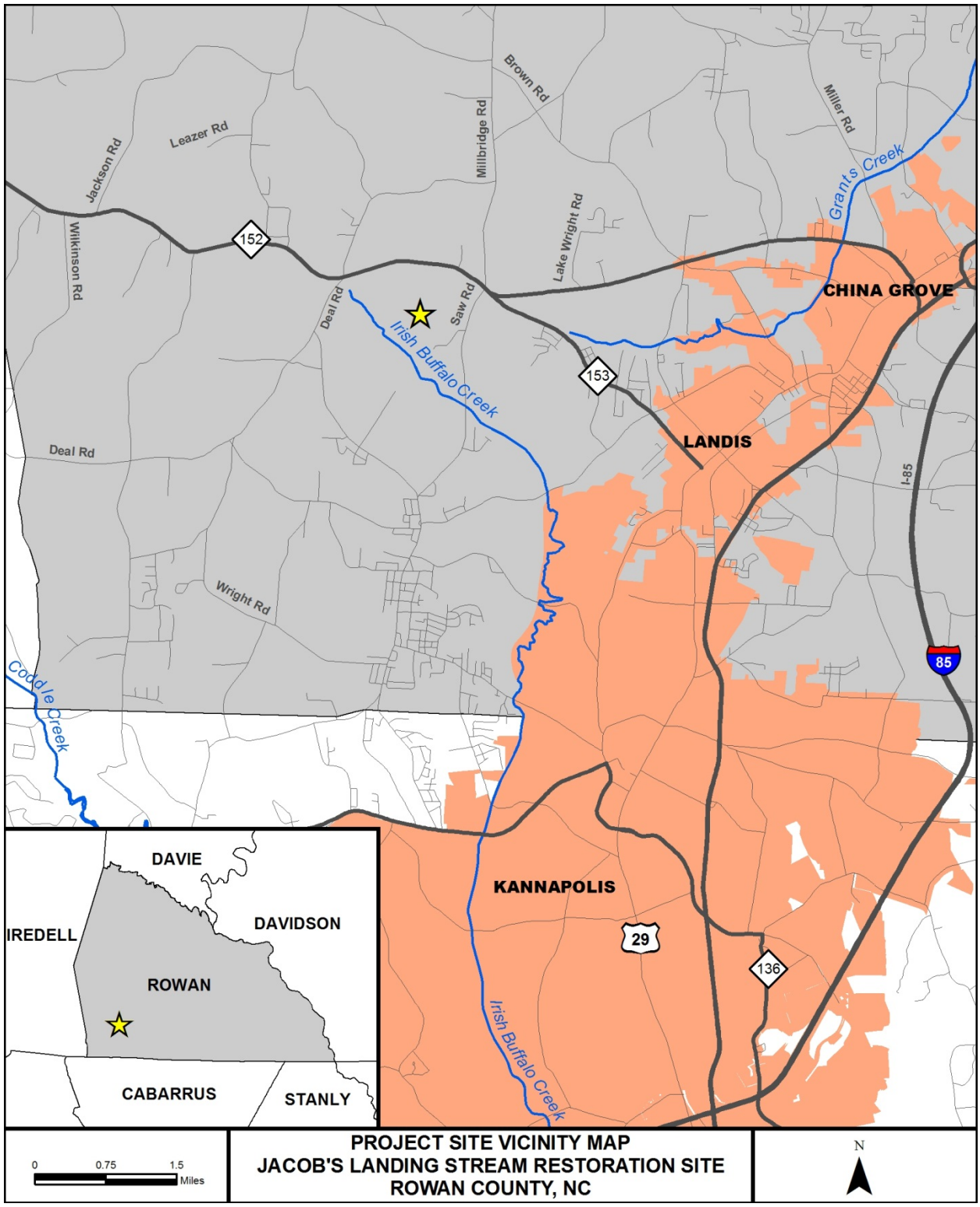
The North Carolina Division of Water Quality (NCDWQ) assigns surface waters a classification in order to help protect, maintain, and preserve water quality. The site is located in a water supply watershed; Irish Buffalo Creek flows into Kannapolis Lake, which is the primary water source for the City of Kannapolis. The section of Irish Buffalo Creek immediately below the project site (DWQ 13-17-9-(0.5)) is classified as a Class C, Water Supply III (WS-III) (NCDENR, DWQ 2012b).

- **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.
- **Water Supply III (WS-III)** Waters used as sources of water supply for drinking, culinary, or food processing purposes where a more protective WS-I or II classification is not feasible. These waters are also protected for Class C uses. WS-III waters are generally in low to moderately developed watersheds.

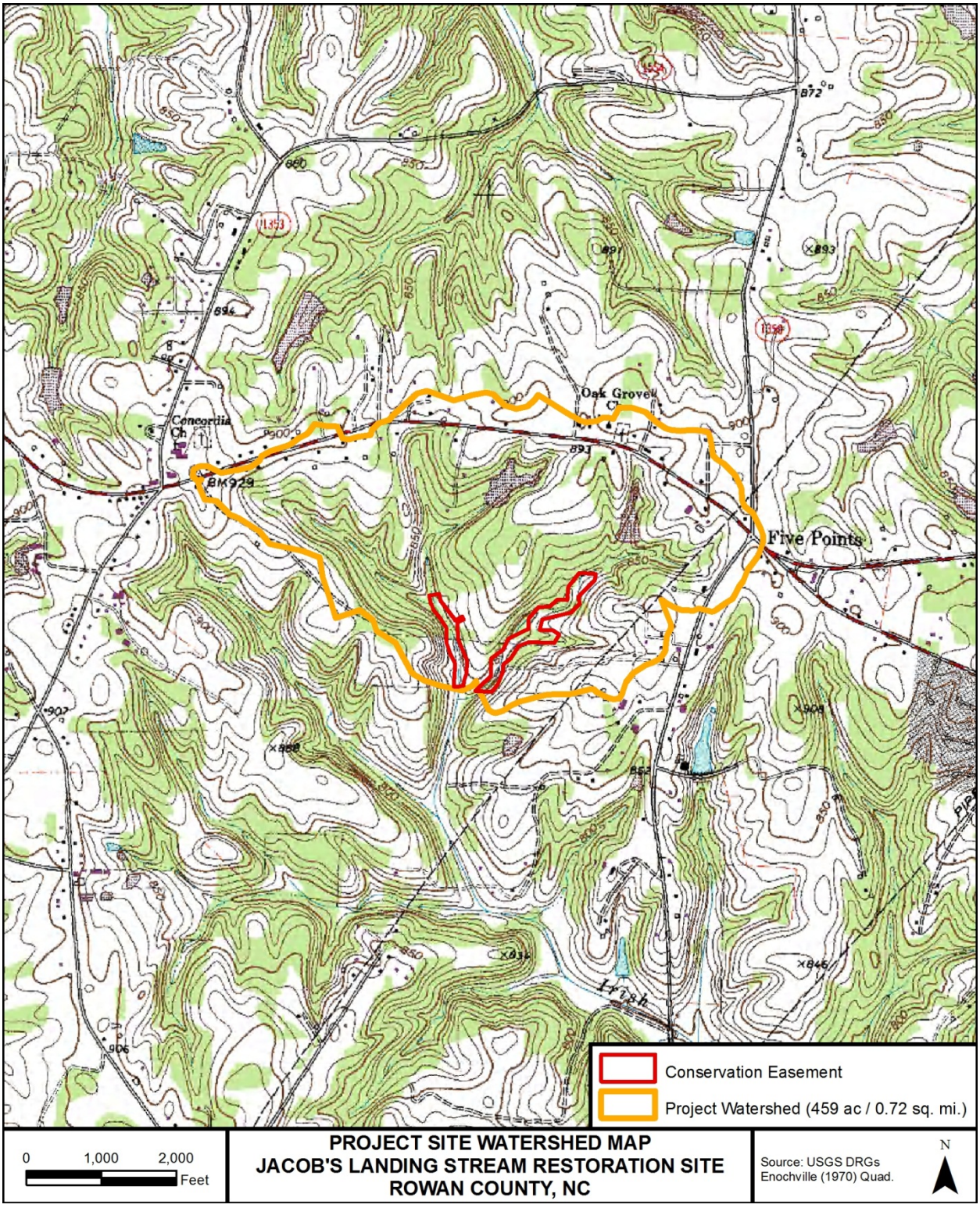
Downstream of Kannapolis Lake, Irish Buffalo Creek is listed as impaired on the 2012 North Carolina 303(d) list-Category 5 (Unit 13-17-9-(2)) listed for turbidity and copper violations (NCDENR, DWQ 2012a). The Lower Yadkin Pee-Dee River Basin Restoration Priorities 2009 report noted that several animal operations existed in the Irish Buffalo Creek watershed and that there was potential for future restoration projects to add to the ecological uplift in the watershed (NCDENR, EEP 2009).

Based on correspondence with the landowner, the site has been actively used for timber and cattle production for over five generations. Historic aerials were examined for any additional information about how the site hydrology and vegetation has changed over the last century. The reviewed aerials are included in Section 2.7 Historical Condition Plan View. Historic aerials were obtained from Rowan County NRCS and the USGS Earth Explorer for 1936, 1949, 1965, 1983, 1993, 1998, 2006, and 2009. The photographs show that as early as 1936 the lower portion of the site had straightened stream channels and by 1949 sparse riparian vegetation. In the upper part of the site, the western tributaries remained partially forested, but were cleared close to the stream channels. The eastern tributaries were primarily cleared at this time. By 1965, the upper western tributaries had regained denser forest cover while the lower portions of the site remained cleared and straightened. The site condition did not change much by 1983. By 1993, the western tributaries had developed into mixed forest. In 1993 and 1998, the vegetation remained sparse along the eastern side of the site. Moving into 2006, the site's vegetation cover stayed the same. In 2009, the pines along the western side of the site had been logged and replanted.

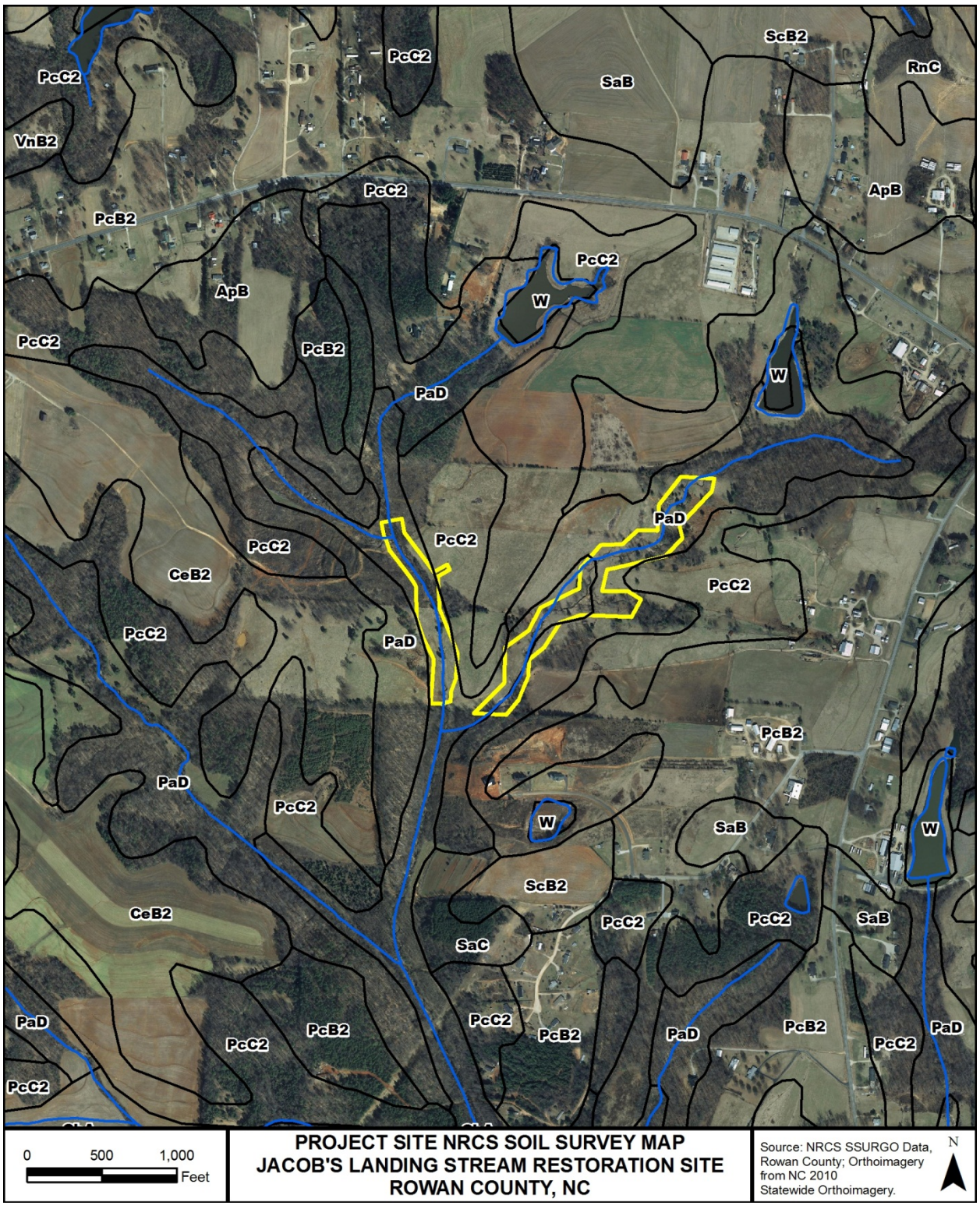
2.3 Vicinity Map



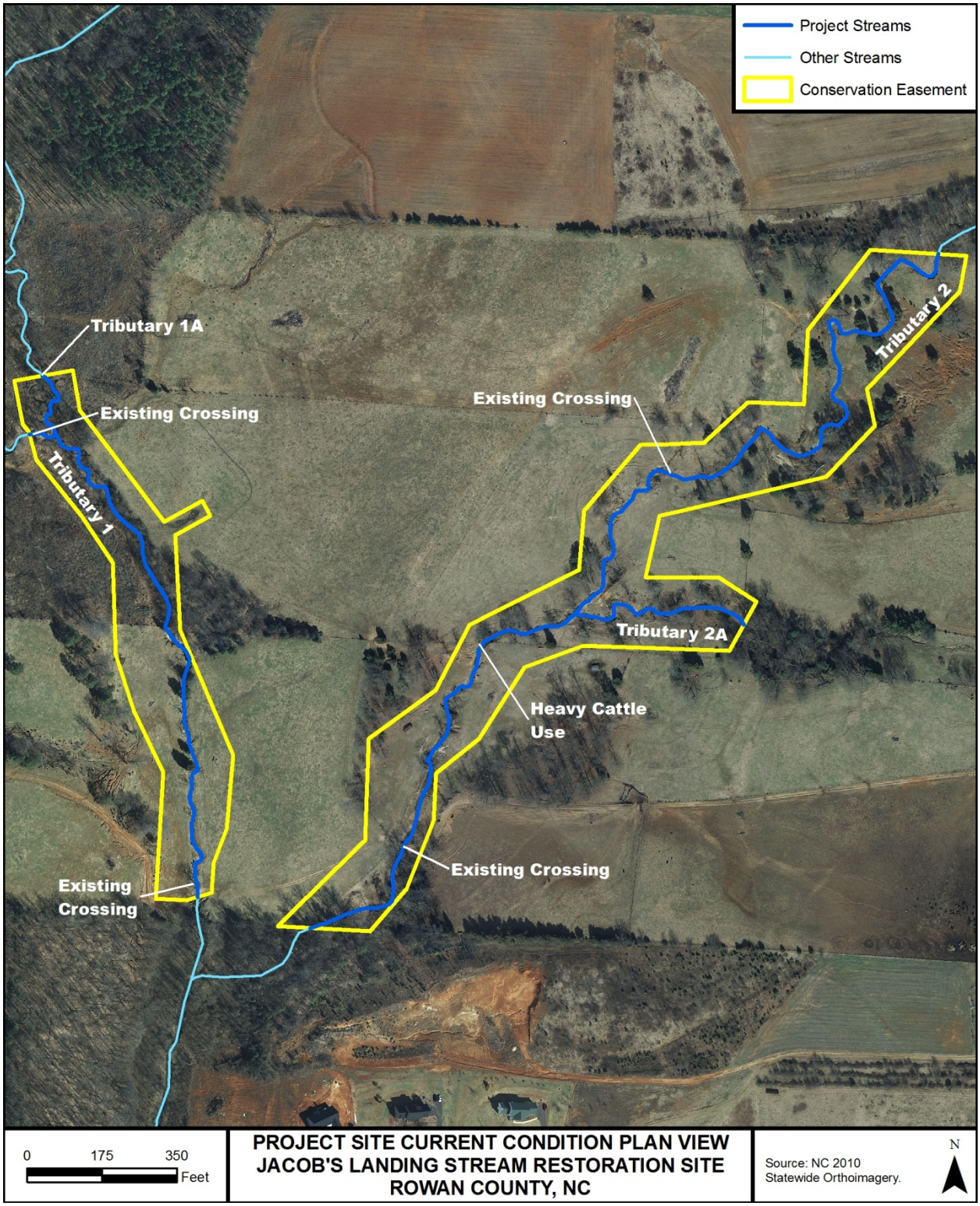
2.4 Watershed Map



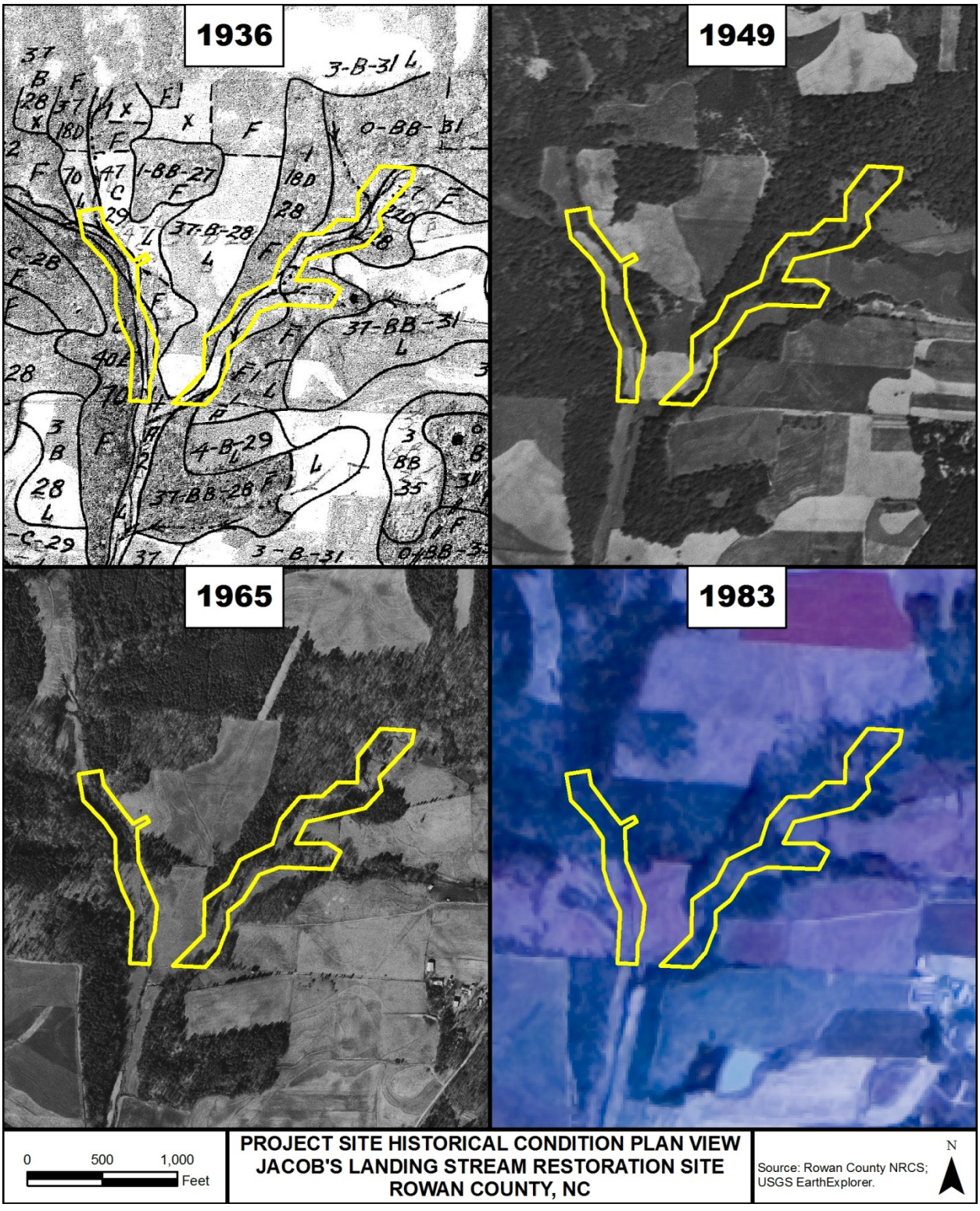
2.5 Soil Survey



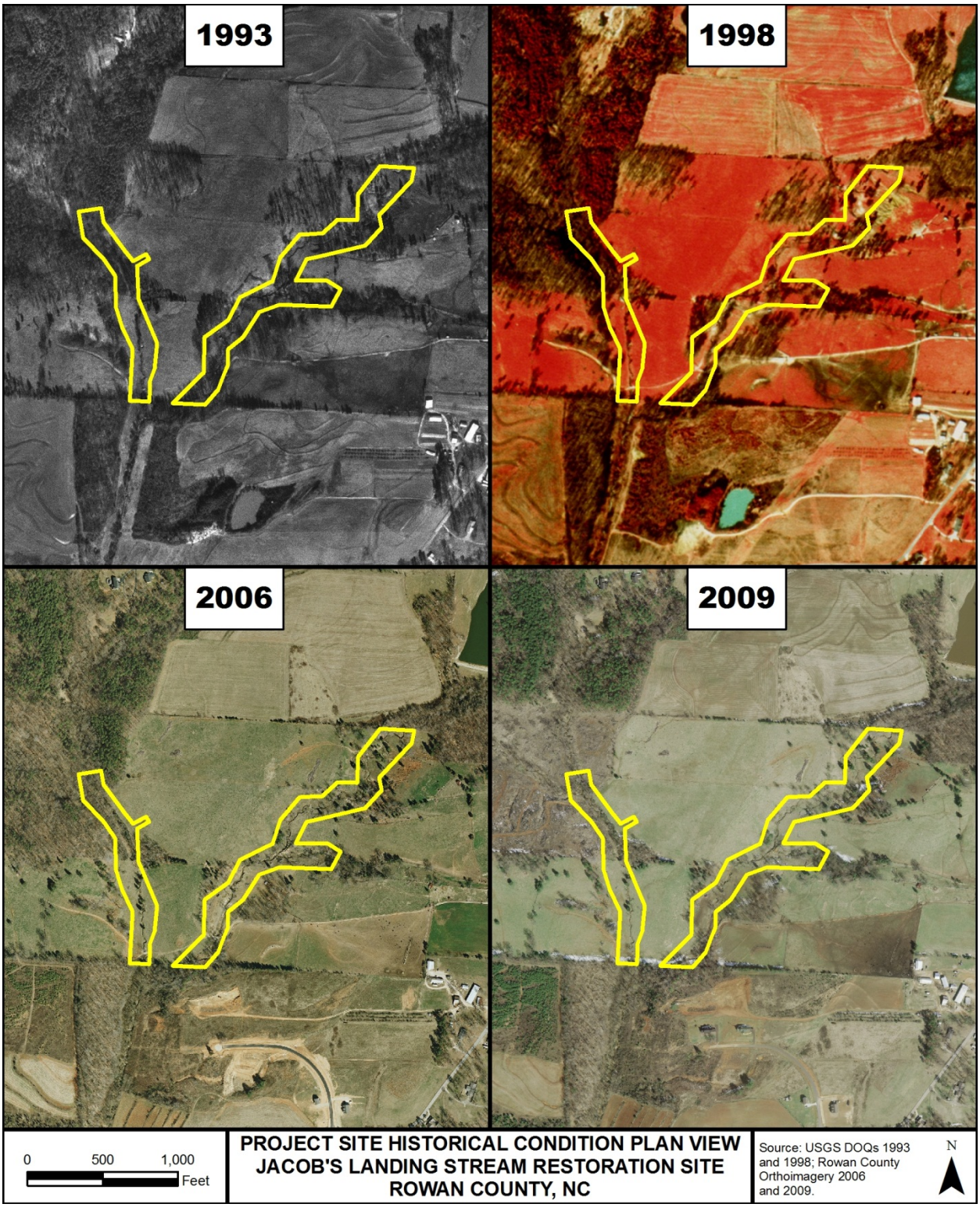
2.6 Current Condition Plan View



2.7 Historical Condition Plan View



Historical Condition Plan View



2.8 Site Photographs


Looking upstream at the confluence of T1-1 and T1A. 1/24/2011


Looking downstream at T1-1. 2/21/2012


Looking downstream at T1-1. 2/21/2012


Looking downstream at T1-2. 2/21/2012


Looking downstream at T1-3. 2/21/2012


Looking downstream at T1-3. 2/21/2012


Looking downstream at T1-3. 2/21/2012


Looking downstream at the culvert on T1-3. 2/21/2012


Looking downstream at the end of T1-3. 2/21/2012


Looking upstream at T1-3. 2/21/2012


Looking downstream at the beginning of T1A. 1/24/2011


Looking downstream at T1A. 1/24/2011


Looking downstream at the beginning of T2-1. 1/24/2011


Looking downstream at T2-1. 1/24/2011


Looking downstream at T2-1. 2/15/2012


Looking downstream at a culvert on T2-1. 2/15/2012


Looking upstream at cattle crossing on T2-1. 2/15/2012


Looking downstream at cattle crossing on T2-1. 2/15/2012


Looking downstream at incised banks on T2A. 2/21/2012


Looking downstream at incised banks on T2A. 2/21/2012

3.0 SITE PROTECTION INSTRUMENT

3.1 Site Protection Instrument Summary Information

The project site will be placed in a permanent conservation easement held by the State of North Carolina and will consist of 13.9 acres.

All site protection instruments require 60-day advance notification to the US Army Corps of Engineers (USACE) and the State prior to any action to void, amend, or modify the document. No such action shall take place unless approved by the State.

3.2 Site Protection Instrument Figure

The land required for the construction, management, and stewardship of this mitigation project includes one parcel owned by the following entities in Rowan County; Martha Myers Deal Revocable Trust, Oscho Roy Deal, Oscho Roy Deal Revocable Trust. The preliminary conservation easement boundary has been included in Appendix A.

4.0 BASELINE INFORMATION

Table 2. Project Information

Project Information							
Project Name	Jacob's Landing Stream Restoration Site						
County	Rowan County						
Project Area (acres)	13.9 acres						
Project Coordinates (lat. and long.)	35.552956 N, 80.653116 W						
Project Watershed Summary Information							
Physiographic Province	Piedmont						
River Basin	Yadkin-Pee Dee						
USGS Hydrologic Unit 8-digit	03040105	**USGS Hydrologic Unit 14-digit**	03040105020040				
DWQ Sub-basin	13-17-09						
Project Drainage Area	459 acres/0.72 square miles						
Project Drainage Area Percentage of Impervious Area	2.3% / 6 acres						
CGIA Land Use Classification	4.8% Cultivated, 60.1% Managed Herbaceous Cover, and 35.1% Mixed Upland Hardwoods.						
Reach Summary Information							
Parameters	**T1-1**	**T1-2**	**T1-3**	**T1A**	**T2A**	**T2-1**	**T2-2**
Length of reach (linear feet)	326	158	846	294	465	1,800	1,135
Valley classification	VIII	VIII	VIII	VIII	VIII	VIII	VIII
Drainage area (acres)	239.0	241.4	258.6	136.9	35.7	147.5	200.6
NCDWQ Water Quality Classification	Class C, WSIII	Class C, WSIII	Class C, WSIII	Class C, WSIII	Class C, WSIII	Class C, WSIII	Class C, WSIII
Morphological Description (stream type)	Modified	Modified	Modified	Modified	Modified	Modified	Modified
Evolutionary trend	Ditching and Pasture	Ditching and Pasture	Ditching and Pasture	Ditching and Pasture	Ditching and Pasture	Ditching and Pasture	Ditching and Pasture
Mapped Soil Series	Chewacla loam	Chewacla loam	Chewacla loam	Chewacla loam	Pacolet sandy loam	Pacolet sandy loam	Chewacla loam
Drainage class	Poorly drained	Poorly drained	Poorly drained	Poorly drained	Well drained	Well drained	Poorly drained
Soil Hydric status	Non hydric	Non hydric	Non hydric	Non hydric	Non hydric	Non hydric	Non hydric
Slope	0-2%	0-2%	0-2%	0-2%	0-2%	0-2%	0-2%
FEMA classification	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Native vegetation community	Mixed hardwoods	Mixed hardwoods	Pasture	Mixed hardwoods	Pasture	Pasture	Pasture
Percent composition of exotic invasive vegetation	10-25%	10-25%	0%	0%	0%	0%	0%

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Submitting NWP 27 following Mitigation Plan approval	N/A
Waters of the United States – Section 401	Yes	Submitting NWP 27 following Mitigation Plan approval	N/A
Endangered Species Act*	No	N/A	N/A
Historic Preservation Act*	No	N/A	N/A
Coastal Zone Management Act * (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat*	No	N/A	N/A

* Items addressed in the Categorical Exclusion in Appendix B.

4.1 Watershed Summary Information

The site is part of the 03040105 Rocky River Watershed Unit (Rocky River). The Rocky River Watershed as a whole is experiencing extensive habitat alteration due to population growth from Charlotte and its surrounding metropolitan area. The project drainage is comprised of 0.72 square mile (459 acres) that flow through the project floodplain before reaching Irish Buffalo Creek, which ultimately flows into the Kannapolis Lake downstream of the project site. Current land use in the project watershed (See 2.4 Watershed Map) consists of cultivated land (22 ac/4.8%), managed herbaceous cover (276 ac/60.1%), and mixed upland hardwoods (161 ac/35.1%) (NCCGIA Land Cover, 2006). The approximate total impervious cover of the project watershed is 2.3% (6 acres). This estimate was developed using the following percent impervious estimates: agricultural (2%) and forest (0%). The surrounding area is rural with moderate development pressure. The project area is located in the United States Geological Survey USGS Enochville Quadrangle (1970).

According to the Rowan County Land Use Plan the Jacob's Landing Stream Restoration Site is located in "Area 3" of their land use plan (Benchmark, 2009). This area of the county will encourage "conservation subdivision" design for all proposed developments greater than 20 acres in size. The rural character of the area will be preserved by promoting the clustering of small residential tracts while preserving open space and farmland. If the watershed that drains to the project site is developed, one acre lot sizes will be the minimum allowed lot size. Based on this information, and the stormwater requirements for new development, it does not appear that the project will be significantly impacted by stormwater discharges, even if a full build-out scenario is implemented in the watershed.

4.2 Geology and Soils Information

The site lies within the Southern Outer Piedmont (Level IV 45b) ecoregion of the Piedmont physiographic province. This area is characterized by irregular plains with low rounded hills and ridges consisting of low to moderate gradient streams with mostly cobble, gravel and sandy substrates. The underlying rocks of the area consist of gneiss, schist and granite covered with deep saprolite and mostly red, clayey subsoils. According to the soil survey for Rowan County, the soils within the project site are mapped as Chewacla loam for the northwestern and southern portions of the site and Pacolet sandy loam for the northeastern tributaries as shown in 2.5 Soil Survey. Chewacla loam is described as a very deep, somewhat poorly drained soil that occurs within river or stream valleys and drainage ways of the piedmont. Pacolet sandy loam is a very deep and well-drained soil that occurs within narrow ridges and side slopes in piedmont uplands. (Soil Survey of Rowan County, NC, NRCS, 2004).

4.3 Reach Summary Information

Existing Streams

The streams at the Jacob's Landing Stream Restoration Site have been impacted by a history of logging and grazing (See 2.8 Site Photographs). Four separate streams make up the site: Tributary 1 (T1) begins in the northwestern project corner, Tributary 1A (T1A) flows south to join T1; Tributary 2 (T2) comes onto the site from the northeastern corner; and Tributary 2A (T2A) originates on the property from seep flow to then join T2. T1 and T2 come together just south of the project boundary before joining another tributary to form Irish Buffalo Creek (See 2.6. Current Condition Plan View).

T1 comes onto the site in the northwestern corner of the property and is a perennial first-order stream that flows for approximately 1,330 linear feet through the Jacob's Landing Stream Restoration Site. The stream's drainage originates from the forested slopes south of State Highway 152, where the B-type channel comes down through a moderately steep valley. T1-1 flows southeast with isolated bank erosion

and thick invasive vegetation (primarily Chinese privet) on the banks. Downstream, T1-2 enters a more heavily wooded section with a steeper slope along the left bank. T1-3 flows through the wooded section through a wooden gate and moves into the open pasture. T1-3 flows approximately 680 linear feet through the pasture before it reaches the southern project boundary. The stream has been straightened and consequently lacks the appropriate stream planform. The riparian zone has sparse to no vegetation and the banks are actively widening and eroding. A culverted crossing is on T1-3 before it leaves the property.

T1A is a perennial first-order stream that enters the site from the northern project boundary and occupies a similar landscape position to T1. Its drainage area also begins south of State Highway 152 and flows south out of a pond upstream of the project site. Once onto the Jacob's Landing Stream Restoration Site, the stream is a B-type channel approximately 294 linear feet in length before it reaches the confluence with T1. The tributary enters from a mature forested system upstream, but the riparian vegetation in the project reach is less mature than that upstream and consists of a few mature trees mixed in with shrubs and invasive species. As a result, there are sections of banks without rooted protection that are eroding. T1A has developed torturous meanders as a result of the riparian modifications.

T2 begins from the northeastern corner of the project and is a perennial first-order stream that flows for approximately 2,935 linear feet until reaching the southern edge of the Jacob's Landing Stream Restoration Site. Upstream of the project, T2 originates from a farm pond and then travels through a mature forested slope to reach the start of the project. Once onto the Jacob's Landing Stream Restoration Site, the stream comes out into a broader valley type where the riparian vegetation has been removed aside from isolated mature trees. Livestock have had access to the channel and they have further impacted the bank stability and increased rates of erosion. The existing channel begins with a low width-to-depth ratio and high bank heights. Eroding slopes within the valley have contributed additional sediment to the stream and further induced scour and downcutting. The channel has tried to adjust by becoming more highly sinuous. At approximately 1,300 linear feet downstream on T2, there is a culverted crossing across the channel and then the stream begins to move to the south and into an entrenched position in the valley. The stream is characterized by high, eroding banks. Downstream, a bedrock feature serves as grade control by keeping a large headcut from continuing to migrate upstream. At 1,800 linear feet along T2, T2A enters from the east. Shortly after the confluence, there is wooden gate across the channel and then the stream enters a broader valley type. Here the cattle have severely impacted the channel. There is no riparian vegetation and the stream is actively eroding. Another culverted crossing goes over the channel, and after this point the stream runs along a steep valley slope on the left bank before leaving the project site.

T2A is the only stream that originates on the project and is a perennial, first-order, seep-driven stream that flows west until the confluence with T2. The T2A reach begins at a makeshift tire fence across the channel. Upstream of the reach, the flow originates out of deep rock gulch. According to the landowner, the stream has persistent base flow. The stream is deeply entrenched with vertical valley walls. The riparian vegetation has been removed, which has allowed the steep banks to begin eroding and obscured the pool and riffle features in the tributary. The valley begins to open up as the channel makes its way to the confluence with T2.

All project reaches (existing) were evaluated using NCDWQ Stream Classification Forms in February 2012 (Appendix C). The NCDWQ forms were used to determine if the tributaries were classified as perennial or intermittent streams. A numerical value of at least 30 points is determined from the NCDWQ stream identification form to classify the stream as a perennial stream (NCDENR, September 1, 2010). All project reaches scored a numerical value of at least 30 points.

Channel Classification
T1-1 begins as a "G4" stream type with an entrenchment ratio of 1.5, a width-to-depth ratio of 9.6, and a bank height ratio of 1.6. Downstream, after the confluence with T1A, the channel classifies as an "E4" stream type with a very low width-to-depth ratio of 3.7, and an entrenchment ratio of 2.5. The stream then continues downstream through the pasture with an entrenchment ratio of 3.3 and a very low width-to-depth ratio of 5.2, classifying the stream as "G4" before reaching Irish Buffalo Creek. T1A is classified as an "E4" stream type with an entrenchment ratio of 1.9, a moderate width-to-depth ratio of 9.3, and a bank height ratio of 2.2 as it reaches the confluence of T1-1.

T2-1 begins as an "E4" stream type with an entrenchment ratio of 2.3 and a low width-to-depth ratio of 8.4. After T2A enters from the east, T2-2 is classified as "F4" stream type with an entrenchment ratio of 1.4, a width-to-depth ratio of 12.9, and a very high bank height ratio of 4.7. Further downstream, the channel is classified as a "G4" with a low width-to-depth ratio. T2A is deeply entrenched and classified as a "G4" stream type with an entrenchment ratio of 1.7, a moderate width-to-depth ratio of 12.8, and a high bank height ratio of 6.3. The stream continues to be entrenched as it reaches the confluence of T2-2.

Channel Morphology (Pattern, Dimension, and Profile)
A Rosgen Level III assessment was conducted to gather existing stream dimension, pattern, and profile data to determine the degree of channel instability. Channel cross-sections were surveyed at eleven representative locations along the project, one location each on T1-1, T1-3, T1A and T2A, as well as two locations each on T1-2, T2-1, and T2-2. Data developed from these surveys are presented in a channel morphology summary in Appendix C.

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. Streambank measurements were taken on the following characteristics; bank heights, bank angles, materials, presence of soil layers, rooting depth, rooting density and percent of bank protection. The data was used to develop the Bank Erodibility Hazard Rating (BEHI) forms for all reaches (Appendix C), (Rosgen, 2001).

A total of nineteen BEHI rating forms were performed and completed for all reaches. Table 3 summarizes total BEHI values for all reaches. T1-1 exhibited BEHI ratings of moderate 29.8, high 33.2, and very high 40.7 with a bank height ratio at 1.6. The T1-2 assessment exhibited a high BEHI rating of 34.9 with bank height ratios in the project reach ranging from of 1.9 to 2.2. T1-3 exhibited BEHI ratings of moderate 29.0, high 36.6, and very high 40.9 with a bank height ratio of 1.9. The T1A assessment exhibited BEHI ratings of moderate 29.8, high 38.8, and very high 40.1 with a bank height ratio at 2.2. T2-1 exhibited moderate 28.8, high 38.3, and very high 40.5 BEHI ratings with bank height ratios in the project reach ranging from 1.5 to 2.0. T2-2 assessment exhibited BEHI ratings of moderate 29.3, high 39.4, and very high 41.3 with bank height ratios in the reach ranging from 2.9 and 4.7. T1A exhibited moderate 29.8, high 38.8, and very high 40.1 BEHI ratings with a bank height ratio of 6.3.

The reaches exhibit characteristics of unstable stream channels. High bank height ratios (>1-2) are typical of incised and/or channelized streams. Most notably, the channels show evidence of bank erosion and undercutting along with channelization in portions of each reach. Furthermore, several sections do not have vegetation on the banks and consequently lack rooting strength and cover protection. The high bank height ratio indicates the lack of a bankfull or floodplain feature along the stream to provide any access during high flow events.

Table 3. BEHI Data

	Left Bank		Right Bank		Total	
	BEHI	**Linear Footage**	**BEHI**	**Linear Footage**	**BEHI Rating**	**Linear Footage**
T1-1	Very High		Very High	70	40.7	70
	High	20	High	40	33.2	60
	Moderate	30	Moderate	15	29.8	45
Reach Total		**50**		**125**		
T1-2	-	-	High	40	34.9	40
Reach Total		**-**		**40**		
T1-3	Very High	45	Very High	90	29.0	135
	High	50	High	100	36.6	150
	Moderate	110	Moderate	33	40.9	143
Reach Total		**205**		**223**		
T1A	Very High	60	Very High	47	29.8	107
	High	20	High	15	38.8	35
	Moderate	23	Moderate	-	40.1	23
Reach Total		**103**		**62**		
T2-1	Very High	340	Very High	-	28.8	340
	High	50	High	95	38.3	145
	Moderate	145	Moderate	130	40.5	275
Reach Total		**535**		**225**		
T2-2	Very High	85	Very High	145	29.3	230
	High	250	High	135	39.4	385
	Moderate	160	Moderate	145	41.3	305
Reach Total		**495**		**425**		
T2A	Very High	70	Very High	55	29.8	125
	High	30	High	15	39.6	45
	Moderate	30	Moderate	55	42.5	85
Reach Total		**130**		**125**		

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: incipient point of flooding, 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 validate the correct identification of the bankfull stage on all project reaches.

The regional hydraulic geometry relationships (regional curves) were utilized to compare the bankfull discharge calculated from the field identification. 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 from "Bankfull Hydraulic Geometry Relationships for North Carolina Streams" (Harman *et al*., 1999) were used to approximate bankfull in the project reaches. Based on the regional curves, a bankfull discharge and cross-sectional area were estimated for all reaches. For T1-1 and T1-2, the regional curve estimates a bankfull discharge of 46 ft^3/s and a cross-sectional area of 11.4 ft^2. For T1-3, the regional curve estimates a bankfull discharge of 48 ft^3/s and a cross-sectional area of 12 ft^2. For T1A, the values were estimated at 27 ft^3/s, and 7 ft^2. For T2-1, the regional curve estimates a bankfull discharge of 32 ft^3/s and a cross-sectional area of 8.2 ft^2, while T2-2 estimates a bankfull discharge of 40 ft^3/s and a cross-sectional area of 10.1 ft^2. For T2A, the values were estimated at 12 ft^3/s and 3.2 ft^2.

A similar reach of UT to Irish Buffalo Creek, located 400 linear feet upstream on the existing project reach T1, was surveyed for a reference stream by KCI in February 2012. KCI analyzed the relationship between drainage area and discharge to the NC rural piedmont regional curve data. The results indicated the bankfull cross-sectional area and discharge for the reference stream reveal consistent plotting of the regional curve data, demonstrating that bankfull stage is suitable at the reference stream. Since this stream is located upstream T1, KCI feels that it is a suitable reference for the project reaches.

The method used to confirm bankfull stage at Jacob's Landing Stream Restoration Site was bankfull field identification. Field identification of bankfull indicators on existing cross-sections were utilized on T2 and UT to Irish Buffalo Creek Reference Reach (T1). For T2-1, XS-1 bankfull field indicators resulted in a discharge of 31 ft^3/s, which correlated to the regional curve bankfull discharge of 32 ft^3/s. For the reference reach cross-section, bankfull field indicators resulted in a discharge of 25 ft^3/s, which is similar to the regional curve bankfull discharge of 25 ft^3/s. After analyzing the bankfull verification results, the design discharges were set for the project reaches. The design bankfull discharges are shown in Table 4.

Table 4. Bankfull Discharge

Parameters	Reference XS	T1-1	T1-2	T1-3	T1A	T2A	T2-1	T2-2
Regional Curve								
	25 ft^3/s	46 ft^3/s	46 ft^3/s	48 ft^3/s	27 ft^3/s	12 ft^3/s	32 ft^3/s	40 ft^3/s
Bankfull Field Indicators								
XS-1							31 ft^3/s	
Design Discharge								
		46 ft^3/s	45 ft^3/s	47 ft^3/s	27 ft^3/s	12 ft^3/s	33 ft^3/s	40 ft^3/s
UT to Irish Buffalo Creek Reference (T1) Discharge								
	25 ft^3/s							

Bankfull data for the project reaches were compared with the NC rural piedmont regional curve. The proposed cross-sectional areas and bankfull discharge for the reaches are shown overlaid with the NC rural piedmont regional curve in (4.4 Regional Curve Discharge). Analysis of the bankfull cross-sectional areas and discharge for the project reaches reveal consistent correlation with the NC rural piedmont regional curve data

Vegetation

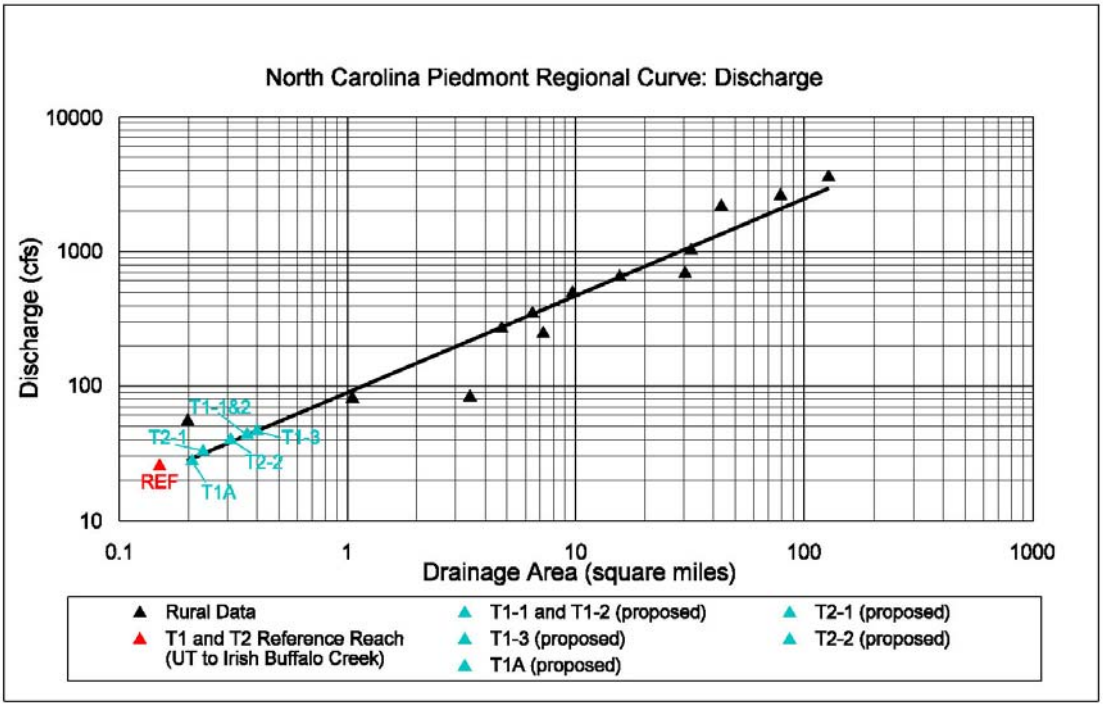
Because of previous cattle impacts and logging at Jacob's Landing Stream Restoration Site, no distinct vegetative communities exist on the site. The vegetation within the project area is primarily comprised of open pastures dominated by various grass species and small understory trees.

