BASELINE MONITORING DOCUMENT
AND ASBUILT BASELINE REPORT
HERMAN DAIRY
STREAM AND WETLAND RESTORATION SITE

Alexander County, North Carolina
Full Delivery Contract No. 003271

Catawba River Basin
Cataloging Unit and Targeted Local Watershed
03050101120030

PREPARED BY:

RESTORATION SYSTEMS, LLC
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AND

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JUNE 2012

EXECUTIVE SUMMARY

Restoration Systems, LLC has established the Herman Dairy Stream and Wetland Mitigation Site (Site) located approximately 1.5 miles northwest of Taylorsville, in central Alexander County within 14-digit Cataloging Unit and Targeted Local Watershed 03050101120030 of the Catawba River Basin. The Site encompasses approximately 31.12 acres of land previously used for agricultural row crop production and the spray application of sludge from a lagoon associated with a dairy cattle operation. The Site was identified to assist the North Carolina Ecosystem Enhancement Program (NCEEP) in meeting its stream and wetland restoration goals.

The Site is located on tributaries to Muddy Fork, which has been assigned Stream Index Number 11-69-4, a Best Usage Classification of C, and is Fully Supporting its intended uses (NCDWQ 2010b). Site streams are listed on the NCDWQ final 2010 Section 303(d) list of impaired streams in the state due to declines in the ecological and biological integrity of benthic communities and aquatic life (NCDWQ 2010a).

This project is located within a Targeted Local Watershed that has been identified for of stream and buffer restoration opportunities (NCEEP 2009). Existing Site streams are impaired as indicated by declines in fish and benthic bioclassification scores resulting from degraded or nonexistent buffers and sediment inputs from unstable streambanks, in-stream sediment mining, and agricultural practices (NCEEP 2009, NCDWQ 2010a).

The primary goals of this stream and wetland restoration project focused on improving water quality, enhancing flood attenuation, and restoring wildlife habitat and will be accomplished by the following.

1. Removing nonpoint sources of pollution associated with agricultural production including a) cessation of broadcasting sludge, fertilizer, pesticides, and other agricultural materials into and adjacent to Site streams/wetlands and b) restoration of a forested riparian buffer adjacent to streams and wetlands to treat surface runoff.
2. Reducing sedimentation within onsite and downstream receiving waters through a) reduction of bank erosion, vegetation maintenance, and plowing to Site streams and wetlands and b) restoration of a forested riparian buffer adjacent to Site streams and wetlands.
3. Reestablishing stream stability and the capacity to transport watershed flows and sediment loads by restoring stable dimension, pattern, and profile supported by natural in-stream habitat and grade/bank stabilization structures.
4. Promoting overbank events and Site storage capacities by a) reconnecting bankfull stream flows to the abandoned floodplain, b) restoring secondary, entrenched tributaries within smaller catchment basins, c) restoring depressional floodplain wetlands within the Site, and d) revegetating Site floodplains to increase frictional resistance on floodwaters crossing Site floodplains.
5. Improving aquatic habitat by enhancing stream bed variability and the use of in-stream structures.
6. Providing a terrestrial wildlife corridor and refuge in an area extensively developed for agricultural production.
7. Restoring and reestablishing natural community structure, habitat diversity, and functional continuity.
8. Enhancing and protecting the Site's full potential of stream and wetland functions and values in perpetuity.

Project construction and planting was completed between December 2011 and March 2012. The Site's plan included 1) construction of a stable, riffle-pool stream channel, 2) restoration of braided stream systems, 3) restoration/enhancement of historic wetland functions, 4) enhancement of water quality

functions (reduced nonpoint source sedimentation and nutrient inputs), 5) restoration of a natural woody riparian buffer (at least 50' wide) along Site stream reaches, 6) restoration of wildlife habitat associated with a riparian corridor/stable stream, and 7) establishment of a permanent conservation easement which will encompass all restoration activities.

The implemented mitigation is as follows.

Mitigation Activity	Mitigation Quantity*			Mitigation Units (Credits)*		
	Streams (linear feet)	Riparian Wetlands (acres)	Nonriparian Wetlands (acres)	Stream Units (SMUs)	Riparian Wetland Units (WMUs)	Nonriparian Wetland Units (WMUs)
Stream Restoration	4560			4560		
Stream Enhancement (Level I)	330			220		
Wetland Restoration		7.2	1.2		7.2	1.2
Wetland Enhancement		2.2	0.1		1.1	0.05
			TOTALS	**4780**	**8.3**	**1.25**

*Mitigation quantities and units only include linear footages/acreages within the easement. All mitigation activities completed outside of the easement are excluded from the mitigation units. A complete breakdown of mitigation activities and units is included in Table 1 (Appendix A).

After completion of construction, the Site offers **4780 Stream Mitigation Units, 8.3 Riparian Wetland Mitigation Units,** and **1.25 Nonriparian Wetland Mitigation Units.**

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APPENDICES

1.0 PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

1.1 Location and Setting

Restoration Systems, LLC has established the Herman Dairy Stream and Wetland Mitigation Site (Site) located approximately 1.5 miles northwest of Taylorsville, in central Alexander County within 14-digit Cataloging Unit and Targeted Local Watershed 03050101120030 of the Catawba River Basin (Figure 1, Appendix A). The Site encompasses 31.12 acres of land previously used for agricultural row crop production and the spray application of sludge from a lagoon associated with a dairy cattle operation. Prior to construction, the Site was cleared of native forest vegetation; streams were relocated, ditched, and straightened; and groundwater hydrology was lowered due to entrenchment of Site streams. Land use practices resulted in degraded water quality, unstable channel characteristics (stream entrenchment, erosion, and bank collapse), and reduced storage capacity.