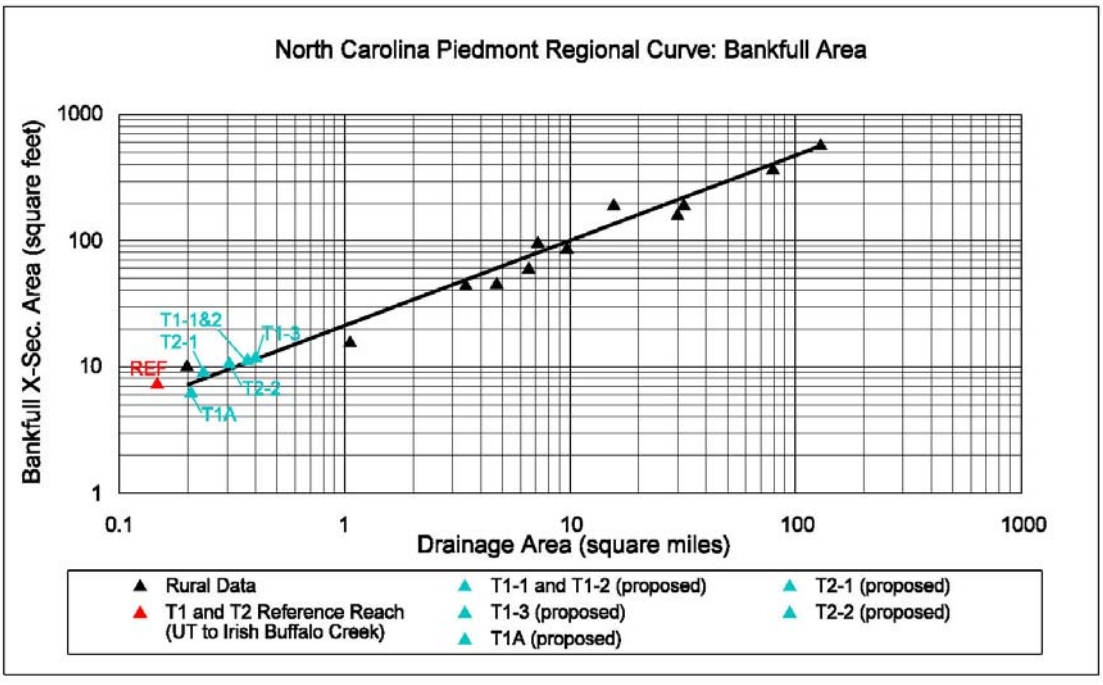
The start of T1 is in early successional growth with riparian vegetation limited to small trees and shrubs or herbaceous vegetation. The dominant species consist of tulip poplar (*Liriodendron tulipifera*), red maple (*Acer rubrum*), and box elder (*Acer negundo*). Chinese privet (*Ligustrum sinense*) and multiflora rose (*Rosa multiflora*) are the main invasive species interspersed along the upstream portion of T1. These species will be mechanically removed during the construction phase of the project and any remaining plants will be treated. Treatment techniques may vary based on seasonality, the concern for drift and the size of the plants and stems. Basal bark spray of Garlon 4 (triclopyr ester) and foliar spraying of Rodeo (glyphosate) or Escort XP (metsulfuron methyl) will be the preferred treatment methods. Treatments will be targeted in late summer, when possible. For large stems, stem injections using Garlon 3A (triclopyr) will be completed in the fall. The downstream portion of T1 has been affected by cattle grazing and consists of various grass species. In order to minimize the allelopathic influence of tall fescue (primarily Kentucky 31) along the stream banks and within the riparian zone, fescue will be mechanically removed and or treated with glyphosate herbicide. A chelated form of glyphosate (Rodeo, or similar) will be used in proximity to the stream, and a non-chelated form (Roundup, or similar) will be used in upland areas.

Along T1A the riparian vegetation in this reach is less mature than upstream of the project and consists of various grasses.

The entire length of T2 has been affected by cattle grazing. The vegetation within the project area is primarily comprised of open pastures dominated by various grass species.

4.4 Regional Curve Discharge





Reference; Wildlands Engineering, Inc. 2010

4.5 Wetland Summary Information

Not applicable for this project.

4.6 Regulatory Considerations

The Jacob's Landing Stream Restoration Site is not located within the 100-year floodplain (Zone AE); therefore regulatory considerations are not applicable for this project.

5.0 DETERMINATION OF CREDITS

Mitigation credits presented in these tables are projections based upon site design. Upon completion of site construction the project components and credits data will be revised to be consistent with the as-built condition.

Table 5. Determination of Credits

Mitigation Credits								
	Stream			Riparian Wetland	Non-riparian Wetland	Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	EI	EII	-	-	-	-	-
Length	4,015	465	109	-	-	-	-	-
Credit	4,015	310	44					
TOTAL CREDITS	4,369							

Project Components					
Reach ID	Existing Footage	Approach *(PI, PII etc.)*	Restoration -or-Restoration Equivalent	Designed Footage	Mitigation Ratio
T1-1	326	P2	Restoration	303	1:1
T1-2	158	-	Enhancement II	109	1:2.5
T1-3	846	P2	Restoration	893	1:1
T1A	294	P2	Restoration	178	1:1
T2-1	1,800	P2	Restoration	1,581	1:1
T2-2	1,135	P2	Restoration	1,060	1:1
T2A	465	-	Enhancement I	465	1:1.5

6.0 CREDIT RELEASE SCHEDULE

All credit releases will be based on the total credit generated as reported by the as-built survey of the mitigation site. Under no circumstances shall any mitigation project be debited until the necessary Department of Army (DA) authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the Interagency Review Team (IRT), will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to restart or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of project credits will be subject to the criteria described as follows:

Stream Credits			
Monitoring Year	**Credit Release Activity**	**Interim Release**	**Total Released**
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50% (65%*)
3	Third year monitoring report demonstrates performance standards are being met	10%	60% (75%*)
4	Fourth year monitoring report demonstrates performance standards are being met	10%	70% (85%*)
5	Fifth year monitoring report demonstrates performance standards are being met and project has received closeout approval	15%	100%

*If two bankfull events have been observe

Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the mitigation plan can be released by the NCEEP without prior written approval of the DE upon satisfactory completion of the following activities:

a. Approval of the final Mitigation Plan
b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property
c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; Per the NCEEP Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and an as-built report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.
d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the IRT, based on a determination that required performance standards have been achieved. For stream projects a reserve of 15% of a site's total stream credits shall be released after two bank-full events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than two bank-full events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT. As projects approach milestones associated with credit release, the NCEEP will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring report.

7.0 MITIGATION WORK PLAN

7.1 Target Stream Type and Plant Communities

Target Streams
The design for the Jacob's Landing Stream Restoration Site proposes the Restoration of approximately 4,015 linear feet, Enhancement I of approximately 465 linear feet, and Enhancement II of 109 linear feet. The Enhancement I will involve adjusting the stream to have the appropriate profile and dimension, while the Enhancement II will involve grading the stream banks, removing invasive vegetation and planting the buffer with native trees (USACE *et. al* 2003). The tributaries are divided into seven separate reaches based on the restoration or enhancement approach applied to the portions of the channels. The project reaches are identified in 7.6 Proposed Mitigation Plan View.

Target Plant Communities
The 50-foot buffer along the project streams will receive riparian plantings consisting of native woody species and will be incorporated as outlined in the planting plan. Six hundred and eighty (680) stems per acre (8' x 8' spacing) will be planted along restoration reaches to achieve a mature survivability of two hundred sixty (260) stems per acre. Woody vegetation planting will take place during dormancy. The riparian areas for T1-1, T1-2, T1-3, T1A, T2-1, and T2-2 will be planted as a Piedmont Alluvial Forest and will consist of at least five of the following:

American Sycamore	*Platanus occidentalis*	River Birch	*Betula nigra*
Swamp Chestnut Oak	*Quercus michauxii*	Willow Oak	*Quercus phellos*
Green Ash	*Fraxinus pennsylvanica*	Tulip Poplar	*Liriodendron tulipifera*

The riparian areas of T2A will be planted as Mesic Mixed Hardwood Forest and may consist of the following species:

Tulip Poplar	*Liriodendron tulipifera*	White oak	*Quercus alba*
Southern Red Oak	*Quercus falcata*	American Persimmon	*Diospyros virginiana*
Willow Oak	*Quercus phellos*	Pin oak	*Quercus palustris*

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

Silky Dogwood	*Cornus amomum*	Silky Willow	*Salix sericea*
Black Willow	*Salix nigra*	Common Elderberry	*Sambucus canadensis*

A 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 addition to planting the proposed community types, vegetative restoration will also include eliminating invasive species that have moved into portions of the site. The targeted species will be treated with an appropriate herbicide as needed to control populations.

7.2 Design Parameters

The mitigation approach for the Jacob's Landing Stream Restoration Site will aim to restore and protect the headwater tributaries to Irish Buffalo Creek. Mitigation actions will focus on repairing isolated sections of bed degradation and bank erosion and restoring the unstable reaches that have been straightened or severely degraded by cattle. The overall approach to the design of Jacob's Landing Stream Restoration Site is Priority 2 Restoration, which will involve creating a new stream profile and dimension and a bankfull bench (Rosgen, 1997). A combination of Priorities 1 and 2 approach will be utilized along T1-3 by creating an appropriate dimension, pattern, profile and reconnecting the floodplain to an elevation at or similar to the historic floodplain elevation.

Tributary T1-1 – 303 linear feet of Restoration
Upstream of the T1-1 is an existing culvert crossing, which will be reset and stabilized. The stream will be restored to a C4-type channel with a stable planform using a Priority 2 approach. Restoration of this reach will involve stabilizing the outer left vertical bank, which is currently a large source of sediment into the stream. Grade control structures will be installed to direct the stream along the reconstructed channel and a bankfull bench will better accommodate large flows.

Tributary T1-2 – 109 linear feet of Enhancement II
This reach has stable gravel/cobble riffles, but the riparian buffer has been impacted by grazing along the left bank and logging on the right bank. Enhancement actions will focus on stabilizing bank erosion as well as removing invasive vegetation and replanting with native trees. A seep coming into T1 from the east will also be stabilized and protected within the conservation easement.

A 50-foot easement exception will be left out of the project easement along this reach to ensure landowner access to the other side of the channel in the future. No crossing will be constructed at this time.

Tributary T1-3 – 893 linear feet of Restoration
This final reach of T1-3 is the most highly modified section of the tributary. The existing stream has been straightened as it comes out into a broader valley type. A combination of Priorities 1 and 2 approach will be used to restore a C4-type channel. A new channel planform will be constructed by moving the stream to the right (west). Pulling the stream away from the old channel will allow for the channel to be brought up closer to the relic floodplain and for larger entrenchment ratios with a wider floodprone area to attenuate flows. A stable meandering planform with low to moderate sinuosity will be developed to tie the stream into the downstream end of the project.

The existing road crossing located at the end of the downstream reach will be reconstructed into a culverted crossing.

Tributary T1A – 178 linear feet of Restoration
T1A exhibits a highly sinuous stream with unstable meander curves, which have resulted in bank erosion along the outer bends. This section immediately before the confluence with T1-1 will be restored to stable B4c/C4-type channel using a Priority 2 approach. The planform will be altered to create a stable

alignment as the stream flows to the confluence with T1. To account for the slightly higher slope on T1A, the design will include frequent grade control structures that will mimic the natural step pool sequences found in streams of this type. These step pools will create the pool habitat that the stream is currently lacking.

Tributary T2-1 – 1,581 linear feet of Restoration
T2-1 enters the Jacob's Landing Stream Restoration Site from a mature forested area and then becomes highly sinuous within the project bounds as it has attempted to adjust to the removal of riparian vegetation and an increased sediment supply from unstable banks and valley walls. As a result, the channel is attempting to downcut and there is a lack of riffle and pool sequencing. The restoration of T2-1 will use a Priority 2 approach to restore a C4-type channel. Unstable meanders will be reshaped to a stable pattern with a bankfull bench. Habitat and grade control structures will be used to create feature diversity in the profile, maintain pool depth, and prevent further downcutting of the stream.

The existing road crossing within this reach will be reconstructed. The new road crossing will be a culverted crossing within a 50-foot wide easement exception.

Tributary T2-2 – 1,060 linear feet of Restoration
Downstream of the confluence with T2A, T2-2 continues to be entrenched within a tight valley for another 200 linear feet but then emerges in a broader valley type for the remainder of the reach. In this section, T2-2 has experienced severe impacts from cattle. A new channel planform will be constructed by moving the stream to the left (east) for approximately 400 linear feet before crossing the existing channel to move the stream to the right (west). A stable meandering planform with low to moderate sinuosity will be developed to tie the stream into the downstream end of the project.

The existing road crossing within this reach will be reconstructed into a culverted crossing within a 50-foot wide easement exception.

Tributary T2A – 465 linear feet of Enhancement I
T2A is confined within a steep valley and the removal of riparian vegetation has led to bank erosion. The stream is also cutting down to meet the confluence with T2-2, which has caused bed degradation and an incised channel. This reach will be enhanced by shaping the banks to creating a bankfull bench, and installing grade control structures to gradually drop the bed elevation down. The reach will be stabilized by replanting the riparian buffer to achieve a mix of native tree species.

Additional Site Enhancement Measures:
In addition to the stream mitigation proposed, KCI will also stabilize incoming seeps and side slopes at the Jacob's Landing Stream Restoration Site. Due to the hilly terrain at the site, there are many incoming small drainages and seeps. Currently, these seeps are not protected and most are open to cattle impacts or contributing to bank instability as they enter the project streams. However, they have high potential for ecosystem uplift as amphibian habitat and pocket wetlands alongside the riparian buffer. As part of the overall site restoration, these seeps will be protected in the project easement and stabilized as necessary to become an integral part of the riparian corridor connecting to Irish Buffalo Creek.

There are also other swales and drainage ways that lead to the project stream. Installing water quality treatment structures at the outlet of these drainage paths will provide opportunities to improve water quality by catching runoff in small basins before it drains directly to a project stream. The purpose of these structures is to catch the initial flush of surface runoff that is currently routed through these drainage ways from overland flow through pasture areas during rain events. The water quality treatment structures offer the potential for nutrient reduction of agricultural runoff. Potential locations for these detention basins are indicated in the plans. The final placement of these structures may be adjusted as necessary

during construction by the designer. Their placement will be dependent on the specific conditions during construction and how the structure fits into the surrounding topography. One of these structures will be installed at the bottom of a drainage swale near Station 17+00, using the footprint of the former channel as a detention area.

KCI recognizes that a strategy to maintain an adequate topsoil layer is necessary for the long-term success of the project by improving vegetation survival and vigor. This strategy will involve stockpiling and reapplying topsoil during construction where suitable topsoil exists. In addition to managing the existing topsoil, KCI will apply biosolids to areas further than 30 feet from the stream to increase the soil fertility where the existing topsoil is thin or has been eroded to the subsoil. For areas within 30 feet of the stream, an organic compost mixture will be applied and mixed with the soil to help ensure success of the planted vegetation.

7.3 Data Analysis

The streams at the Jacob's Landing Stream Restoration Site will be restored using a combination of C4 and B4c/C4 Rosgen stream types. The project streams are divided into reaches based on the drainages entering the streams and the restoration or enhancement approach needed to design the proposed channels. The morphological design criteria for each of the reaches are found in Table 6. Morphological Design Criteria. Below is a description of the specific design approach used for all project reaches.

T1 has been divided into three reaches based on the restoration and enhancement approach. T1-1 and T1-3, will be restored as C4 channels, while T1-2 will be enhanced as a C4 channel, using the UT to Irish Buffalo Creek Reference Reach (T1) morphological criteria. T2 was also divided into separate reaches and will be restored as C4 channels using the UT to Irish Buffalo Creek Reference Reach (T1) morphological criteria. The pattern and profile for T1 and T2 were developed from detailed morphological criteria and hydraulic geometry relationships taken from stable sections of UT to Irish Buffalo Creek Reference Reach (T1) (See Table 6 and Appendix C Morphological Design Criteria).

T1A will be restored as a B4c/C4 stream type, using the UTFR Reference Reach to develop the morphological criteria. T2A will be enhanced to a B4c/C4 stream type by grading a stable cross-section and profile with a newly stabilized riffle-pool sequence, and restoring a native riparian buffer. The UTFR Reference Reach was used to develop the morphological criteria.

The design discharges and cross-sectional areas for all project reaches compare closely to their values as predicted by the regional curve. The designed stream discharges were also evaluated using the channel hydraulics and sediment transport for the proposed cross-sectional areas.

In-stream structures, including step pools, riffle grade controls, soil lifts, and log drops will be used to stabilize the restored channels (Refer to Plan Sheets 3 and 4). These structures are designed to reduce bank erosion, influence secondary circulation in the near-bank region of stream bends, and provide grade control. The structures further promote efficient sediment transport and produce/enhance in-stream habitat. Riffle areas will also be enhanced with graded gravel material to mimic existing stable riffle features. Coir fiber matting and seeding will be used to stabilize the newly graded stream banks and live stakes will be planted to provide long-term rooting strength.

During construction, the number of mature trees removed from the existing riparian areas will be minimized as much as possible. Any valuable trees that may provide immediate shade to the restored channel will be left in place if feasible. In the enhancement areas, certain trees may be able to remain on one bank if the opposite bank can be reshaped to accommodate the appropriate dimension for the stream.

Prior to construction, woven wire exclusion fencing (Stay Tuff, model 949-12) and alternative watering options will be installed along the easement boundary to keep livestock out of the project streams. The fence will be expanded upslope of the easement boundary in several areas to include areas of steep slope where cattle access could potentially cause erosion. In these areas additional easement signage will be required to adequately mark the easement boundary. T1-3 and all of T2 and T2A will have fence installed along the easement boundary. Further upstream along T1 and T1A, new fence will be installed along the eastern easement boundary and then tie into existing fence in the upper forested reaches. To ensure adequate cattle watering, a groundwater well and five, four-hole cattle waterers will be installed prior to construction.

7.4 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, two reference reaches were used to design the proposed restoration reaches: an Unnamed Tributary to Fisher River (UTFR) in Surry County and UT to Irish Buffalo Creek (T1) (see Appendix C for detailed reference reach data).

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 the project streams. The reference reach is located on Fisher Valley Road off of Exit 93 from Interstate 77. The valley slope is approximately 1.6%. The sediment distribution and transport are similar to the project streams. The local topography is characterized by rolling hills. Approximately 300 linear feet of UTFR was surveyed and was classified as a B4c channel.

UTFR flows northeast into Fisher River and drains approximately 0.38 square mile of predominantly forested land with a small section of rangeland. 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 in 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.

UT to Irish Buffalo Creek Reference Site (T1)

A short reach of a tributary to Irish Buffalo Creek, located approximately 400 linear feet upstream of the existing project reach on T1-1, was surveyed by KCI in February 2012 (Appendix C). The sediment distribution and transport are the same as the project streams. A stable riffle cross-section was surveyed and classified as an E4 channel to be used as a dimensional reference. Although likely logged previously, historic aerial photos indicate that this upstream reach of T1 has been under mature forest for at least fifty years. The stream flows through a hardwood forest and has stable planform and banks. Small cobble/gravel riffles are present and there is no evidence of bed degradation. The forest cover becomes less mature as the stream travels downslope, but the channel remains stable with functional riffles and pools. The dimensionless hydraulic geometry relationships were developed from stable channel dimensions to facilitate the design of the proposed channel cross-section, planform, and pattern data for T1 and T2 restoration reaches.

Table 6. Morphological Design Criteria

Variables	Existing T1-1	Existing T1-2	Existing T1-3	Existing T2-1	Existing T2-2	Ref. Reach UT to Irish Buffalo	Proposed T1-1	Proposed T1-2	Proposed T1-3	Proposed T2-1	Proposed T2-2
Rosgen Stream Type	G4	E4	G4	E4	F4	E4	C4	C4	C4	C4	C4
Mitigation Type	Restoration	Enh.2	Restoration	Restoration	Restoration	N/A	Restoration	Enh.2	Restoration	Restoration	Restoration
Drainage Area (mi^2)	0.37	0.38	0.40	0.23	0.31	0.16	0.37	0.38	0.40	0.23	0.31
Bankfull Width (W_{bkf}) (ft)	9.1	6.5-9.0	7.9	8.8	11.1-12.3	6.9	11.5	11.5	12.2	10.4	11.6
Bankfull Mean Depth (d_{bkf}) (ft)	0.9	1.3-1.8	1.5	1	1.0	1.1	1.0	1.0	1.0	0.9	1.0
Bankfull Cross-Sectional area (A_{bkf}) (ft^2)	8.6	11.4-12.0	12.1	9.2	11.3-11.7	7.4	11.2	11.2	12.6	9.1	11.1
Width/depth Ratio (W_{bkf}/d_{bkf})	9.6	3.7-6.8	5.2	8.4	10.9-12.9	6.4	12.0	12.0	12.0	12.0	12.0
Maximum Depth (d_{mbkf}) (ft)	1.1	1.7-2.7	2.8	1.8	1.3-1.5	1.6	1.5	1.5	1.6	1.4	1.5
Width of flood prone area (W_{fpa}) (ft)	1-14	15-16	26	20	17-19	23	25-40	25-40	27-60	23-35	26-50
Entrenchment Ratio (ER)	1.5	1.6-2.5	3.3	2.3	1.4-1.7	3.4	2.2-3.5	2.2-3.5	2.2-4.9	2.2-3.4	2.2-4.3
Sinuosity (stream length/valley length) (K)	1.15	1.09	1.07	1.45	1.09	1.18	1.11	1.09	1.12	1.31	1.16
Bank Height Ratio (BHR)	1.6	1.9-2.2	1.9	1.5-2.0	2.9-4.7	1.0	1.0	1.0	1.0	1.0	1.0
Mean Bankfull Velocity (V) (fps)	5.4	3.9-4.0	4	3.4-3.5	3.5-3.6	3.3	4.1	4.1	3.8	3.6	3.6
Bankfull Discharge (Q) (cfs)	46.3	45.5-46.5	48	30.7-32.3	41.0-41.2	24.7	45.2	45.2	47.4	32.5	40.2
Average water surface slope	0.0140	0.0080	0.009	0.010	0.007	0.007	0.010	0.010	0.007	0.010	0.009

Variables	Existing	Existing	Ref. Reach UTFR	Proposed	Proposed
	T1A	T2A		T1A	T2A
Rosgen Stream Type	E4	G4	B4c	B4c/C4	B4c/C4
Mitigation Type	Enh. I	Enh. II	N/A	Enh. I	Enh. II
Drainage Area (mi^2)	0.21	0.06	0.4	0.21	0.06
Bankfull Width (W_{bkf}) (ft)	7.7	6.6	9.0-10.0	8.5	6.5
Bankfull Mean Depth (d_{bkf}) (ft)	0.8	0.5	1.1-1.2	0.7	0.5
Bankfull Cross-Sectional area (A_{bkf}) (ft^2)	6.4	3.4	10.4-10.7	6.2	3.5
Width/depth Ratio (W_{bkf}/d_{bkf})	9.3	12.8	8.0-10.0	12.0	12.0
Maximum Depth (d_{mbkf}) (ft)	1.2	1.1	1.3-1.5	1.2	0.9
Width of flood prone area (W_{fpa}) (ft)	15	11	13-21	19	14
Entrenchment Ratio (ER)	1.9	1.7	1.3-2.3	2.2	2.2
Sinuosity (stream length/valley length) (K)	2.10	1.16	1.20	1.11	1.13
Bank Height Ratio (BHR)	2.2	6.3	1.0	1.0	1.0
Mean Bankfull Velocity (V) (fps)	4.8	3.3	4.1-4.5	4.4	3.3
Bankfull Discharge (Q) (cfs)	30.5	11	42-46	27.1	11.5
Average water surface slope	0.023	0.019	0.013	0.017	0.014

7.5 Sediment Transport Analysis

In order to analyze the existing sediment conditions within the project streams, bar samples were taken from the Jacob's Landing Stream Restoration Site. In addition, the streams were sampled using the Wolman pebble count method at eight locations for trend analysis. These data are provided in Appendix C. Based on this analysis, the majority of the project reaches are dominated by gravel material with portions of sand in the smaller, headwater reaches.

After analyzing the existing sediment conditions, the site was studied with respect to proposed sediment transport. In active bed systems, there is a threshold level of bedload movement. 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 proposed riffle cross-sections and channel gradient using the equation below. 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 (See Table 7) (Shields *et al.* 1936). An approximate bedload transport rate was modeled using the Wilcock and Crowe model for mixed gravel-sand beds using existing surface (pebble count) data.

$$\tau = \gamma R s$$

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

Table 7. Sediment Analysis

Project Reach	Shear Stress at Designed Reaches (lb/sq. ft)	Largest Grain Diameter Mobilized (mm)	Equivalent Grain Type	Bedload Transport Rate (lb/min)
T1-1	0.64	49	Very Coarse Gravel	117
T1-2	0.64	49	Very Coarse Gravel	152
T1-3	0.43	33	Very Coarse Gravel	70
T1A	0.74	57	Very Coarse Gravel	134
T2-1	0.52	40	Very Coarse Gravel	129
T2-2	0.52	39	Very Coarse Gravel	222
T2A	0.45	34	Very Coarse Gravel	N/A

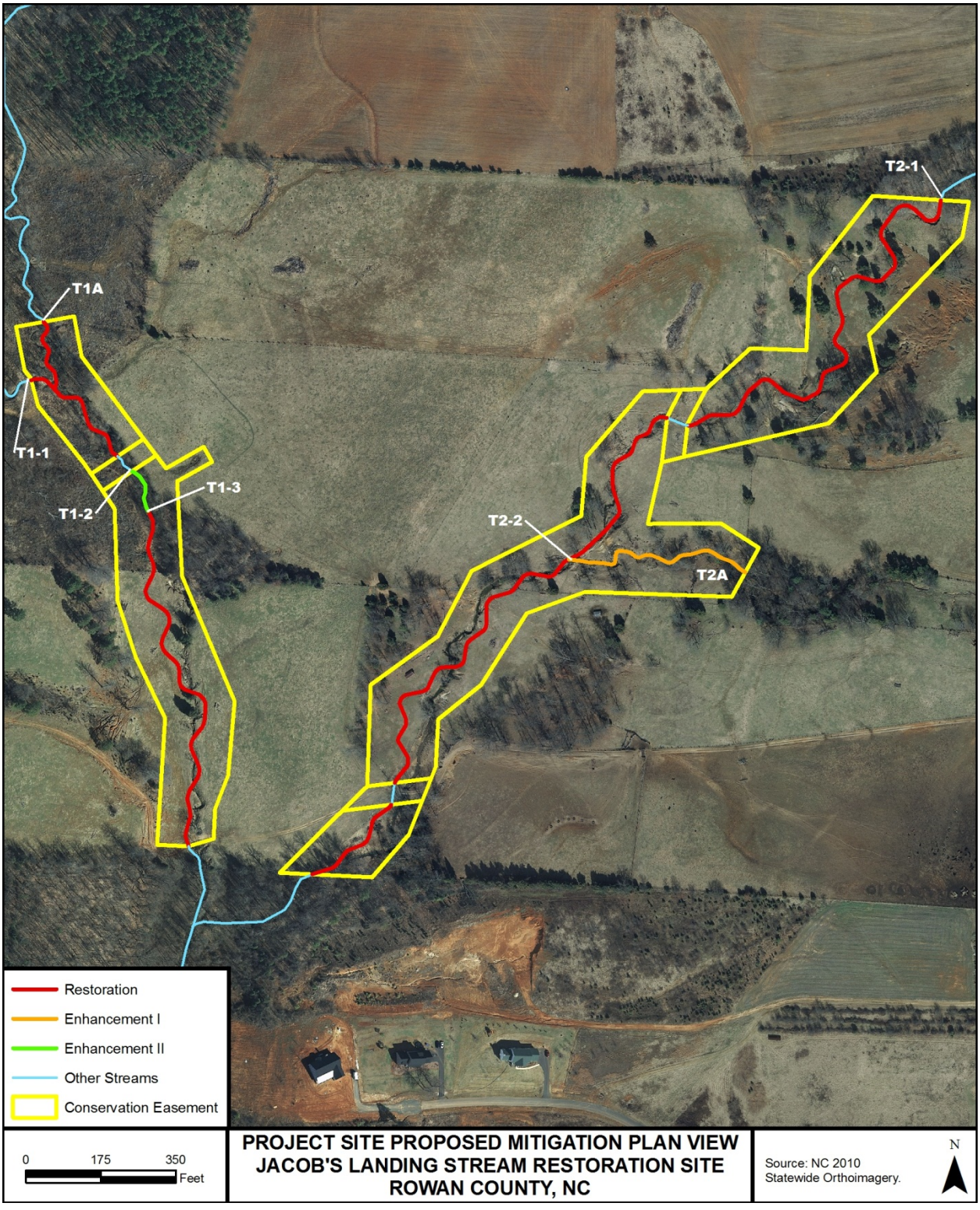
The predicted mobilized material and bedload transport rates are appropriate for the gravel material existing within the project streams. The project streams all have small watershed areas that drain to them and the incoming sediment supply is limited. Currently, the smaller-sized sands and fine gravels within the project streams are coming from active bank erosion. This source will be reduced following the project restoration. Along T1, the proposed stream progresses from steeper, slightly entrenched reaches in

T1-1 and T1-2 to the proposed Priority 1-reach of T1-3 with less stream energy. T2 maintains a similar slope along its length and therefore both reaches are similar in the size of material moved.

T2A is a threshold channel, which is defined as a stream where the bed material inflow is negligible and the channel boundary is immobile even at high flows (Shields *et al.* 2003). T2A is a seep-driven channel, and due to its location in a deep valley it has a limited supply of sediment that reaches the channel. There is an existing stable gravel bed layer that is not mobilized during bankfull events. As opposed to an active bed system, a threshold channel never achieves full sediment transport; the system only achieves partial sediment transport. Therefore, the bedload rates provided for the other tributaries are not relevant for T2A. The existing stable gravel bed will be maintained or enhanced for this tributary.

Based on this analysis, the designed channels provide sufficient competency for the type of streams proposed and are capable of transporting sediment during bankfull events.

7.6 Proposed Mitigation Plan View



8.0 MAINTENANCE PLAN

KCI shall monitor the site on a regular basis and shall conduct a physical inspection of the site a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance should be expected most often in the first two years following site construction and may include the following:

Component/Feature	Maintenance Through Project Close-Out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where stormwater and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.
Utility Right-of-Way	Utility rights-of-way within the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.
Road Crossing	Road crossings within the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.
Stormwater Management Device	Storm water management devices will be monitored and maintained per the protocols and procedures defined by the NC Division of Water Quality Storm Water Best Management Practices Manual.

9.0 PERFORMANCE STANDARDS

Monitoring of the Jacob's Landing Stream Restoration Site 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 and profile; site photographs, and vegetation sampling.

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 measurements, longitudinal profiles, and bed materials sampling.

Dimension

Permanent cross-sections will be established along the restored and enhanced reaches and will be used to evaluate stream dimension stability. Permanent monuments will be established at the left and right extents

of each cross-section by either conventional survey or GPS. 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
A 3,000 linear foot detailed longitudinal profile will be conducted along portions of T1, T2, T1A, and T2A. 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.

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

Verification of Bankfull Events
During the monitoring period, a minimum of two bankfull events must be recorded within the five-year monitoring period. These two bankfull events must occur in separate monitoring years. Bankfull events will be verified using automatic stream monitoring gauges to record daily stream depth readings.

Photograph Reference Points
Permanent photograph reference points 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.

Visual Assessment
An annual site walk will be conducted at the end of each monitoring period to document any stream problem areas. Particular attention will be paid to the enhancement reaches and the two tributaries. Specific problem areas that could arise include excessive bank erosion, bed deposition or aggradation, or problems with the installed structures. The findings of the visual assessment as well as any recommended corrective actions for problem areas will be summarized in the monitoring reports by way of a Current Conditions Plan View figure.

Vegetation
The success of the riparian buffer plantings will be evaluated using thirteen, ten-by-ten meter vegetative sampling plots and will use the CVS-EEP version 4.2, stream vegetation monitoring protocol (Lee *et al*. 2008). The corners of each monitoring plot will be permanently marked in the field. The coordinates of the plot corners 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 breast height 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 three years, 288 stems/acre after four years, and 260 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.

10.0 MONITORING REQUIREMENTS

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 or until the project meets its success criteria.

Beginning at the end of the first growing season, KCI will monitor the planted vegetation for five years or until the success criterion is met. Annual monitoring reports will be prepared and submitted after all monitoring tasks for each year are completed. The report will document the monitored components 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. Monitoring will also include evaluating the site for potential maintenance needs, including but not limited to invasive species problems, stream channel instability, riparian vegetation survival, floodplain scour and easement violations or encroachments. If problems arise, maintenance will occur to address the problem area. Maintenance will occur throughout the monitoring period on an as-needed basis. Specific maintenance activities, including any easement violations or encroachments will be documented in yearly monitoring reports. The monitoring report format will be similar to that set out in the most recent EEP monitoring protocol.

Required	Parameter	Quantity	Frequency	Notes
Yes	Pattern		Once, during as-built survey	
Yes	Dimension	11 Cross-sections	annual	To be distributed throughout the project reaches.
Yes	Profile	3,000 linear feet	annual	Profile will include sections of all project reaches
Yes	Substrate	Pebble counts at permanent riffle cross-sections	annual	
Yes	Surface Water Hydrology	Two, one each on T1 and T2.	annual	Two pressure transducer gauges will be installed on site; the devices will be inspected every two months to document the occurrence of bankfull events on the project
Yes	Vegetation	A total of 13 plots will be distributed to ensure sufficient coverage of planted vegetation	annual	Vegetation will be monitored using the Carolina Vegetation Survey (CVS) protocols
Yes	Exotic and nuisance vegetation		annual	Locations of exotic and nuisance vegetation will be mapped
Yes	Project boundary		annual	Locations of fence damage, vegetation damage, boundary encroachments, etc. will be mapped

11.0 LONG-TERM MANAGEMENT PLAN

Upon approval for close-out by the Interagency Review Team (IRT), the site will be transferred to the NCDENR Division of Natural Resource Planning and Conservation's Stewardship Program. This party shall be responsible for periodic inspection of the site to ensure that restrictions required in the conservation easement are upheld. Endowment funds required to uphold easement and deed restrictions shall be negotiated prior to site transfer to the responsible party. Section III of the Conservation Easement allows perpetual Right of Access to the Grantee, its employees and agents at reasonable times to undertake any activities to restore, construct, manage, maintain, enhance and monitor the site. Although the Conservation Easement does not restrict how the Grantee can access the site, the Conservation Easement plat shows the preferred access route into the site for the convenience of the Conservation Stewardship Program.

The NCDENR Division of Natural Resource Planning and Conservation's Stewardship Program currently houses EEP stewardship endowments within the non-reverting, interest-bearing Conservation Lands Stewardship Endowment Account. The use of funds from the Endowment Account is governed by North Carolina General Statute GS 113A-232(d)(3). Interest gained by the endowment fund may be used only for the purpose of stewardship, monitoring, stewardship administration, and land transaction costs, if applicable. The NCDENR Stewardship Program intends to manage the account as a non-wasting endowment. Only interest generated from the endowment funds will be used to steward the compensatory mitigation sites. Interest funds not used for those purposes will be re-invested in the Endowment Account to offset losses due to inflation.

12.0 ADAPTIVE MANAGEMENT PLAN

Upon completion of site construction, KCI will implement the post-construction monitoring protocols previously defined in this document. Project maintenance will be performed as described previously in this document. If, during the course of annual monitoring it is determined the site's ability to achieve site performance standards are jeopardized, KCI will notify the EEP and the USACE of the need to develop a Plan of Corrective Action. Once the Corrective Action Plan is prepared and finalized KCI will:

1. Notify the EEP and USACE as required by the Nationwide 27 permit general conditions.
2. Revise performance standards, maintenance requirements, and monitoring requirements as necessary and/or required by the USACE.
3. Obtain other permits as necessary.
4. Implement the Corrective Action Plan.
5. Provide the USACE a Record Drawing of Corrective Actions. This document shall depict the extent and nature of the work performed.

13.0 FINANCIAL ASSURANCES

Pursuant to Section IV H and Appendix III of the Ecosystem Enhancement Program's In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environment and Natural Resources has provided the U.S. Army Corps of Engineers Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by EEP. This commitment provides financial assurance for all mitigation projects implemented by the program.

14.0 OTHER INFORMATION

14.1 Definitions

Morphological description – the stream type; stream type is determined by quantifying channel entrenchment, dimension, pattern, profile, and boundary materials; as described in Rosgen, D. (1996), *Applied River Morphology, 2nd edition*

Native vegetation community – a distinct and reoccurring assemblage of populations of plants, animals, bacteria and fungi naturally associated with each other and their population; as described in Schafale, M.P. and Weakley, A. S. (1990), *Classification of the Natural Communities of North Carolina, Third Approximation***.**

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Appendix A

Conservation Easement (Preliminary)

NOTES:

1. THIS PLAT DOES NOT REPRESENT A BOUNDARY SURVEY OF THE PARENT TRACTS. THE PARENT TRACT BOUNDARIES ADJACENT TO THIS EASEMENT ARE NOT CHANGED BY THIS PLAT. BOUNDARY INFORMATION SHOWN HEREON WAS DERIVED FROM DEEDS AND MAPS OF RECORD IN ROWAN COUNTY AND MONUMENTATION FOUND IN THE FIELD.
2. DISTANCES SHOWN ARE HORIZONTAL GROUND DISTANCES IN U.S. SURVEY FEET UNLESS OTHERWISE NOTED.
3. AREA COMPUTED BY COORDINATE METHOD.
4. THE BASIS OF THE MERIDIANS AND COORDINATES FOR THIS PLAT IS THE NORTH CAROLINA STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM 1983 (NAD 83), BASED ON DIFFERENTIAL GPS OBSERVATIONS PERFORMED IN FEBRUARY 2011. ALL DISTANCES ARE GROUND UNLESS OTHERWISE NOTED.
5. DEED REFERENCES: AS SHOWN HEREON.
6. SUBJECT PROPERTIES KNOWN AS TAX NUMBER: AS SHOWN HEREON.
7. SUBJECT PROPERTIES LIE WITHIN THE AREA DESIGNATED AS ZONE "X", BASED ON FEDERAL FLOOD INSURANCE RATE MAP 37105060600J EFFECTIVE JUNE 16, 2009.
8. NO UNDERGROUND UTILITY LOCATING PERFORMED DURING THE COURSE OF THIS SURVEY.

POINT TABLE			
POINT	NORTHING	EASTING	DESCRIPTION
1	664891.27	1504065.32	ESMT CORNER
2	665186.15	1504083.62	ESMT CORNER
3	665329.99	1504014.21	ESMT CORNER
4	665460.26	1503972.14	ESMT CORNER
5	665675.39	1503965.46	ESMT CORNER
6	665717.12	1503937.42	ESMT CORNER
7	665756.68	1503910.85	ESMT CORNER
8	665782.96	1503893.19	ESMT CORNER
9	665915.59	1503787.38	ESMT CORNER
10	665980.55	1503769.11	ESMT CORNER
11	665998.56	1503755.47	ESMT CORNER
12	666100.08	1503735.31	ESMT CORNER
13	666123.94	1503871.63	ESMT CORNER
14	666031.12	1503888.67	ESMT CORNER
15	665838.68	1504033.66	ESMT CORNER
16	665800.56	1504062.38	ESMT CORNER
17	665770.18	1504085.26	ESMT CORNER
18	665819.68	1504173.62	ESMT CORNER
19	665784.79	1504193.17	ESMT CORNER
20	665739.15	1504111.71	ESMT CORNER
21	665517.68	1504123.36	ESMT CORNER
22	665226.26	1504246.02	ESMT CORNER
23	665053.88	1504230.78	ESMT CORNER
24	664975.26	1504200.46	ESMT CORNER
25	664904.95	1504196.73	ESMT CORNER
26	664887.52	1504138.39	ESMT CORNER
27	664826.29	1504350.89	ESMT CORNER
28	664970.21	1504496.33	ESMT CORNER
29	665027.83	1504554.56	ESMT CORNER
30	665264.22	1504562.53	ESMT CORNER

POINT TABLE			
POINT	NORTHING	EASTING	DESCRIPTION
31	665377.52	1504719.53	ESMT CORNER
32	665530.64	1504798.86	ESMT CORNER
33	665658.94	1505054.22	ESMT CORNER
34	665796.22	1505065.50	ESMT CORNER
35	665949.85	1505197.45	ESMT CORNER
36	665953.03	1505290.41	ESMT CORNER
37	665954.92	1505345.72	ESMT CORNER
38	666049.78	1505448.15	ESMT CORNER
39	666045.02	1505578.65	ESMT CORNER
40	666217.42	1505587.63	ESMT CORNER
41	666405.06	1505733.80	ESMT CORNER
42	666391.84	1505957.73	ESMT CORNER
43	666308.82	1505942.55	ESMT CORNER
44	666079.66	1505725.43	ESMT CORNER
45	665994.78	1505743.94	ESMT CORNER
46	665875.33	1505631.35	ESMT CORNER
47	665796.25	1505293.72	ESMT CORNER
48	665784.13	1505241.94	ESMT CORNER
49	665640.81	1505209.21	ESMT CORNER
50	665640.98	1505379.57	ESMT CORNER
51	665583.81	1505468.23	ESMT CORNER
52	665469.36	1505405.32	ESMT CORNER
53	665481.57	1505063.34	ESMT CORNER
54	665431.18	1504926.69	ESMT CORNER
55	665264.52	1504820.72	ESMT CORNER
56	665184.42	1504720.64	ESMT CORNER
57	665073.71	1504714.56	ESMT CORNER
58	665046.36	1504703.66	ESMT CORNER
59	664993.35	1504682.55	ESMT CORNER
60	664914.85	1504651.27	ESMT CORNER
61	664814.84	1504566.67	ESMT CORNER

LINE TABLE		
LINE	LENGTH	BEARING
L1	49.76	N03°02'14"E
L2	295.45	N03°33'05"E
L3	159.71	N25°45'29"W
L4	136.90	N17°53'51"W
L5	215.23	N01°46'45"W
L6	129.59	N33°53'35"W
L7	169.67	N38°34'58"W
L8	67.48	N15°42'20"W
L9	22.60	N37°08'37"W
L10	103.51	N11°13'58"W
L11	138.39	N80°04'30"E
L12	94.37	S10°24'10"E
L13	326.71	S36°59'41"E
L14	101.28	N60°44'24"E
L15	40.00	S29°15'36"E
L16	93.37	S60°44'24"W
L17	221.77	S03°00'37"E
L18	316.18	S22°49'34"E
L19	173.05	S05°03'11"W
L20	84.27	S21°05'09"W
L21	70.40	S03°02'15"W
L22	60.89	S73°21'49"W
L23	73.17	N87°03'40"W
L24	50.28	N33°53'35"W
L25	47.65	N33°53'35"W

LINE TABLE		
LINE	LENGTH	BEARING
L26	147.67	N56°16'02"E
L27	47.73	S36°59'41"E
L28	150.25	S56°16'02"W
L29	286.53	N45°18'02"E
L30	236.52	N01°55'50"E
L31	193.62	N54°11'06"E
L32	172.45	N27°23'14"E
L33	285.78	N63°19'24"E
L34	137.74	N04°42'00"E
L35	202.51	N40°39'24"E
L36	148.36	N88°02'34"E
L37	139.61	N47°11'55"E
L38	130.58	S87°54'41"E
L39	172.64	N02°58'54"E
L40	237.85	N37°55'10"E
L41	224.32	S86°37'23"E
L42	84.40	S10°22'01"W
L43	315.68	S43°27'17"W
L44	86.87	S12°18'04"E
L45	164.15	S43°18'17"W
L46	399.95	S76°49'08"W
L47	147.01	S12°51'47"W
L48	170.35	N89°56'49"E
L49	105.50	S57°11'08"E
L50	130.60	S28°17'44"W

LINE TABLE		
LINE	LENGTH	BEARING
L50	130.60	S28°47'44"W
L51	342.20	N87°57'20"W
L52	145.64	S69°55'39"W
L53	197.49	S35°26'56"W
L54	128.19	S51°19'30"W
L55	110.87	S03°08'39"W
L56	171.01	S21°43'20"W
L57	130.99	S40°13'44"W
L58	216.69	N86°57'46"W
L59	204.62	N45°18'02"E
L60	81.91	N45°18'02"E
L61	150.25	N82°55'06"E
L62	57.06	S21°43'20"W
L63	187.64	S82°55'06"W
L64	115.01	S23°26'03"W
L65	53.50	S06°43'25"W
L66	53.18	S76°49'08"W
L67	78.95	N06°43'25"E
L68	98.63	N23°26'03"E
L69	55.35	N88°02'34"E

VICINITY MAP
(NOT TO SCALE)

N/F
ALLEN CORRIHER
PARCEL ID# 234 057
DB 551 PG 666

N/F
MARTHA MYERS DEAL
REVOCABLE TRUST
PARCEL ID# 234 023
DB 915 PG 687 (PAR. 2)

N/F
OSCHO ROY DEAL
REVOCABLE TRUST
PARCEL ID# 234 024
DB 875 PG 742 (PAR. 1)

N/F
WILLIAM CORRIHER
PARCEL ID# 234 025
DB 1117 PG 976

N/F
JACQUELYN FULCHER
PARCEL ID# 234 044
DB 1038 PG 76

N/F
ERIC LEONARD DEAL
PARCEL ID# 234 062
DB 875 PG 743
DB 234 PG 62

N/F
OSCHO ROY DEAL
PARCEL ID# 234 025
DB 1122 PG 670
DB 756 PG 923

N/F
ERIC LEONARD DEAL
PARCEL ID# 234 099
DB 1098 PG 954

N/F
CITY OF KANNAPOLIS
PARCEL ID# 236 025
DB 1022 PG 574

N/F
PINEWOOD HOMES INC TR.
PARCEL ID# 236 086
DB 873 PG 976

N/F
F&L HOLDINGS LLC
PARCEL ID# 236001010
PARCEL ID# 236 004
DB 1070 PG 976

NCGS MON
CONCORDIA AZ MK
FA4167
N: 668,151.63
E: 1,502,373.52
CSF: 0.99985034

FOUND
IRON BAR
N: 664914.29
E: 1502692.37

FOUND
IRON BAR
ON LINE
N: 664737.86
E: 1506017.45

FOUND
AXLE

BENT
IRON

48"TREE
STUMP

POINT
"Y1"

POINT
"X"

P.O.B.
CONSERVATION
EASEMENT A

P.O.B.
CONSERVATION
EASEMENT B
POINT "X1"

S05°37'30"E
3253.00'(GRID)

S86°57'46"E 1372.24'
S86°57'46"E 1660.86'

N86°57'46"W 1452.82'

EXCEPTION
EASEMENT A
0.16 ACRES

CONSERVATION
EASEMENT "A"
4.51 ACRES
PARCEL #234 023 3,180 SF (0.07 AC)
PARCEL #234 024 87,646 SF (2.01 AC)
PARCEL #233 025 105,515 SF (2.42 AC)

EXCEPTION 2
EASEMENT B
0.19 ACRES

CONSERVATION
EASEMENT "B"
9.41 ACRES
PARCEL #234 023 2,634 SF (0.06 AC)
PARCEL #234 024 17,926 SF (0.41 AC)
PARCEL #233 025 389,379 SF (8.94 AC)

EXCEPTION 1
EASEMENT B
0.20 ACRES

TRIBUTARY TO IRISH BUFFALO CREEK

LOCATION OF CREEK DURING MAY 2012 SURVEY

70' RIGHT OF WAY CANNON MILLS CO.

100' RIGHT OF WAY COLONIAL PIPELINE AS PER ROWAN COUNTY GIS

EXISTING DIRT ACCESS PATH

WETLAND

SAW ROAD S.R. 1350
60' PUBLIC R/W

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 AS SHOWN HEREON; 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 5TH DAY OF MAY, 2012

I, JAMES M. GELLENTHIN, PROFESSIONAL LAND SURVEYOR, NO. L-3860 CERTIFY TO THE FOLLOWING AS REQUIRED IN G.S. 47-30 (F)(11):

THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT ORDERED SURVEY, OR OTHER EXCEPTION TO THE DEFINITION OF SUBDIVISION.

NORTH CAROLINA REGISTRATION NUMBER L-3860
JAMES M. GELLENTHIN

STATE OF NORTH CAROLINA
ROWAN COUNTY

PRESENTED FOR REGISTRATION AND RECORDED IN THIS OFFICE IN BOOK OF MAPS_____, PAGE _____ THIS THE _____DAY OF _____, 2012.

REGISTER OF DEEDS

STATE OF NORTH CAROLINA
ROWAN COUNTY

I, _____, REVIEW OFFICER OF ROWAN COUNTY, CERTIFY THAT THE MAP OR PLAT WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

REVIEW OFFICER DATE

LEGEND

- EXISTING PK NAIL
- EXISTING IRON
- IRON PIN SET W/ 3.25" REF. CAP
- CALCULATED POINT
- EXISTING CONCRETE MONUMENT
- NEW CONSERVATION EASEMENT FOR "THE STATE OF NC, ECOSYSTEM ENHANCEMENT PROGRAM."
- P.O.B. POINT OF BEGINNING

GRAPHIC SCALE
200' 0 100' 200' 400'
1 INCH = 200 FEET

SHEET: 1 OF 1
DATE: MAY 4, 2012

KCI ASSOCIATES OF NORTH CAROLINA C-0764

KCI ASSOCIATES OF N.C.
ENGINEERS, SURVEYORS AND PLANNERS
4601 SIX FORKS ROAD, SUITE 220
RALEIGH, NC 27609
PHONE (919) 783-9214 * FAX (919) 783-9266

FINAL PLAT
CONSERVATION EASEMENT
FOR
NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM
PROJECT NAME: JACOB'S LANDING STREAM MITIGATION PROJECT
SPO FILE NO. 80-AU, EEP SITE NO. 95024
PROPERTY OF OSCHO ROY DEAL, THE OSCHO ROY DEAL REVOCABLE TRUST AND THE MARTHA MYERS DEAL REVOCABLE TRUST
ATWELL TOWNSHIP, ROWAN COUNTY, NC

Appendix B

Baseline Information Data

FHWA Categorical Exclusion Form

Appendix A

Categorical Exclusion Form for Ecosystem Enhancement Program Projects
Version 1.4

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	Jacob's Landing Stream Restoration Project
County Name:	Rowan
EEP Number:	003984
Project Sponsor:	NC Ecosystem Enhancement Program (EEP) / KCI Technologies, Inc.
Project Contact Name:	Tim Morris
Project Contact Address:	4601 Six Forks Road, Suite 220, Raleigh NC 27609
Project Contact E-mail:	tim.morris@kci.com
EEP Project Manager:	Guy Pearce

Project Description

This project proposes to improve water quality and protect aquatic habitat in an agricultural area of Rowan County that has undergone degradation from unrestricted agricultural activities and human induced disturbances. This stream restoration project intends to restore approximately 4,700 linear feet of tributary stream draining to Irish Buffalo Creek in southwestern Rowan County.

For Official Use Only

Reviewed By:

Deborah A Dann

EEP Project Manager

Date

Conditional Approved By:

For Division Administrator FHWA

Date

☐ **Check this box if there are outstanding issues**

Final Approval By:

10-21-11

For Division Administrator FHWA

Date

RECEIVED
OCT - 5 2011
NC ECOSYSTEM ENHANCEMENT PROGRAM

Part 2: All Projects Regulation/Question	Response
Coastal Zone Management Act (CZMA)	
1. Is the project located in a CAMA county?	☐ Yes ☑ No
2. Does the project involve ground-disturbing activities within a CAMA Area of Environmental Concern (AEC)?	☐ Yes ☐ No ☑ N/A
3. Has a CAMA permit been secured?	☐ Yes ☐ No ☑ N/A
4. Has NCDCM agreed that the project is consistent with the NC Coastal Management Program?	☐ Yes ☐ No ☑ N/A
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	
1. Is this a "full-delivery" project?	☑ Yes ☐ No
2. Has the zoning/land use of the subject property and adjacent properties ever been designated as commercial or industrial?	☐ Yes ☑ No ☐ N/A
3. As a result of a limited Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☑ No ☐ N/A
4. As a result of a Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☐ No ☑ N/A
5. As a result of a Phase II Site Assessment, are there known or potential hazardous waste sites within the project area?	☐ Yes ☐ No ☑ N/A
6. Is there an approved hazardous mitigation plan?	☐ Yes ☐ No ☑ N/A
National Historic Preservation Act (Section 106)	
1. Are there properties listed on, or eligible for listing on, the National Register of Historic Places in the project area?	☐ Yes ☑ No
2. Does the project affect such properties and does the SHPO/THPO concur?	☐ Yes ☐ No ☑ N/A
3. If the effects are adverse, have they been resolved?	☐ Yes ☐ No ☑ N/A
Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)	
1. Is this a "full-delivery" project?	☑ Yes ☐ No
2. Does the project require the acquisition of real estate?	☑ Yes ☐ No ☐ N/A
3. Was the property acquisition completed prior to the intent to use federal funds?	☐ Yes ☑ No ☐ N/A
4. Has the owner of the property been informed: * prior to making an offer that the agency does not have condemnation authority; and * what the fair market value is believed to be?	☑ Yes ☐ No ☐ N/A

Part 3: Ground-Disturbing Activities Regulation/Question	Response
American Indian Religious Freedom Act (AIRFA)	
1. Is the project located in a county claimed as "territory" by the Eastern Band of Cherokee Indians?	☐ Yes ☑ No
2. Is the site of religious importance to American Indians?	☐ Yes ☐ No ☑ N/A
3. Is the project listed on, or eligible for listing on, the National Register of Historic Places?	☐ Yes ☑ No ☐ N/A
4. Have the effects of the project on this site been considered?	☐ Yes ☐ No ☑ N/A
Antiquities Act (AA)	
1. Is the project located on Federal lands?	☐ Yes ☑ No
2. Will there be loss or destruction of historic or prehistoric ruins, monuments or objects of antiquity?	☐ Yes ☑ No ☐ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☑ No ☐ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Archaeological Resources Protection Act (ARPA)	
1. Is the project located on federal or Indian lands (reservation)?	☐ Yes ☑ No
2. Will there be a loss or destruction of archaeological resources?	☐ Yes ☑ No ☐ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☑ No ☐ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Endangered Species Act (ESA)	
1. Are federal Threatened and Endangered species and/or Designated Critical Habitat listed for the county?	☑ Yes ☐ No
2. Is Designated Critical Habitat or suitable habitat present for listed species?	☐ Yes ☑ No ☐ N/A
3. Are T&E species present or is the project being conducted in Designated Critical Habitat?	☐ Yes ☑ No ☐ N/A
4. Is the project "likely to adversely affect" the species and/or "likely to adversely modify" Designated Critical Habitat?	☐ Yes ☐ No ☑ N/A
5. Does the USFWS/NOAA-Fisheries concur in the effects determination?	☑ Yes ☐ No ☐ N/A
6. Has the USFWS/NOAA-Fisheries rendered a "jeopardy" determination?	☐ Yes ☑ No ☐ N/A

Executive Order 13007 (Indian Sacred Sites)	
1. Is the project located on Federal lands that are within a county claimed as "territory" by the EBCI?	☐ Yes ☑ No
2. Has the EBCI indicated that Indian sacred sites may be impacted by the proposed project?	☐ Yes ☐ No ☑ N/A
3. Have accommodations been made for access to and ceremonial use of Indian sacred sites?	☐ Yes ☐ No ☑ N/A
Farmland Protection Policy Act (FPPA)	
1. Will real estate be acquired?	☑ Yes ☐ No
2. Has NRCS determined that the project contains prime, unique, statewide or locally important farmland?	☑ Yes ☐ No ☐ N/A
3. Has the completed Form AD-1006 been submitted to NRCS?	☑ Yes ☐ No ☐ N/A
Fish and Wildlife Coordination Act (FWCA)	
1. Will the project impound, divert, channel deepen, or otherwise control/modify any water body?	☐ Yes ☑ No
2. Have the USFWS and the NCWRC been consulted?	☑ Yes ☐ No ☐ N/A
Land and Water Conservation Fund Act (Section 6(f))	
1. Will the project require the conversion of such property to a use other than public, outdoor recreation?	☐ Yes ☑ No
2. Has the NPS approved of the conversion?	☐ Yes ☐ No ☑ N/A
Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat)	
1. Is the project located in an estuarine system?	☐ Yes ☑ No
2. Is suitable habitat present for EFH-protected species?	☐ Yes ☐ No ☑ N/A
3. Is sufficient design information available to make a determination of the effect of the project on EFH?	☐ Yes ☐ No ☑ N/A
4. Will the project adversely affect EFH?	☐ Yes ☐ No ☑ N/A
5. Has consultation with NOAA-Fisheries occurred?	☐ Yes ☐ No ☑ N/A
Migratory Bird Treaty Act (MBTA)	
1. Does the USFWS have any recommendations with the project relative to the MBTA?	☐ Yes ☑ No
2. Have the USFWS recommendations been incorporated?	☐ Yes ☐ No ☑ N/A
Wilderness Act	
1. Is the project in a Wilderness area?	☐ Yes ☑ No
2. Has a special use permit and/or easement been obtained from the maintaining federal agency?	☐ Yes ☐ No ☑ N/A

Appendix C

Mitigation Work Plan Data and Analyses

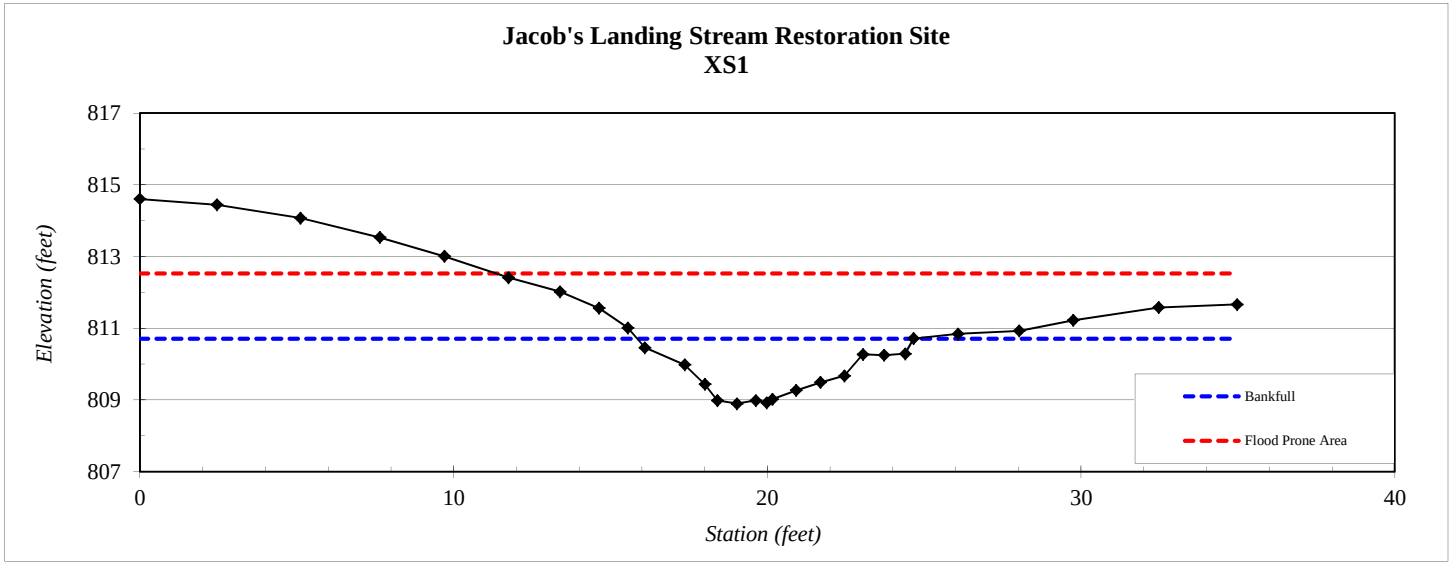
Existing Conditions

Cross-Sections

River Basin:	Yadkin-PeeDee
Watershed:	Irish Buffalo Creek, Existing Conditions, T2-1
XS ID	XS1 Riffle
Drainage Area (sq mi):	0.23
Date:	2/15/2012
Field Crew:	A. French, K. O'Briant

Station	Elevation
0.0	814.61
2.5	814.45
5.1	814.07
7.6	813.53
9.7	813.01
11.7	812.41
13.4	812.02
14.6	811.56
15.6	811.01
16.1	810.46
17.4	809.98
18.0	809.44
18.4	808.99
19.0	808.90
19.6	808.99
20.0	808.92
20.2	809.02
20.9	809.27
21.7	809.49
22.5	809.67
23.0	810.27
23.7	810.25
24.4	810.29
24.7	810.72
26.1	810.84
28.0	810.93
29.7	811.22
32.5	811.58
35.0	811.66

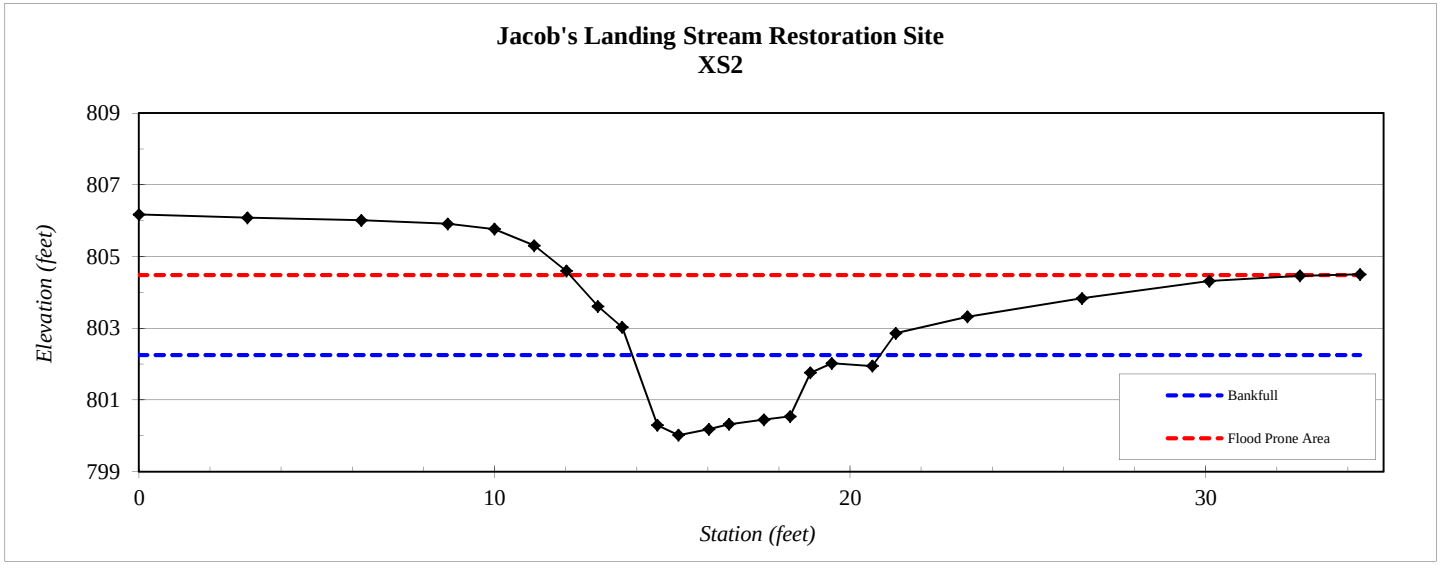
SUMMARY DATA	
Bankfull Elevation:	810.7
Bankfull Cross-Sectional Area:	9.2
Bankfull Width:	8.8
Flood Prone Area Elevation:	812.5
Flood Prone Width:	>20
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	1.0
W / D Ratio:	8.4
Entrenchment Ratio:	2.3
Bank Height Ratio:	1.5



River Basin:	Yadkin-PeeDee
Watershed:	Irish Buffalo Creek, Existing Conditions, T2-1
XS ID	XS2-Pool
Drainage Area (sq mi):	0.23
Date:	2/15/2012
Field Crew:	A. French, K. O'Briant

Station	Elevation
0.0	806.17
3.0	806.08
6.3	806.01
8.7	805.91
10.0	805.76
11.1	805.31
12.0	804.60
12.9	803.61
13.6	803.03
14.6	800.29
15.2	800.02
16.0	800.18
16.6	800.32
17.6	800.45
18.3	800.54
18.9	801.76
19.5	802.02
20.6	801.94
21.3	802.86
23.3	803.32
26.5	803.83
30.1	804.32
32.7	804.46
34.3	804.50

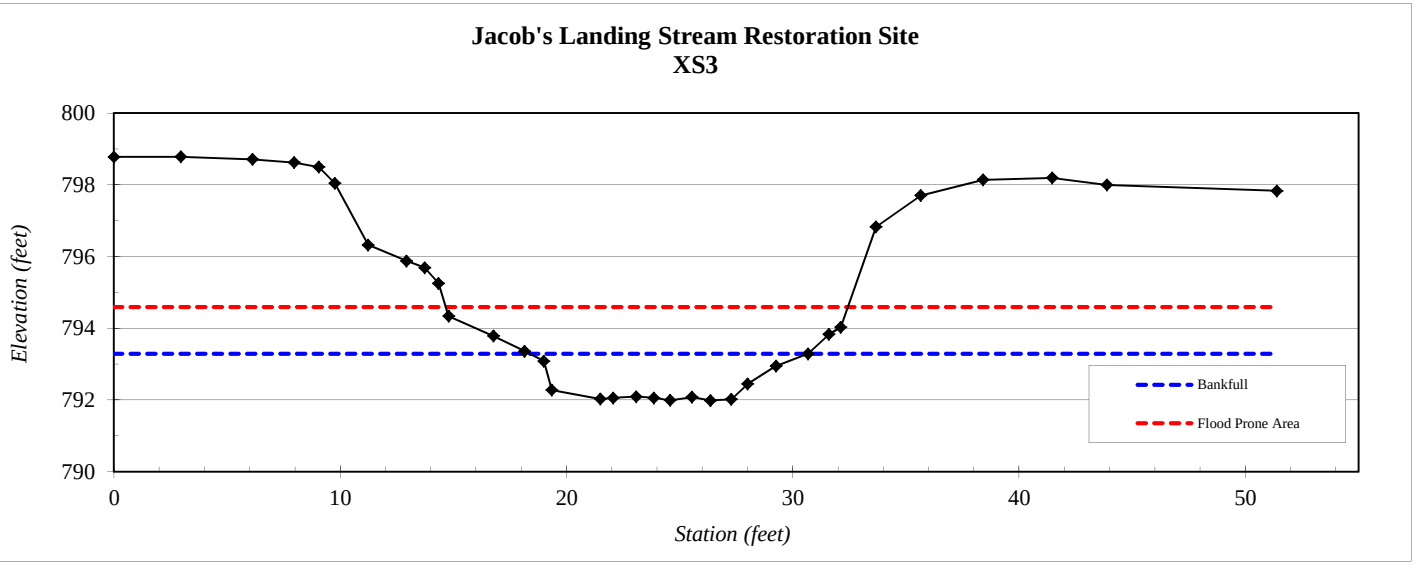
SUMMARY DATA	
Bankfull Elevation:	802.3
Bankfull Cross-Sectional Area:	9.2
Bankfull Width:	7.0
Flood Prone Area Elevation:	804.5
Flood Prone Width:	14
Max Depth at Bankfull:	2.2
Mean Depth at Bankfull:	1.3
W / D Ratio:	5.3
Entrenchment Ratio:	1.9
Bank Height Ratio:	2.0



River Basin:	Yadkin-PeeDee
Watershed:	Irish Buffalo Creek, Existing Conditions, T2-2
XS ID	XS3 Riffle
Drainage Area (sq mi):	0.31
Date:	2/15/2012
Field Crew:	A. French, K. O'Briant

Station	Elevation
0.0	798.78
3.0	798.78
6.1	798.71
8.0	798.62
9.1	798.50
9.8	798.04
11.2	796.33
12.9	795.88
13.7	795.69
14.3	795.25
14.8	794.34
16.8	793.79
18.2	793.36
19.0	793.08
19.4	792.28
21.5	792.03
22.1	792.06
23.1	792.10
23.9	792.06
24.6	791.99
25.5	792.08
26.4	791.99
27.3	792.02
28.0	792.45
29.3	792.95
30.7	793.29
31.6	793.83
32.1	794.03
33.7	796.83
35.7	797.70
38.4	798.14
41.5	798.19
43.9	798.00
51.4	797.83

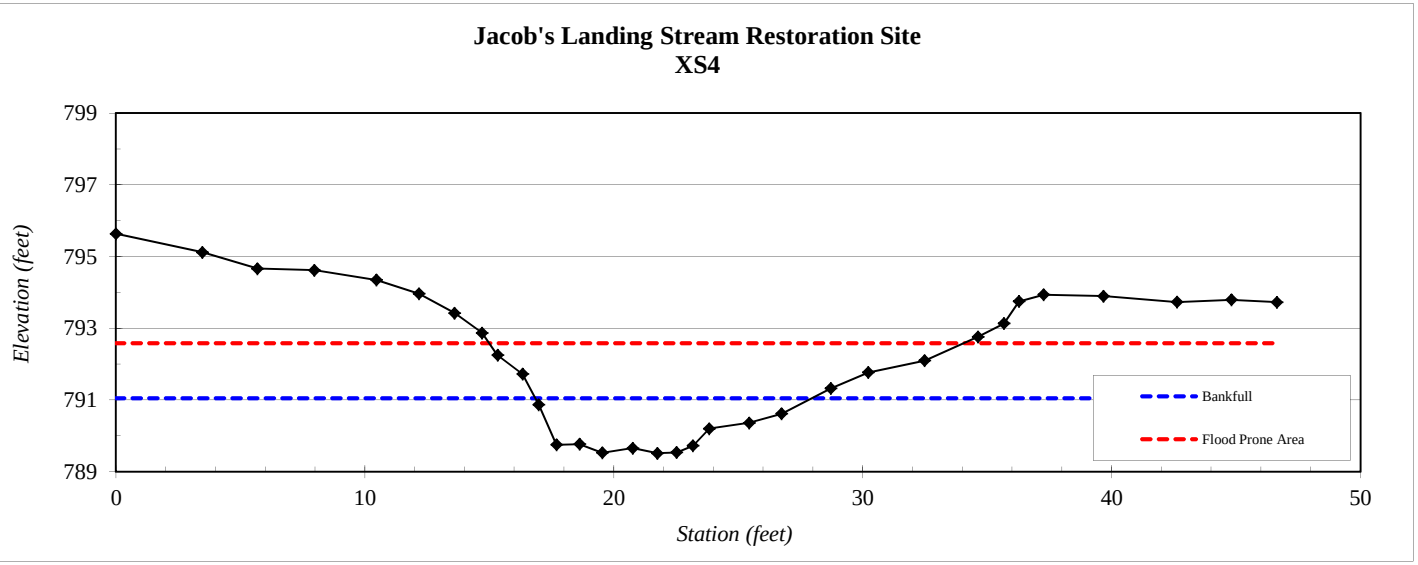
SUMMARY DATA	
Bankfull Elevation:	793.3
Bankfull Cross-Sectional Area:	11.7
Bankfull Width:	12.3
Flood Prone Area Elevation:	794.6
Flood Prone Width:	17
Max Depth at Bankfull:	1.3
Mean Depth at Bankfull:	1.0
W / D Ratio:	12.9
Entrenchment Ratio:	1.4
Bank Height Ratio:	4.7



River Basin:	Yadkin-PeeDee
Watershed:	Irish Buffalo Creek, Existing Conditions, T2-2
XS ID	XS4 Riffle
Drainage Area (sq mi):	0.31
Date:	2/15/2012
Field Crew:	A. French, K. O'Briant

Station	Elevation
0.0	795.64
3.5	795.12
5.7	794.66
8.0	794.62
10.5	794.34
12.2	793.96
13.6	793.42
14.7	792.87
15.3	792.25
16.3	791.72
17.0	790.86
17.7	789.75
18.6	789.77
19.5	789.53
20.8	789.66
21.7	789.51
22.5	789.54
23.2	789.72
23.8	790.20
25.4	790.36
26.7	790.61
28.7	791.32
30.2	791.77
32.5	792.10
34.6	792.76
35.7	793.13
36.3	793.75
37.3	793.94
39.7	793.90
42.6	793.73
44.8	793.79
46.6	793.73

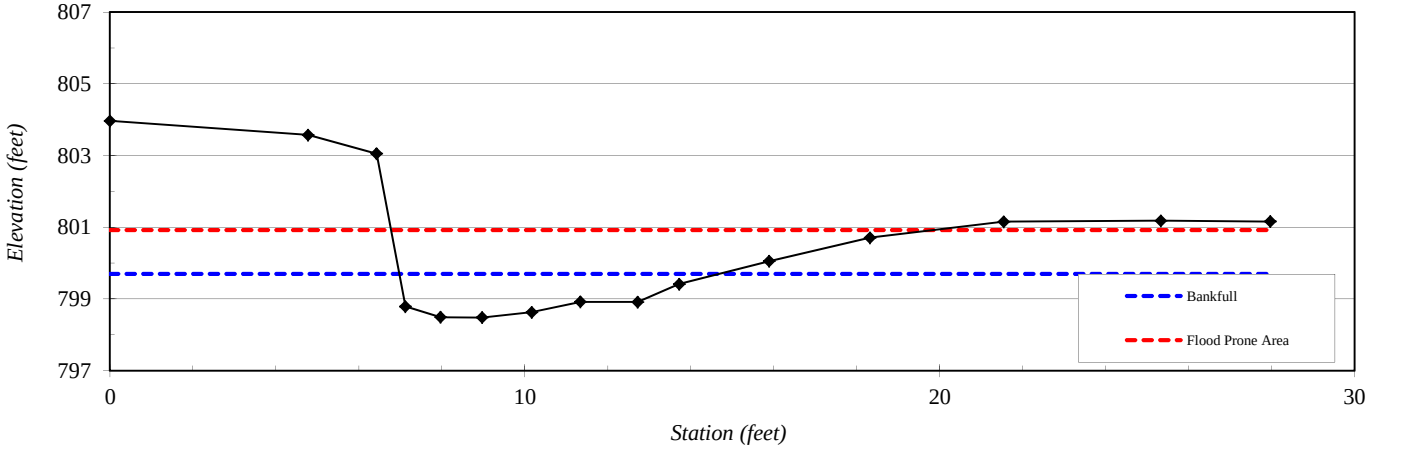
SUMMARY DATA	
Bankfull Elevation:	791.1
Bankfull Cross-Sectional Area:	11.3
Bankfull Width:	11.1
Flood Prone Area Elevation:	792.6
Flood Prone Width:	19
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	1.0
W / D Ratio:	10.9
Entrenchment Ratio:	1.7
Bank Height Ratio:	2.9



River Basin:	Yadkin-PeeDee
Watershed:	Irish Buffalo Creek, Existing Conditions, T1A
XS ID	XS5
Drainage Area (sq mi):	0.21
Date:	2/17/2012
Field Crew:	A. French, K. O'Briant

Station	Elevation
0.0	803.97
4.8	803.57
6.4	803.05
7.1	798.79
8.0	798.49
9.0	798.48
10.2	798.63
11.3	798.92
12.7	798.91
13.7	799.41
15.9	800.05
18.3	800.71
21.5	801.15
25.3	801.18
28.0	801.16

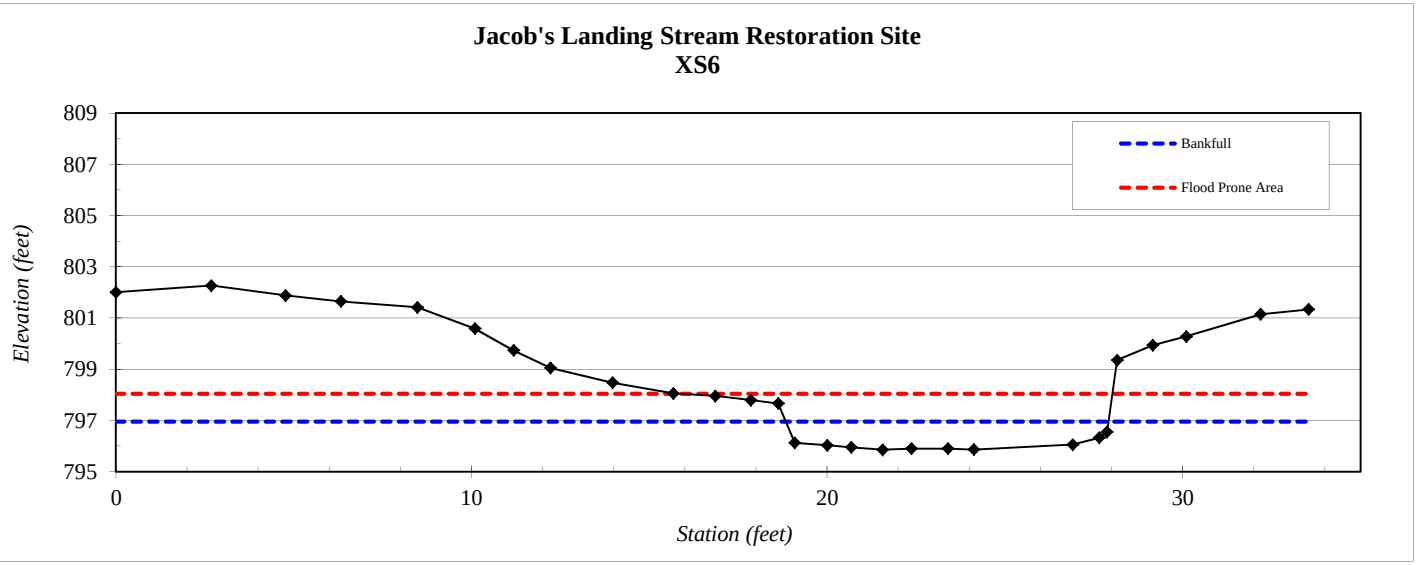
SUMMARY DATA	
Bankfull Elevation:	799.7
Bankfull Cross-Sectional Area:	6.4
Bankfull Width:	7.7
Flood Prone Area Elevation:	800.9
Flood Prone Width:	15
Max Depth at Bankfull:	1.2
Mean Depth at Bankfull:	0.8
W / D Ratio:	9.3
Entrenchment Ratio:	1.9
Bank Height Ratio:	2.2



River Basin:	Yadkin-PeeDee
Watershed:	Irish Buffalo Creek, Existing Conditions, T1-1
XS ID	XS6 Riffle
Drainage Area (sq mi):	0.37
Date:	2/17/2012
Field Crew:	A. French, K. O'Briant

Station	Elevation
0.0	802.00
2.7	802.27
4.8	801.88
6.3	801.65
8.5	801.41
10.1	800.59
11.2	799.73
12.2	799.05
14.0	798.47
15.7	798.06
16.9	797.95
17.9	797.79
18.6	797.66
19.1	796.12
20.0	796.03
20.7	795.95
21.6	795.85
22.4	795.90
23.4	795.90
24.1	795.86
26.9	796.06
27.7	796.32
27.9	796.56
28.2	799.35
29.2	799.94
30.1	800.28
32.2	801.15
33.5	801.34

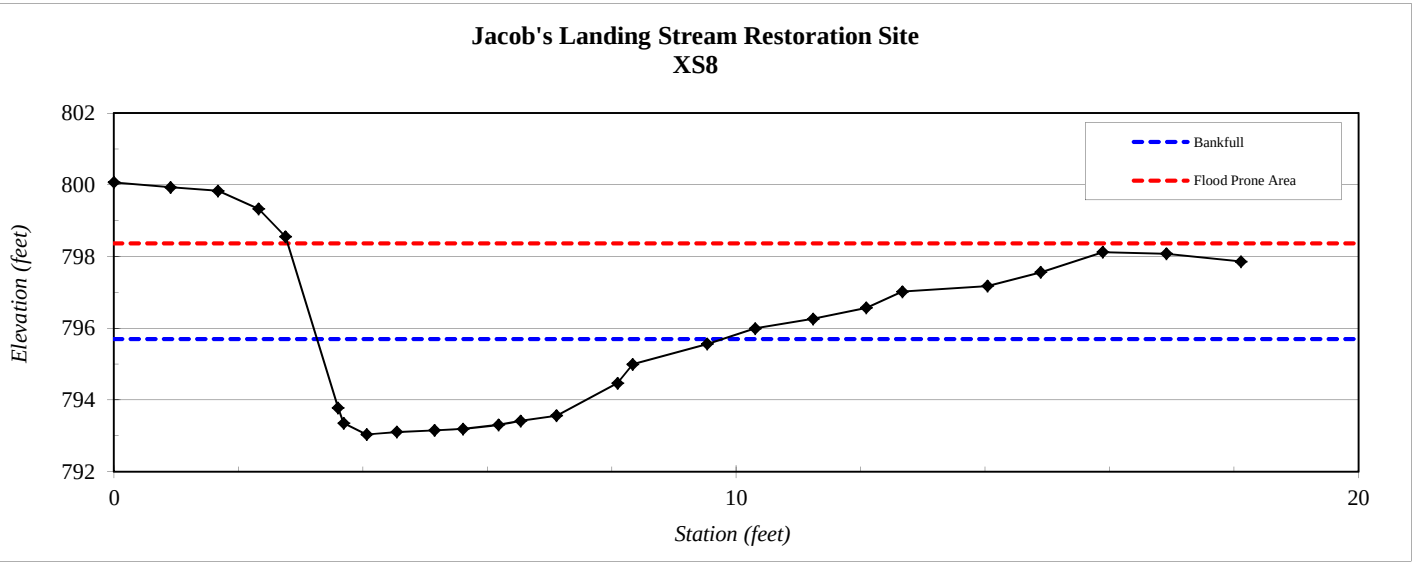
SUMMARY DATA	
Bankfull Elevation:	797.0
Bankfull Cross-Sectional Area:	8.6
Bankfull Width:	9.1
Flood Prone Area Elevation:	798.0
Flood Prone Width:	14
Max Depth at Bankfull:	1.1
Mean Depth at Bankfull:	0.9
W / D Ratio:	9.6
Entrenchment Ratio:	1.5
Bank Height Ratio:	1.6



River Basin:	Yadkin-PeeDee
Watershed:	Irish Buffalo Creek, Existing Conditions, T1-2
XS ID	XS8
Drainage Area (sq mi):	0.37
Date:	2/10/2012
Field Crew:	A. French, A. Helms

Station	Elevation
0.0	800.07
0.9	799.93
1.7	799.83
2.3	799.33
2.8	798.55
3.6	793.78
3.7	793.35
4.1	793.04
4.5	793.11
5.2	793.15
5.6	793.19
6.2	793.31
6.5	793.42
7.1	793.56
8.1	794.47
8.3	794.99
9.5	795.56
10.3	795.99
11.2	796.26
12.1	796.57
12.7	797.02
14.0	797.18
14.9	797.56
15.9	798.12
16.9	798.08
18.1	797.86

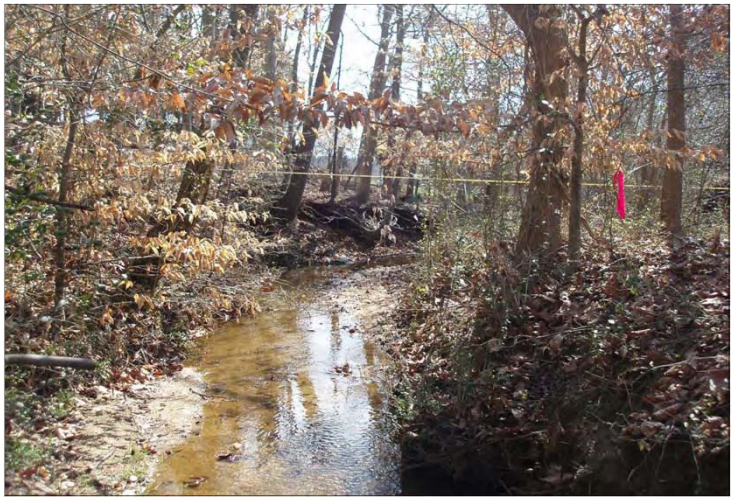
SUMMARY DATA	
Bankfull Elevation:	795.7
Bankfull Cross-Sectional Area:	11.4
Bankfull Width:	6.5
Flood Prone Area Elevation:	798.4
Flood Prone Width:	>16
Max Depth at Bankfull:	2.7
Mean Depth at Bankfull:	1.8
W / D Ratio:	3.7
Entrenchment Ratio:	2.5
Bank Height Ratio:	1.9

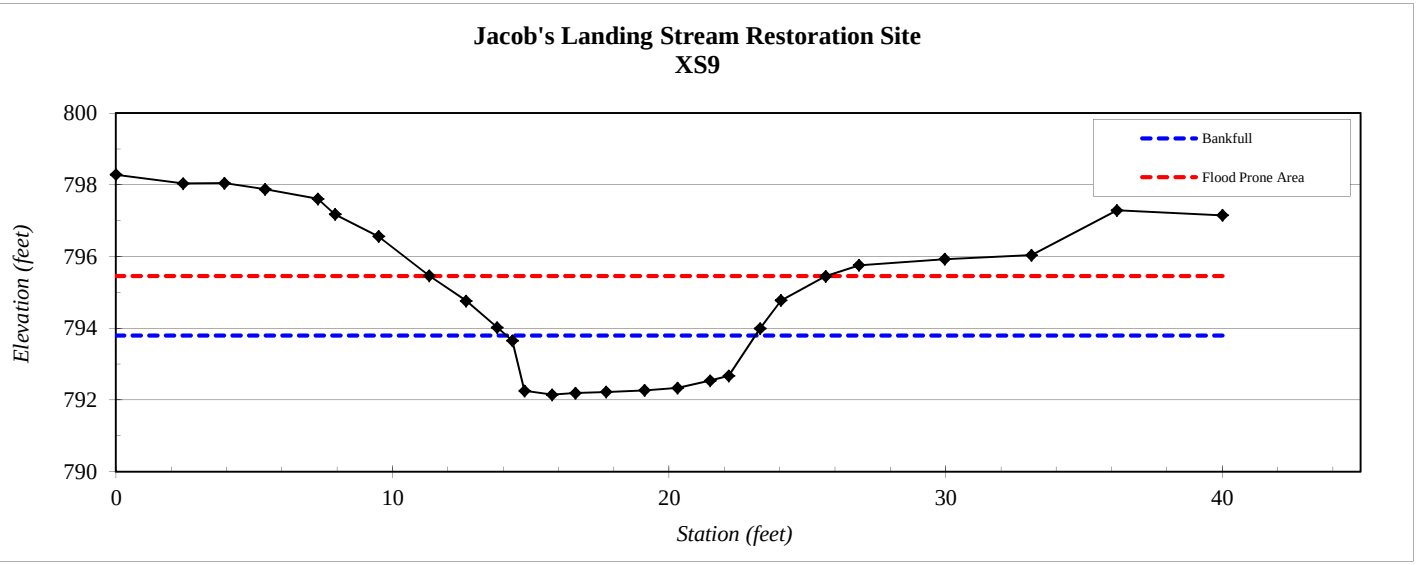


River Basin:	Yadkin-PeeDee
Watershed:	Irish Buffalo Creek, Existing Conditions, T1-2
XS ID	XS9 Riffle
Drainage Area (sq mi):	0.38
Date:	2/10/2012
Field Crew:	A. French, A. Helms

Station	Elevation
0.0	798.28
2.4	798.04
3.9	798.05
5.4	797.88
7.3	797.61
7.9	797.17
9.5	796.56
11.3	795.46
12.7	794.76
13.8	794.02
14.3	793.66
14.8	792.25
15.8	792.15
16.6	792.19
17.7	792.22
19.1	792.27
20.3	792.34
21.5	792.54
22.2	792.67
23.3	793.99
24.1	794.78
25.7	795.45
26.9	795.76
30.0	795.93
33.1	796.04
36.2	797.29
40.0	797.15

SUMMARY DATA	
Bankfull Elevation:	793.8
Bankfull Cross-Sectional Area:	12.0
Bankfull Width:	9.0
Flood Prone Area Elevation:	795.5
Flood Prone Width:	15
Max Depth at Bankfull:	1.7
Mean Depth at Bankfull:	1.3
W / D Ratio:	6.8
Entrenchment Ratio:	1.6
Bank Height Ratio:	2.2