Directions to the Site from Statesville, North Carolina:

- From Interstate 40 take exit 148 onto NC 64 north, travel ~ 17 miles
- Turn north (right) on NC 16 (towards Taylorsville), travel ~ 1 mile
- Turn west (left) on NC 90, travel ~ 1.5 miles
- Turn right on Three Forks Ch. Road, travel ~2 miles
- Site is on right
    - Site Latitude, Longitude at access from Three Forks Church Road 35.931617ºN, 81.206949ºW (NAD83/WGS84)

1.2 Project Goals and Objectives

The primary goals of this stream and wetland restoration project focused on improving water quality, enhancing flood attenuation, and restoring wildlife habitat and will be accomplished by the following.

1. Removing nonpoint sources of pollution associated with agricultural production including a) cessation of broadcasting sludge, fertilizer, pesticides, and other agricultural materials into and adjacent to Site streams/wetlands and b) restoration of a forested riparian buffer adjacent to streams and wetlands to treat surface runoff.
2. Reducing sedimentation within onsite and downstream receiving waters through a) reduction of bank erosion, vegetation maintenance, and plowing to Site streams and wetlands and b) restoration of a forested riparian buffer adjacent to Site streams and wetlands.
3. Reestablishing stream stability and the capacity to transport watershed flows and sediment loads by restoring stable dimension, pattern, and profile supported by natural in-stream habitat and grade/bank stabilization structures.
4. Promoting overbank events and Site storage capacities by a) reconnecting bankfull stream flows to the abandoned floodplain, b) restoring secondary, entrenched tributaries within smaller catchment basins, c) restoring depressional floodplain wetlands within the Site, and d) revegetating Site floodplains to increase frictional resistance on floodwaters crossing Site floodplains.
5. Improving aquatic habitat by enhancing stream bed variability and the use of in-stream structures.
6. Providing a terrestrial wildlife corridor and refuge in an area extensively developed for agricultural production.

7. Restoring and reestablishing natural community structure, habitat diversity, and functional continuity.
8. Enhancing and protecting the Site's full potential of stream and wetland functions and values in perpetuity.

1.3 Project Structure, Restoration Type, and Approach

1.3.1 Project Structure

Prior to construction, the Site was cleared of native forest vegetation; streams were relocated, ditched, and straightened; and groundwater hydrology was lowered due to entrenchment of Site streams. Land use practices resulted in degraded water quality, unstable channel characteristics (stream entrenchment, erosion, and bank collapse), and reduced storage capacity.

1.3.2 Restoration Type and Approach

As constructed, Site restoration activities resulted in the following.

- 4780 Stream Mitigation Units by:
    - Restoring approximately 3997 linear feet of stream channel through construction of stable channel at the historic floodplain elevation.
    - Restoring approximately 563 linear feet of braided stream channel by redirecting flow across riparian wetlands.
    - Enhancing (Level I) approximately 330 linear feet of stream channel through cessation of current land use practices, removing invasive species, and planting with native forest vegetation.
- 8.3 Riparian Wetland Mitigation Units by:
    - Restoring approximately 7.2 acres of riparian wetland by removing spoil castings, restoring stream inverts to historic elevations to rehydrate stream-side wetlands, filling ditches and abandoned channels, eliminating land use practices, and planting with native forest vegetation.
    - Enhancing approximately 2.2 acres of riparian wetland by filling ditches/abandoned channels and supplemental planting.
- 1.25 Nonriparian Wetland Mitigation Units by:
    - Restoring approximately 1.2 acres of nonriparian wetland by removing spoil castings, filling abandoned ditches to rehydrate slope wetlands, eliminating land use practices, and planting with native forest vegetation.
    - Enhancing approximately 0.1 acres of nonriparian wetland through supplemental plantings.
- Planting a native woody riparian buffer (at least 50' wide) adjacent to restored/enhanced streams and wetlands within the Site.
- Protecting the Site in perpetuity with a conservation easement.

Completed project activities, reporting history, completion dates, project contacts, and project attributes are summarized in Tables 1-4 (Appendix A).

2.0 SUCCESS CRITERIA

2.1 Streams

Success criteria for stream restoration will include 1) successful classification of the reach as a functioning stream system (Rosgen 1996) and 2) channel variables indicative of a stable stream system.

The channel configuration will be measured on 3000 linear feet of stream and 20 cross-sections on an annual basis in order to track changes in channel geometry, profile, or substrate. These data will be utilized to determine the success in restoring stream channel stability. Specifically, the bank-height ratios ($\leq$ 1.2) and entrenchment ratios ($\geq$ 2.2) should be indicative of a stable or moderately unstable channel with minimal changes in cross-sectional area, channel width, and/or bank erosion along the monitoring reach. In addition, channel abandonment and/or shoot cutoffs must not occur and sinuosity values must remain relatively constant. Visual assessment of in-stream structures will be conducted to determine if failure has occurred. Failure of a structure may be indicated by collapse of the structure, undermining of the structure, abandonment of the channel around the structure, and/or stream flow beneath the structure.