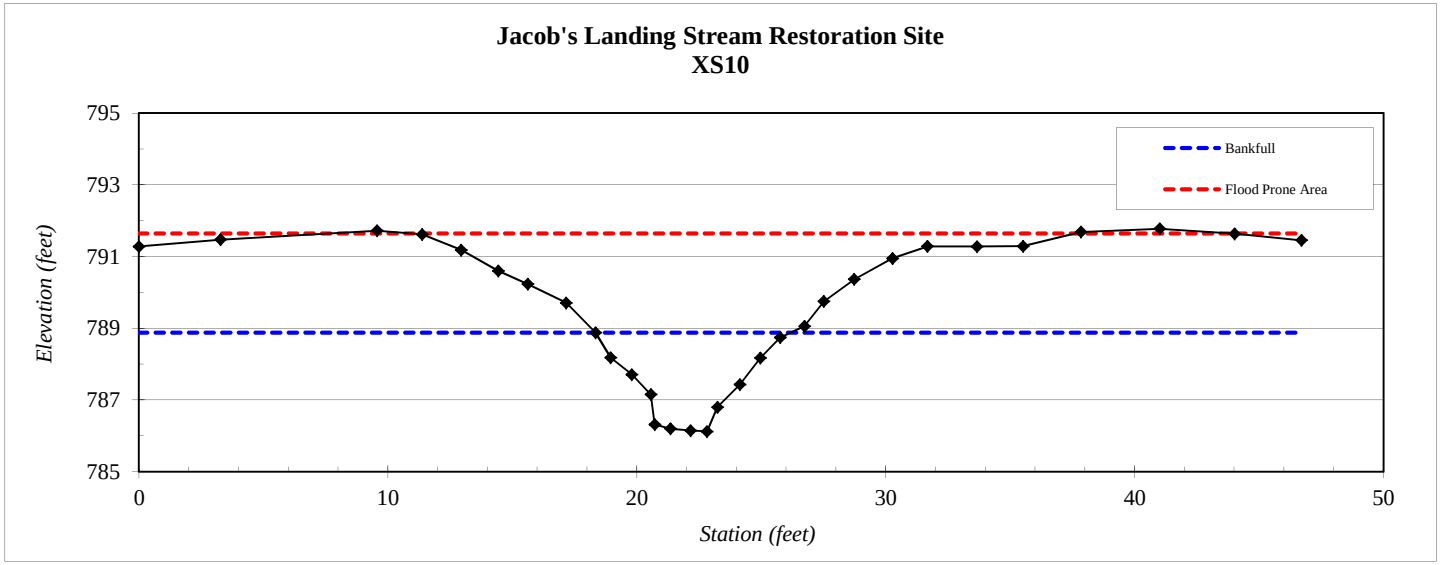




River Basin:	Yadkin-PeeDee
Watershed:	Irish Buffalo Creek, Existing Conditions, T1-3
XS ID	XS10 Riffle
Drainage Area (sq mi):	0.4
Date:	2/10/2012
Field Crew:	A. French, A. Helms

Station	Elevation
0.0	791.28
3.3	791.47
9.6	791.72
11.4	791.62
13.0	791.18
14.4	790.60
15.6	790.23
17.2	789.71
18.3	788.88
19.0	788.18
19.8	787.71
20.6	787.15
20.7	786.32
21.4	786.20
22.2	786.15
22.8	786.12
23.2	786.80
24.1	787.43
25.0	788.17
25.8	788.74
26.7	789.06
27.5	789.75
28.7	790.36
30.3	790.95
31.7	791.28
33.7	791.28
35.5	791.29
37.8	791.69
41.0	791.78
44.0	791.64
46.7	791.45

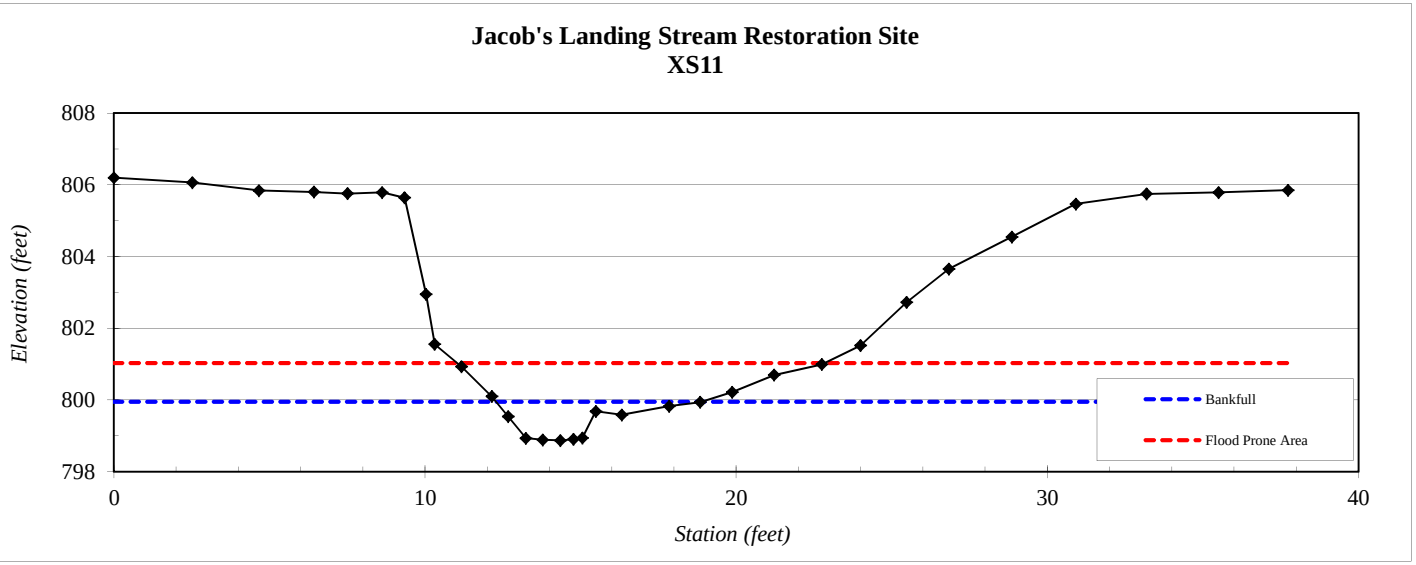
SUMMARY DATA	
Bankfull Elevation:	788.9
Bankfull Cross-Sectional Area:	12.1
Bankfull Width:	7.9
Flood Prone Area Elevation:	791.6
Flood Prone Width:	26
Max Depth at Bankfull:	2.8
Mean Depth at Bankfull:	1.5
W / D Ratio:	5.2
Entrenchment Ratio:	3.3
Bank Height Ratio:	1.9



River Basin:	Yadkin-PeeDee
Watershed:	Irish Buffalo Creek, Existing Conditions, T2A
XS ID	XS11
Drainage Area (sq mi):	0.06
Date:	2/10/2012
Field Crew:	A. French, A. Helms

Station	Elevation
0.0	806.20
2.5	806.06
4.7	805.84
6.4	805.80
7.5	805.75
8.6	805.79
9.3	805.64
10.0	802.94
10.3	801.55
11.2	800.93
12.1	800.10
12.7	799.54
13.2	798.93
13.8	798.89
14.3	798.87
14.8	798.90
15.1	798.94
15.5	799.68
16.3	799.58
17.8	799.83
18.8	799.94
19.9	800.22
21.2	800.70
22.8	800.99
24.0	801.52
25.5	802.72
26.8	803.65
28.9	804.55
30.9	805.47
33.2	805.75
35.5	805.79
37.7	805.85

SUMMARY DATA	
Bankfull Elevation:	799.95
Bankfull Cross-Sectional Area:	3.4
Bankfull Width:	6.6
Flood Prone Area Elevation:	801.0
Flood Prone Width:	11
Max Depth at Bankfull:	1.1
Mean Depth at Bankfull:	0.5
W / D Ratio:	12.8
Entrenchment Ratio:	1.7
Bank Height Ratio:	6.3



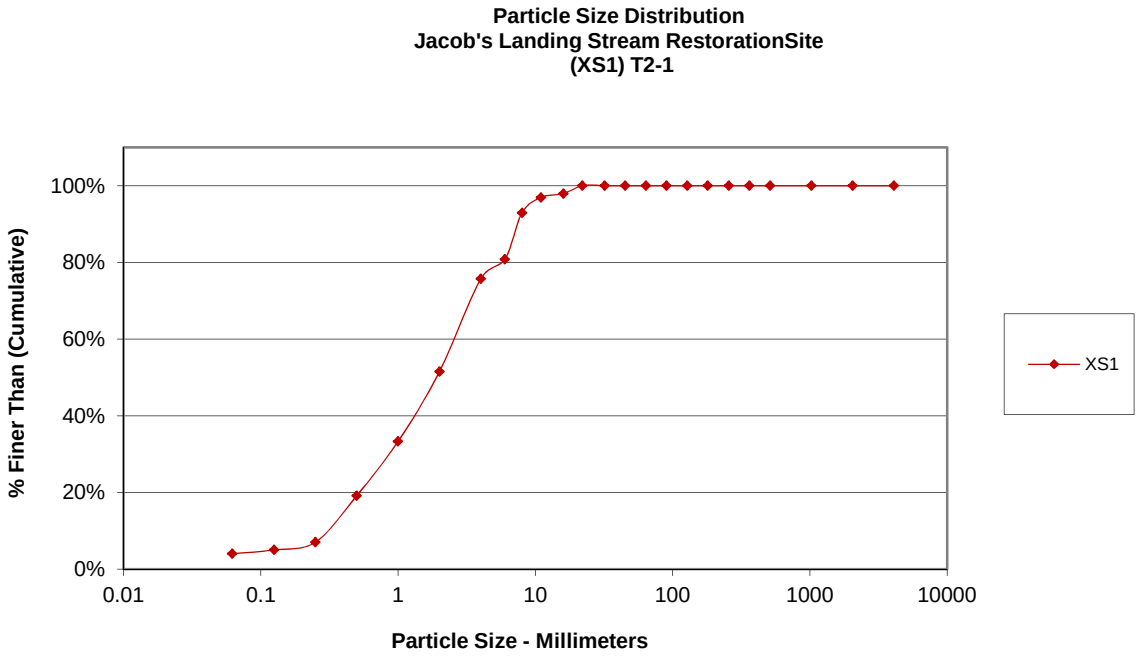
Existing Conditions

Sediment Data

Pebble Count Plots

Cross-Section 1			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	4
Very Fine	.062 - .125	S	1
Fine	.125 - .25	A	2
Medium	.25 - .50	N	12
Coarse	.50 - 1	D	14
Very Coarse	1 - 2	S	18
Very Fine	2 - 4		24
Fine	4 - 5.7	G	5
Fine	5.7 - 8	R	12
Medium	8 - 11.3	A	4
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	2
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	99

Note:



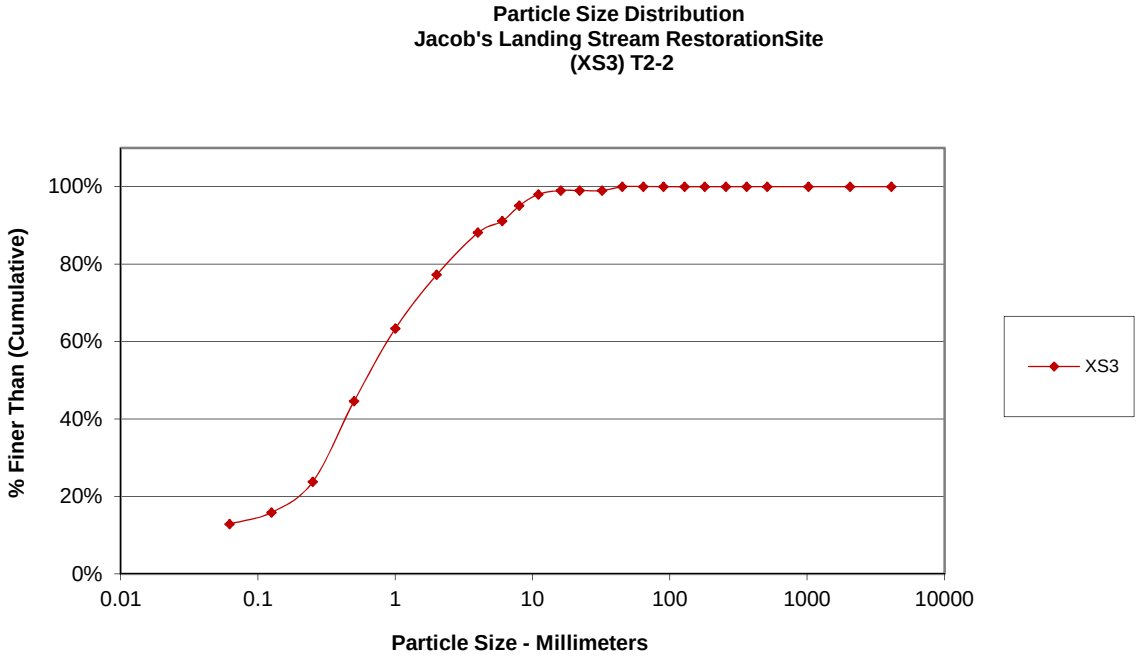
Size (mm)	
D16	0.42
D35	1.1
D50	1.9
D65	2.9
D84	6.5
D95	9.4

Size Distribution	
mean	1.7
dispersion	4.0
skewness	-0.06

Type	
silt/clay	4%
sand	47%
gravel	48%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 3			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	13
Very Fine	.062 - .125	S	3
Fine	.125 - .25	A	8
Medium	.25 - .50	N	21
Coarse	.50 - 1	D	19
Very Coarse	1 - 2	S	14
Very Fine	2 - 4		11
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	4
Medium	8 - 11.3	A	3
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	101

Note:



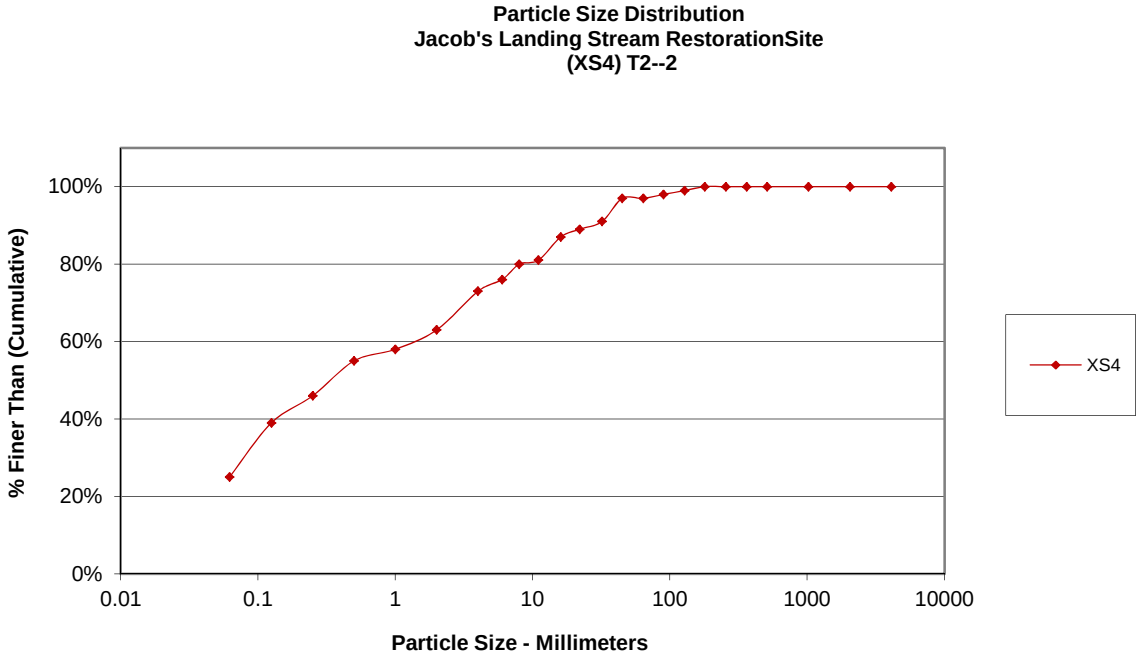
Size (mm)	
D16	0.062
D35	0.36
D50	0.61
D65	1.1
D84	3.1
D95	8

Size Distribution	
mean	0.4
dispersion	7.5
skewness	-0.11

Type	
silt/clay	13%
sand	64%
gravel	23%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 4			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	25
Very Fine	.062 - .125	S	14
Fine	.125 - .25	A	7
Medium	.25 - .50	N	9
Coarse	.50 - 1	D	3
Very Coarse	1 - 2	S	5
Very Fine	2 - 4		10
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	4
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	6
Coarse	16 - 22.6	E	2
Coarse	22.6 - 32	L	2
Very Coarse	32 - 45	S	6
Very Coarse	45 - 64		
Small	64 - 90	C	1
Small	90 - 128	O	1
Large	128 - 180	B	1
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



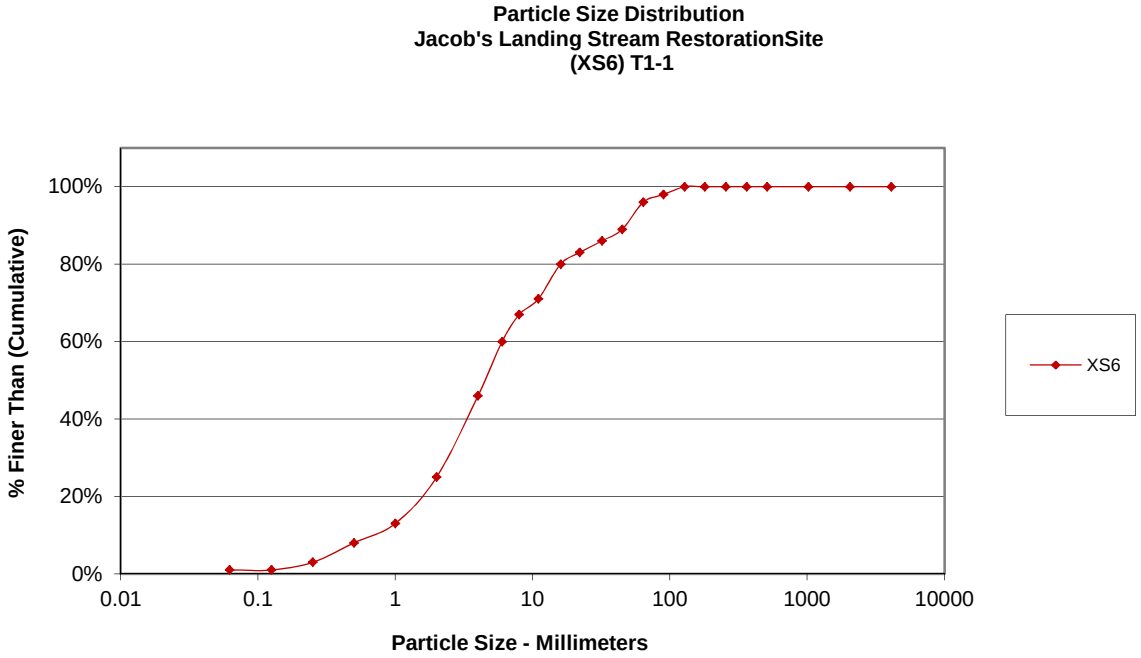
Size (mm)	
D16	0.062
D35	0.1
D50	0.34
D65	2.3
D84	13
D95	40

Size Distribution	
mean	0.9
dispersion	21.9
skewness	0.28

Type	
silt/clay	25%
sand	38%
gravel	34%
cobble	3%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 6			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	1
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	2
Medium	.25 - .50	N	5
Coarse	.50 - 1	D	5
Very Coarse	1 - 2	S	12
Very Fine	2 - 4		21
Fine	4 - 5.7	G	14
Fine	5.7 - 8	R	7
Medium	8 - 11.3	A	4
Medium	11.3 - 16	V	9
Coarse	16 - 22.6	E	3
Coarse	22.6 - 32	L	3
Very Coarse	32 - 45	S	3
Very Coarse	45 - 64		7
Small	64 - 90	C	2
Small	90 - 128	O	2
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



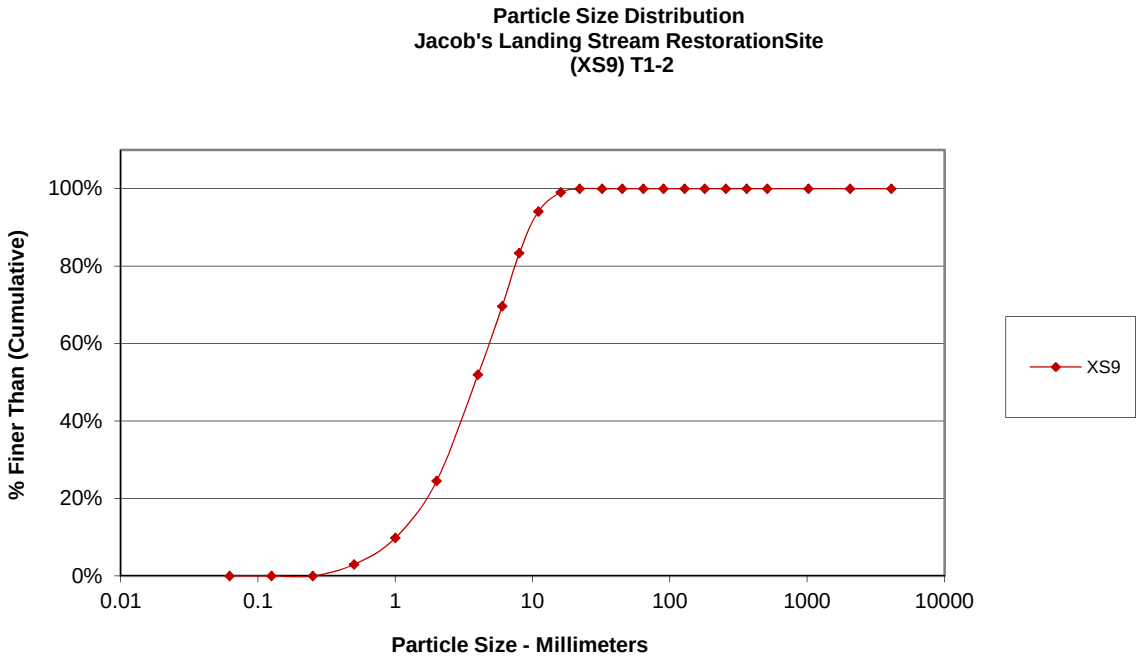
Size (mm)	
D16	1.2
D35	2.8
D50	4.5
D65	7.4
D84	25
D95	61

Size Distribution	
mean	5.5
dispersion	4.7
skewness	0.07

Type	
silt/clay	1%
sand	24%
gravel	71%
cobble	4%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 9			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	3
Coarse	.50 - 1	D	7
Very Coarse	1 - 2	S	15
Very Fine	2 - 4		28
Fine	4 - 5.7	G	18
Fine	5.7 - 8	R	14
Medium	8 - 11.3	A	11
Medium	11.3 - 16	V	5
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	102

Note:



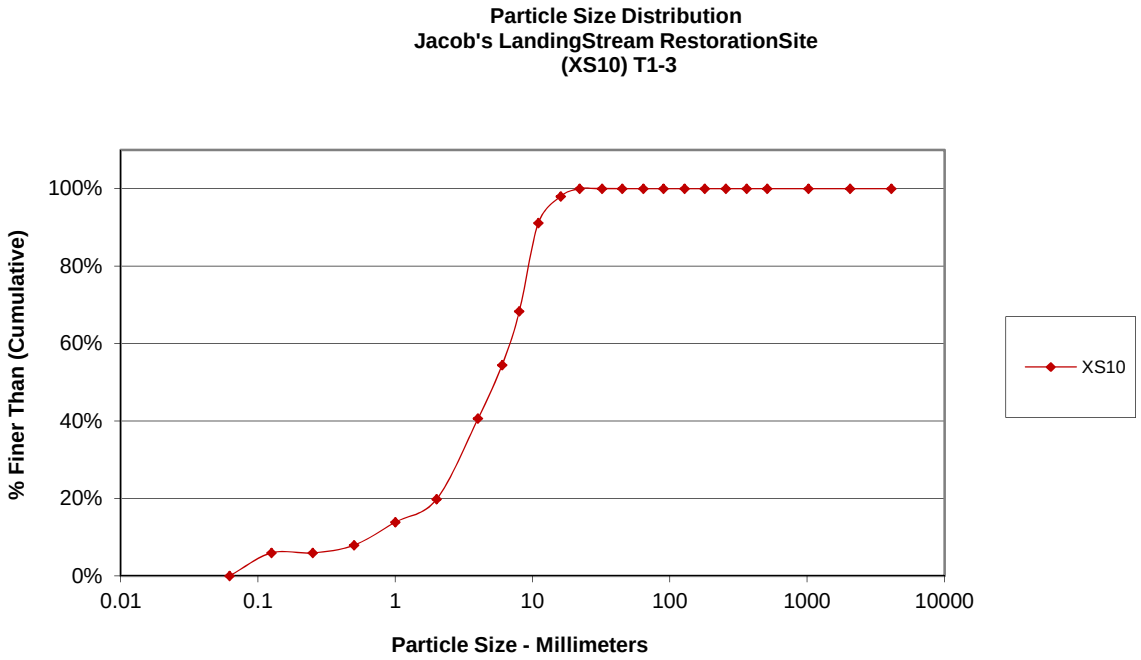
Size (mm)	
D16	1.3
D35	2.6
D50	3.8
D65	5.4
D84	8.2
D95	12

Size Distribution	
mean	3.3
dispersion	2.5
skewness	-0.07

Type	
silt/clay	0%
sand	25%
gravel	75%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 10			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	6
Fine	.125 - .25	A	
Medium	.25 - .50	N	2
Coarse	.50 - 1	D	6
Very Coarse	1 - 2	S	6
Very Fine	2 - 4		21
Fine	4 - 5.7	G	14
Fine	5.7 - 8	R	14
Medium	8 - 11.3	A	23
Medium	11.3 - 16	V	7
Coarse	16 - 22.6	E	2
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	101

Note:



Size (mm)	
D16	1.3
D35	3.3
D50	5.3
D65	7.5
D84	10
D95	14

Size Distribution	
mean	3.6
dispersion	3.0
skewness	-0.18

Type	
silt/clay	0%
sand	20%
gravel	80%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 11			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	2
Very Coarse	1 - 2	S	13
Very Fine	2 - 4		25
Fine	4 - 5.7	G	6
Fine	5.7 - 8	R	22
Medium	8 - 11.3	A	25
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	3
Coarse	22.6 - 32	L	1
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		
Small	64 - 90	C	1
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:

Size (mm)	
D16	2.1
D35	3.5
D50	6.3
D65	7.7
D84	9.8
D95	18

Size Distribution	
mean	4.5
dispersion	2.3
skewness	-0.17

Type	
silt/clay	0%
sand	15%
gravel	84%
cobble	1%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Point / Side BAR-BULK MATERIALS SAMPLE DATA: Size Distribution Analysis

Party: AF, AH

Location: Jacob's Landing T1 | Date: 2-22-2012 | Notes: Bar sample 0-6 inches

SUB SAMPLES

Sieve Size (mm)	Sieve Size (mm)	Sieve Size (mm)	Sieve Size (mm)	Sieve Size (mm)	Sieve Size (mm)	Sieve Size (mm)	Sieve Size (mm)	Sieve Size (mm)	Sieve Size (mm)	Sieve Size (mm)	Sieve Size (mm)
< 1.0	1.0	2.0	4.0	8.0	16.0	31.5	128.0	256.0	> 256.0		
Tare Weight (oz)	Tare Weight (oz)	Tare Weight (oz)	Tare Weight (oz)	Tare Weight (oz)	Tare Weight (oz)	Tare Weight (oz)	Tare Weight (oz)	Tare Weight (oz)	Tare Weight (oz)		
30	31	43	45	47	48						
Sample Weights	Sample Weights	Sample Weights	Sample Weights	Sample Weights	Sample Weights	Sample Weights	Sample Weights	Sample Weights	Sample Weights		
Total	Net	Total	Net	Total	Net	Total	Net	Total	Net	Total	Net	Total	Net	Total	Net	Total	Net	Total	Net
1	173.0	143.0	140.0	109.0	88.0	45.0	64.0	19.0	55.0	8.0										
2			150.0	119.0	107.0	64.0	70.0	25.0												
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
Net Wt. Total	143.0		228.0		109.0		44.0		8.0		0.0		0.0		0.0		0.0		0.0	**532.0**
% Grand Tot.	26.9%		42.9%		20.5%		8.3%		1.5%		0.0%		0.0%		0.0%		0.0%		0.0%	
Accum. % =<	26.9%	→	69.7%	→	90.2%	→	98.5%	→	100.0%	→	100.0%	→	100.0%	→	100.0%	→	100.0%	→	100.0%	

SURFACE MATERIALS DATA
(Two Largest Particles)

No.	Dia.	WT.
1	19mm	.5 oz
2	19mm	.5 oz

Bucket + Materials Weight_____

Bucket Tare Weight_____

Materials Weight_____
(Materials less than: _____mm.)

Be Sure to Add Separate Material Weights to Grand Total

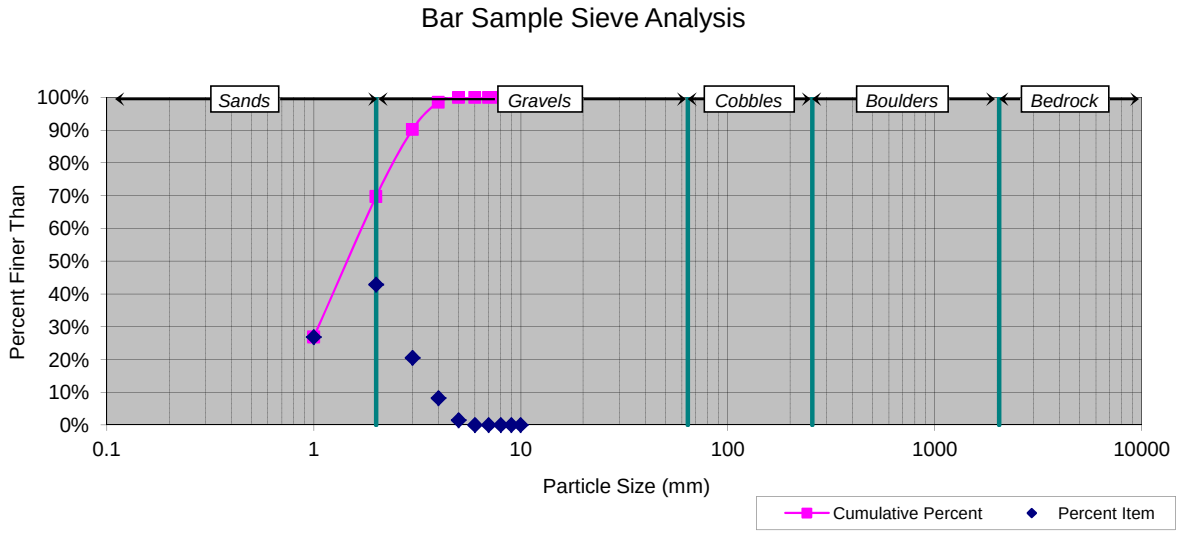
GRAND TOTAL SAMPLE WEIGHT

NOTES

Bar Sample Sieve Analysis

Smallest Sieve Passed (mm)	Weight (oz)	% Item	Percent Finer Than
<1	143	26.9%	26.9%
1.0	228.0	42.9%	69.7%
2.0	109.0	20.5%	90.2%
4.0	44.0	8.3%	98.5%
8.0	8.0	1.5%	100.0%
16.0	0.0	0.0%	100.0%
31.5	0.0	0.0%	100.0%
128.0	0.0	0.0%	100.0%
256.0	0.0	0.0%	100.0%
> 256.0	0.0	0.0%	100.0%
Total:	532.0	100%	

Stream:	Jacob's Landing Stream Restoration Site T1
Watershed:	
Location:	
Note:	Bar Sample # 1 (0-6 inches)



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
1.6	1.6	1.6	1.6	3.0	0%	90%	10%	0%	---	---

Point / Side BAR-BULK MATERIALS SAMPLE DATA: Size Distribution Analysis

Party: AF, AH

Location: Jacob's Landing T2 | Date: 2-22-2012 | Notes: Bar sample 0-6 inches

SUB SAMPLES

	Sieve Size (mm)		Sieve Size (mm)		Sieve Size (mm)		Sieve Size (mm)		Sieve Size (mm)		Sieve Size (mm)		Sieve Size (mm)		Sieve Size (mm)		Sieve Size (mm)		Sieve Size (mm)	
	< 1.0		1.0		2.0		4.0		8.0		16.0		31.5		128.0		256.0		> 256.0	
	Tare Weight (oz)		Tare Weight (oz)		Tare Weight (oz)		Tare Weight (oz)		Tare Weight (oz)		Tare Weight (oz)		Tare Weight (oz)		Tare Weight (oz)		Tare Weight (oz)		Tare Weight (oz)	
	30		31		43		45		47		48									
	Sample Weights		Sample Weights		Sample Weights		Sample Weights		Sample Weights		Sample Weights		Sample Weights		Sample Weights		Sample Weights		Sample Weights	
	Total	Net	Total	Net	Total	Net	Total	Net	Total	Net	Total	Net	Total	Net	Total	Net	Total	Net	Total	Net
1	104.0	74.0	110.0	79.0	126.0	83.0	84.0	39.0	64.0	17.0	55.0									
2			77.0	46.0	94.0	51.0	74.0	29.0												
3			70.0	39.0	88.0	45.0	76.0	31.0												
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
Net Wt. Total	74.0		164.0		179.0		99.0		17.0		0.0		0.0		0.0		0.0		0.0	533.0
% Grand Tot.	13.9%		30.8%		33.6%		18.6%		3.2%		0.0%		0.0%		0.0%		0.0%		0.0%	
Accum. % =<	13.9%	→	44.7%	→	78.2%	→	96.8%	→	100.0%	→	100.0%	→	100.0%	→	100.0%	→	100.0%	→	100.0%	

SURFACE MATERIALS DATA
(Two Largest Particles)

No.	Dia.	WT.
1	38mm	2.5oz
2	39mm	3.5oz

Bucket + Materials Weight_____

Bucket Tare Weight_____

Materials Weight_____
(Materials less than: _____mm.)

Be Sure to Add Separate Material Weights to Grand Total

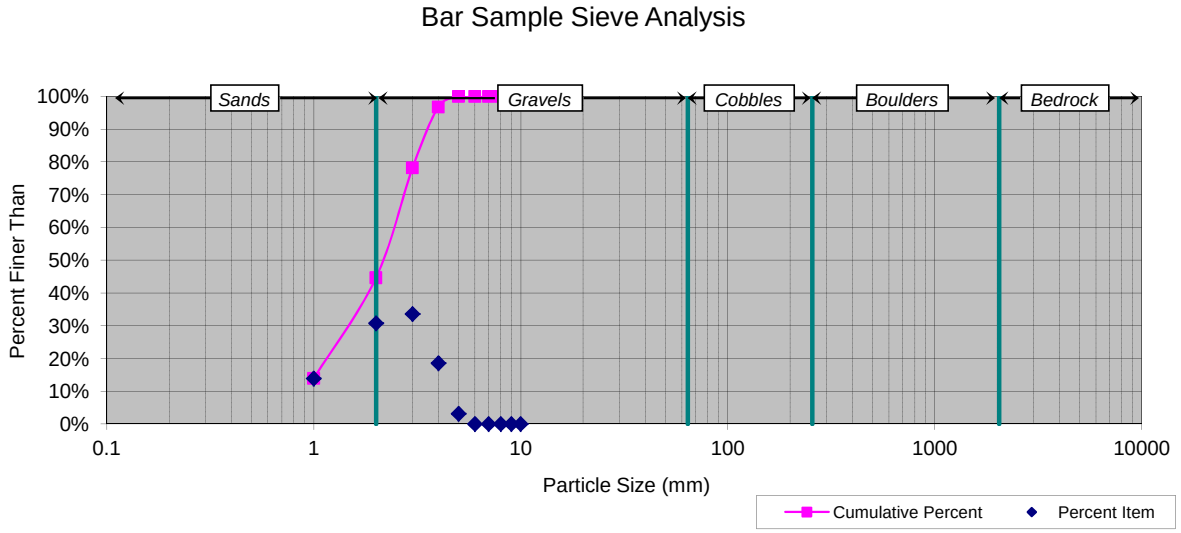
GRAND TOTAL SAMPLE WEIGHT

NOTES

Bar Sample Sieve Analysis

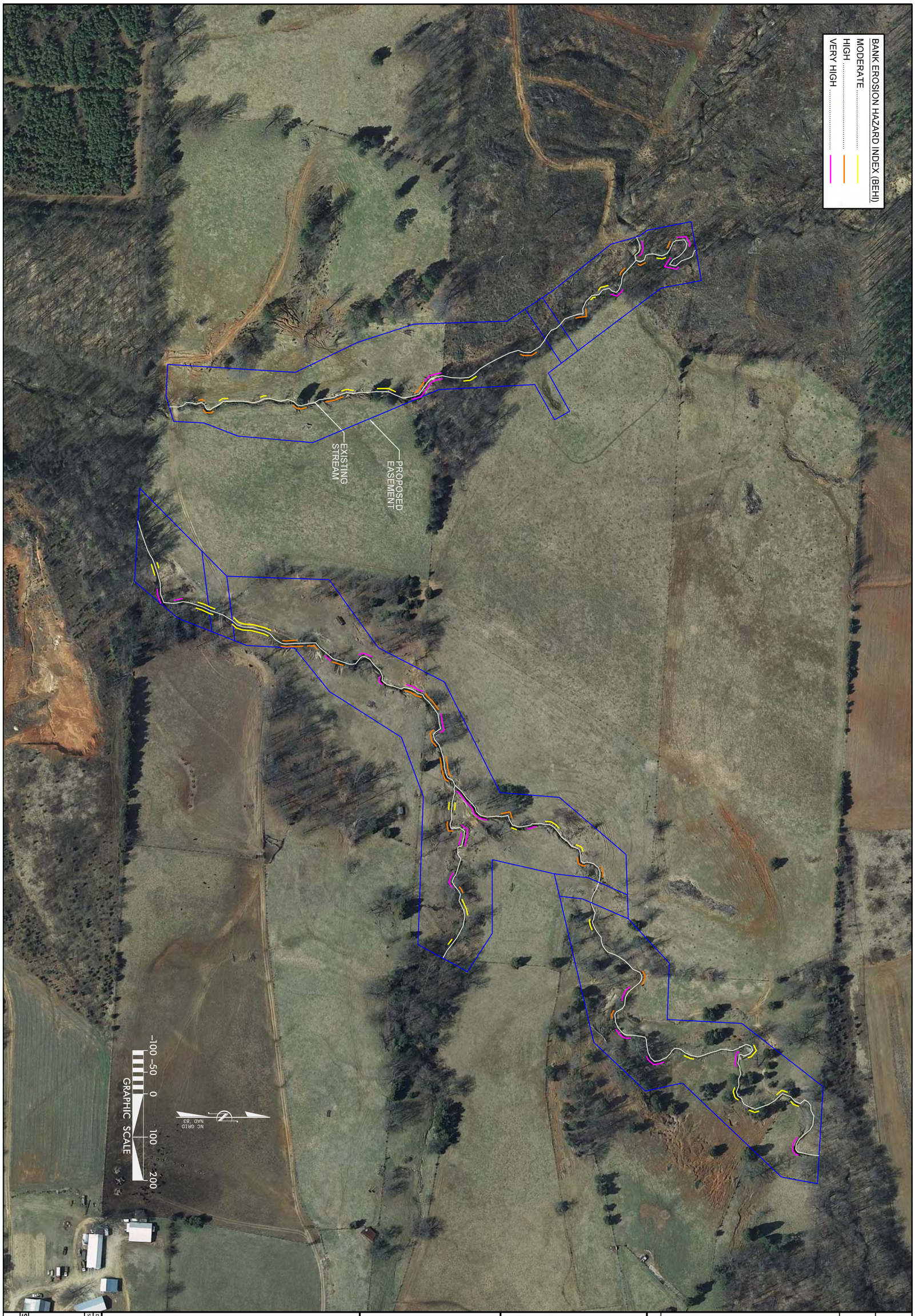
Smallest Sieve Passed (mm)	Weight (oz)	% Item	Percent Finer Than
<1	74	13.9%	13.9%
1.0	164.0	30.8%	44.7%
2.0	179.0	33.6%	78.2%
4.0	99.0	18.6%	96.8%
8.0	17.0	3.2%	100.0%
16.0	0.0	0.0%	100.0%
31.5	0.0	0.0%	100.0%
128.0	0.0	0.0%	100.0%
256.0	0.0	0.0%	100.0%
> 256.0	0.0	0.0%	100.0%
Total:	533.0	100%	

Stream:	Jacob's Landing Stream Restoration Site T2
Watershed:	
Location:	
Note:	Bar Sample # 1 (0-6 inches)



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
1.1	1.1	1.1	2.5	3.7	0%	78%	22%	0%	---	---

BEHI



BEHI FIGURE

SHEET 1 OF 1

DATE: APRIL 2012

SCALE: 1"=200'

JACOBS LANDING
STREAM MITIGATION PROJECT

CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

Ecosystem Enhancement Program

SYM.	DESCRIPTION	DATE	APPROVED

REVISIONS

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T1-1) **Reach:** 45 Linear Feet **Date:** 2/21/12 **Crew:** AH

Moderate Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 85.0**	**I: 1.7**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V: 0.60**	**I: 3.4**	**V:**	**I:**	**V: 45.0**	**I: 3.2**	**V:**	**I:**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V: 36.0**	**I: 5.4**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V: 1.6**	**I: 6.0**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 19.7

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 5

Stratification Comments:

Few stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T1-1 at representative bank features throughout.

GRAND TOTAL 29.7

BEHI RATING Moderate

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T1-1) **Reach:** 60 Linear Feet **Date:** 2/21/12 **Crew:** AH

High Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V: 0.50**	**I: 3.9**	**V:**	**I:**	**V: 45.0**	**I: 3.2**	**V: 75.0**	**I: 3.6**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V: 35.0**	**I: 5.5**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V: 1.8**	**I: 7.0**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 24.1

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 8

Stratification Comments:

Few stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T1-1 at representative bank features throughout.

GRAND TOTAL 37.1

BEHI RATING High

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T1-1) **Reach:** 70 Linear Feet **Date:** 2/21/12 **Crew:** AH

Very High Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 50.0**	**I: 3.4**	**V: 60.0**	**I: 3.5**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V:**	**I:**	**V: 0.35**	**I: 5.4**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V: 28.0**	**I: 6.1**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V: 2.5**	**I: 8.6**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 27.0

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 8

Stratification Comments:

Few stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T1-1 at representative bank features throughout.

GRAND TOTAL 40.0

BEHI RATING Very High

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T1-2) **Reach:** 40 Linear Feet **Date:** 2/21/12 **Crew:** AH

High Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 80.0**	**I: 1.9**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 45.0**	**I: 3.2**	**V:**	**I:**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V:**	**I:**	**V: 0.30**	**I: 5.9**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V: 1.7**	**I: 6.5**	**V:**	**I:**	**V: 24.0**	**I: 6.7**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 24.2

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 8

Stratification Comments:

stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at one location on T1-2 at a representative bank feature.

GRAND TOTAL 37.2

BEHI RATING High

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T1-3) **Reach:** 143 Linear Feet **Date:** 2/21/12 **Crew:** AH

Moderate Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 90.0**	**I: 1.5**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V: 0.50**	**I: 3.9**	**V:**	**I:**	**V: 40.0**	**I: 2.9**	**V:**	**I:**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V: 1.2**	**I: 4.0**	**V:**	**I:**	**V: 48.0**	**I: 4.5**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 16.8

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 8

Stratification Comments:

few stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T1-3 at representative bank features throughout.

GRAND TOTAL 29.8

BEHI RATING Moderate

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T1-3) **Reach:** 150 Linear Feet **Date:** 2/21/12 **Crew:** AH

High Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 85.0**	**I: 1.7**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V: 0.50**	**I: 3.9**	**V:**	**I:**	**V: 40.0**	**I: 2.9**	**V:**	**I:**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V: 1.4**	**I: 5.3**	**V:**	**I:**	**V: 37.5**	**I: 5.3**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 19.1

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 8

Stratification Comments:

few stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T1-3 at representative bank features throughout.

GRAND TOTAL 32.1

BEHI RATING High

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T1-3) **Reach:** 135 Linear Feet **Date:** 2/21/12 **Crew:** AH

Very High Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 50.0**	**I: 3.4**	**V: 55.0**	**I: 2.0**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V: 2.0**	**I: 7.9**	**V: 0.20**	**I: 7.2**	**V: 15.0**	**I: 7.9**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 28.4

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 8

Stratification Comments:

few stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T1-3 at representative bank features throughout.

GRAND TOTAL 41.4

BEHI RATING Very High

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T1A) **Reach:** 23 Linear Feet **Date:** 2/21/12 **Crew:** AH

Moderate Rating

Bank Erosion Potential	Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
	VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
		Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
		Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 90.0**	**I: 1.5**
	LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
		Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
		Choice	**V:**	**I:**	**V: 0.52**	**I: 3.8**	**V:**	**I:**	**V: 45.0**	**I: 3.2**	**V:**	**I:**
	MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
		Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
		Choice	**V: 1.5**	**I: 5.9**	**V:**	**I:**	**V: 36.0**	**I: 5.4**	**V:**	**I:**	**V:**	**I:**
	HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
		Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
		Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
	VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
		Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
		Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
	EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
		Index Range	10		10		10		10		10	
		Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
	V = value, I = index								**SUB-TOTAL (Sum one index from each column)**		**19.8**	

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 8

Stratification Comments:

stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T1A at representative bank features throughout.

GRAND TOTAL 29.8

BEHI RATING Moderate

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T1A) **Reach:** 35 Linear Feet **Date:** 2/21/12 **Crew:** AH

High Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 45.0**	**I: 3.2**	**V: 70.0**	**I: 3.2**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V:**	**I:**	**V: 0.37**	**I: 5.2**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V: 1.6**	**I: 6.0**	**V:**	**I:**	**V: 29.0**	**I: 6.0**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 25.8

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 8

Stratification Comments:

stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T1A at representative bank features throughout.

GRAND TOTAL 38.8

BEHI RATING High

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T1A) **Reach:** 107 Linear Feet **Date:** 2/21/12 **Crew:** AH

Very High Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 45.0**	**I: 3.2**	**V: 70.0**	**I: 3.2**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V:**	**I:**	**V: 0.37**	**I: 5.2**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V: 1.6**	**I: 6.0**	**V:**	**I:**	**V: 29.0**	**I: 6.0**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 27.1

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 8

Stratification Comments:

stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T1A at representative bank features throughout.

GRAND TOTAL 40.1

BEHI RATING Very High

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T2-1) **Reach:** 275 Linear Feet **Date:** 2/21/12 **Crew:** AH

Moderate Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 95.0**	**I: 1.2**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V: 0.50**	**I: 3.9**	**V:**	**I:**	**V: 40.0**	**I: 2.9**	**V:**	**I:**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V: 1.3**	**I: 4.6**	**V:**	**I:**	**V: 45.0**	**I: 4.7**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 17.3

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 7

Stratification Comments:

Few stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T2-1 at representative bank features throughout.

GRAND TOTAL 29.3

BEHI RATING Moderate

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T2-1) **Reach:** 145 Linear Feet **Date:** 2/21/12 **Crew:** AH

High Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 80.0**	**I: 1.9**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 45.0**	**3.2**	**V:**	**I:**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V: 1.7**	**I: 6.5**	**V: 0.29**	**I: 6.0**	**V: 20.0**	**I: 7.2**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 24.8

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 7

Stratification Comments:

Few stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T2-1 at representative bank features throughout.

GRAND TOTAL 36.8

BEHI RATING High

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T2-1) **Reach:** 340 Linear Feet **Date:** 2/21/12 **Crew:** AH

Very High Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 50.0**	**I: 3.4**	**V: 60.0**	**I: 3.5**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V: 2.0**	**I: 7.9**	**V: 0.28**	**I: 6.1**	**V: 18.0**	**I: 7.5**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 28.4

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 7

Stratification Comments:

Few stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T2-1 at representative bank features throughout.

GRAND TOTAL 40.4

BEHI RATING Very High

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T2-2) **Reach:** 305 Linear Feet **Date:** 2/21/12 **Crew:** AH

Moderate Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 85.0**	**I: 1.7**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V: 0.57**	**I: 3.6**	**V:**	**I:**	**V: 40.0**	**I: 2.9**	**V:**	**I:**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V: 1.2**	**I: 4.0**	**V:**	**I:**	**V: 45.0**	**I: 4.7**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 16.9

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 7

Stratification Comments:

Few stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T2-2 at representative bank features throughout.

GRAND TOTAL 28.9

BEHI RATING Moderate

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T2-2) **Reach:** 385 Linear Feet **Date:** 2/21/12 **Crew:** AH

High Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 80.0**	**I: 1.9**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 45.0**	**I: 3.2**	**V:**	**I:**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V:**	**I:**	**V: 0.22**	**I: 7.0**	**V: 17.6**	**I: 7.5**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V: 2.3**	**I: 8.3**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 27.9

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 7

Stratification Comments:

Few stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T2-2 at representative bank features throughout.

GRAND TOTAL 39.9

BEHI RATING High

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T2-2) **Reach:** 230 Linear Feet **Date:** 2/21/12 **Crew:** AH

Very High Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 45.0**	**I: 3.2**	**V: 75.0**	**I: 2.3**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V:**	**I:**	**V: 0.20**	**I: 7.2**	**V: 16.0**	**I: 7.8**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V: 3.5**	**I: 10.0**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 30.5

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 7

Stratification Comments:

Few stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted at several locations on T2-2 at representative bank features throughout.

GRAND TOTAL 42.5

BEHI RATING Very High

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T2A) **Reach:** 85 Linear Feet **Date:** 2/21/12 **Crew:** AH

Moderate Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 85.0**	**I: 1.7**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 40.0**	**I: 2.9**	**V:**	**I:**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V: 1.2**	**I: 4.0**	**V: 0.50**	**I: 4.0**	**V: 40.0**	**I: 5.1**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 17.7

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 7

Stratification Comments:

stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted on the entire T2A reach due to similar bank features throughout.

GRAND TOTAL 29.7

BEHI RATING Moderate

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T2A) **Reach:** 45 Linear Feet **Date:** 2/21/12 **Crew:** AH

High Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 85.0**	**I: 1.7**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 40.0**	**I: 2.9**	**V:**	**I:**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V:**	**I:**	**V: 0.29**	**I: 6.0**	**V: 20.0**	**I: 7.2**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V: 0.4**	**I: 10.0**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 27.8

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 7

Stratification Comments:

stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted on the entire T2A reach due to similar bank features throughout.

GRAND TOTAL 39.8

BEHI RATING High

Bank Erodibility Hazard Rating Guide

Stream: Jacob's Landing (T2A) **Reach:** 125 Linear Feet **Date:** 2/21/12 **Crew:** AH

Very High Rating

Bank Erosion Potential

Bank Height (ft): / Bankfull Height (ft):		Bank Height/ Bankfull Ht		Root Depth/ Bank Height		Root Density %		Bank Angle (Degrees)		Surface Protection%	
VERY LOW	Value Range	1.0	1.1	1.0	0.9	100	80	0.0	20.0	100	80
	Index Range	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9	1.0	1.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
LOW	Value Range	1.11	1.19	0.9	0.50	79	55	21.0	60.0	79	55
	Index Range	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9	2.0	3.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V: 45.0**	**I: 3.2**	**V: 65.0**	**I: 3.1**
MODERATE	Value Range	1.2	1.5	0.5	0.30	54	30	61.0	80.0	54	30
	Index Range	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9	4.0	5.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
HIGH	Value Range	1.6	2.0	0.29	0.15	29	15	81.0	90.0	29	15
	Index Range	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9	6.0	7.9
	Choice	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**
VERY HIGH	Value Range	2.1	2.8	0.14	0.05	14	5	91.0	119.0	14	10
	Index Range	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0	8.0	9.0
	Choice	**V:**	**I:**	**V: 0.14**	**I: 9.0**	**V: 9.8**	**I: 8.5**	**V:**	**I:**	**V:**	**I:**
EXTREME	Value Range	>2.8		<0.05		<5		>119		<10	
	Index Range	10		10		10		10		10	
	Choice	**V: 6.0**	**I: 10.0**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**	**V:**	**I:**

V = value, I = index

SUB-TOTAL (Sum one index from each column) 33.8

Bank Material Description:

Mostly smaller gravel mixed with sand

Bank Materials

Bedrock (Bedrock banks have very low bank erosion potential)

Boulders (Banks composed of boulders have low bank erosion potential)

Cobble (Subtract 10 points. If sand/gravel matrix greater than 50% of bank material, then do not adjust)

Gravel (Add 5-10 points depending percentage of bank material that is composed of sand)

Sand (Add 10 points)

Silt Clay (+ 0: no adjustment)

Bank Sketch

BANK MATERIAL ADJUSTMENT 7

Stratification Comments:

stratified layers were observed

Stratification

Add 5-10 points depending on position of unstable layers in relation to bankfull stage

STRATIFICATION ADJUSTMENT 5

VERY LOW	LOW	MODERATE	HIGH	VERY HIGH	EXTREME
5-9.9	10-19.9	20-29.9	30-39.9	40-45.9	46-50

Bank location description (check one)

The BEHI was conducted on the entire T2A reach due to similar bank features throughout.

GRAND TOTAL 45.8

BEHI RATING Very High

NCDWQ Stream Forms

NC DWQ Stream Identification Form Version 4.11

Date: February 21, 2012	**Project/Site:** Landing (T1-1)	**Latitude:**
Evaluator: AH	**County:** Rowan	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 33	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** Enochville *e.g. Quad Name:*

A. Geomorphology (Subtotal = 20.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	2	(3)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	(0.5)	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: February 21, 2012	**Project/Site:** Landing (T1-2)	**Latitude:**
Evaluator: AH	**County:** Rowan	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 35	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** Enochville *e.g. Quad Name:*

A. Geomorphology (Subtotal = 23)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	2	(3)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	2	(3)
7. Recent alluvial deposits	0	1	(2)	3
8. Headcuts	(0)	1	2	3
9. Grade control	(0)	0.5	(1)	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = (3)	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	1	(0.5)	0
15. Sediment on plants or debris	0	0.5	(1)	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: February 21, 2012	**Project/Site:** Landing (T1A)	**Latitude:**
Evaluator: AH	**County:** Rowan	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 37	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** Enochville *e.g. Quad Name:*

A. Geomorphology (Subtotal = 24.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	2	(3)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	1	(2)	3
8. Headcuts	0	1	(2)	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = 0		Yes = (3)	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: February 21, 2012	**Project/Site:** Landing (T1-3)	**Latitude:**
Evaluator: AH	**County:** Rowan	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** Enochville *e.g. Quad Name:*

A. Geomorphology (Subtotal = 17.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	(0.5)	1	1.5
11. Second or greater order channel	No = 0		Yes = (3)	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: February 21,2012	**Project/Site:** Landing(T2-1)	**Latitude:**
Evaluator: AH	**County:** Rowan	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 34	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** Enochville *e.g. Quad Name:*

A. Geomorphology (Subtotal = 21.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	2	(3)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	1	(2)	3
8. Headcuts	(0)	1	2	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	(0.5)	1	1.5
11. Second or greater order channel	No = 0		Yes = (3)	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: February 21, 2012	**Project/Site:** Landing (T2-2)	**Latitude:**
Evaluator: AH	**County:** Rowan	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 33	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** Enochville *e.g. Quad Name:*

A. Geomorphology (Subtotal = 21.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	2	(3)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	1	(2)	3
8. Headcuts	(0)	1	2	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	(0.5)	1	1.5
11. Second or greater order channel	No = 0		Yes = (3)	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	(0)	0.5	1	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: February 21, 2012	**Project/Site:** Landing (T2A)	**Latitude:**
Evaluator: AH	**County:** Rowan	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 32.5	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Enochville *e.g. Quad Name:*

A. Geomorphology (Subtotal = 21)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	1	2	(3)
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = 0		Yes = (3)	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 0)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

Reference Reach Data

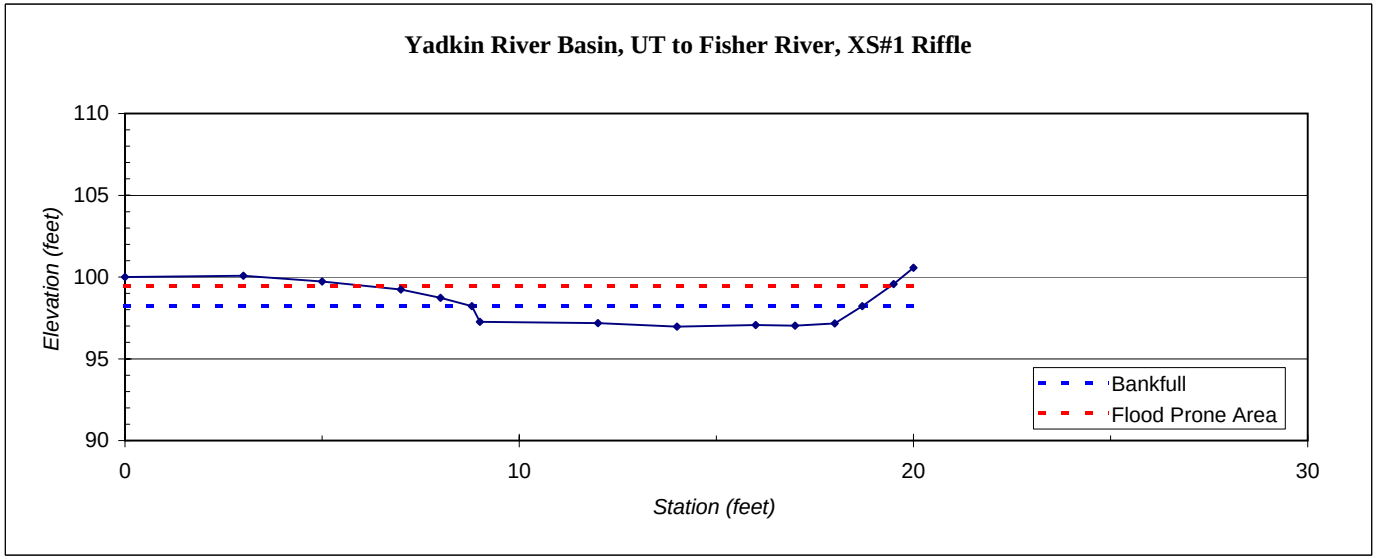
UT to Fisher River Reference Site

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

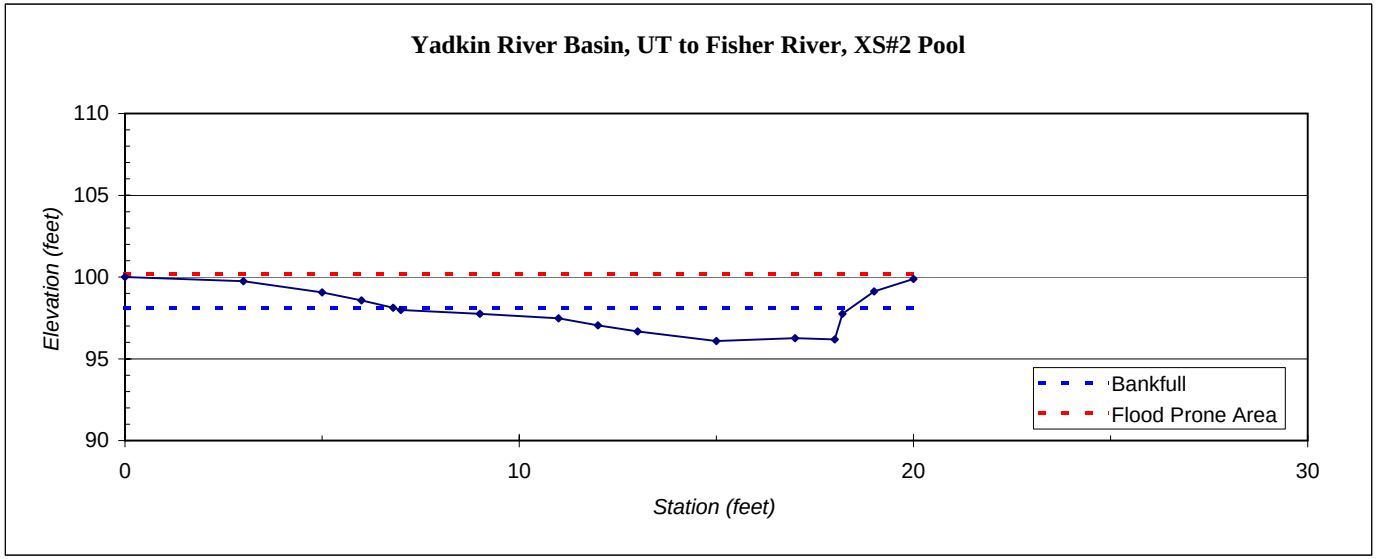


River Basin:	Yadkin
Watershed:	UT to Fisher River
XS ID	XS#2 Pool
Drainage Area (sq mi):	0.38
Date:	6/9/2005
Field Crew:	G. Mryncza, A. Spiller

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

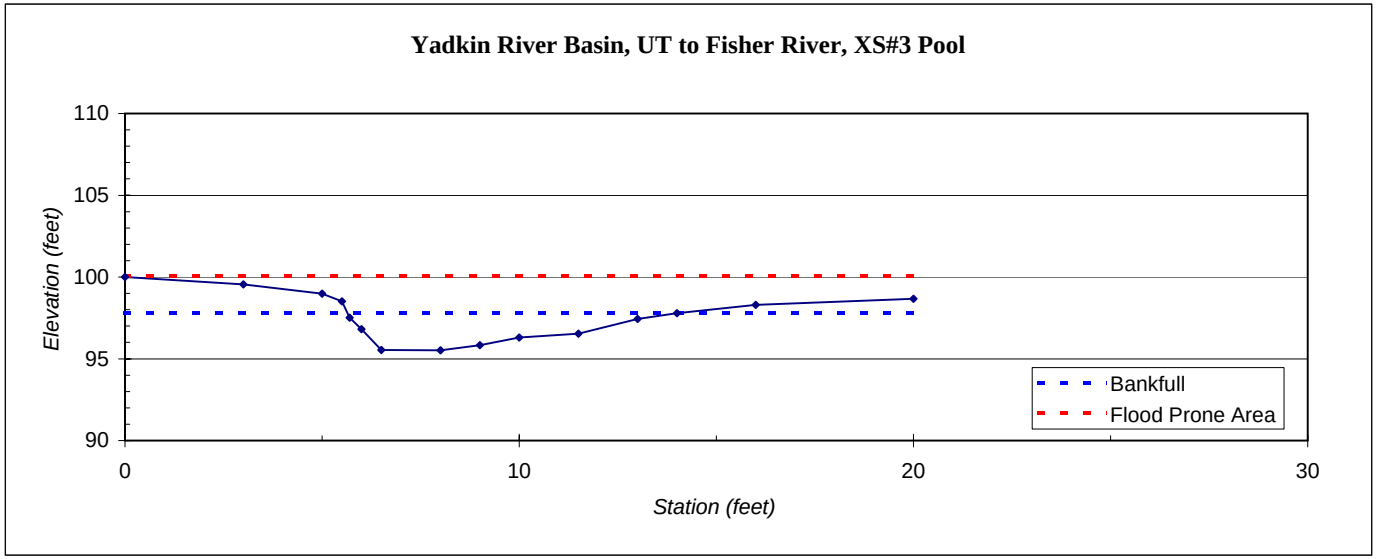


River Basin:	Yadkin
Watershed:	UT to Fisher River
XS ID	XS#3 Pool
Drainage Area (sq mi):	0.38
Date:	6/9/2005
Field Crew:	G. Mryncza, A. Spiller

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

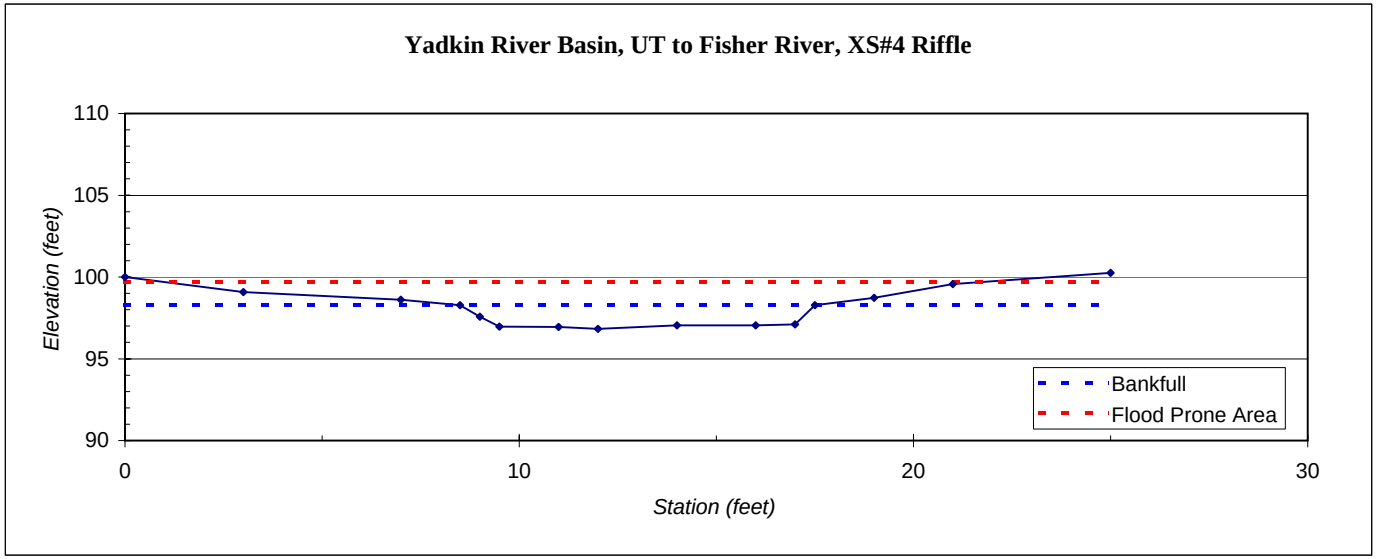


River Basin:	Yadkin
Watershed:	UT to Fisher River
XS ID	XS#4 Riffle
Drainage Area (sq mi):	0.38
Date:	6/9/2005
Field Crew:	G. Mryncza, A. Spiller

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

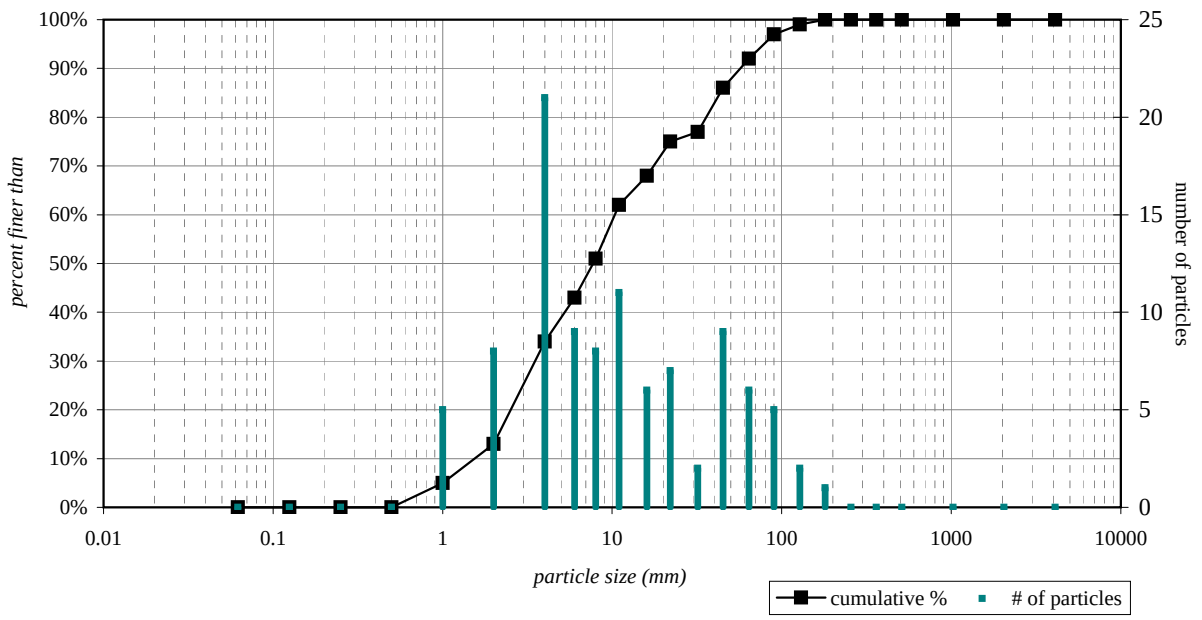
Stream Type:	B4c



Pebble Count

Material	Size Range (mm)		Count
silt/clay	0	0.062	**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

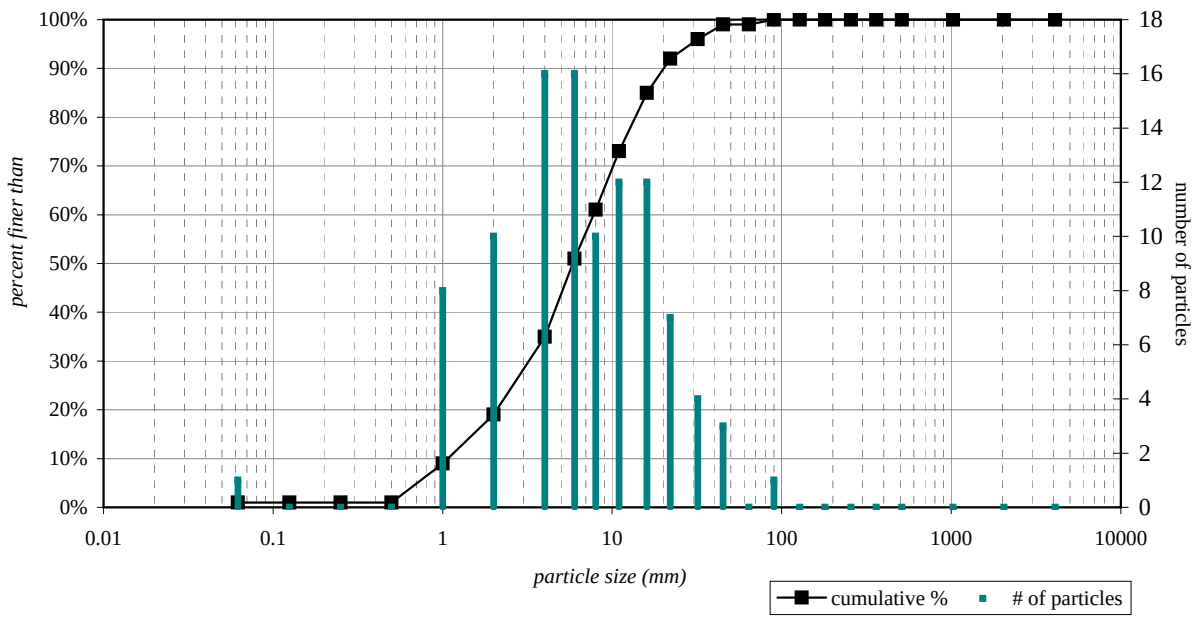
based on sediment particles only	size percent less than (mm)						particle size distribution		
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev
	2.208	4.18	7.7	13	42	79	4.5	9.6	4.3

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%

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

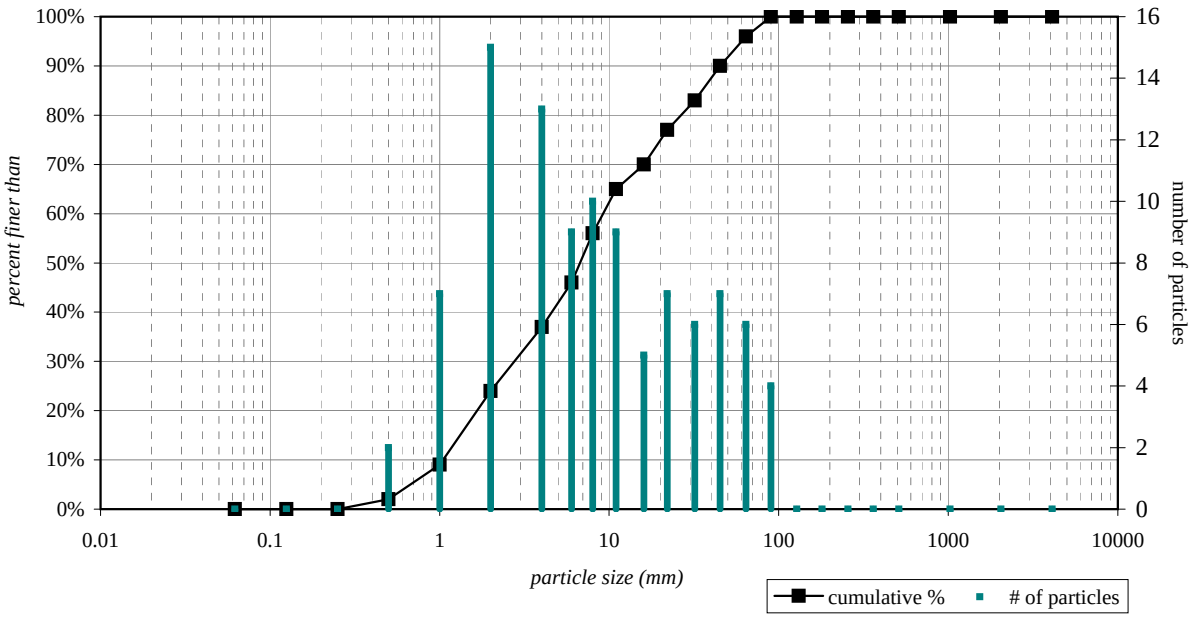
based on total count	percent by substrate type silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial
	1%	18%	80%	1%	0%	0%	0%	0%	0%

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

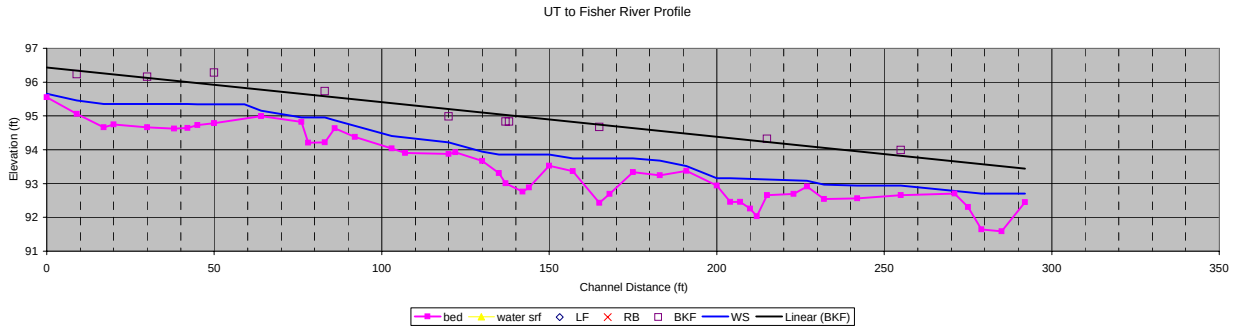
Note: **Reach Pebble Count**



bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:	100	

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

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



Elevation BM: 100

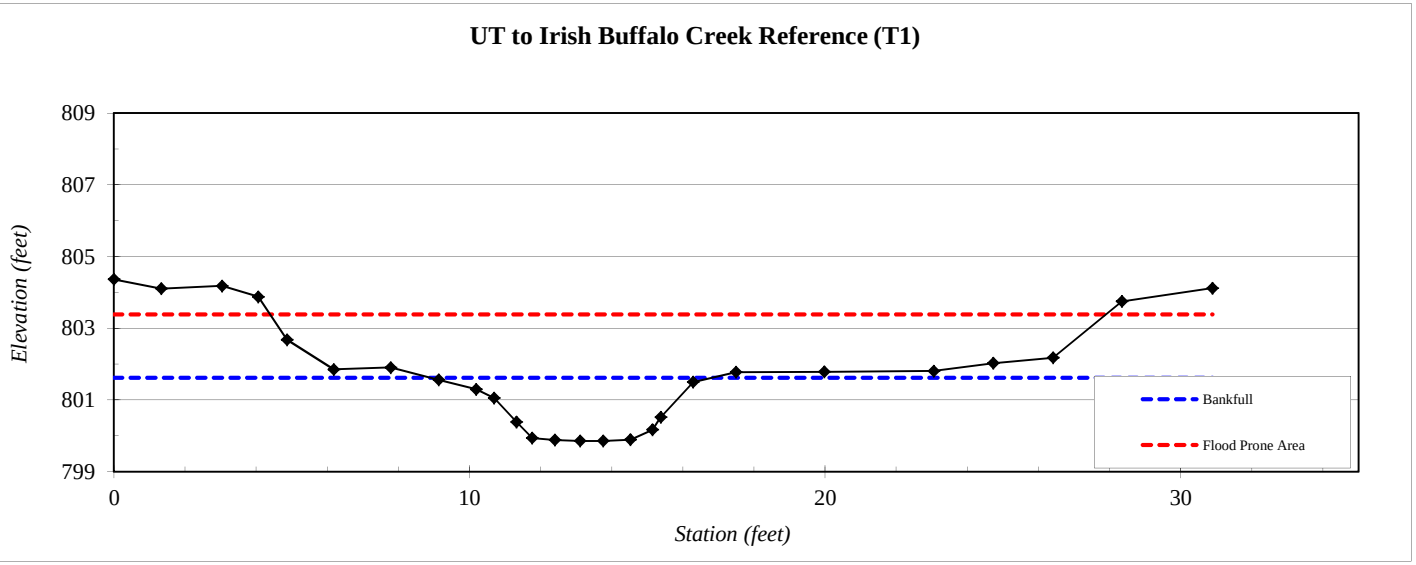
notes	inc distance	station	BS	HI	FS TP	FS bed	depth water	FS LB	FS RB	FS BKF	FS WS	AZ azimuth	ELEV bed	ELEV water srf	ELEV LF	ELEV RB	ELEV BKF	ELEV WS
		5		100		4.45					4.34		95.55					95.66
	9	14		100		4.94				3.77	4.54		95.06				96.23	95.46
	8	22		100		5.34					4.65		94.66					95.35
	3	25		100		5.25							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

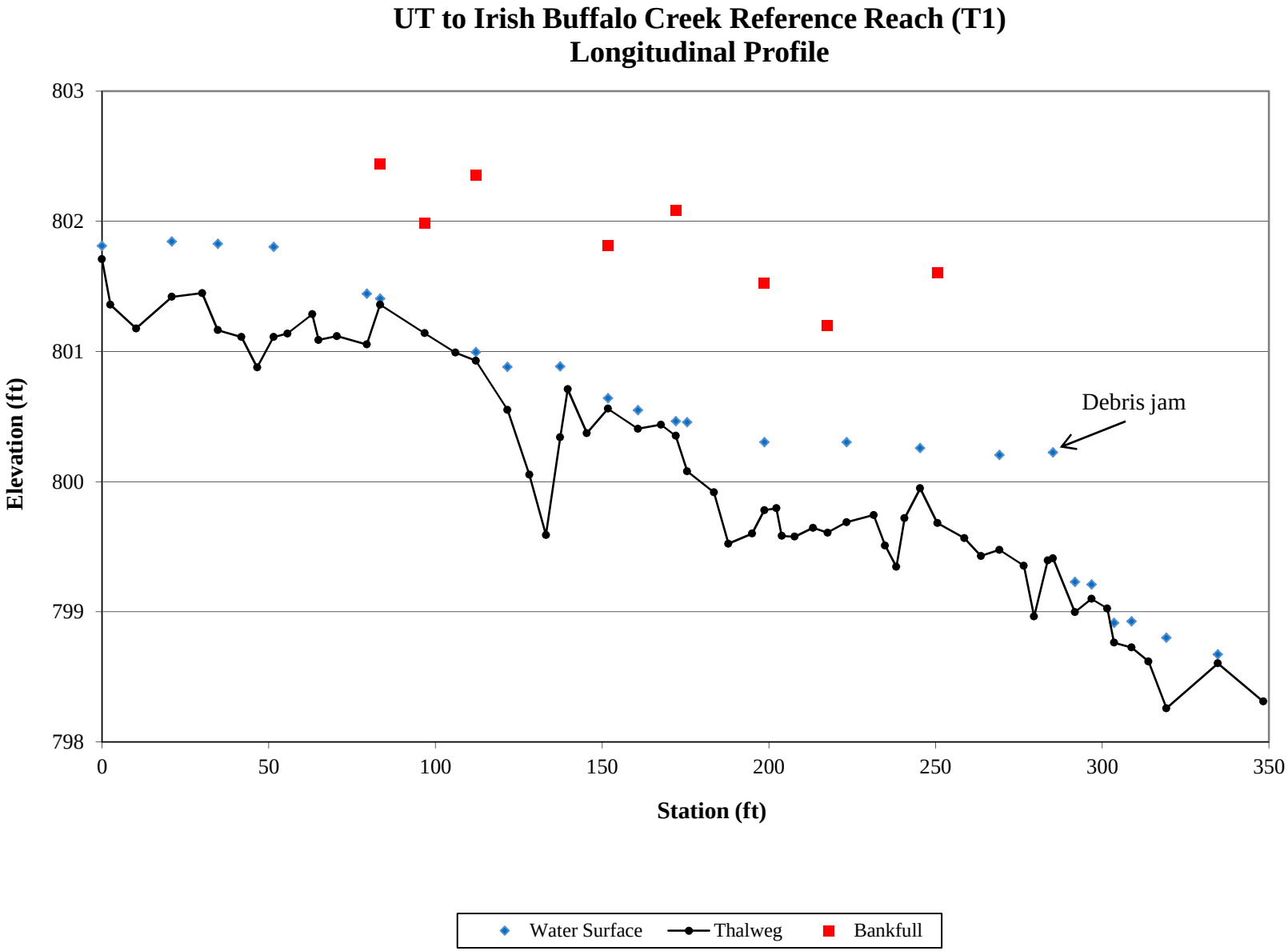
UT to Irish Buffalo Creek Reference Site

River Basin:	Yadkin-PeeDee
Watershed:	Irish Buffalo Creek, T1
XS ID	XS-Riffle (REFERENCE)
Drainage Area (sq mi):	0.16
Date:	2/17/2012
Field Crew:	A. French, K. O'Briant

Station	Elevation
0.0	804.36
1.3	804.11
3.0	804.18
4.1	803.88
4.9	802.68
6.2	801.85
7.8	801.91
9.1	801.56
10.2	801.30
10.7	801.05
11.3	800.38
11.8	799.94
12.4	799.89
13.1	799.86
13.8	799.86
14.5	799.89
15.2	800.17
15.4	800.52
16.3	801.50
17.5	801.77
20.0	801.79
23.1	801.81
24.7	802.02
26.4	802.18
28.3	803.75
30.9	804.12

SUMMARY DATA	
Bankfull Elevation:	801.6
Bankfull Cross-Sectional Area:	8.4
Bankfull Width:	8.0
Flood Prone Area Elevation:	803.4
Flood Prone Width:	23
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	1.1
W / D Ratio:	7.6
Entrenchment Ratio:	2.9
Bank Height Ratio:	1.0




UT to Irish Buffalo Creek Reference Reach (T1)
Longitudinal Profile
Elevation (ft)
803
802
801
800
799
798
0
50
100
150
200
250
300
350
Station (ft)
Debris jam
Water Surface
Thalweg
Bankfull

UT to Irish Buffalo Creek Reference Stream Photos

Looking downstream on reference reach. 2-17-2012

Looking downstream on reference reach. 2-17-2012

Looking downstream on reference reach. 2-17-2012

Morphological Design Criteria

Morphological Design Criteria

Variables		Existing *T1-1	Existing *T1-2	Existing *T1-3	Existing *T2-1	Existing *T2-2	Ref. Reach UT to Irish Buffalo	Proposed T1-1	Proposed ++ T1-2	Proposed T1-3	Proposed T2-1	Proposed T2-2
Rosgen Stream Type		G4	E4	G4	E4	F4	E4	C4	C4	C4	C4	C4
Mitigation Type		Restoration	Enh.2	Restoration	Restoration	Restoration	N/A	Restoration	Enh.2	Restoration	Restoration	Restoration
Drainage Area (mi^2)		0.37	0.38	0.40	0.23	0.31	0.16	0.37	0.38	0.40	0.23	0.31
Bankfull Width (W_{bkf}) (ft)		9.1	6.5-9.0	7.9	8.8	11.1-12.3	6.9	11.5	11.5	12.2	10.4	11.6
Bankfull Mean Depth (d_{bkf}) (ft)		0.9	1.3-1.8	1.5	1	1.0	1.1	1.0	1.0	1.0	0.9	1.0
Bankfull Cross-Sectional area (A_{bkf}) (ft^2)		8.6	11.4-12.0	12.1	9.2	11.3-11.7	7.4	11.2	11.2	12.6	9.1	11.1
Width/depth Ratio (W_{bkf}/d_{bkf})		9.6	3.7-6.8	5.2	8.4	10.9-12.9	6.4	12.0	12.0	12.0	12.0	12.0
Maximum Depth (d_{mbkf}) (ft)		1.1	1.7-2.7	2.8	1.8	1.3-1.5	1.6	1.5	1.5	1.6	1.4	1.5
Width of flood prone area (W_{fpa}) (ft)		1-14	15-16	26	20	17-19	23	25-40	25-40	27-60	23-35	26-50
Entrenchment Ratio (ER)		1.5	1.6-2.5	3.3	2.3	1.4-1.7	3.4	2.2-3.5	2.2-3.5	2.2-4.9	2.2-3.4	2.2-4.3
Sinuosity (stream length/valley length) (K)		1.15	1.09	1.07	1.45	1.09	1.18	1.11	1.09	1.12	1.31	1.16
Dimension	Pool Depth (ft)	-	-	*	1.3	*	1.6	1.4	1.4	1.4	1.3	1.4
	Riffle Depth (ft)	0.9	1.3-1.8	1.5	1.0	1.0	1.1	1.0	1.0	1.0	0.9	1.0
	Max Pool Depth (ft)	-	-	*	2.2	*	2.7	2.8	2.8	2.9	2.6	2.8
	Pool Width (ft)	-	-	*	7.0	*	**	15.0	15.0	15.5	14.0	15.0
	Riffle Width (ft)	9.1	6.5-9.0	7.9	8.8	11.1-12.3	6.9	11.5	11.5	12.2	10.4	11.6
	Pool XS Area (sf)	-	-	*	9.2	*	**	20.7	20.7	22.1	18.3	20.6
	Riffle XS Area (sf)	8.6	11.4-12.0	12.1	9.2	11.3-11.7	7.4	11.2	11.2	12.6	9.1	11.1
	Pool depth/mean riffle depth	-	-	*	1.3	*	**	1.4	1.4	1.4	1.5	1.4
	Pool width/riffle width	-	-	*	0.80	*	**	1.3	1.3	1.3	1.3	1.3
	Pool area/riffle area	-	-	*	1	*	**	1.8	1.8	1.8	2.0	1.9
	Max pool depth/d_{bkf}	-	-	*	2.2	*	**	2.8	2.8	2.9	2.9	2.8
	Bank Height Ratio (BHR)	1.6	1.9-2.2	1.9	1.5-2.0	2.9-4.7	1.0	1.0	1.0	1.0	1.0	1.0
	Mean Bankfull Velocity (V) (fps)	5.4	3.9-4.0	4	3.4-3.5	3.5-3.6	3.3	4.1	4.1	3.8	3.6	3.6
	Bankfull Discharge (Q) (cfs)	46.3	45.5-46.5	48	30.7-32.3	41.0-41.2	24.7	45.2	45.2	47.4	32.5	40.2
Pattern	Meander length (L_m) (ft)	96-110	75	*	65-130	*	43 - 102	65-95	75	90-125	60-130	85-115
	Radius of curvature (R_c) (ft)	6-19	15-30	*	8-35	*	12 - 25	20-45	20-35	25-45	20-40	20-45
	Belt width (W_{blt}) (ft)	13-26	22-26	*	10-60	*	14 - 38	25-35	22-26	25-50	23-50	25-43
	Meander width ratio (W_{blt}/W_{bkf})	1.4-2.9	3.4-4.0	*	1.1-6.8	*	2.0 - 5.5	2.2-3.0	1.9-2.3	2.0-3.5	2.2-4.8	2.2-3.7
	Radius of curvature/bankfull width	0.7-2.1	2.3-4.6	*	0.9-3.9	*	1.7-3.6	2-4	2-3	2-4	2-4	2-4
	Meander length/bankfull width	10.5-12.1	11.5	*	7.3-14.7	*	6.2 - 14.8	5.7-8.3	6.5	7.4-10.2	5.8-12.5	7.3-9.9
Profile	Valley slope	0.0130	0.0260	0.009	0.012	0.009	0.009	0.012	0.012	0.008	0.013	0.010
	Average water surface slope	0.0140	0.0080	0.009	0.010	0.007	0.007	0.010	0.010	0.007	0.010	0.009
	Riffle slope	0.007-0.043	0.007-0.010	0.006-0.011	0.003-0.011	0.006-0.009	0.011-0.025	0.009-0.010	0.007	0.010-0.012	0.006-0.017	0.008-0.010
	Pool slope	-	-	-	0.007	-	0.001-0.007	0.001-0.006	-	0.000-0.001	0.001-0.005	0.001-0.006
	Pool to pool spacing	-	-	-	-	-	28 - 57	30-60	-	20-75	30-95	40-70
	Pool length	-	-	-	-	-	16 - 23	14-17	-	12-30	8-35	9-25
	Riffle slope/avg water surface slope	0.5-3.1	0.9-1.3	0.7-1.2	0.4-1.1	0.9-1.3	1.6 - 3.6	0.9-1.0	0.9	1.4-1.7	0.6-1.7	0.9-1.1
	Pool slope/avg water surface slope	-	-	-	0.7	-	0.2 - 1.0	0.1-0.6	-	0.0-0.1	0.1-0.5	0.1-0.7
	Pool length/bankfull width	-	-	-	-	-	2.3 - 3.4	1.2-1.5	-	1.0-2.5	0.8-3.4	0.8-2.2
	Pool to pool spacing/bankfull width	-	-	-	-	-	4.1 - 8.3	2.6-5.2	-	1.6-6.1	2.9-9.1	3.4-6.0

- T1-1, T1-2 and T2-1 are mostly composed of riffles and runs; therefore no pool data was shown.

* T1-3 and T2-2 are not meandering channels and are mostly composed of riffles and runs; therefore no pattern data and pool data are shown.