2.2 Vegetation

Success criteria have been established to verify that the vegetation component supports community elements necessary for forest development. Success criteria are dependent upon the density and growth of characteristic forest species. Additional success criteria are dependent upon the density and growth of "Characteristic Tree Species." Characteristic Tree Species include planted species, species identified through visual inventory of an approved reference (relatively undisturbed) forest community, and species outlined in Schafale and Weakley (1990).

An average density of 320 stems per acre of Characteristic Tree Species must be surviving in the first three monitoring years. Subsequently, 290 Characteristic Tree Species per acre must be surviving in year 4, 260 Characteristic Tree Species per acre in year 5, and 210 Characteristic Tree Species per acre in year 7.

No single volunteer species (most notably red maple, loblolly pine, and sweet gum) will comprise more than 20 percent of the total composition at years 3, 5, or 7. If this occurs, remedial procedures/protocols outlined in the contingency plan will be implemented. During years 3, 5, and 7, no single volunteer species, comprising over 20 percent of the total composition, may be more than twice the height of the planted trees. If this occurs, remedial procedures outlined in the contingency plan will be implemented.

If, within the first 3 years, any species exhibits greater than 50 percent mortality, the species will either be replanted or an acceptable replacement species will be planted in its place as specified in the contingency plan.

2.3 Wetland Hydrology

According to the *Soil Survey of Alexander County*, the growing season for Alexander County as recorded in Hickory, North Carolina during the period from 1951-1984 is from March 20-November 9 (USDA 1995). However, for purposes of this project gauge hydrologic success will be determined using data from February 1-November 9 to more accurately represent the period of biological activity.

Target hydrological characteristics include saturation or inundation for 8 percent of the monitored period (February 1-November 9), during average climatic conditions. During years with atypical climatic conditions, groundwater gauges in reference wetlands may dictate threshold hydrology success criteria (75

percent of reference). These areas are expected to support hydrophytic vegetation. If wetland parameters are marginal as indicated by vegetation and/or hydrology monitoring, a jurisdictional determination will be performed.

3.0 MONITORING PLAN

Monitoring of the Site's restoration efforts will be performed until agreed upon success criteria are fulfilled. Monitoring is proposed for the stream channel, riparian vegetation, and hydrology (Figure 2, Appendix A). Stream morphology is proposed to be monitored for a period of five years. Riparian vegetation is proposed to be monitored for a period of seven years. Wetland hydrology is proposed to be monitored for a period of five years; at which time a request will be made to the IRT to discontinue groundwater hydrology monitoring. The IRT reserves the right to request additional groundwater monitoring if it deems necessary. Monitoring reports of the data collected will be submitted to the IRT no later than December of each monitoring year.

3.1 Streams

Restored stream reaches are proposed to be monitored for geometric activity for five years. Annual fall monitoring will include development of 20 channel cross-sections on riffles and pools and a water surface profile of the channel. The data will be presented in graphic and tabular format. Data to be presented will include 1) cross-sectional area, 2) bankfull width, 3) average depth, 4) maximum depth, 5) width-to-depth ratio, 6) water surface slope, and 7) sinuosity. The stream will subsequently be classified according to stream geometry and substrate (Rosgen 1996). Significant changes in channel morphology will be tracked and reported by comparing data in each successive monitoring year.

3.2 Vegetation

After planting was completed, an initial evaluation was performed to verify planting methods were successful and to determine initial species composition and density. Ten sample vegetation plots (10-meter by 10-meter) were installed and measured within the Site as per guidelines established in *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006). Vegetation plots are permanently monumented with 4-foot metal garden posts at each corner. In each sample plot, vegetation parameters to be monitored include species composition and species density. Visual observations of the percent cover of shrub and herbaceous species will also be documented by photograph. Baseline vegetation plot information can be found in Appendix C. Initial stem count measurements indicate an average of 587 planted stems per acre across the Site.

3.3 Wetland Hydrology

Ten groundwater monitoring gauges were installed within Site wetland restoration areas and one additional gauge was installed in a reference wetland to monitor groundwater hydrology (Figure 2, Appendix A). Hydrological sampling will continue for five years throughout the growing season at intervals necessary to satisfy the hydrology success criteria within each design unit (USEPA 1990). In addition, an on-site rain gauge will document rainfall data for comparison of groundwater conditions with extended drought conditions. Finally, groundwater gauges located within riverine wetlands adjacent to restored stream reaches will supplement staff gauge measurements to confirm overbank flooding events.

3.4 Biotic Community Changes

Changes in the biotic community are anticipated from a shift in habitat opportunities as tributaries are restored. In-stream, biological monitoring is proposed to track the changes during the monitoring period. The benthic macroinvertebrate community will be sampled using NCDWQ protocols found in the Standard Operating Procedures for Benthic Macroinvertebrates (NCDWQ 2006) and Benthic Macroinvertebrate Protocols for Compensatory Stream Restoration Projects (NCDWQ 2001). Biological sampling of benthic

macroinvertebrates will be used to compare preconstruction baseline data with postconstruction restored conditions.

Three benthic macroinvertebrate monitoring locations will be established within restoration reaches. Postrestoration collections will occur in the approximate location of the prerestoration sampling. Benthic macroinvertebrate samples will be collected from individual reaches using the Qual-4 collection method. Sampling techniques of the Qual-4 collection method consist of kick nets, sweep nets, leaf packs, and visual searches. Preproject biological sampling occurred on October 18, 2011 (data are included in Appendix E); postproject monitoring will occur in June of each monitoring year.

Identification of collected organisms will be performed by personnel with NCDWQ or by a NCDWQ certified laboratory. Other data collected will include D50 values/NCDWQ habitat assessment forms.