** No pool cross-section were surveyed for Ref. Reach UT to Irish Buffalo, T1-1, or T1-2.

Variables		Existing T1A	Existing T2A	Ref. Reach UTFR	Proposed T1A	Proposed T2A
Rosgen Stream Type		E4	G4	B4c	B4c/C4	B4c/C4
Mitigation Type		Enh. I	Enh. II	N/A	Enh. I	Enh. II
Drainage Area (mi^2)		0.21	0.06	0.4	0.21	0.06
Bankfull Width (W_{bkf}) (ft)		7.7	6.6	9.0-10.0	8.5	6.5
Bankfull Mean Depth (d_{bkf}) (ft)		0.8	0.5	1.1-1.2	0.7	0.5
Bankfull Cross-Sectional area (A_{bkf}) (ft^2)		6.4	3.4	10.4-10.7	6.2	3.5
Width/depth Ratio (W_{bkf}/d_{bkf})		9.3	12.8	8.0-10.0	12.0	12.0
Maximum Depth (d_{mbkf}) (ft)		1.2	1.1	1.3-1.5	1.2	0.9
Width of flood prone area (W_{fpa}) (ft)		15	11	13-21	19	14
Entrenchment Ratio (ER)		1.9	1.7	1.3-2.3	2.2	2.2
Sinuosity (stream length/valley length) (K)		2.10	1.16	1.20	1.11	1.13
Dimension	Pool Depth (ft)	-	-	1.2-1.4	1.2	1.0
	Riffle Depth (ft)	0.8	0.5	1.1-1.2	0.7	0.5
	Max Pool Depth (ft)	-	-	2.1-2.4	2.4	2.0
	Pool Width (ft)	-	-	8.4-11.6	11.2	8.6
	Riffle Width (ft)	7.7	6.6	9.0-9.9	8.5	6.5
	Pool XS Area (sf)	-	-	11.6-13.4	13.5	8.6
	Riffle XS Area (sf)	6.4	3.4	10.4-10.7	6.2	3.5
	Pool depth/mean riffle depth	-	-	1.0-1.3	1.7	2.0
	Pool width/riffle width	-	-	0.8-1.3	1.3	1.3
	Pool area/riffle area	-	-	1.1-1.3	2.2	2.5
	Max pool depth/d_{bkf}	-	-	1.9-2.0	3.4	4.0
	Bank Height Ratio (BHR)	2.2	6.3	1.0	1.0	1.0
	Mean Bankfull Velocity (V) (fps)	4.8	3.3	4.1-4.5	4.4	3.3
	Bankfull Discharge (Q) (cfs)	30.5	11	42-46	27.1	11.5
Pattern	Meander length (L_m) (ft)	25-50	50-63	93-136	50-55	50-63
	Radius of curvature (R_c) (ft)	8-24	10-12	13-42	10-25	10-25
	Belt width (W_{blt}) (ft)	20-75	8-15	45	19-24	8-15
	Meander width ratio (W_{blt}/W_{bkf})	2.6-9.7	1.2-2.3	4.5-5.0	2.2-2.8	1.2-2.3
	Radius of curvature/bankfull width	1.0-3.1	1.5-1.8	1.3-4.4	1.2-2.9	1.5-3.8
	Meander length/bankfull width	3.2-6.5	7.6-9.5	9.0-15.0	5.9-6.5	7.7-9.7
Profile	Valley slope	0.012	0.035	0.016	0.02	0.039
	Average water surface slope	0.023	0.019	0.013	0.017	0.014
	Riffle slope	0.013-0.019	0.010-0.017	0.013-0.028	0.010-0.012	0.010-0.0012
	Pool slope	-	-	0-0.0010	0.001-0.008	0.000-0.001
	Pool to pool spacing	-	-	30-59	22-34	22-42
	Pool length	-	-	3-25	7-14	4-15
	Riffle slope/avg water surface slope	0.7-1.0	0.6-1.0	1.00-2.20	0.6-0.7	0.7-0.9
	Pool slope/avg water surface slope	-	-	0	0.1-0.5	0.0-0.1
	Pool length/bankfull width	-	-	0.3-2.5	0.8-1.6	0.6-2.3
	Pool to pool spacing/bankfull width	-	-	3.3-6.0	2.6-4.0	3.4-6.5

- T1A and T2A are mostly composed of riffles and runs; therefore no pool data was shown.

Appendix D

Project Plan Sheets

KCI JOB# : 20110675

CONTRACT #: 003984

STATE OF NORTH CAROLINA
ECOSYSTEM ENHANCEMENT PROGRAM

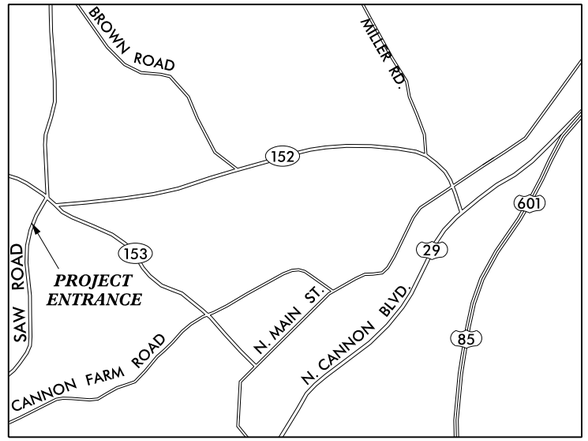
STATE	CONTRACT NUMBER	SHEET NO.	TOTAL SHEETS
N.C.	003984	1	22

A	PRELIMINARY DESIGN - SUBMITTED WITH MITIGATION PLAN	MAY 2012	
B	SUBMITTED FOR LAND QUALITY PERMIT	JUNE 2012	
C	EDITS PER IRT COMMENTS	SEPT 2012	
SYM.	DESCRIPTION	DATE	APPROVED
REVISIONS			

ROWAN COUNTY

LOCATION: JACOB'S LANDING
CHINA GROVE, NORTH CAROLINA

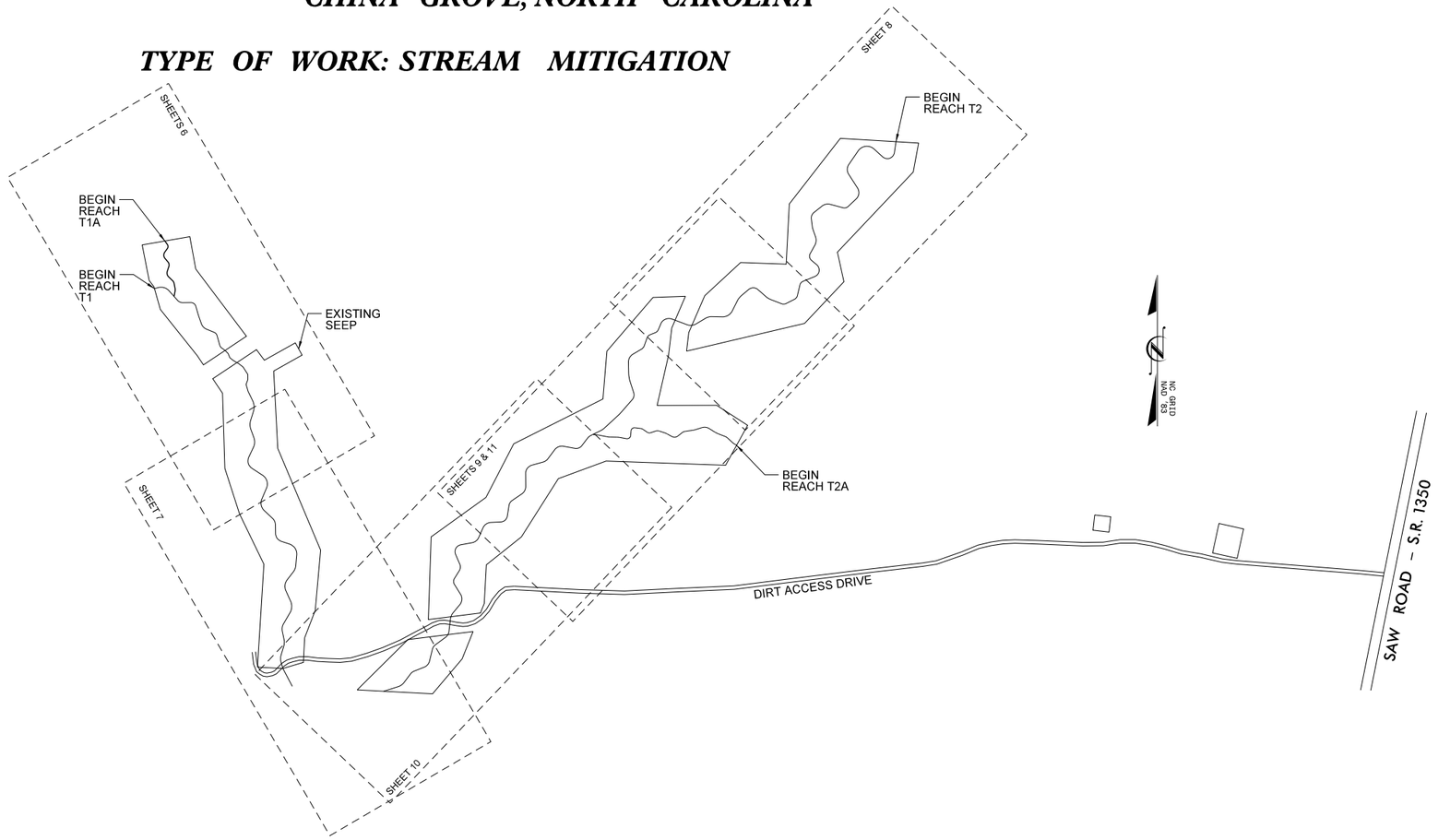
TYPE OF WORK: STREAM MITIGATION



VICINITY MAP
NOT TO SCALE

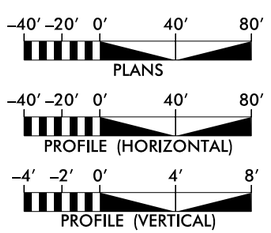
DIRECTIONS TO SITE

FROM RALEIGH, TAKE I-40 WEST. SLIGHT LEFT ONTO I-85 BUS S/US-29 S/US-70 W (signs for High Point/Charlotte). FOLLOW I-85 SOUTH TO EXIT 68. MERGE ONTO US-29 CONNECTOR SOUTH. TURN RIGHT ONTO NORTH CAROLINA 152 W/CHURCH STREET. TURN LEFT ONTO SAW ROAD. TAKE A RIGHT AT THE TWO STORY HOUSE AT 350 SAW ROAD. FOLLOW THE DIRT DRIVE THROUGH THE CATTLE FIELDS TO THE SITE.



INDEX OF SHEETS

GRAPHIC SCALES



PROJECT DATA

STREAM RESTORATION LENGTH = 4,015 FEET

STREAM ENHANCEMENT I LENGTH = 465 FEET

STREAM ENHANCEMENT II LENGTH = 109 FEET

Prepared In the Office of:

KCI Associates of North Carolina, P.A.
SUITE 220 LANDMARK CENTER II, 4601 SIX FORKS RD., RALEIGH, NC
ENGINEERS • PLANNERS • ECOLOGISTS

ALEX FRENCH
NATURAL CHANNEL DESIGN

PROJECT ENGINEER
GARY M. MRYNCZA, P.E.

P.E.
SIGNATURE:

Prepared for:

Ecosystem Enhancement PROGRAM

GUY PEARCE
CONTRACT ADMINISTRATOR

GENERAL NOTES:

BEARINGS AND DISTANCES:
ALL BEARINGS ARE NAD 1983 GRID BEARINGS.
ALL DISTANCES AND COORDINATES SHOWN ARE HORIZONTAL (GROUND) VALUES.

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.

IT IS BROUGHT TO THE CONTRACTORS ATTENTION THAT A WATER EASEMENT IS LOCATED ON THIS PROJECT (SEE SHEET 7).

CONTRACTOR IS RESPONSIBLE FOR PROVIDING TEMPORARY ACCESS ACROSS STREAMS FOR LAND OWNER DURING CULVERT REPLACEMENT.

CONTROL POINTS

POINT	NORTHING	EASTING	ELEV
KCI#1	664976.29	1504398.61	801.43
KCI#2	665302.76	1504918.92	806.58
KCI#3	665525.99	1505032.18	801.94
KCI#4	665848.59	1505257.14	808.23
KCI#5	666044.78	1505627.02	816.76
KCI#6	666203.11	1505696.64	813.59
KCI#7	666320.77	1505815.72	819.84
KCI#8	666069.52	1505777.72	825.43
KCI#9	666224.30	1505878.01	829.38
KCI#10	665537.37	1505186.95	809.24
KCI#11	665608.89	1505387.92	821.87
KCI#12	665427.41	1505456.87	836.44
KCI#13	665449.71	1505627.32	827.06
KCI#14	665329.42	1505589.64	852.09
KCI#15	665446.58	1504086.68	795.07
KCI#16	664838.13	1504605.20	810.80
KCI#17	665446.57	1504086.65	795.14
KCI#18	665613.87	1504130.73	800.92
KCI#19	665725.78	1504068.23	800.51
KCI#20	665796.34	1504030.77	799.88
KCI#21	665904.94	1503965.82	802.15
KCI#22	665981.40	1503816.35	799.51
KCI#23	666098.42	1503801.43	802.46
KCI#24	665950.46	1503684.90	801.59
KCI#25	666381.98	1505581.60	845.94
KCI#26	666341.16	1506134.54	851.82

PROJECT LEGEND:

Proposed Thalweg w/Approximate Bankfull Limits ..... 

Proposed Log Drop ..... 

Proposed Step Pool ..... 

Proposed Riffle Grade Control ..... 

Proposed Soil Lift ..... 

Proposed Riffle Enhancement ..... 

RIFFLE ENHANCEMENT MATERIAL:
MINIMUM OF 6" DEPTH OF SURGE STONE, WASHED IN WITH NATIVE BED MATERIAL.
EXTEND INTO 'RUN' SECTION OF POOL AREA.

Proposed Channel Block ..... 

Existing Channel to be Filled ..... 

Existing Woods Line ..... 

Single Tree ..... 

Minor Contour Line .....

Major Contour Line .....

Existing Barbed Wire Fencing .....

		DESCRIPTION	DATE	APPROVED
A	PRELIMINARY DESIGN - SUBMITTED WITH MITIGATION PLAN		MAY 2012	
B	SUBMITTED FOR LAND QUALITY PERMIT		JUNE 2012	
C	EDITS PER IRT COMMENTS		SEPT 2012	
		SYM.	REVISIONS	

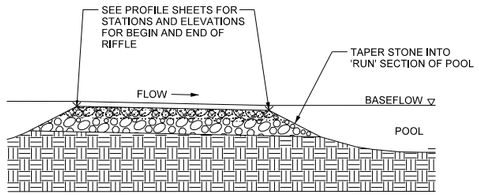
Ecosystem Enhancement Program

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

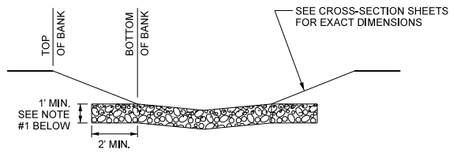
JACOB'S LANDING
STREAM MITIGATION PROJECT
CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

DATE: JUNE 2012
SCALE: N.T.S.

PROJECT LEGEND & NOTES



SECTION (PROFILE VIEW)



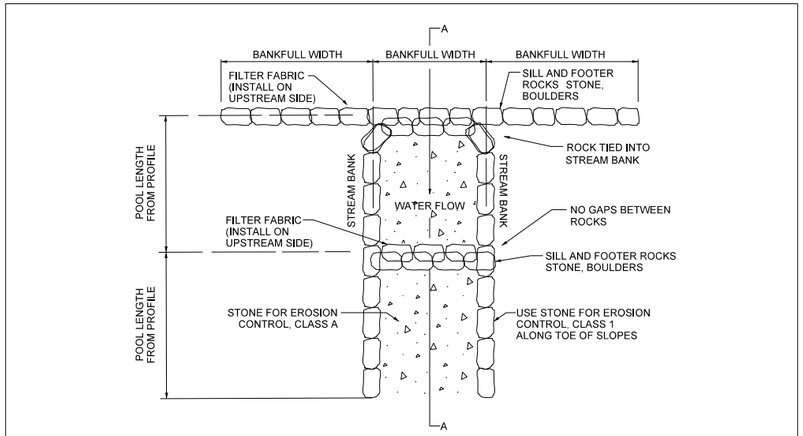
CROSS-SECTION VIEW

RIFFLE GRADE CONTROL

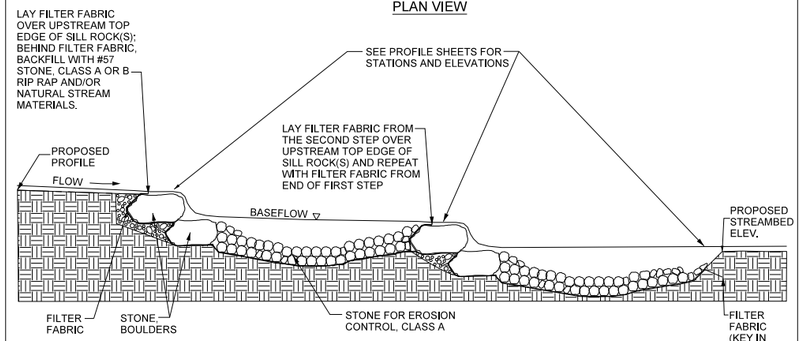
SCALE: NTS

NOTE:

1. START BY INSTALLING CLASS I STONE. THEN ADD SURGE STONE TO FILL IN VOIDS. FINISH BY WASHING IN NATURAL STREAM MATERIAL TO OBTAIN FINAL GRADE.



PLAN VIEW



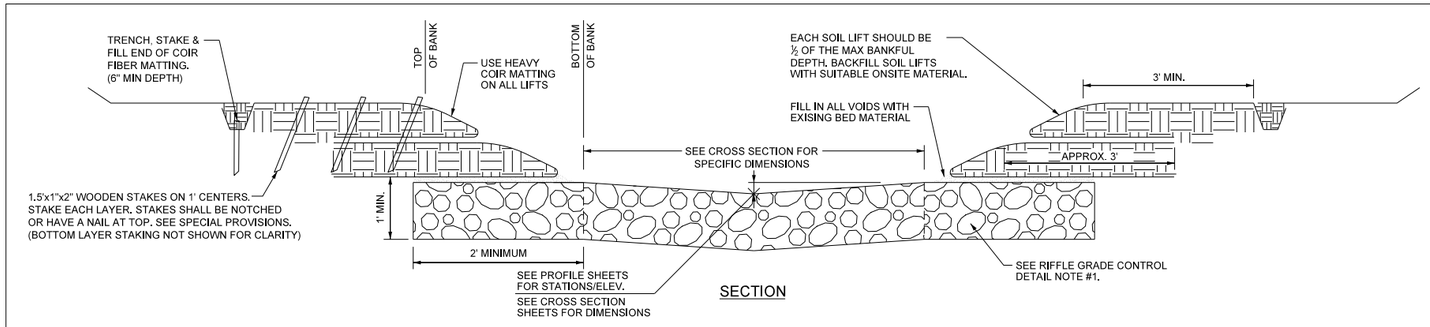
SECTION A - A' (PROFILE VIEW)

DOUBLE STEP POOL

SCALE: NTS

NOTES:

1. ALL SILL OR FOOTER ROCKS ARE STONE, BOULDERS.
2. DETAIL SHOWN IS FOR A DOUBLE STEP POOL. ADJUST ACCORDINGLY FOR SINGLE STEP POOLS. (SEE PROFILE SHEET TO DETERMINE AMOUNT OF STEPS)
3. SUBSTITUTE ALL CLASS A STONE FOR CLASS I STONE FOR DOUBLE STEP POOL AT THE END OF REACH T1-3 (SEE SHEET 7)



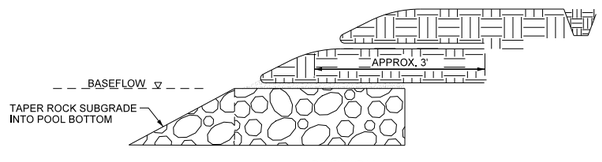
SECTION

SOIL LIFT / RIFFLE GRADE CONTROL

NOT TO SCALE

NOTE:

CERTAIN CIRCUMSTANCES MAY REQUIRE FOR ONLY ONE, THICK LAYER SOIL LIFT TO BE INSTALLED. TO BE DETERMINED BY DESIGN REPRESENTATIVE IN THE FIELD.



SECTION

NOTE:
MATCH ALL SPECS FROM "SOIL LIFT / RIFFLE GRADE CONTROL" DETAIL.

SOIL LIFT DETAIL FOR OUTER BENDS / POOLS

NOT TO SCALE

SYM.	DESCRIPTION	DATE	APPROVED
A	PRELIMINARY DESIGN - SUBMITTED WITH MITIGATION PLAN	MAY 2012	
B	SUBMITTED FOR LAND QUALITY PERMIT	JUNE 2012	
C	EDITS PER IRT COMMENTS	SEPT 2012	

REVISIONS

Ecosystem Enhancement Program

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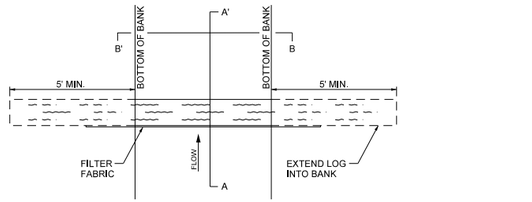
JACOB'S LANDING
STREAM MITIGATION PROJECT
CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

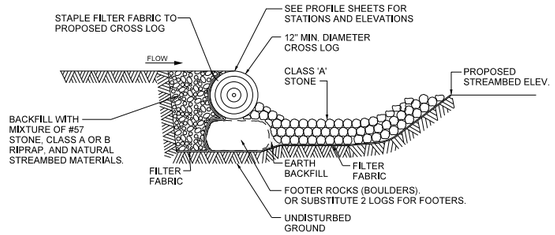
DATE: JUNE 2012
SCALE: N.T.S.

DETAILS:
STABILIZATION

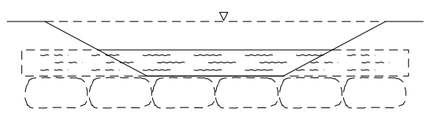
SHEET 3 OF 22



PLAN VIEW

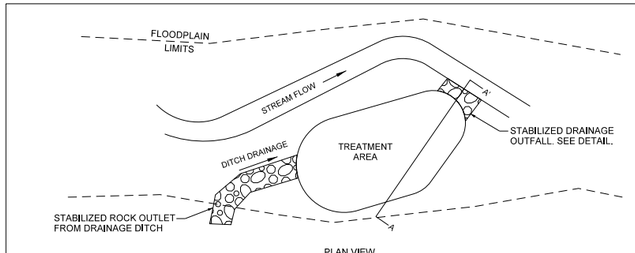


SECTION B-B' (PROFILE VIEW)

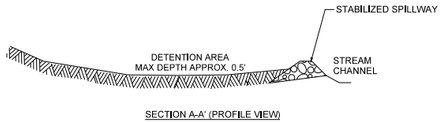


SECTION A-A' (CROSS-SECTION VIEW)

LOG DROP DETAIL
SCALE: NTS



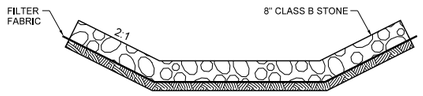
PLAN VIEW



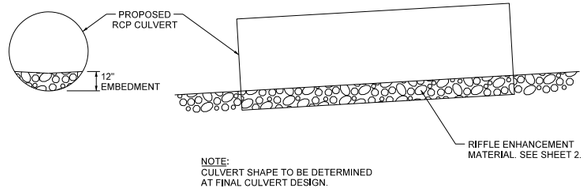
SECTION A-A' (PROFILE VIEW)

NOTE:
EXACT SIZE AND LOCATIONS OF WQT's TO BE DETERMINED BY DESIGN REPRESENTATIVE IN FIELD.

WATER QUALITY TREATMENT AREA (WQT)
SCALE: NTS

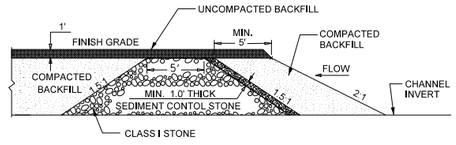


STABILIZED DRAINAGE OUTFALL
SCALE: NTS



NOTE:
CULVERT SHAPE TO BE DETERMINED AT FINAL CULVERT DESIGN.

EMBEDDED CULVERT
SCALE: NTS



CHANNEL BLOCK
SCALE: NTS

A	PRELIMINARY DESIGN - SUBMITTED WITH MITIGATION PLAN		MAY 2012
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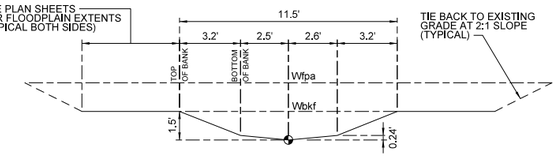
CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

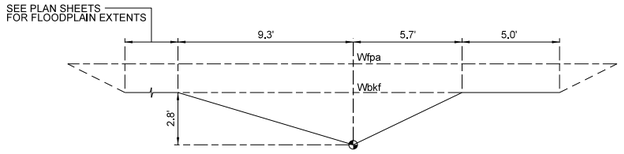
DATE: JUNE 2012
SCALE: N.T.S.

DETAILS: STABILIZATION

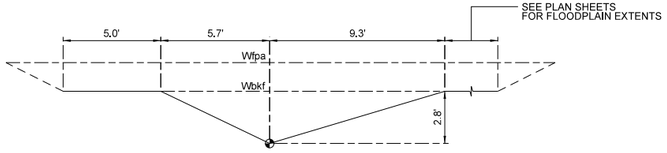
REACH T1-1
STATION 10+00 TO 13+03 = RESTORATION
REACH T1-2
STATION 13+03 TO 14+61 = ENHANCEMENT II
"C4" STREAM TYPE



TYPICAL RIFFLE
= THALWEG LOCATION

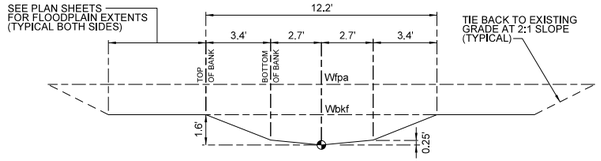


TYPICAL POOL - RIGHT MEANDER
= THALWEG LOCATION

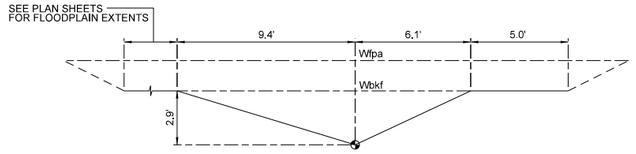


TYPICAL POOL - LEFT MEANDER
= THALWEG LOCATION

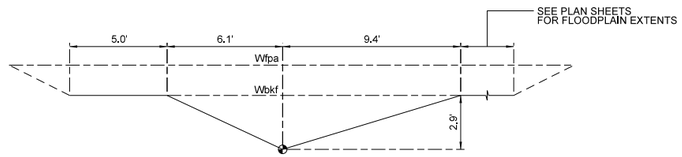
REACH T1-3
STATION 14+61 TO 24+12 = RESTORATION
"C4" STREAM TYPE



TYPICAL RIFFLE
= THALWEG LOCATION

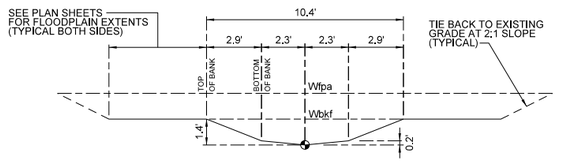


TYPICAL POOL - RIGHT MEANDER
= THALWEG LOCATION

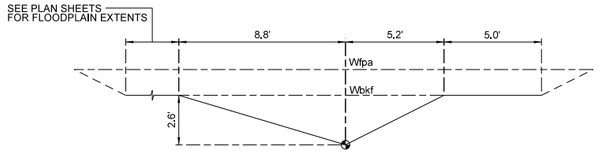


TYPICAL POOL - LEFT MEANDER
= THALWEG LOCATION

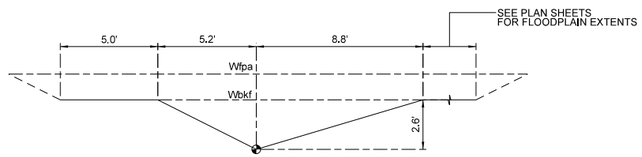
REACH T2-1
STATION 50+00 TO 66+32 = RESTORATION
"C4" STREAM TYPE



TYPICAL RIFFLE
= THALWEG LOCATION

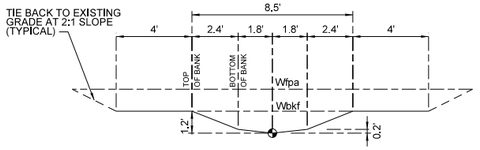


TYPICAL POOL - RIGHT MEANDER
= THALWEG LOCATION

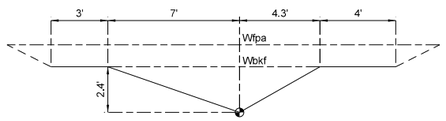


TYPICAL POOL - LEFT MEANDER
= THALWEG LOCATION

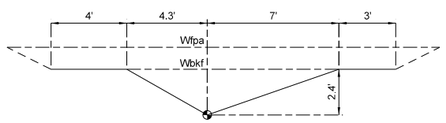
REACH T1A
STATION 40+00 TO 41+78 = RESTORATION
"B4c / C4" STREAM TYPE



TYPICAL RIFFLE
= THALWEG LOCATION

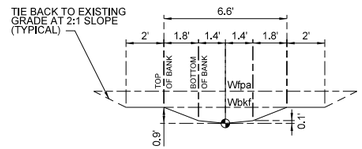


TYPICAL POOL - RIGHT MEANDER
= THALWEG LOCATION

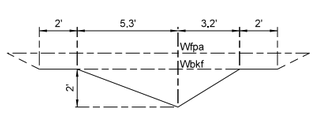


TYPICAL POOL - LEFT MEANDER
= THALWEG LOCATION

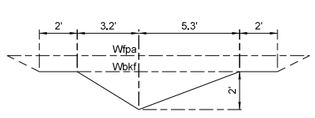
REACH T2A
STATION 100+00 TO 104+65 = ENHANCEMENT I
"B4c / C4" STREAM TYPE



TYPICAL RIFFLE
= THALWEG LOCATION

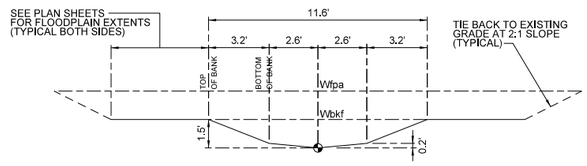


TYPICAL POOL - RIGHT MEANDER
= THALWEG LOCATION

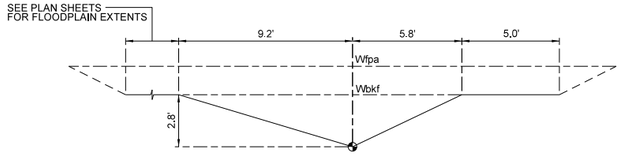


TYPICAL POOL - LEFT MEANDER
= THALWEG LOCATION

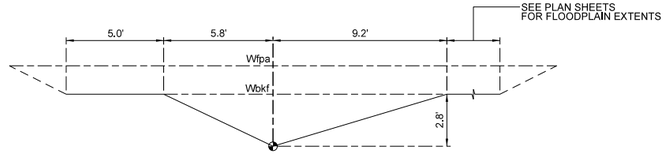
REACH T2-2
STATION 66+32 TO 77+45 = RESTORATION
"C4" STREAM TYPE



TYPICAL RIFFLE
= THALWEG LOCATION



TYPICAL POOL - RIGHT MEANDER
= THALWEG LOCATION



TYPICAL POOL - LEFT MEANDER
= THALWEG LOCATION

A	PRELIMINARY DESIGN - SUBMITTED WITH MITIGATION PLAN				MAY 2012	
B	SUBMITTED FOR LAND QUALITY PERMIT				JUNE 2012	
C	EDITS PER IRT COMMENTS				SEPT 2012	
SYM.	DESCRIPTION				DATE	APPROVED

REVISIONS

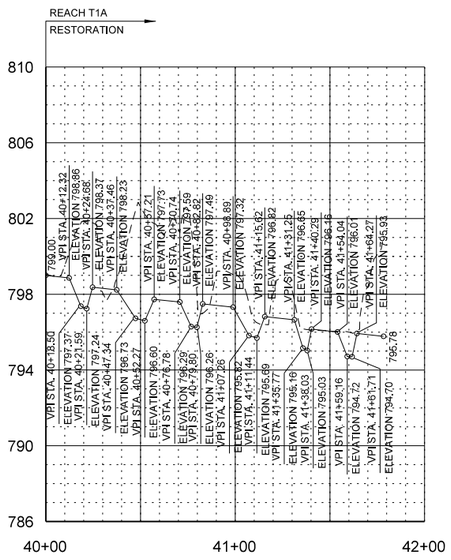
Ecosystem Enhancement Program

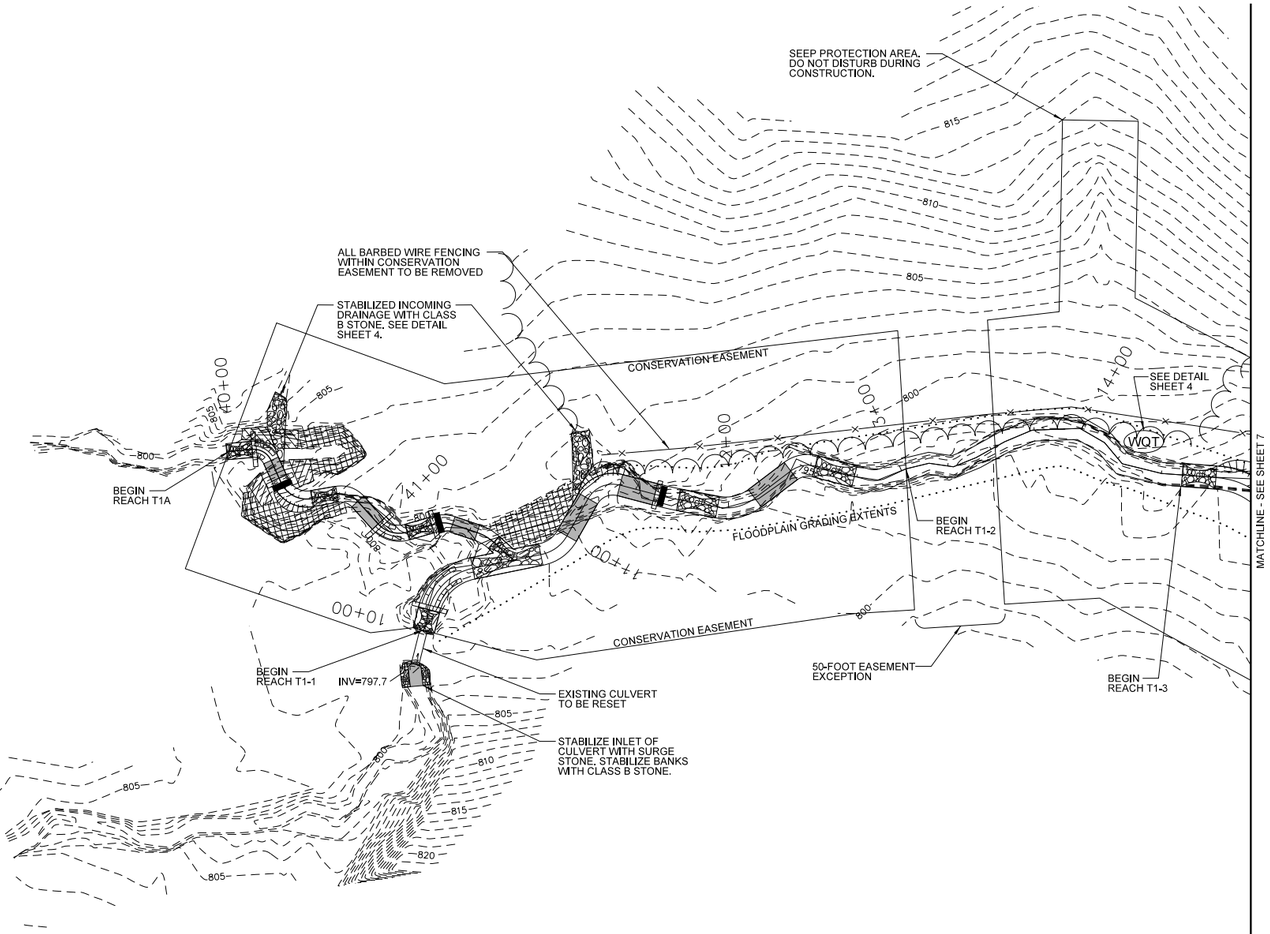
KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SW FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

JACOB'S LANDING
STREAM MITIGATION PROJECT
CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

DATE: JUNE 2012
SCALE: SEE SHEET

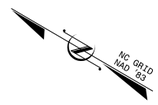
TYPICAL CROSS SECTIONS

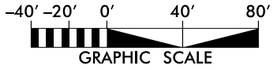


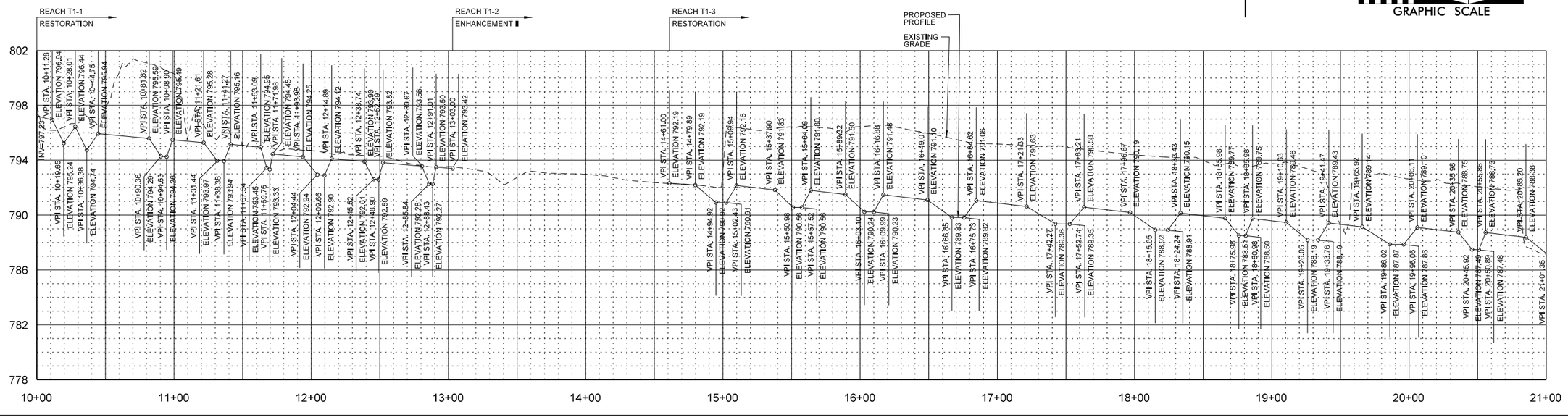


NOTE:

GRADING MAY NEED TO BE ALTERED IN CERTAIN AREAS TO AVOID TREES; AS DETERMINED BY DESIGN REPRESENTATIVE IN FIELD.







A	PRELIMINARY DESIGN - SUBMITTED WITH MITIGATION PLAN	MAY 2012	
B	SUBMITTED FOR LAND QUALITY PERMIT	JUNE 2012	
C	EDITS PER IRT COMMENTS	SEPT 2012	
SYM.	DESCRIPTION	DATE	APPROVED

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JACOB'S LANDING STREAM MITIGATION PROJECT

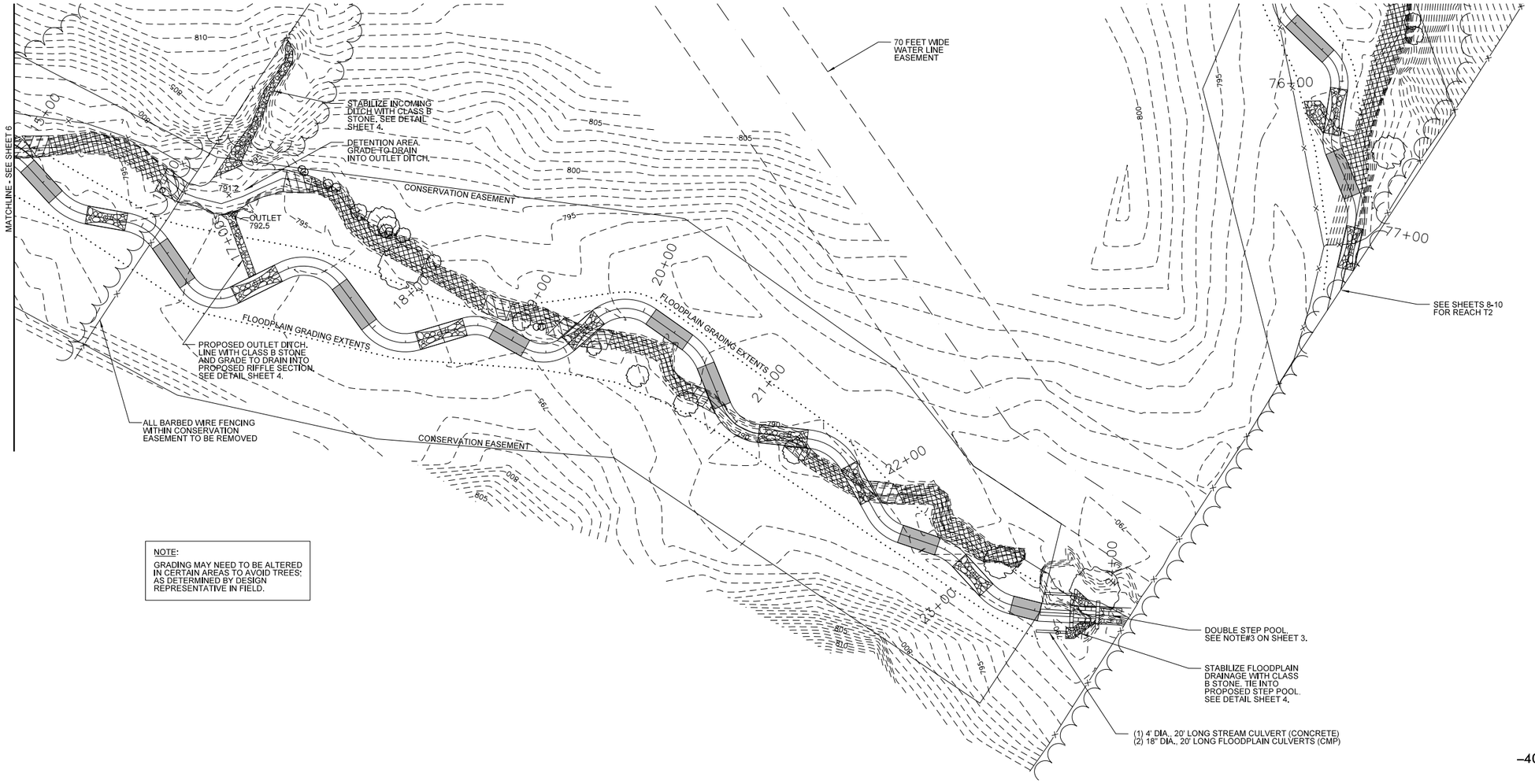
CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

REACHES T1A, T1-1, T1-2, AND T1-3

DATE: JUNE 2012

SCALE: 1"=40'

SITE PLAN & PROFILE



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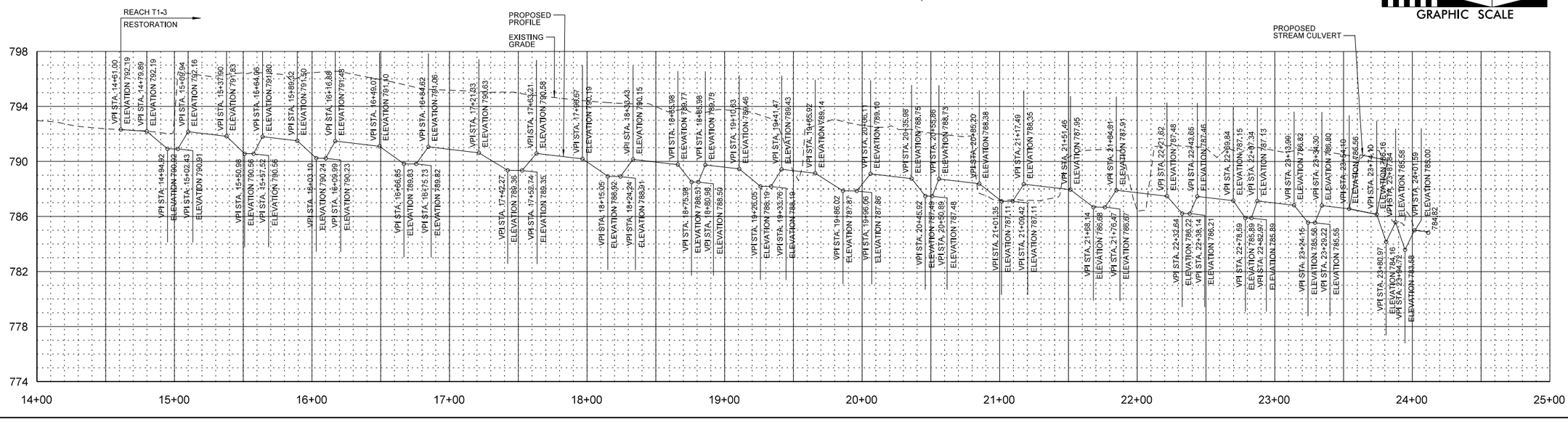

	DESCRIPTION	DATE
A	PRELIMINARY DESIGN - SUBMITTED WITH MITIGATION PLAN	MAY 2012
B	SUBMITTED FOR LAND QUALITY PERMIT	JUNE 2012
C	EDITS PER IRT COMMENTS	SEPT 2012
SYM.	REVISIONS	APPROVED

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JACOB'S LANDING STREAM MITIGATION PROJECT

CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

REACH T1-3

DATE: JUNE 2012
SCALE: 1"=40'

SITE PLAN & PROFILE

SHEET 7 OF 22

NOTE:
GRADING MAY NEED TO BE ALTERED IN CERTAIN AREAS TO AVOID TREES; AS DETERMINED BY DESIGN REPRESENTATIVE IN FIELD.