4.0 MAINTENANCE AND CONTINGENCY

In the event that success criteria are not fulfilled, a mechanism for contingency will be implemented.

Stream

In the event that stream success criteria are not fulfilled, a mechanism for contingency will be implemented. Stream contingency may include, but may not be limited to 1) structure repair and/or installation; 2) repair of dimension, pattern, and/or profile variables; and 3) bank stabilization. The method of contingency is expected to be dependent upon stream variables that are not in compliance with success criteria. Primary concerns, which may jeopardize stream success include 1) structure failure, 2) headcut migration through the Site, and/or 3) bank erosion.

Structure Failure: In the event that structures are compromised and is no longer maintaining grade control functions the affected structure will be repaired, maintained, or replaced. Once the structure is repaired or replaced, it must function to stabilize adjacent stream banks and/or maintain grade control within the channel. Structures which remain intact, but exhibit flow around, beneath, or through the header/footer will be repaired by excavating a trench on the upstream side of the structure and reinstalling filter fabric in front of the pilings. Structures which have been compromised, resulting in shifting or collapse of header/footer, will be removed and replaced with a structure suitable for Site flows.

Headcut Migration Through the Site: In the event that a headcut occurs within the Site (identified visually and/or through mapping and measurements, provisions for impeding headcut migration and repairing damage caused by the headcut will be implemented. Headcut migration may be impeded through the installation of in-stream grade control structures (rip-rap sill and/or log cross-vane weir) and/or restoring stream geometry variables until channel stability is achieved. Channel repairs to stream geometry may include channel backfill with coarse material and stabilizing the material with erosion control matting, vegetative transplants, and/or willow stakes.

Bank Erosion: In the event that severe bank erosion occurs within the Site, resulting in elevated width-to-depth ratios, contingency measures to reduce bank erosion and width-to-depth ratio will be implemented. Bank erosion contingency measures may include the installation of log-vane weirs and/or other bank stabilization measures. If the resultant bank erosion induces shoot cutoffs or channel abandonment, a channel may be excavated which will reduce shear stress to stable values.

Vegetation

If vegetation success criteria are not achieved based on average density calculations from combined plots over the entire restoration area, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting will be performed as needed until achievement of vegetation success criteria.

Hydrology

Hydrological contingency will require consultation with hydrologists and regulatory agencies if wetland hydrology enhancement is not achieved. Floodplain surface modifications, including construction of ephemeral pools, represent a likely mechanism to increase the floodplain area in support of jurisdictional wetlands. Recommendations for contingency to establish wetland hydrology will be implemented and monitored until Hydrology Success Criteria are achieved.

5.0 REFERENCES

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation. Version 4.0. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.

North Carolina Division of Water Quality (NCDWQ). 2001. Benthic Macroinvertebrate Monitoring Protocols for Compensatory Mitigation. 401/Wetlands Unit, Department of Environment and Natural Resources. Raleigh, North Carolina.

North Carolina Division of Water Quality (NCDWQ). 2006. Standard Operating Procedures for Benthic Macroinvertebrates. Biological Assessment Unit, Department of Environment and Natural Resources. Raleigh, North Carolina.

North Carolina Division of Water Quality (NCDWQ). 2010a. Final North Carolina Water Quality Assessment and Impaired Waters List (NC 2010 Integrated Report Category 4 and 5, 303(d) List Approved Auguts 31, 2010) (online). Available:
http://portal.ncdenr.org/c/document_library/get_file?uuid=8ff0bb29-62c2-4b33-810c-2eee5afa75e9&groupId=38364 [December 8, 2010]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.

North Carolina Division of Water Quality (NCDWQ). 2010b. North Carolina Water Bodies Report (online). Available:
http://h2o.enr.state.nc.us/bims/reports/basinsandwaterbodies/03-08-32.pdf [December 8, 2010]. North Carolina Department of Environment and Natural Resources, Raleigh.

North Carolina Ecosystem Enhancement Program (NCEEP). 2009. Upper Catawba River Basin Restoration Priorities 2009 (online). Available:
http://www.nceep.net/services/restplans/Upper_Catawba_RBRP_2009.pdf [December 8, 2010]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.

Rosgen, D.L. 1996. Applied River Morphology. Wildland Hydrology Books, Pagosa Springs, CO.

Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, North Carolina Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.

United States Army Corps of Engineers, United States Environmental Protection Agency, North Carolina Wildlife Resources Commission, North Carolina Division of Water Quality (USACE et al.). 2003. Stream Mitigation Guidelines.

United States Department of Agriculture (USDA). 1995. Soil Survey of Alexander County, North Carolina. Natural Resources Conservation Service, United States Department of Agriculture.

United States Department of Agriculture (USDA). 2010. Web Soil Survey (online). Available: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx [February 25, 2010].United States

Environmental Protection Agency (USEPA). 1990. Mitigation Site Type Classification (MiST). USEPA Workshop, August 13-15, 1989. EPA Region IV and Hardwood Research Cooperative, NCSU, Raleigh, North Carolina.

United States Geological Survey (USGS). 1974. Hydrologic Unit Map - 1974. State of North Carolina.