CONSERVATION EASEMENT

SEE DETAIL SHEET 4

WQT

BEGIN REACH T2-1

FLOODPLAIN GRADING EXTENTS

STABILIZED INCOMING DRAINAGE WITH CLASS B STONE TO DRAIN INTO PROPOSED RIFFLE SECTION. STABILIZE WITH COIR MATTING AND LIVE STAKES.

SEE DETAIL SHEET 4.

CONSERVATION EASEMENT

STABILIZED INCOMING DRAINAGE WITH CLASS B STONE TO DRAIN INTO PROPOSED RIFFLE SECTION. STABILIZE WITH COIR MATTING AND LIVE STAKES.

ALL BARBED WIRE FENCING WITHIN CONSERVATION EASEMENT TO BE REMOVED

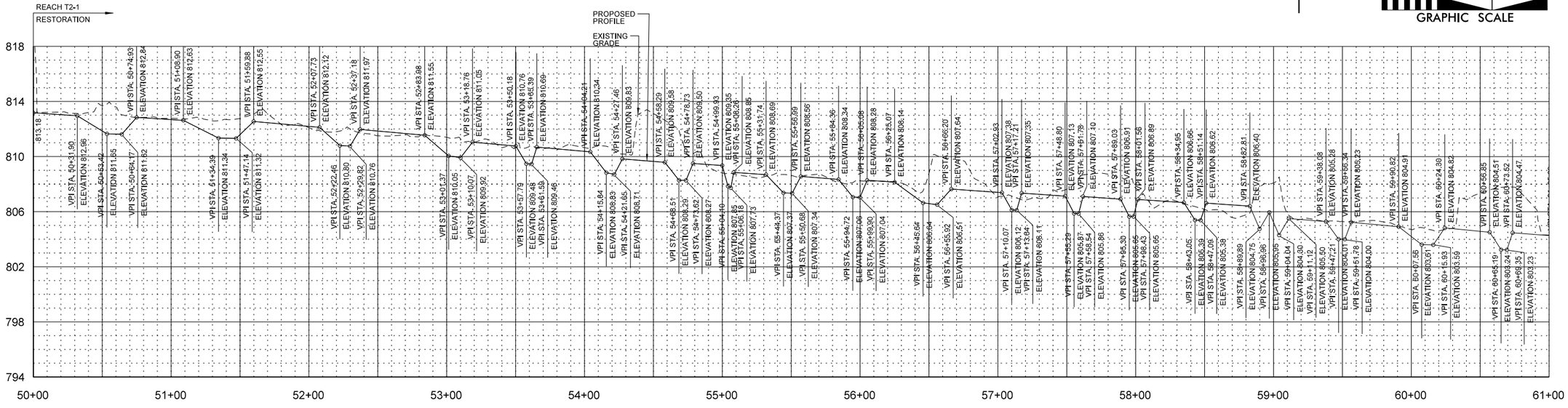
GRADE LINES SHOWN TO ILLUSTRATE SLOPE GRADING EXTENTS/SCALE. EXACT TIE OUTS DETERMINED BY CROSS SECTION TIE OUTS.

SEE DETAIL SHEET 4

MATCHLINE - SEE SHEET 9

NC GRID MAG 163

–40′ –20′ 0′ 40′ 80′
GRAPHIC SCALE



A	PRELIMINARY DESIGN - SUBMITTED WITH MITIGATION PLAN	MAY 2012
B	SUBMITTED FOR LAND QUALITY PERMIT	JUNE 2012
C	EDITS PER IRT COMMENTS	SEPT 2012
SYM.	DESCRIPTION	DATE

REVISIONS

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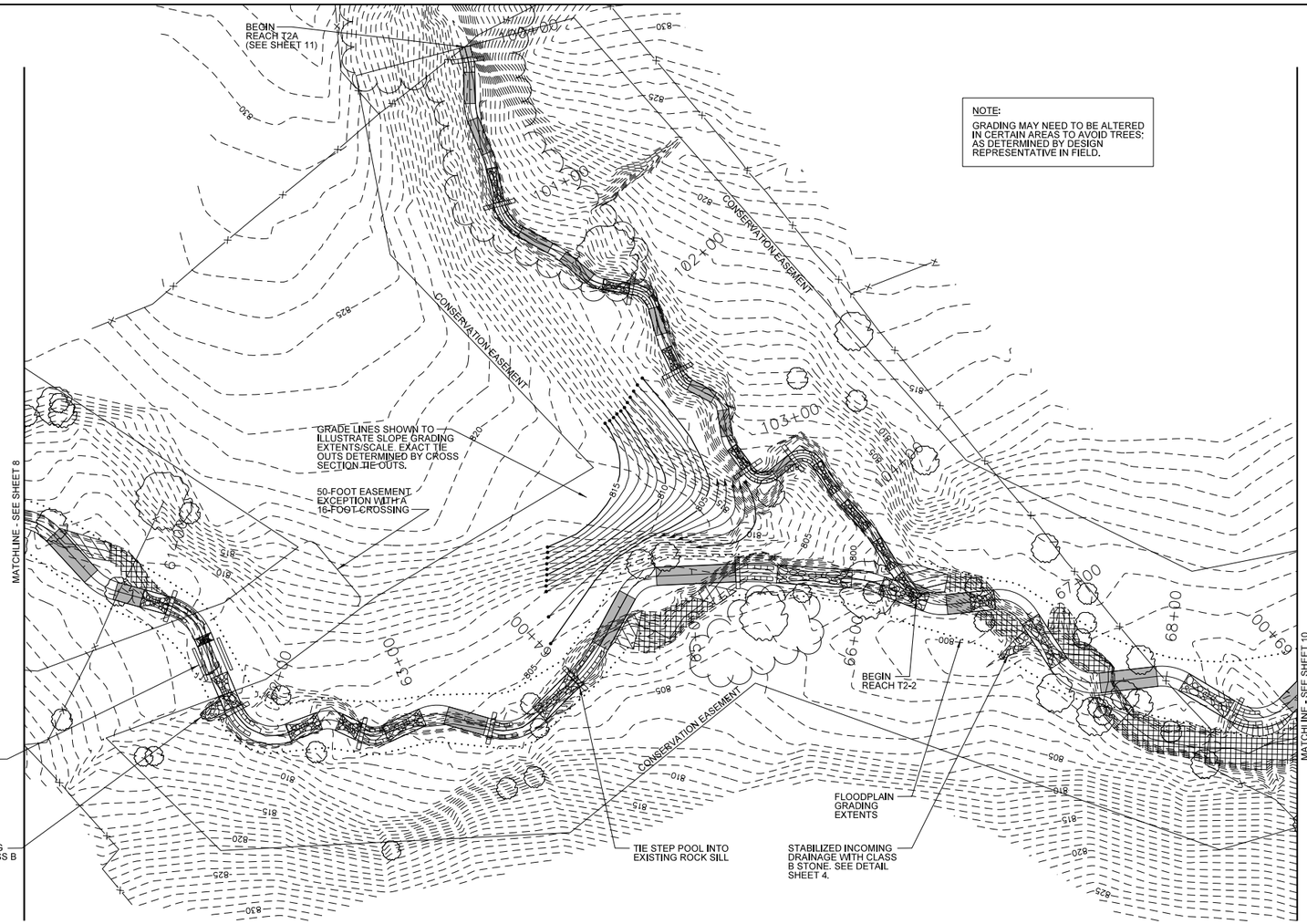
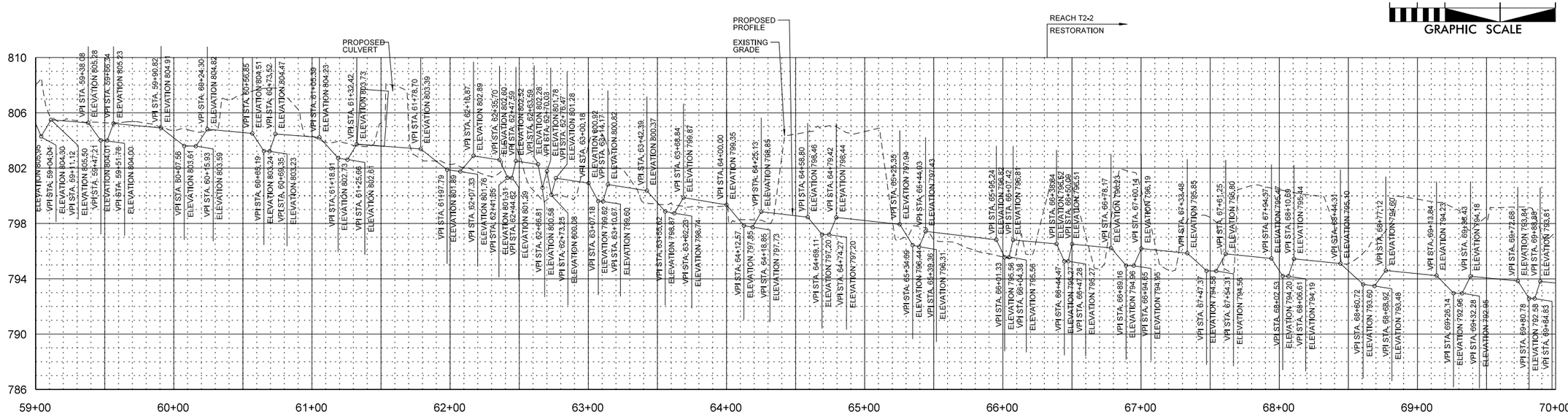
JACOB'S LANDING
STREAM MITIGATION PROJECT
CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA
REACH T2-1

DATE: JUNE 2012
SCALE: 1"=40'

SITE PLAN & PROFILE





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B	SUBMITTED FOR LAND QUALITY PERMIT	JUNE 2012
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SYM.	REVISIONS	APPROVED

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JACOB'S LANDING STREAM MITIGATION PROJECT

CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

REACHES T2-1, T2-2 AND T2A

DATE: JUNE 2012
SCALE: 1"=40'

SITE PLAN & PROFILE

NOTE:
GRADING MAY NEED TO BE ALTERED IN CERTAIN AREAS TO AVOID TREES: AS DETERMINED BY DESIGN REPRESENTATIVE IN FIELD.

50-FOOT EASEMENT EXCEPTION WITH A 16-FOOT CROSSING

CONSERVATION EASEMENT

FLOODPLAIN GRADING EXTENTS

MATCHLINE - SEE SHEET 9

SEE DETAIL SHEET 4

WQT

(1) 4' DIA., 20' LONG STREAM CULVERT (CONCRETE)
(2) 18" DIA., 20' LONG FLOODPLAIN CULVERTS (CMP)

ALL BARBED WIRE FENCING WITHIN CONSERVATION EASEMENT TO BE REMOVED

STABILIZED INCOMING DRAINAGE WITH CLASS B STONE. SEE DETAIL SHEET 4.

SEE SHEETS 6&7 FOR REACH T1

NC GRID NAD 83

–40′ –20′ 0′ 40′ 80′
GRAPHIC SCALE

PROPOSED PROFILE
EXISTING GRADE
PROPOSED STREAM CULVERT

802
798
794
790
786
782
778

67+00 68+00 69+00 70+00 71+00 72+00 73+00 74+00 75+00 76+00 77+00 78+00

A	PRELIMINARY DESIGN - SUBMITTED WITH MITIGATION PLAN	MAY 2012
B	SUBMITTED FOR LAND QUALITY PERMIT	JUNE 2012
C	EDITS PER IRT COMMENTS	SEPT 2012
SYM.	DESCRIPTION	DATE

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JACOB'S LANDING STREAM MITIGATION PROJECT

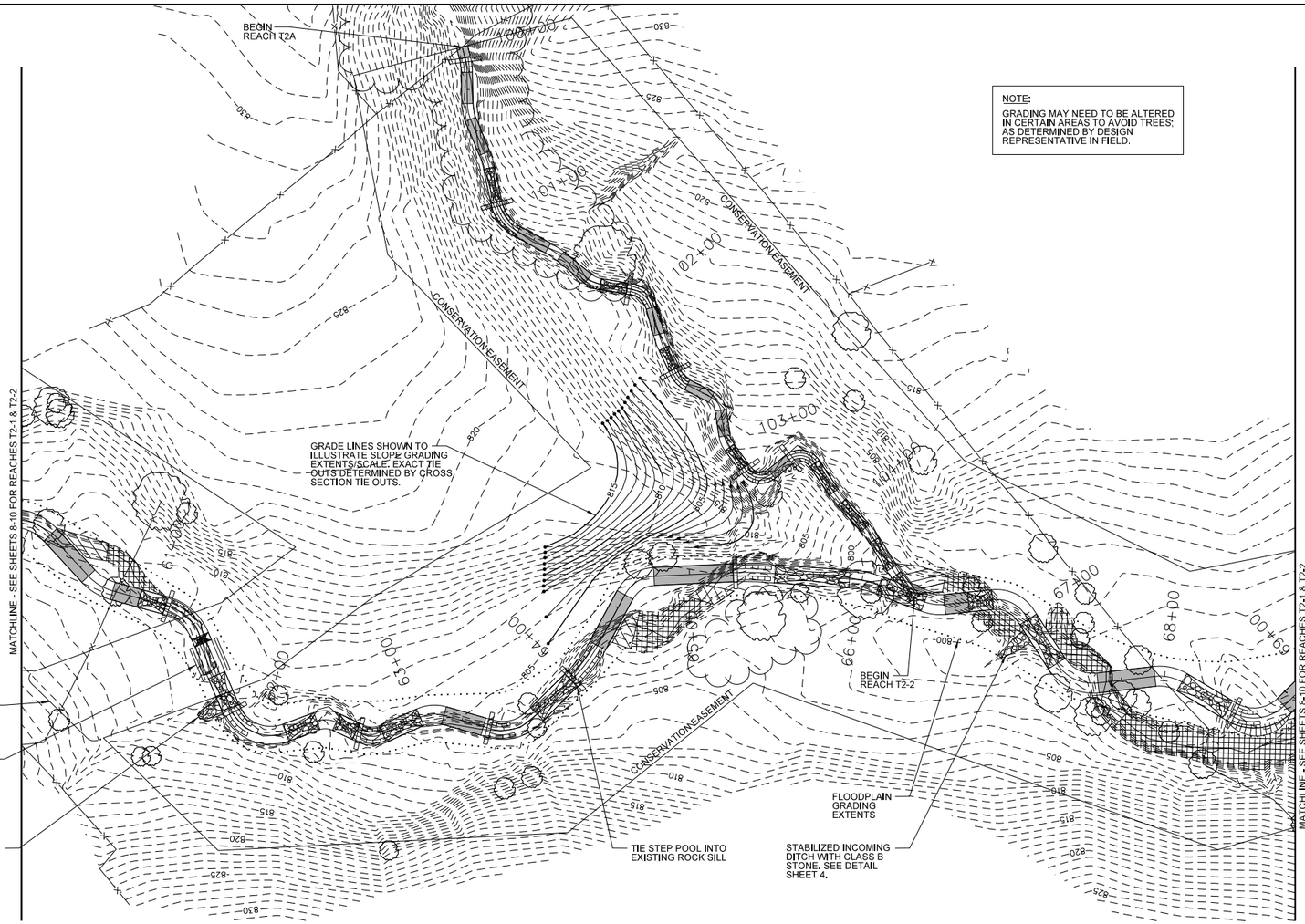
CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

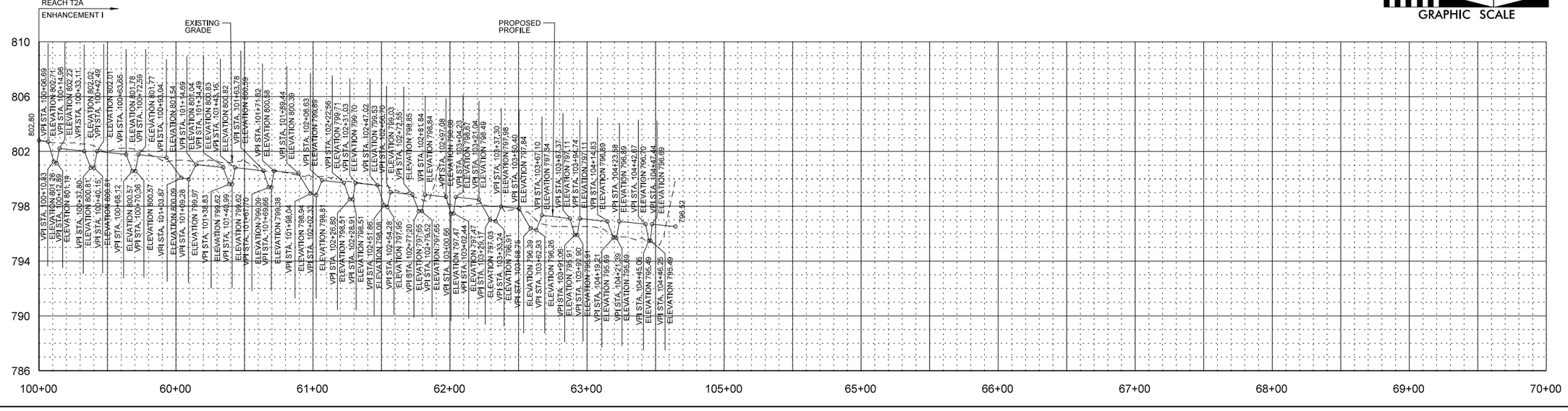
REACH T2-2

DATE: JUNE 2012
SCALE: 1"=40'

SITE PLAN & PROFILE

SHEET 10 OF 22





A	PRELIMINARY DESIGN - SUBMITTED WITH MITIGATION PLAN	MAY 2012
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SYM.	DESCRIPTION	DATE

REVISIONS

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JACOB'S LANDING STREAM MITIGATION PROJECT

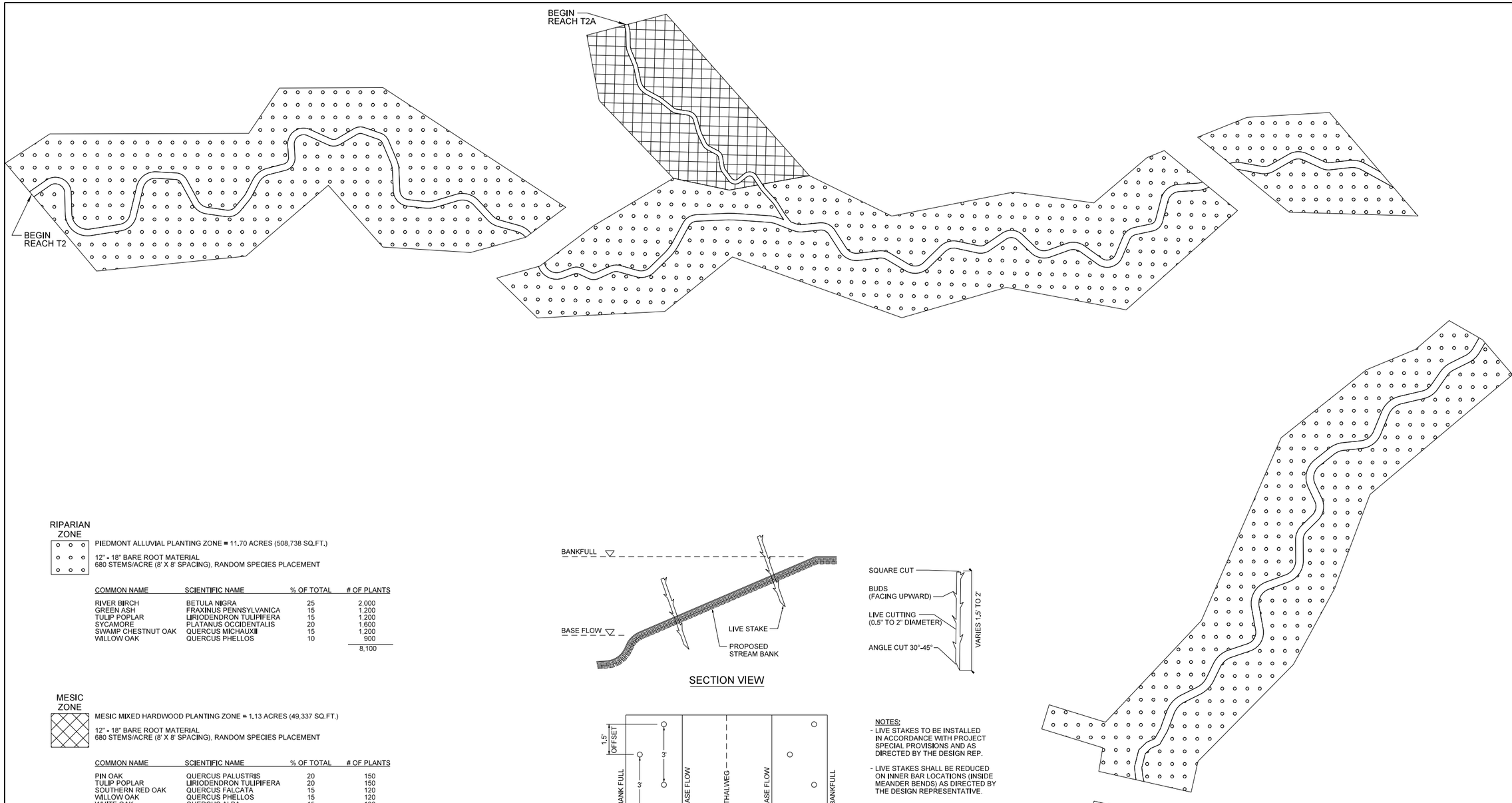
CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

REACH T2A

DATE: JUNE 2012
SCALE: 1"=40'

SITE PLAN & PROFILE

SHEET 11 OF 22



RIPARIAN ZONE

PIEDMONT ALLUVIAL PLANTING ZONE = 11.70 ACRES (508,738 SQ.FT.)

12" - 18" BARE ROOT MATERIAL
680 STEMS/ACRE (8' X 8' SPACING), RANDOM SPECIES PLACEMENT

COMMON NAME	SCIENTIFIC NAME	% OF TOTAL	# OF PLANTS
RIVER BIRCH	BETULA NIGRA	25	2,000
GREEN ASH	FRAXINUS PENNSYLVANICA	15	1,200
TULIP POPLAR	LIRIODENDRON TULIPIFERA	15	1,200
SYCAMORE	PLATANUS OCCIDENTALIS	20	1,600
SWAMP CHESTNUT OAK	QUERCUS MICHAUXII	15	1,200
WILLOW OAK	QUERCUS PHELLOS	10	900
			8,100

MESIC ZONE

MESIC MIXED HARDWOOD PLANTING ZONE = 1.13 ACRES (49,337 SQ.FT.)

12" - 18" BARE ROOT MATERIAL
680 STEMS/ACRE (8' X 8' SPACING), RANDOM SPECIES PLACEMENT

COMMON NAME	SCIENTIFIC NAME	% OF TOTAL	# OF PLANTS
PIN OAK	QUERCUS PALUSTRIS	20	150
TULIP POPLAR	LIRIODENDRON TULIPIFERA	20	150
SOUTHERN RED OAK	QUERCUS FALCATA	15	120
WILLOW OAK	QUERCUS PHELLOS	15	120
WHITE OAK	QUERCUS ALBA	15	120
PERSIMMON	DIOSPYROS VIRGINIANA	15	120
			780

STREAM ZONE

STREAM ZONE
LIVE STAKES: 1.5' TO 2' LENGTHS, 1/2' TO 2" DIAMETER,
2 ROWS AT 3' CENTER SPACING (SEE DETAIL), RANDOM SPECIES PLACEMENT

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

NOTE: AT LEAST THREE OF THE LISTED SPECIES MUST BE INSTALLED AND NO SINGLE LIVE STAKING SPECIES SHALL COMPOSE MORE THAN 40% OF THE TOTAL NUMBER OF LIVE STAKES TO BE INSTALLED.

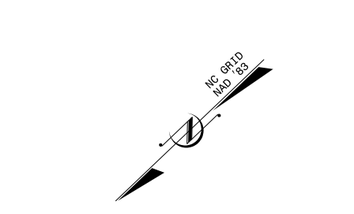
SECTION VIEW

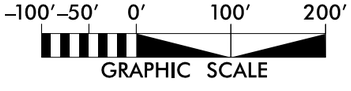
PLAN VIEW

NOTES:
- LIVE STAKES TO BE INSTALLED IN ACCORDANCE WITH PROJECT SPECIAL PROVISIONS AND AS DIRECTED BY THE DESIGN REP.
- LIVE STAKES SHALL BE REDUCED ON INNER BAR LOCATIONS (INSIDE MEANDER BENDS) AS DIRECTED BY THE DESIGN REPRESENTATIVE.

LIVE STAKES DETAIL

SCALE: NTS





REVISIONS

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RALEIGH, NORTH CAROLINA 27609

JACOB'S LANDING STREAM MITIGATION PROJECT

CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

DATE: JUNE 2012
SCALE: 1"=80'

PLANTING PLAN

LEGEND:

STABILIZED CONSTRUCTION ENTRANCE ..... SCE

LIMITS OF DISTURBANCE ..... LOD

SILT FENCE ..... SF

STRAW WADDLE .....

ROCK SILT SCREEN .....

TEMPORARY STREAM CROSSING .....

SILT FENCE ROCK OUTLET .....

TEMPORARY STOCKPILE .....

SLOPE STABILIZATION .....

PROPOSED STREAM THALWEG W / APPROX. BANKFULL LIMITS ..... 12+00 13+00

EXISTING STREAM THALWEG .....

LIMITS OF DISTURBANCE = 22.4 AC

SHEET 18

SHEETS 14

SHEET 17

SHEET 15

SHEET 16

BEGIN REACH T1A

BEGIN REACH T1

BEGIN REACH T2

BEGIN REACH T2A

N/F
MARTHA MYERS DEAL
REVOCABLE TRUST
PARCEL ID# 234 023
DB 915 PG 687 (PAR. 2)

N/F
OSCHO ROY DEAL
REVOCABLE TRUST
PARCEL ID# 234 024
DB 875 PG 742 (PAR. 1)

N/F
WILLIAM CORRIHER
PARCEL ID# 234 025
DB 1117 PG 976

N/F
JACQUELYN FULCHER
PARCEL ID# 234 044
DB 1036 PG 76

N/F
ERIC LEONARD DEAL
PARCEL ID# 234 062
DB 875 PG 743
DB 234 PG 62

N/F
ERIC LEONARD DEAL
PARCEL ID# 234 099
DB 1098 PG 954

N/F
OSCHO ROY DEAL
PARCEL ID# 234 025
DB 1122 PG 670
DB 756 PG 923

N/F
CITY OF KANNAPOLIS
PARCEL ID# 236 025
DB 1022 PG 574

N/F
PINEWOOD HOMES INC TR.
PARCEL ID# 236 086
DB 873 PG 976

N/F
F&L HOLDINGS LLC
PARCEL ID# 236001010
PARCEL ID# 236 004
DB 1070 PG 976

70' RIGHT OF WAY
CANNON MILLS CO.

DIRT ACCESS DRIVE

SCE

SAW ROAD - S.R. 1350

NAD 1983

–150′ –75′ 0′ 150′ 300′

GRAPHIC SCALE

A	PRELIMINARY DESIGN - SUBMITTED WITH MITIGATION PLAN	MAY 2012		
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SYM.	DESCRIPTION	DATE	APPROVED	

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JACOB'S LANDING STREAM MITIGATION PROJECT

CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

DATE: JUNE 2012

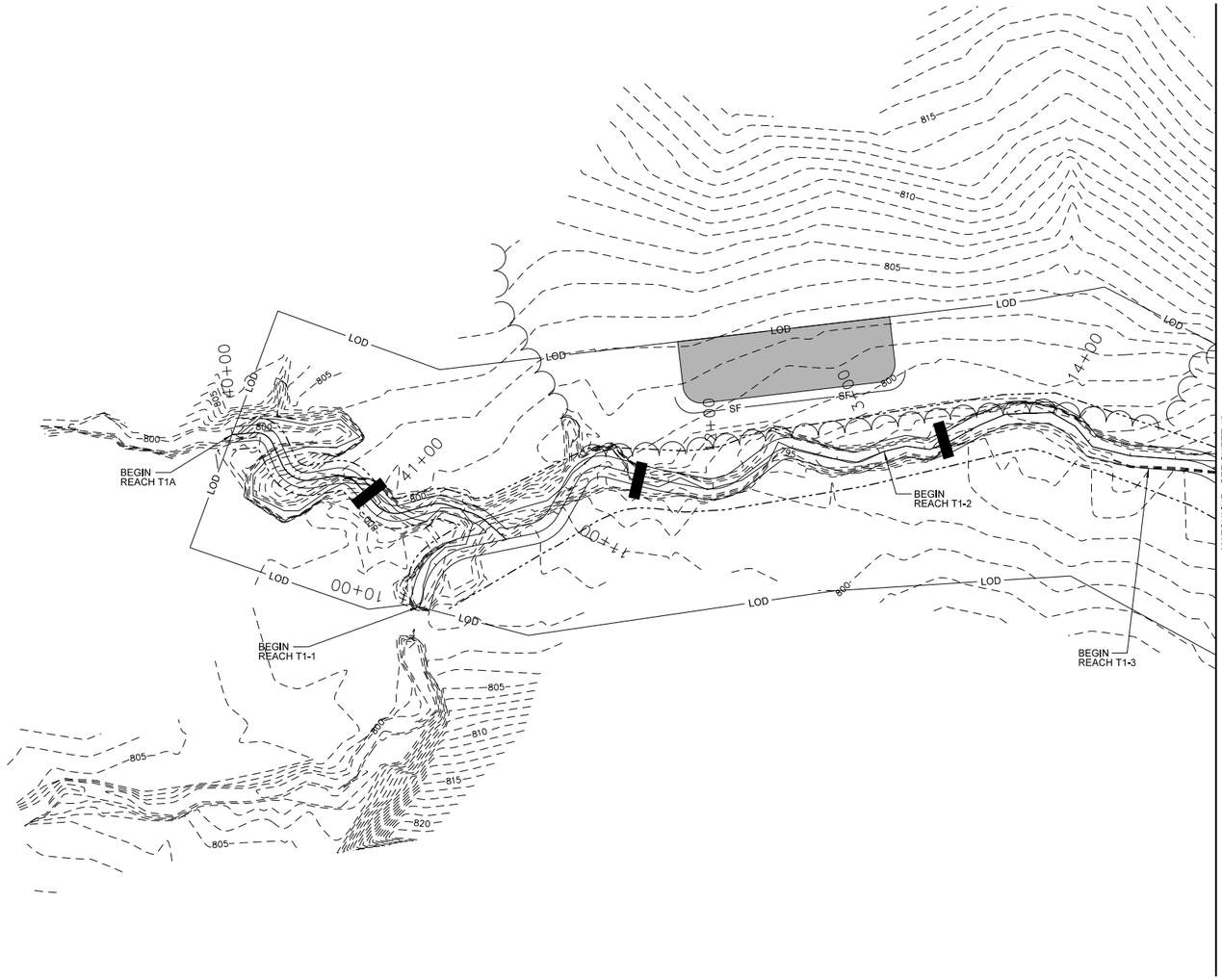
SCALE: 1"=150'

SEDIMENTATION AND EROSION CONTROL PLAN

SHEET 13 OF 22

LEGEND:

- STABILIZED CONSTRUCTION ENTRANCE ..... SCE
- LIMITS OF DISTURBANCE ..... LOD
- SILT FENCE ..... SF
- STRAW WADDLE .....
- ROCK SILT SCREEN .....
- TEMPORARY STREAM CROSSING .....
- SILT FENCE ROCK OUTLET .....
- TEMPORARY STOCKPILE .....
- SLOPE STABILIZATION .....
- PROPOSED STREAM THALWEG W / APPROX. BANKFULL LIMITS ..... 12+00, 13+00
- EXISTING STREAM THALWEG .....



NOTE:
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NC GRID NAD 83

–40′ –20′ 0′ 40′ 80′
GRAPHIC SCALE

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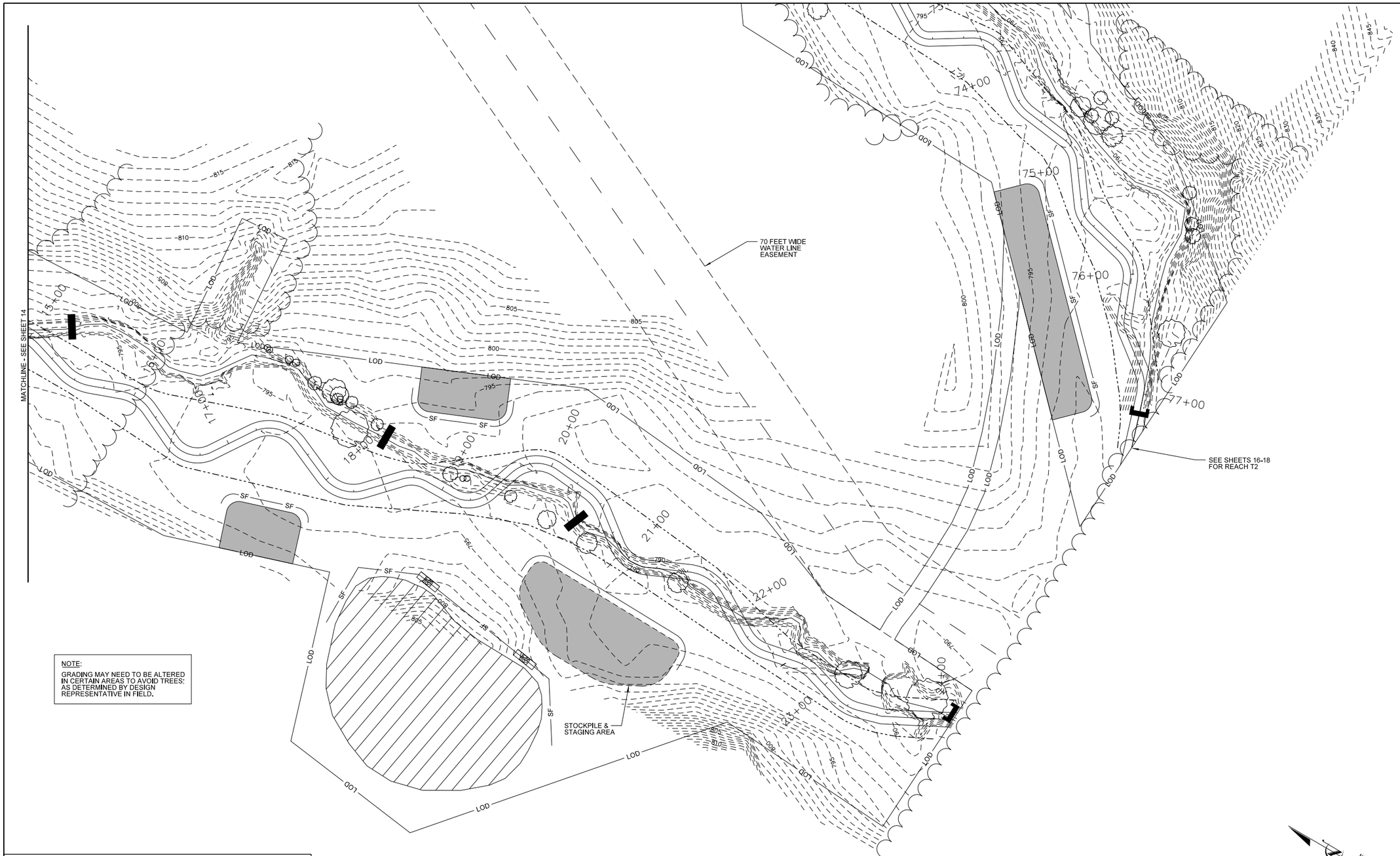
CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

REACHES T1A, T1-1, T1-2, AND T1-3

DATE: JUNE 2012
SCALE: 1"=40'

SEDIMENTATION AND EROSION CONTROL PLAN

SHEET 14 OF 22



SYM.	DESCRIPTION	DATE	APPROVED
A	PRELIMINARY DESIGN - SUBMITTED WITH MITIGATION PLAN	MAY 2012	
B	SUBMITTED FOR LAND QUALITY PERMIT	JUNE 2012	
C	EDITS PER IRT COMMENTS	SEPT 2012	

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RALEIGH, NORTH CAROLINA 27609

JACOB'S LANDING STREAM MITIGATION PROJECT

CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

REACH T1-3

DATE: JUNE 2012

SCALE: 1"=40'

SEDIMENTATION AND EROSION CONTROL PLAN

LEGEND:

- STABILIZED CONSTRUCTION ENTRANCE ..... SCE
- LIMITS OF DISTURBANCE ..... LOD
- SILT FENCE ..... SF
- STRAW WADDLE .....
- ROCK SILT SCREEN .....
- TEMPORARY STREAM CROSSING .....
- SILT FENCE ROCK OUTLET .....
- TEMPORARY STOCKPILE .....
- SLOPE STABILIZATION .....
- PROPOSED STREAM THALWEG W / APPROX. BANKFULL LIMITS ..... 12+00 13+00
- EXISTING STREAM THALWEG .....

NOTE:
GRADING MAY NEED TO BE ALTERED IN CERTAIN AREAS TO AVOID TREES; AS DETERMINED BY DESIGN REPRESENTATIVE IN FIELD.

NC GRID MAD 83

–40′ –20′ 0′ 40′ 80′
GRAPHIC SCALE

SYM.	DESCRIPTION	DATE	APPROVED
A	PRELIMINARY DESIGN - SUBMITTED WITH MITIGATION PLAN	MAY 2012	
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JACOB'S LANDING STREAM MITIGATION PROJECT

CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

REACH T2-1

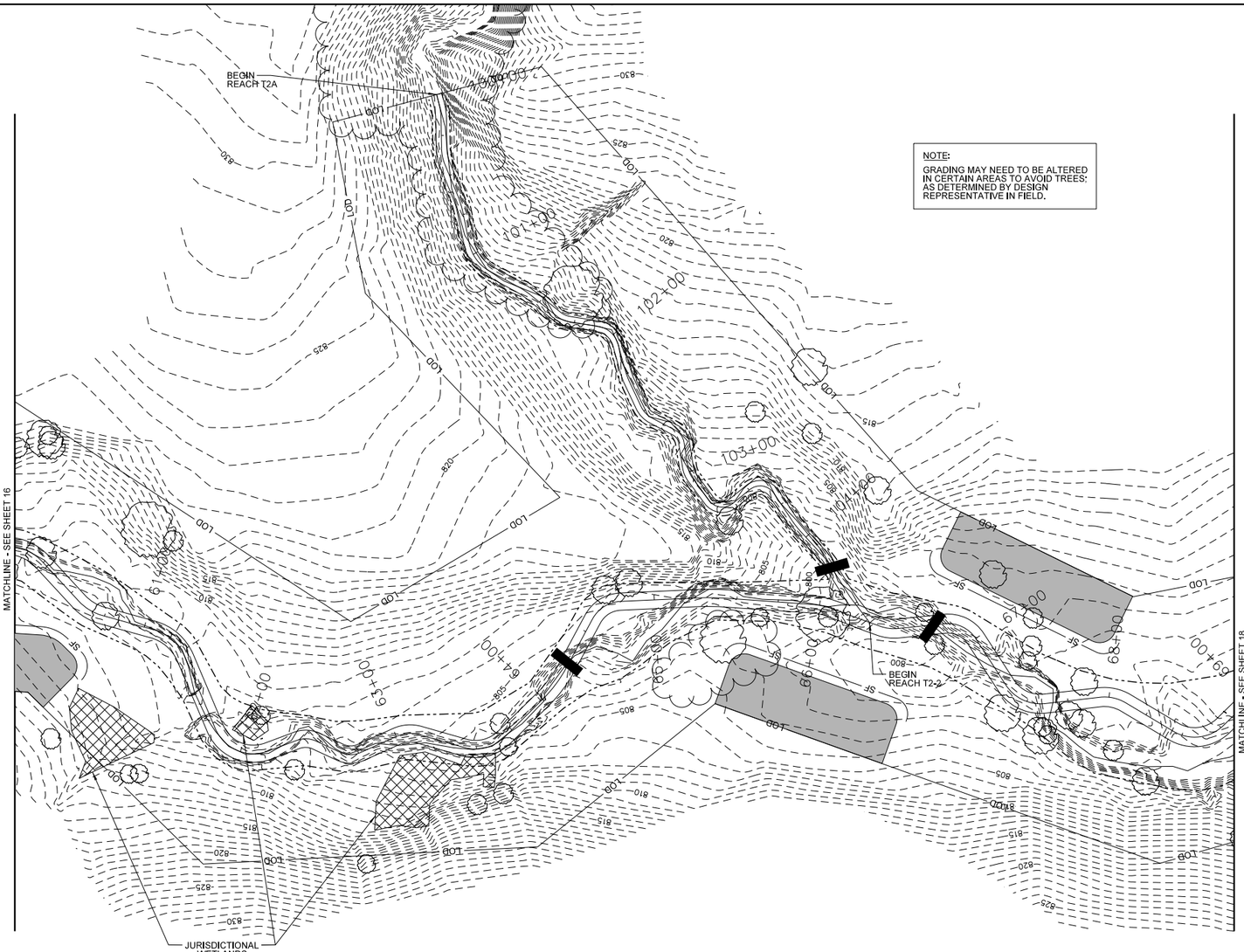
DATE: JUNE 2012
SCALE: 1"=40'

SEDIMENTATION AND EROSION CONTROL PLAN

SHEET 16 OF 22

LEGEND:

- STABILIZED CONSTRUCTION ENTRANCE ..... SCE
- LIMITS OF DISTURBANCE ..... LOD
- SILT FENCE ..... SF
- STRAW WADDLE .....
- ROCK SILT SCREEN .....
- TEMPORARY STREAM CROSSING .....
- SILT FENCE ROCK OUTLET .....
- TEMPORARY STOCKPILE .....
- SLOPE STABILIZATION .....
- PROPOSED STREAM THALWEG W / APPROX. BANKFULL LIMITS ..... 0+00 1+00
- EXISTING STREAM THALWEG .....



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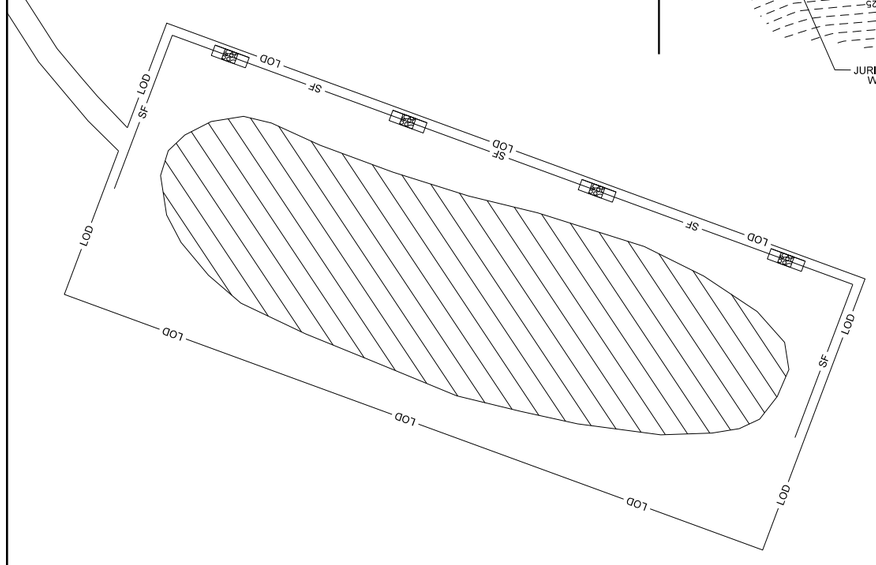

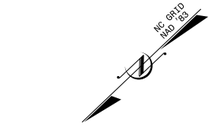

–40′ –20′ 0′ 40′ 80′
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JACOB'S LANDING
STREAM MITIGATION PROJECT
CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

DATE: JUNE 2012
SCALE:

SHEET OF 22

LEGEND:

- STABILIZED CONSTRUCTION ENTRANCE ..... SCE
- LIMITS OF DISTURBANCE ..... LOD
- SILT FENCE ..... SF
- STRAW WADDLE .....
- ROCK SILT SCREEN .....
- TEMPORARY STREAM CROSSING .....
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- TEMPORARY STOCKPILE .....
- SLOPE STABILIZATION .....
- PROPOSED STREAM THALWEG W / APPROX. BANKFULL LIMITS ..... 12+00 13+00
- EXISTING STREAM THALWEG .....

NOTE:
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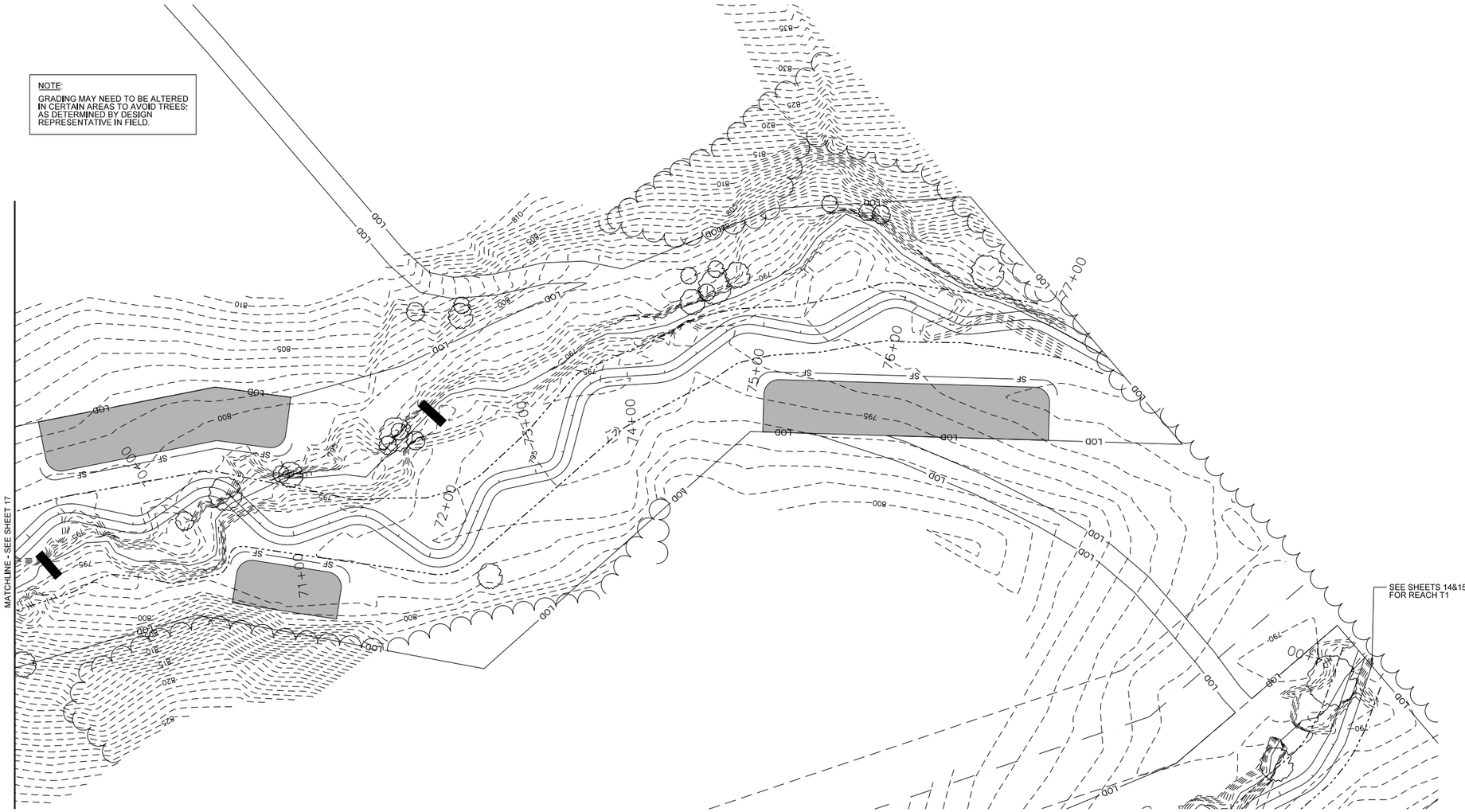

NC GRID NAD 83

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GRAPHIC SCALE

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JACOB'S LANDING STREAM MITIGATION PROJECT

CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

REACH T2-2

DATE: JUNE 2012
SCALE: 1"=40'

SEDIMENTATION AND EROSION CONTROL PLAN

SEEDBED PREPARATION

THE SEEDBED SHALL BE COMPRISED OF LOOSE UNCOMPACTED SOIL. THIS MAY REQUIRE MECHANICAL LOOSENING OF THE SOIL. SOIL AMENDMENTS SHOULD FOLLOW THE FERTILIZER AND LIMING DESCRIPTION IN THE FOLLOWING SECTIONS. FOLLOWING SEEDING, MULCHING SHALL FOLLOW THE BELOW APPLICATION METHODS AND AMOUNTS.

MULCHING

SEEDED AREAS ARE TO BE PROTECTED BY SPREADING STRAW MULCH UNIFORMLY TO FORM A CONTINUOUS BLANKET (75% COVERAGE = 2 TONS/ACRE) OVER SEEDED AREAS. CONTRACTOR MAY PROPOSE ALTERNATE METHODS OF SEED, FERTILIZER AND LIMING (HYDRO-SEEDING) UPON SUBMISSION TO THE DESIGNER OF CALCULATIONS SHOWING THE EQUIVALENCY OF THE PROPOSED METHOD.

TEMPORARY SEED MIX

THE CONTRACTOR SHALL UTILIZE THE FOLLOWING SEED/FERTILIZER MIX IN SEEDING ALL DISTURBED AREAS WITHIN THE PROJECT LIMITS:

WINTER MIX (AUG.15-MAY 1)
- RYE GRAIN · · · · · · · · SECALE CEREALE · · · · · 20 LBS / ACRE
- WHEAT · · · · · · · · · · · TRITICUM AESTIVUM · · · 10 LBS / ACRE

SUMMER MIX (MAY 1-AUG.15)
- GERMAN MILLET · · · · · SETARIA ITALICA · · · · · 5 LBS / ACRE
- BROWNTOP MILLET · · · UROCHLOA RAMOSA · · · 5 LBS / ACRE

FERTILIZER · 500 LBS / ACRE
LIMESTONE · 4000 LBS / ACRE

FERTILIZER SHALL BE 10-20-20 ANALYSIS. UPON WRITTEN APPROVAL OF THE SITE SUPERVISOR, A DIFFERENT ANALYSIS OF FERTILIZER MAY BE USED PROVIDED THE 1-2-2 RATIO IS MAINTAINED AND THE RATE OF APPLICATION ADJUSTED TO PROVIDE THE SAME AMOUNT OF PLANT FOOD AS A 10-20-20 ANALYSIS.

PERMANENT SEED MIX

THE CONTRACTOR SHALL UTILIZE THE FOLLOWING SEED MIX AND FERTILIZER SPECIFICATION IN ALL AREAS INSIDE THE RIPARIAN BUFFER ZONES, INCLUDING THE STREAM BANKS:

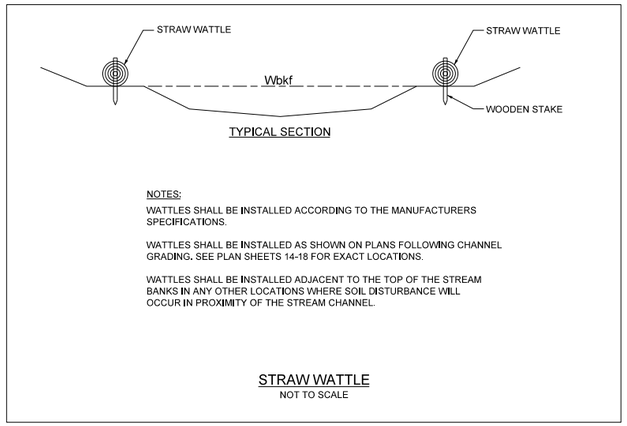
FERTILIZER AND LIMESTONE SHALL BE APPLIED AT THE RATE OF 500 LBS / ACRE AND 4000 LBS / ACRE, RESPECTIVELY. FERTILIZER SHALL BE 10-20-20 ANALYSIS, UPON WRITTEN APPROVAL OF THE DESIGN REPRESENTATIVE. A DIFFERENT ANALYSIS OF FERTILIZER MAY BE USED BASED ON SOIL TESTING RESULTS AND AS APPROVED BY THE DESIGN REPRESENTATIVE.

SUMMER MIX (MAY 15 – AUGUST 15)

SPECIES	APPLICATION RATE (IN MIX) % OF MIX	LBS / ACRE
ORCHARDGRASS – DACTYLIS GLOMERATA	5	1.5
BLUESTEM – ANDROPOGON GLOMERATUS	5	1.5
VIRGINIA WILDRYE – ELYMUS VIRGINICUS	5	1.5
RIVER OATS – CHASMANTHIUM LATIFOLIUM	5	1.5
PURPLE LOVE GRASS – ERAGROSTIS SPECTABILIS	5	1.5
DEERTONGUE – PANICUM CLANDESTINUM	25	7.5
SWITCHGRASS – PANICUM VIRGATUM	25	7.5
PEARL MILLET – PENNISETUM GLAUCOMA	25	7.5
TOTALS	100	30

WINTER MIX (AUGUST 15 – MAY 15)

SPECIES	APPLICATION RATE (IN MIX) % OF MIX	LBS / ACRE
ORCHARDGRASS – DACTYLIS GLOMERATA	5	1.5
BLUESTEM – ANDROPOGON GLOMERATUS	5	1.5
VIRGINIA WILDRYE – ELYMUS VIRGINICUS	5	1.5
RIVER OATS – CHASMANTHIUM LATIFOLIUM	5	1.5
PURPLE LOVE GRASS – ERAGROSTIS SPECTABILIS	5	1.5
DEERTONGUE – DICHANTHELIUM CLANDESTINUM	25	7.5
SWITCHGRASS – PANICUM VIRGATUM	25	7.5
RYE GRAIN – SECALE CEREALE	25	7.5
TOTALS	100	30



TYPICAL SECTION

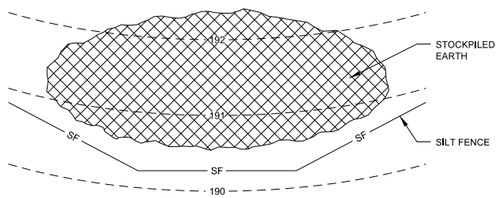
NOTES:

WATTLES SHALL BE INSTALLED ACCORDING TO THE MANUFACTURERS SPECIFICATIONS.

WATTLES SHALL BE INSTALLED AS SHOWN ON PLANS FOLLOWING CHANNEL GRADING. SEE PLAN SHEETS 14-18 FOR EXACT LOCATIONS.

WATTLES SHALL BE INSTALLED ADJACENT TO THE TOP OF THE STREAM BANKS IN ANY OTHER LOCATIONS WHERE SOIL DISTURBANCE WILL OCCUR IN PROXIMITY OF THE STREAM CHANNEL.

STRAW WATTLE
NOT TO SCALE



NOTES:

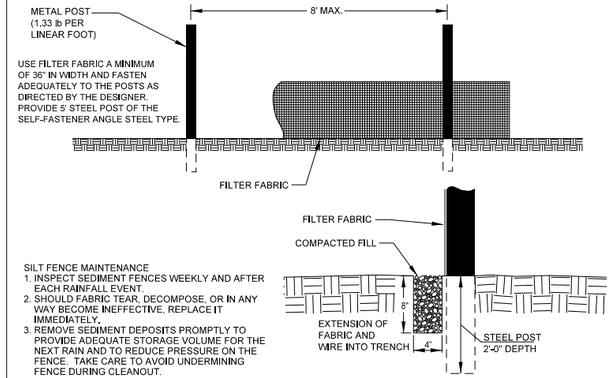
STOCKPILE LOCATIONS DEPICTED ON SITE PLANS ARE APPROXIMATE AND ARE SUBJECT TO CHANGE AT THE DISCRETION OF THE DESIGN REPRESENTATIVE.

TEMPORARY SEEDING MUST BE APPLIED TO STOCKPILES IF NOT RELOCATED WITHIN 7 DAYS.

ALL STOCKPILES SHALL BE WITHIN LIMITS OF DISTURBANCE.

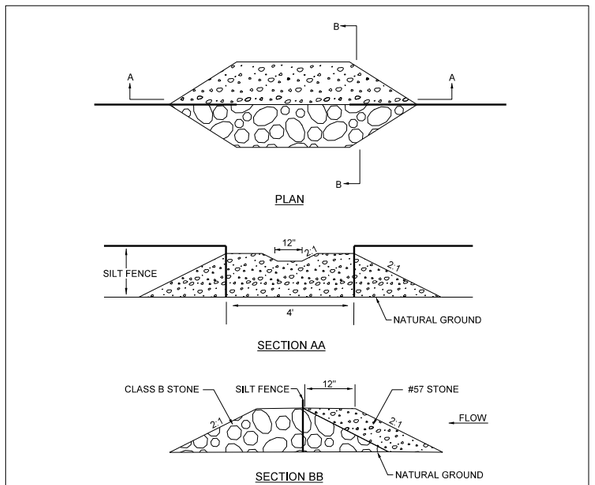
SILT FENCE SHALL BE INSTALLED DOWN GRADIENT OF ALL STOCK-PILES. ANY STOCKPILE LOCATED BETWEEN BOTH THE EXISTING AND PROPOSED STREAM CENTERLINES WILL REQUIRE SILT FENCE TO BE INSTALLED COMPLETELY AROUND THE STOCKPILE.

STOCKPILE DETAIL
NOT TO SCALE



SILT FENCE MAINTENANCE
1. INSPECT SEDIMENT FENCES WEEKLY AND AFTER EACH RAINFALL EVENT.
2. SHOULD FABRIC TEAR, DECOMPOSE, OR IN ANY WAY BECOME INEFFECTIVE, REPLACE IT IMMEDIATELY.
3. REMOVE SEDIMENT DEPOSITS PROMPTLY TO PROVIDE ADEQUATE STORAGE VOLUME FOR THE NEXT RAIN AND TO REDUCE PRESSURE ON THE FENCE. TAKE CARE TO AVOID UNDERMINING FENCE DURING CLEANOUT.
4. REMOVE ALL FENCING MATERIALS AND UNSTABLE SEDIMENT DEPOSITS AFTER THE CONTRIBUTING DRAINAGE AREA HAS BEEN PROPERLY STABILIZED, INSPECTED AND APPROVED. BRING THE DISTURBED AREA TO GRADE AND STABILIZE AS SHOWN IN THE VEGETATION PLAN.

SILT FENCE DETAIL
NOT TO SCALE



SILT FENCE ROCK OUTLET MAINTENANCE:
1. REMOVE SEDIMENT WHEN IT ACCUMULATES TO ONE-HALF THE DESIGN VOLUME.
2. CHECK STRUCTURE AND ABUTMENTS FOR EROSION, PIPING, OR ROCK DISPLACEMENT. REPAIR IMMEDIATELY.
3. REMOVE ROCK OUTLET WHEN CONTRIBUTING DRAINAGE AREA HAS BEEN PERMANENTLY STABILIZED, INSPECTED AND APPROVED. REMOVE ALL WATER AND SEDIMENT PRIOR TO REMOVING SCREEN. DISPOSE OF WASTE MATERIAL IN DESIGNATED DISPOSAL AREA.

TEMPORARY SILT FENCE ROCK OUTLET
NOT TO SCALE

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JACOB'S LANDING
STREAM MITIGATION PROJECT
CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

DATE: JUNE 2012
SCALE: NTS

SEDIMENTATION AND EROSION CONTROL PLAN

NOTES:

-MATTING SHALL BE INSTALLED PRIOR TO THE INTRODUCTION OF WATER TO A STREAM SECTION.

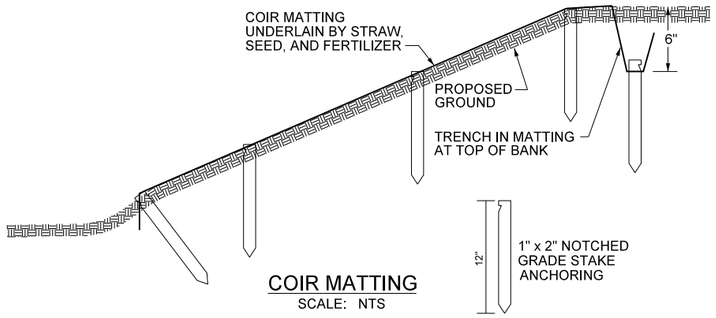
-ALL DISTURBED AREAS INSIDE FLOOD-PLAIN EXTENTS SHALL BE SEEDED DAILY.

-GROUND SHALL BE PREPARED AND SEED & FERTILIZER APPLIED ACCORDING TO PROJECT SPECIAL PROVISIONS.

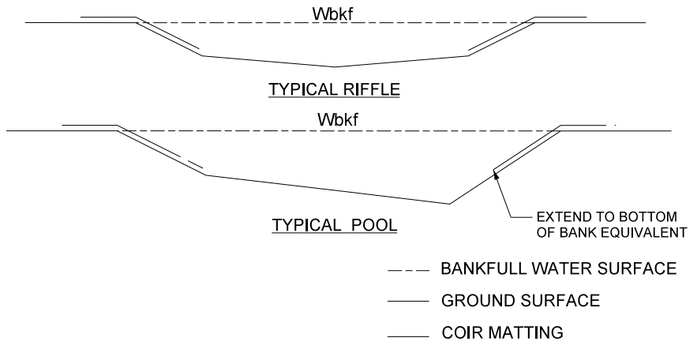
-MATTING SHALL BE INSTALLED ALONG BOTH SIDES OF NEW STREAM LENGTH.

-MATTING SHALL EXTEND FROM TOE OF SLOPE TO THE TOP OF BANK.

-MATTING SHALL BE APPLIED AND STAKED IN ACCORDANCE WITH PROJECT SPECIAL PROVISIONS.



COIR MATTING
SCALE: NTS



EXAMPLE COIR MATTING PLACEMENT
NOT TO SCALE

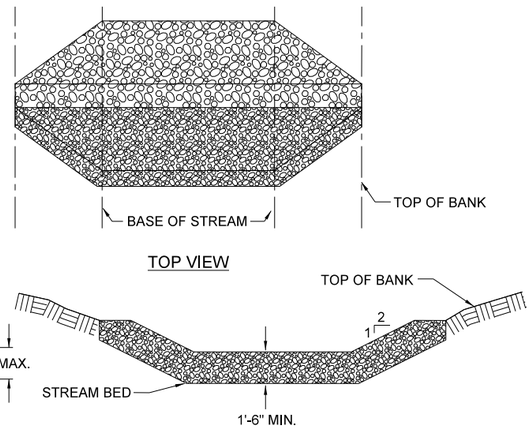
ROCK SILT SCREEN MAINTENANCE:
1. REMOVE SEDIMENT WHEN IT ACCUMULATES TO ONE-HALF THE DESIGN VOLUME.
2. CHECK STRUCTURE AND ABUTMENTS FOR EROSION, PIPING, OR ROCK DISPLACEMENT. REPAIR IMMEDIATELY.
3. REPLACE AGGREGATE ON INSIDE FACE OF STRUCTURE WHEN SEDIMENT POOL DOES NOT DRAIN BETWEEN STORMS.
4. ADD FINE GRAVEL TO UPSTREAM FACE OF SCREEN IF SEDIMENT POOL DRAINS TOO RAPIDLY FOLLOWING A STORM.
5. REMOVE SILT SCREEN WHEN CONTRIBUTING DRAINAGE AREA HAS BEEN PERMANENTLY STABILIZED, INSPECTED AND APPROVED. REMOVE ALL WATER AND SEDIMENT PRIOR TO REMOVING SCREEN. DISPOSE OF WASTE MATERIAL IN DESIGNATED DISPOSAL AREA.

NOTES:

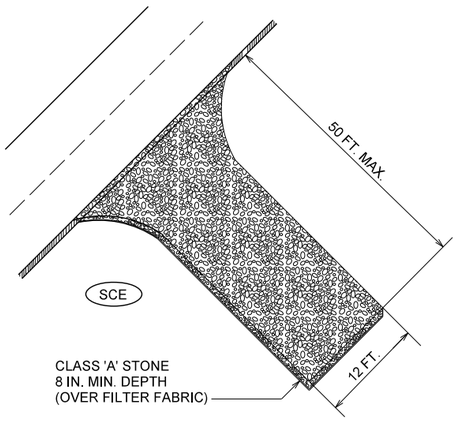
USE CLASS I STONE FOR STRUCTURAL STONE.

USE STONE NO. 57 STONE FOR SEDIMENT CONTROL.

CONSTRUCT DAM A MAXIMUM OF 1 FT. ABOVE NORMAL FLOW DEPTH.



TEMPORARY ROCK SILT SCREEN
NOT TO SCALE

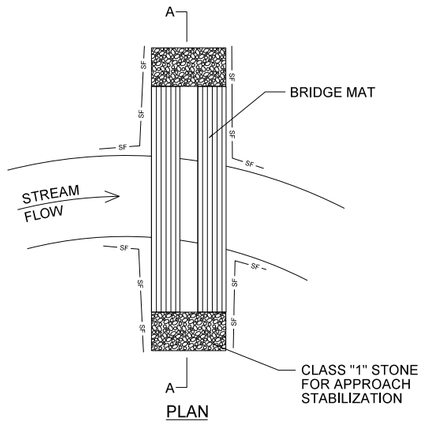


NOTES:
1. TURNING RADIUS SUFFICIENT TO ACCOMODATE LARGE TRUCKS SHALL BE PROVIDED.
2. ENTRANCE(S) SHOULD BE LOCATED TO PROVIDE FOR UTILIZATION BY ALL CONSTRUCTION VEHICLES.
3. MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO STREETS. PERIODIC TOPDRESSING WITH STONE WILL BE NECESSARY.
4. ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED UP IMMEDIATELY.
5. GRAVEL CONSTRUCTION ENTRANCE SHALL BE LOCATED AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE MUST BE PROVIDED.

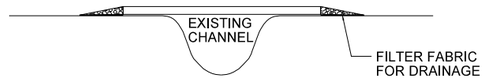
SCE MAINTENANCE:
1. INSPECT ENTRANCE/EXIT PAD AND SEDIMENT DISPOSAL AREA WEEKLY AND AFTER HEAVY RAINS OR HEAVY USE.
2. RESHAPE PAD AS NEEDED FOR DRAINAGE AND RUNOFF CONTROL.
3. TOPDRESS WITH CLEAN STONE, AS NEEDED.
4. IMMEDIATELY REMOVE MUD AND SEDIMENT TRACKED OR WASHED ONTO PUBLIC ROAD.

STABILIZED CONSTRUCTION ENTRANCE / ACCESS ROAD
SCALE: NTS

STREAM CROSSING MAINTENANCE:
1. INSPECT TEMPORARY CROSSING AFTER EACH RAINFALL EVENT FOR ACCUMULATION OF DEBRIS, BLOCKAGE, EROSION OF ABUTMENTS AND OVERFLOW AREAS, CHANNEL SCOUR, RIPRAP DISPLACEMENT, OR PIPING ALONG CULVERTS.
2. REMOVE DEBRIS, REPAIR AND REINFORCE DAMAGED AREAS IMMEDIATELY TO PREVENT FURTHER DAMAGE TO THE INSTALLATION.



PLAN



SECTION AA
NOT TO SCALE

1. BRIDGE LOCATIONS DEPICTED ON SITE PLANS ARE APPROXIMATE AND ARE SUBJECT TO CHANGE DEPENDING ON THE AREA THAT IS BEING WORKED UPON.
2. WIDTH OF EACH MAT IS DEPENDENT ON THE SIZE OF THE EQUIPMENT MEANT TO CROSS IT.
3. DISTANCE BETWEEN MATS IS DEPENDENT ON THE DISTANCE BETWEEN TRACKS ON THE EQUIPMENT MEANT TO CROSS IT.
4. APPROACH STABILIZATION, COMPOSED OF CLASS 1 STONE, WILL BE REQUIRED FOR EACH SECTION OF THE BRIDGE.

BRIDGE MAT STREAM CROSSING
PLACE AS SPECIFIED IN THE PLANS AND APPROVED BY THE DESIGNER

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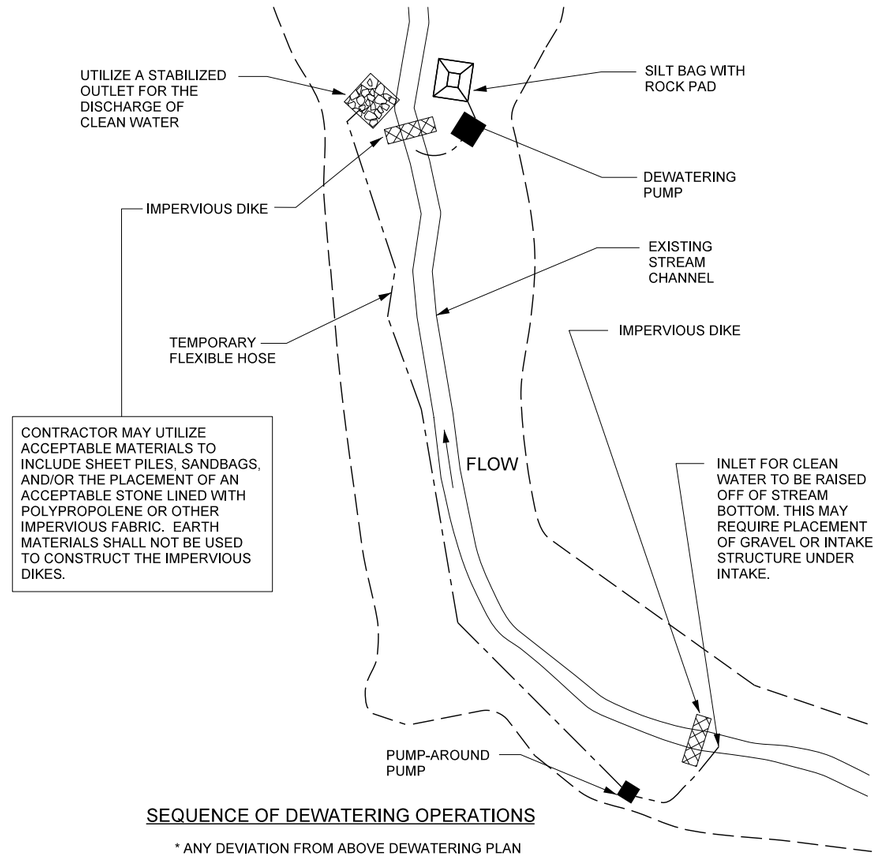
SEDIMENTATION AND EROSION CONTROL PLAN

EXAMPLE OF PUMP-AROUND OPERATION

NOT TO SCALE



CONTRACTOR MAY UTILIZE ACCEPTABLE MATERIALS TO INCLUDE SHEET PILES, SANDBAGS, AND/OR THE PLACEMENT OF AN ACCEPTABLE STONE LINED WITH POLYPROPOLENE OR OTHER IMPERVIOUS FABRIC. EARTH MATERIALS SHALL NOT BE USED TO CONSTRUCT THE IMPERVIOUS DIKES.

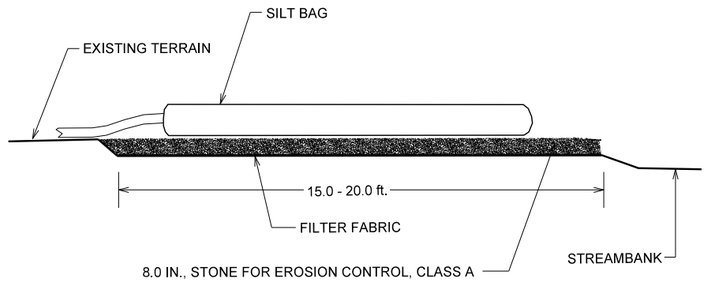
SEQUENCE OF DEWATERING OPERATIONS

* ANY DEVIATION FROM ABOVE DEWATERING PLAN WILL REQUIRE DESIGNER AND NCDLQ APPROVAL.

1. INSTALL SILT BAGS(S) AND ROCK PAD(S).
2. INSTALL UPSTREAM PUMP AND TEMPORARY FLEXIBLE HOSE.
3. PLACE UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. PLACE DOWNSTREAM IMPERVIOUS DIKE AND PUMPING APPARATUS. DEWATER ENTRAPPED AREA.
5. PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLANS.
6. EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF IMPERVIOUS DIKES. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE (DOWNSTREAM IMPERVIOUS DIKES FIRST).
7. REMOVE SILT BAG(S) AND STABILIZE DISTURBED AREA WITH SEED AND MULCH.

STILLING BASIN MAINTENANCE:

1. SEDIMENT BAGS SHOULD BE REPLACED WHEN THE CAPACITY OF THE SEDIMENT BAG HAS EXCEEDED 50%.
2. ACCUMULATED SEDIMENT SHOULD BE DISPOSED OF IN A DESIGNATED DISPOSAL AREA.
3. SPENT BAGS SHOULD BE DISPOSED OF PROPERLY AND NOT BURIED.
4. GRAVEL PADS SHOULD BE CHECKED DAILY DURING USE TO ENSURE THAT GRAVEL HAS NOT BEEN WASHED AWAY OR BEEN CHOKED BY EXCESSIVE SEDIMENTATION.
5. REPLACE PAD WITH CLEAN GRAVEL, AS NEEDED.



NOTE: PROVIDE STABILIZED OUTLET DOWN BANK TO STREAM

SPECIAL STILLING BASIN (SILT BAG) WITH ROCK PAD

NOT TO SCALE

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CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

DATE: JUNE 2012
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SEDIMENTATION AND EROSION CONTROL PLAN

SEQUENCE OF CONSTRUCTION:

THE CONTRACTOR IS RESPONSIBLE FOR FOLLOWING THE SEQUENCE OF CONSTRUCTION IN ACCORDANCE WITH THE PLANS AND THE FOLLOWING PROVISIONS, AS DIRECTED BY THE DESIGNER. CONSTRUCTION SHALL PROCEED IN THE SPECIFIED MANNER UNLESS OTHERWISE DIRECTED OR APPROVED BY THE DESIGNER. THE FOLLOWING PROVISIONS, ALONG WITH THE INSTRUCTIONS CONTAINED IN THE PLANS, CONSTITUTE THE SEQUENCE OF CONSTRUCTION.

GENERAL SITE NOTES:

I. THE CONTRACTOR SHALL ONLY CONDUCT STREAM WORK, INCLUDING ALL IN-STREAM STRUCTURES, GRADING, STABILIZATION MEASURES, AND SEEDING, MULCHING, AND MATTING WORK, ON A SECTION OF STREAM THAT SHALL BE ENTIRELY COMPLETED WITHIN A SINGLE DAY. EACH SECTION OF COMPLETED STREAM MUST BE STABILIZED AND MATTED BEFORE FLOW CAN BE RETURNED INTO THE CHANNEL

II. IF APPROVED BY THE DESIGNER, THE CONTRACTOR MAY WORK SIMULTANEOUSLY ON MORE THAN ONE PHASE OR CHANGE THE ORDER OF PHASES 2-5.

III. WHEN WORKING IN STREAMS WITH NO ACTIVE FLOW THE CONTRACTOR IS REQUIRED TO HAVE APPROPRIATELY SIZED PUMPS AND MATERIALS TO INSTALL AND MAINTAIN A TEMPORARY STREAM DIVERSION IN ANTICIPATION OF PENDING STORM EVENTS. WORKING IN A DRY CHANNEL DOES NOT PRECLUDE THE CONTRACTOR FROM HAVING TO COMPLY WITH NOTE I ABOVE.

PHASE 1: INITIAL SITE PREPARATION
- A. IDENTIFY PROJECT BOUNDARY, LIMITS OF DISTURBANCE, SENSITIVE AREAS, STAGING AREAS, STABILIZED ENTRANCES, AND ACCESS POINTS WITH THE DESIGNER.
- B. CONSTRUCT ENTRANCES AND STAGING AREAS AND THEIR ASSOCIATED SEDIMENT AND EROSION CONTROL DEVICES IN A MANNER TO SUPPORT EXECUTION OF THE STREAM RESTORATION IN PHASES AS INDICATED IN THE PLANS AND AS DIRECTED BY THE DESIGNER.

PHASE 2: REACH T1 STA. 10+00 TO STA. 24+12
- A. PERFORM STREAM RESTORATION FROM STA. 10+00 TO STA. 13+03.
  - i. CLEAR VEGETATION AS NEEDED TO INSTALL SEDIMENT AND EROSION CONTROL MEASURES. INSTALL SEDIMENT AND EROSION CONTROL MEASURES ALONG EXISTING CHANNEL AS DEPICTED ON THE PLANS.
  - ii. CONDUCT CLEARING NECESSARY TO COMPLETE CHANNEL WORK, PROTECTING EXISTING TREES WHEREVER POSSIBLE OR AS INDICATED BY THE DESIGNER.
  - iii. ESTABLISH AN ISOLATED WORK AREA BY INSTALLING IMPERVIOUS DIKES AND TEMPORARY STREAM DIVERSION AND DIVERT STREAM FLOWS AROUND THE DESIGNATED WORK AREA (LENGTH OF ISOLATED WORK AREA IS LEFT TO THE DISCRETION OF THE CONTRACTOR).
  - iv. COMPLETE CHANNEL GRADING AS DIRECTED IN THE PLANS. INSTALL ANY BANK STABILIZATION TREATMENTS AND IN-STREAM STRUCTURES
  - v. SEED AND MULCH COMPLETED WORK AREAS.
- B. PERFORM STREAM ENHANCEMENT-II FROM STA. 13+03 TO STA. 14+61 IN ACCORDANCE WITH PROCEDURES ESTABLISHED IN PHASE 2A.
- C. PERFORM STREAM RESTORATION FROM STA. 14+61 TO STA. 24+12 IN ACCORDANCE WITH PROCEDURES ESTABLISHED IN PHASE 2A.

PHASE 3: REACH T2 STA. 50+00 TO STA. 77+45
- A. COMPLETE STREAM RESTORATION IN ACCORDANCE WITH PROCEDURES ESTABLISHED IN PHASE 2A.

PHASE 4: T1A STA. 40+00 TO STA. 41+78
- A. COMPLETE STREAM RESTORATION IN ACCORDANCE WITH PROCEDURES ESTABLISHED IN PHASE 2A.

PHASE 5: T2A STA. 100+00 TO STA. 104+65
- A. COMPLETE STREAM ENHANCEMENT-I IN ACCORDANCE WITH PROCEDURES ESTABLISHED IN PHASE 2A.

PHASE 6: RIPARIAN BUFFER PLANTING
- A. PHASE 6 CAN BE INITIATED AFTER THE STREAM WORK IS COMPLETED IN EACH SECTION OF THE PROJECT.
- B. PLANTS SHOULD BE PLANTED DURING THE DORMANT SEASON (OCTOBER 20 - APRIL 13).
- C. PREPARE AND PLANT BANK AND RIPARIAN VEGETATION IN ACCORDANCE WITH PLAN SHEET 12 AND AS DIRECTED BY THE DESIGNER.

PHASE 7: COMPLETION OF PROJECT SITE
- A. REMOVE ALL REMAINING WASTE MATERIALS AND RESTORE THE REMAINING STAGING AND STOCKPILING AREAS AND CONSTRUCTION ENTRANCES TO THEIR PRIOR CONDITION. REMOVE TEMPORARY CROSSINGS AND INSTALL BANK STABILIZATION TREATMENTS, AND PLANT, SEED AND MULCH DISTURBED AREAS. SEED AND MULCH ALL DISTURBED AREAS UTILIZING THE SEED/MULCH MIXES SPECIFIED IN THE PLANS.

GROUND STABILIZATION	
SITE AREA DESCRIPTION	STABILIZATION TIME FRAME
PERIMETER DIKES, SWALES, DITCHES AND SLOPES	7 DAYS
HIGH QUALITY WATER (HQW) ZONES	7 DAYS
SLOPES STEEPER THAN 3:1	7 DAYS
SLOPES 3:1 OR FLATTER	7 DAYS
ALL OTHER AREAS WITH SLOPES FLATTER THAN 4:1	7 DAYS

NOTES:
1. ALL DISTURBED AREAS INSIDE FLOODPLAIN EXTENTS SHALL BE SEEDED DAILY.
2. ALL DISTURBED AREAS OUTSIDE OF FLOODPLAIN EXTENTS SHALL BE SEEDED WITHIN 7 DAYS.

Soil Amendments:

Due to erosion caused by surrounding agricultural activities, many areas within the limits of disturbance currently contain unproductive soils with low organic content. Many of these areas are characterized by rill and sheet erosion, exposing inorganic soils. Other areas where Priority 2 restoration will occur will expose these unproductive soils to the surface. In order to ensure appropriate growing media for furnished seed mixes as well as trees and shrubs that will be planted as part of the restoration plan, furnished topsoil or organic amendments will be required on this project at the direction of the designer.

Furnished Topsoil: Furnished topsoil shall be natural, friable surface soil uniform in color and texture. Topsoil shall have an organic content between 3 and 10 percent by weight. Furnished topsoil shall have a corrected pH value of not less than 6 nor more than 7.5. Textural analysis (by weight) shall be as follows: Sand (2.0 to 0.050mm) 20-75%, Silt (0.05 to 0.002mm) 10-60%, Clay (less than 0.002mm) 5-30%.

Furnished Compost: Furnished compost can be used to amend the soil. It should be mixed with existing inorganic sub-soils to enhance soil texture and minimize the potential for soil mobilization. Furnished compost should meet the requirements in the table below:

Parameter	Unit Measure	Product Range
pH	pH units	7.0-8.7
Soluble Salts	mmhos per centimeter	2.0-5.0
Bulk Density	lbs per cubic yard	900-1,000
Moisture Content	% wet wt basis	45%-55%
Organic Matter Content	% dry wt basis	70%-80%
Particle Size	inches	3/8 minus
Growth Screening	% germination	100%
Stability Rating	Mature-Very Mature	Very Mature

Biosolids Compost (Class A): Type A biosolids can be used with the permission of NC DENR Division of Water Quality. They cannot be applied within 25 feet of the top of bank of any perennial or intermittent stream. This material must be mechanically mixed with existing inorganic soils to minimized the potential for runoff.

NOTES:

1. THE LENGTH OF STREAM THAT IS ISOLATED AS A DAILY WORK AREA IS LEFT TO CONTRACTOR'S DISCRETION IN ACCORDANCE WITH THE FOLLOWING PROVISIONS. IT IS THE INTENT OF THIS CONTRACT THAT:
   - A. ALL PROJECT OPERATIONS WILL COMPLY WITH THE PROVIDED SEDIMENT AND EROSION CONTROL PLAN.
   - B. AT THE END OF EACH WORK DAY, EACH PORTION OF STREAM MUST BE A COMPLETED WORK PRODUCT, I.E. ALL BANK AND CHANNEL MODIFICATIONS INCLUDING EXCAVATION, GRADING, FILL, AND ALL STABILIZATION TREATMENTS (WITH THE EXCEPTION OF LIVE STAKING, WHICH MAY BE DEFERRED UNTIL ALL BANK AND CHANNEL WORK IS COMPLETED) MUST BE FINISHED AS CALLED FOR IN THE PLANS AND AS DIRECTED BY THE DESIGNER.
   - C. DUE TO THE ANTICIPATED DURATION AND SEQUENCE OF THE CONSTRUCTION ACTIVITIES, THE CONTRACTOR IS REQUIRED TO MINIMIZE, AS MUCH AS POSSIBLE, THE AMOUNT OF THE AREA THAT IS DISTURBED AT ONE TIME.
2. THE CONTRACTOR SHALL EXERCISE EVERY REASONABLE PRECAUTION THROUGHOUT THE CONSTRUCTION OF THE PROJECT TO PREVENT EROSION AND SEDIMENTATION. EROSION CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE PROJECT PLANS, NORTH CAROLINA SEDIMENT AND EROSION CONTROL GUIDELINES AND AS DIRECTED BY THE DESIGNER.
3. THE CONTRACTOR SHALL ONLY CONDUCT STREAM WORK, INCLUDING ALL IN-STREAM STRUCTURES, GRADING, STABILIZATION MEASURES, AND SEEDING AND MULCHING WORK, ON A SECTION OF STREAM THAT CAN BE ENTIRELY COMPLETED WITHIN A SINGLE DAY.
4. ALL EXCAVATION SHALL BE PERFORMED IN DRY OR ISOLATED SECTIONS OF THE CHANNEL.
5. ALL EXCAVATED MATERIAL SHALL BE STOCKPILED WITHIN THE LIMITS OF DISTURBANCE FOR LATER USE AS EMBANKMENT MATERIAL OR DISPOSAL. THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING APPROPRIATE STABILIZATION MEASURES AROUND THE STOCKPILE AREA(S) TO PREVENT EROSION AND SEDIMENTATION.
6. A TEMPORARY PUMP-AROUND SHALL BE UTILIZED BY THE CONTRACTOR IN ALL PORTIONS OF THE STREAM TO DIVERT FLOW FROM AND DEWATER THE DESIGNATED AREA IN ORDER TO WORK. THE PUMP-AROUND USED BY THE CONTRACTOR SHALL MEET ALL REQUIREMENTS SPECIFIED IN THESE PLANS. THE PUMP-AROUND SHALL BE INSTALLED AND REMOVED IN ACCORDANCE WITH THE MANUFACTURER'S GUIDELINES. TWENTY-FOUR (24) HOURS PRIOR TO THE INITIATION OF PUMP-AROUND ACTIVITIES, THE CONTRACTOR SHALL MEASURE THE APPROXIMATE FLOW RATE IN THE EXISTING STREAM AT THE PUMP-AROUND LOCATION. THE FLOW RATE SHALL BE SUBMITTED TO THE DESIGNER FOR APPROVAL. THE CONTRACTOR SHALL, THEREAFTER, UTILIZE A PUMP(S) SUFFICIENT TO ACCOMODATE 120% (1.2 TIMES) THE APPROVED FLOW RATE.
7. IN THE EVENT OF A STORM, THE CONTRACTOR WILL BE RESPONSIBLE FOR REMOVAL OR PROTECTION OF ANY EQUIPMENT, TOOLS, MATERIALS OR OTHER ITEMS NEEDED TO COMPLETE THE WORK THAT COULD BE AFFECTED BY STORM FLOWS.
8. AFTER THE STREAM CHANNEL IS DEWATERED AND INITIAL STREAM GRADING CALLED FOR IN THE PLANS IS COMPLETED, THE CONTRACTOR SHALL IMMEDIATELY INSTALL APPROPRIATE STABILIZATION MATERIALS AS CALLED FOR IN THE PLANS TO STABILIZE SLOPES AND PROVIDE IMMEDIATE SEDIMENT/EROSION CONTROL.
9. WITH THE EXCEPTION OF STRAW WATTLES, EACH SEDIMENT CONTROL DEVICE WILL BE REMOVED AFTER ALL WORK IN THE CORRESPONDING CONSTRUCTION PHASE HAS BEEN COMPLETED AND THE AREAS HAVE BEEN STABILIZED.
10. THE CONSTRUCTION ENTRANCES AND STAGING AREAS IDENTIFIED ON THE PLANS PROVIDE THE ONLY ACCESS POINTS INTO THE LIMITS OF DISTURBANCE. NO ADDITIONAL ACCESS POINTS SHALL BE USED WITHOUT APPROVAL OF THE DESIGN REPRESENTATIVE.
11. SILT FENCE SHALL BE INSTALLED ON THE LOW SIDE OF ANY TEMPORARY OR PERMANENT SPOIL AND TOPSOIL PILES.
12. ALL DISTURBED SOILS WILL BE SEEDED FOR VEGETATIVE STABILIZATION IMMEDIATELY AFTER DISTURBANCE ACTIVITIES, FOLLOWING THE GUIDELINES DESCRIBED ON SHEET 19 OF THESE PLANS.
13. BRIDGE MATS WILL BE USED FOR ALL STREAM CROSSINGS. SUGGESTED LOCATIONS FOR THE CROSSINGS ARE SHOWN ON THE PLANS, HOWEVER, THE LOCATIONS CAN BE MODIFIED UPON CONSULTATION WITH THE DESIGNER. THE NUMBER OF CROSSING LOCATIONS SHOULD BE MINIMIZED TO THE EXTENT PRACTICAL.
14. THE CONSTRUCTION MANAGER AND EROSION CONTROL CONTACT FOR THIS SITE IS TIM MORRIS. OFFICE PHONE - 919-783-9214 CELL PHONE - 919-793-6886

A	PRELIMINARY DESIGN - SUBMITTED WITH MITIGATION PLAN	MAY 2012	
B	SUBMITTED FOR LAND QUALITY PERMIT	JUNE 2012	
C	EDITS PER IRT COMMENTS	SEPT 2012	
SYM.	DESCRIPTION	DATE	APPROVED

REVISIONS

Ecosystem Enhancement Program

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JACOBS LANDING
STREAM MITIGATION PROJECT
CHINA GROVE, ROWAN COUNTY, NORTH CAROLINA

DATE: JUNE 2012
SCALE: NTS

SEDIMENTATION AND EROSION CONTROL PLAN

SHEET 22 OF 22