Appendix A.
General Tables and Figures

Table 1. Project Components and Mitigation Credits
Table 2. Project Activity and Reporting History
Table 3. Project Contacts Table
Table 4. Project Attributes Table
Figure 1. The Site Location
Figure 2. Monitoring Plan View

Table 1. Project Components and Mitigation Credits
Herman Dairy Restoration Site

Mitigation Credits					
Stream		**Riparian Wetland**		**Nonriparian Wetland**	
Restoration	**Restoration Equivalent**	**Restoration**	**Restoration Equivalent**	**Restoration**	**Restoration Equivalent**
4560	**220**	**7.2**	**1.1**	**1.2**	**0.05**

Projects Components						
Station Range	**Existing Linear Footage/ Acreage**	**Priority Approach**	**Restoration/ Restoration Equivalent**	**Restoration Linear Footage/ Acreage**	**Mitigation Ratio**	**Comment**
UT1 10+00-31+67.8* UT1A 10+00-10+85.71 UT2 10+00-16+69.04, 21+50.67-27+10.09 UT3 10+00-17+28.39	4540	I	Restoration	3997	1:1	Priority I stream restoration through construction of stable channel at the historic floodplain elevation.
UT2 16+69.04-21+50.67 UT3 upper 81.10 linear feet		--	Restoration	563	1:1	Braided stream restoration by redirecting diffuse flow across riparian wetlands. Linear footage of stream is based on a straight line valley distance.
UT1 upper 330.00 linear feet	330	Level I	Enhancement	330	1.5:1	Level I stream enhancement through cessation of current land use practices, removing invasive species, and planting with native forest vegetation.
--	0	--	Restoration	7.2	1:1	Restoration of riparian wetlands within the floodplain as the result of stream restoration activities, filling abandoned channels and ditches, removing spoil castings, and planting with native forest vegetation.
--	2.2	--	Enhancement	2.2	2:1	Enhancement of existing riparian wetlands characterized by disturbed pasture by planting with native forest vegetation.
--	0	--	Restoration	1.2	1:1	Restoration of nonriparian wetlands by removing spoil castings, filling abandoned ditches to rehydrate hydric soils along the slope, eliminating land use practices, and planting with native forest vegetation.
--	0.1	--	Enhancement	0.1	2:1	Enhancement of existing nonriparian wetlands characterized by disturbed pasture by planting with native forest vegetation.

Component Summation			
Restoration Level	**Stream (linear footage)**	**Riparian Wetland (acreage)**	**Nonriparian Wetland (acreage)**
Restoration	4560	7.2	1.2
Enhancement (Level 1)	330	--	--
Enhancement	--	2.2	0.05
Totals	**4890**	**9.4**	**1.25**
Mitigation Units	**4780 SMUs**	**8.3 Riparian WMUs**	**1.25 Nonriparian WMUs**

*Restoration linear footage excludes 145.76 linear feet of stream located within the utility easement and 67.79 linear feet of stream located within a culverted crossing, which are both excluded from the easement.

Table 2. Project Activity and Reporting History
Herman Dairy Restoration Site

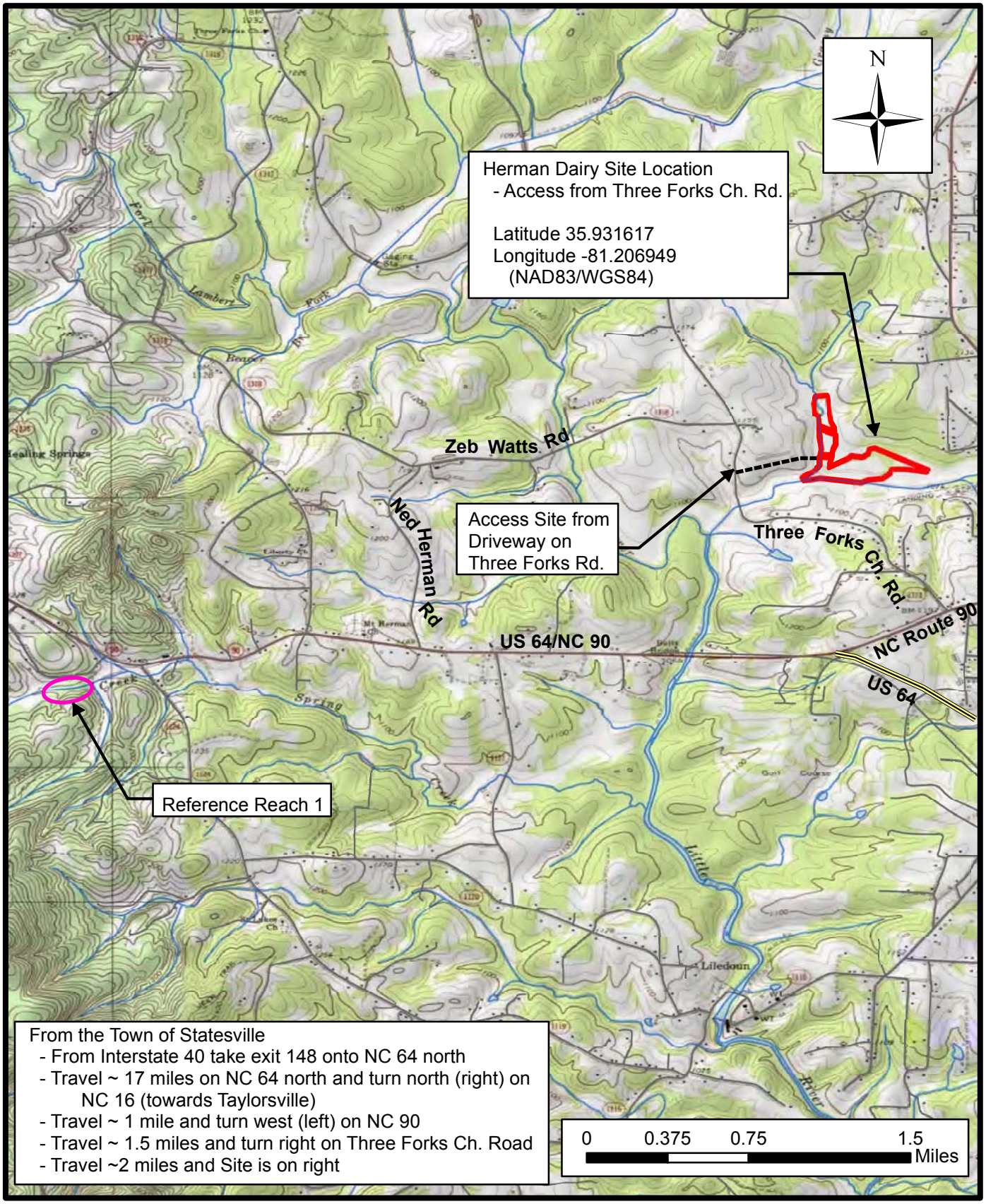
Activity or Deliverable	Data Collection Complete	Completion or Delivery
Technical Proposal (RFP No. 16-002830)	--	March 2010
EEP Contract No. 003271	--	July 23, 2010
Restoration Plan	--	January 2011
Construction Plans	--	August 2011

Table 3. Project Contacts Table
Herman Dairy Restoration Site

Full Delivery Provider	Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 George Howard and John Preyer 919-755-9490
Designer	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693
Construction Plans and Sediment and Erosion Control Plans	Sungate Design Group, PA 915 Jones Franklin Road Raleigh, NC 27606 W. Henry Wells, Jr, PE 919-859-2243
Construction and Planting Contractor	Land Mechanic Designs 780 Landmark Road Willow Spring, NC 27592 Lloyd Glover 919-639-6132
As-built Surveyor	K2 Design Group 5688 US Highway 70 East Goldsboro, NC 27534 John Rudolph 919-751-0075
Baseline Data Collection	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

Table 4. Project Attribute Table
Herman Dairy Restoration Site

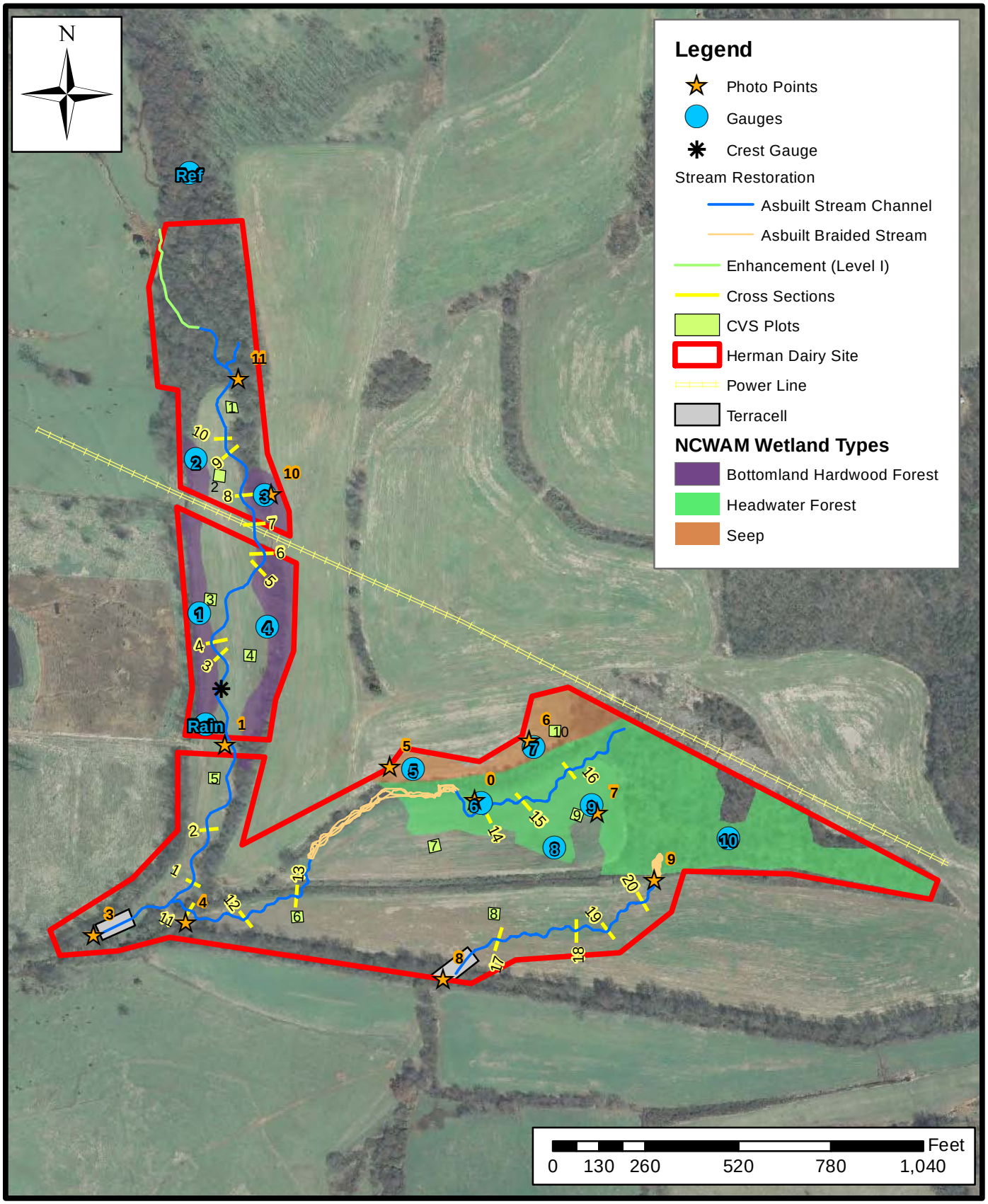
Project County	Alexander County, North Carolina		
Physiographic Region	Northern Inner Piedmont		
Ecoregion	Carolina Slate Belt		
Project River Basin	Catawba		
USGS HUC for Project (14 digit)	03050101120030		
NCDWQ Sub-basin for Project	03-08-32		
Identify planning area (LWP, RBRP, other)?	Yes – Upper Catawba River Basin Restoration Priorities 2009		
WRC Class (Warm, Cool, Cold)	Warm		
% of project easement fenced or demarcated	100		
Beaver activity observed during design phase?	Yes		
	Unnamed Tributaries to Muddy Fork		
	UT 1	**UT 2**	**UT 3**
Drainage Area	1.0	0.06	0.04
Stream Order (USGS topo)	2nd	1st	1st
Restored Length (feet)	2156	1684	760
Perennial (P) or Intermittent (I)	P	P	I
Watershed Type	Rural	Rural	Rural
Watershed impervious cover	<5%	<5%	<5%
NCDWQ AU/Index number	11-69-4	11-69-4	11-69-4
NCDWQ Classification	C	C	C
303d listed?	No	No	No
Upstream of a 303d listed	Yes	Yes	Yes
Reasons for 303d listed segment	aquatic life/sediment	aquatic life/sediment	aquatic life/sediment
Total acreage of easement	31.12	31.12	31.12
Total existing vegetated acreage of easement	8	8	8
Total planted restoration acreage	31.5	31.5	31.5
Rosgen Classification of preexisting	Cd5	Fc5/6	Fc5/6
Rosgen Classification of As-built	E/C 4/5	E/C 4/5	E/C 4/5
Valley type	VIII	VIII	VIII
Valley slope	0.0066	0.0052	0.0013
Cowardin classification of proposed	R3UB1/2	R3UB1/2	R4SB3/4
Trout waters designation	NA	NA	NA
Species of concern, endangered etc.	NA	NA	NA
Dominant Soil Series	Codorus/Hatboro	Codorus/Hatboro	Codorus/Hatboro



Axiom Environmental
218 Snow Avenue
Raleigh, NC 27603
(919) 215-1693
Axiom Environmental, Inc.

HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
THE SITE LOCATION
Alexander County, North Carolina

Dwn. By: WGL/CLF	FIGURE
Date: May 2012	1
Project: 10-016	



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HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
MONITORING PLAN
Alexander County, North Carolina

Dwn. By:	CLF
Date:	May 2012
Project:	10-016
FIGURE	2

Appendix B
Morphological Summary Data and Plots

Tables 5a-5c. Baseline Stream Data Summary
Tables 6a-6c. Monitoring Data-Dimensional Data Summary
Longitudinal Profile Plots
Cross-section Plots
Fixed Station Photo Points

Table 5A. Baseline Morphology and Hydraulic Summary
Herman Dairy UT 1

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Stream UT Catawba*			Project Reference Reach 1			Design			As-built		
Dimension	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
BF Width (ft)	USGS gage data is unavailable for this project			16	19	18	9	12	10	9	10	10	16	18	17	15.5	16.4	16.1
Floodprone Width (ft)				26	150	150	25	150	50	22	25	24			150			250
BF Cross Sectional Area (ft2)						20.2			10.9			11.8	36	53	20.2	14	18.2	16.4
BF Mean Depth (ft)				1.1	1.3	1.2	1.1	1.3	1.1	1.2	1.3	1.3	1.1	1.3	1.2	0.9	1.1	1
BF Max Depth (ft)				1.9	2.3	2	1.5	1.8	1.7	1.5	1.6	1.6	1.4	1.8	1.6	1.2	1.6	1.4
Width/Depth Ratio				12	17	16	8	13	10	7.2	8	7.6	12	16	14	14	17	16
Entrenchment Ratio				1.6	9.6	7.9	2.7	14.6	4.9	2.3	2.7	2.5	8	10	9	15	16	16
Bank Height Ratio				1.8	3.1	1.9			1			1	1	1.3	1.1			1
Wetted Perimeter(ft)						===			===			===			===	15.9	16.8	16.7
Hydraulic radius (ft)						===			===			===			===	0.9	1.1	1
Pattern																		
Channel Beltwidth (ft)				No pattern of riffles and pools due to straightening activties			30	40	35	35	58	45	50	101	67	50	101	67
Radius of Curvature (ft)							12.5	25	18	10	32	16	34	168	50	34	168	50
Meander Wavelength (ft)							25	70	45	65	128	81	101	202	143	101	202	143
Meander Width ratio							2.9	3.9	3.4	3.7	6.1	4.7	3	6	4	3	6	4
Profile																		
Riffle length (ft)				No pattern of riffles and pools due to straightening activties					===			===			===	23	65	36
Riffle slope (ft/ft)							0.30%	0.36%	0.34%	0.34%	4.31%	2.48%	1.10%	1.65%	1.38%	0.00%	1.50%	0.64%
Pool length (ft)									===			===			===	10	54	32
Pool spacing (ft)							22	62	39	29	103	60	50	134	67	50	134	67
Substrate																		
d50 (mm)						===			===			===			===			===
d84 (mm)						===			===			===			===			===
Additional Reach Parameters																		
Valley Length (ft)						===			===			===			===			.
Channel Length (ft)						===			===			===			===			2108
Sinuosity						1.1			1.4			1.4			1.2			1.2
Water Surface Slope (ft/ft)						0.62%			0.28%			1.27%			0.55%			0.53%
BF slope (ft/ft)						===			===			===			===			===
Rosgen Classification						Cd 5			E 4/5			E 4/5			Ec4/5			E/C 4/5

*UT to Catawba River Reference Site includes measurements from a stream measured in 2008

Table 5B. Baseline Morphology and Hydraulic Summary
Herman Dairy UT 2

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Stream UT Catawba*			Project Reference Reach 1			Design			As-built^		
Dimension	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
BF Width (ft)	USGS gage data is unavailable for this project			6	15	9	9	12	10	9	10	10	5.3	6.1	5.7	6.8	7.9	6.9
Floodprone Width (ft)				14	19	15	25	150	50	22	25	24			150			150
BF Cross Sectional Area (ft2)						2.3			10.9			11.8			2.3	2.2	2.4	2.3
BF Mean Depth (ft)				0.2	0.4	0.3	1.1	1.3	1.1	1.2	1.3	1.3	0.3	0.5	0.4	0.3	0.3	0.3
BF Max Depth (ft)				0.4	0.8	0.5	1.5	1.8	1.7	1.5	1.6	1.6	0.4	0.6	0.5	0.5	0.5	0.5
Width/Depth Ratio				16	76	30	8	13	10	7.2	8	7.6	12	16	14	20	27	21
Entrenchment Ratio				1.3	2.2	1.6	2.7	14.6	4.9	2.3	2.7	2.5	14	38	26	19	22	22
Bank Height Ratio				5	12	7			1			1	1	1.3	1.1			1
Wetted Perimeter(ft)						===			===			===			===	7	8	7.1
Hydraulic radius (ft)						===			===			===			===	0.3	0.3	0.3
Pattern																		
Channel Beltwidth (ft)				No pattern of riffles and pools due to straightening activties			30	40	35	35	58	45	17	34	23	17	34	23
Radius of Curvature (ft)							12.5	25	18	10	32	16	11	57	17	11	57	17
Meander Wavelength (ft)							25	70	45	65	128	81	34	68	49	34	68	49
Meander Width ratio							2.9	3.9	3.4	3.7	6.1	4.7	3	8	4	3	8	4
Profile																		
Riffle length (ft)				No pattern of riffles and pools due to straightening activties					===			===			===	6	44	14
Riffle slope (ft/ft)							0.30%	0.36%	0.34%	0.34%	4.31%	2.48%	0.86%	1.29%	1.08%	0.00%	1.25%	0.39%
Pool length (ft)									===			===			===	6	32	13
Pool spacing (ft)							22	62	39	29	103	60	17	46	23	17	46	23
Substrate																		
d50 (mm)						===			===			===			===			===
d84 (mm)						===			===			===			===			===
Additional Reach Parameters																		
Valley Length (ft)						===			===			===			===			.
Channel Length (ft)						===			===			===			===			1696
Sinuosity						1.04			1.4			1.4			1.2			1.2
Water Surface Slope (ft/ft)						0.85%			0.28%			1.27%			0.43%			0.40%
BF slope (ft/ft)						===			===			===			===			===
Rosgen Classification						Fc 5/6			E 4/5			E 4/5			Ec4/5			C 4/5

^Measured as-built numbers do not include D-type reach.
*UT to Catawba River Reference Site includes measurements from a stream measured in 2008.

Table 5C. Baseline Morphology and Hydraulic Summary
Herman Dairy UT 3

Parameter	USGS Gage Data			Pre-Existing Condition			Project Reference Stream UT Catawba*			Project Reference Reach 1			Design			As-built		
Dimension	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
BF Width (ft)	USGS gage data is unavailable for this project			6	9	7	9	12	10	9	10	10	6	7	6.5	6.8	8.5	7.7
Floodprone Width (ft)				12	13	12	25	150	50	22	25	24			150			150
BF Cross Sectional Area (ft2)						3			10.9			11.8			3	2.2	3.1	2.7
BF Mean Depth (ft)				0.3	0.5	0.4	1.1	1.3	1.1	1.2	1.3	1.3	0.4	0.6	0.5	0.3	0.4	0.4
BF Max Depth (ft)				0.6	0.9	0.7	1.5	1.8	1.7	1.5	1.6	1.6	0.6	0.8	0.7	0.5	0.5	0.5
Width/Depth Ratio				13	31	17	8	13	10	7.2	8	7.6	12	16	14	21	23	22
Entrenchment Ratio				1.4	1.9	1.7	2.7	14.6	4.9	2.3	2.7	2.5	22	25	23	17	22	19.5
Bank Height Ratio				4	7	6			1			1	1	1.3	1.1			1
Wetted Perimeter(ft)						===			===			===			===	7	8.7	7.9
Hydraulic radius (ft)						===			===			===			===	0.3	0.4	0.4
Pattern																		
Channel Beltwidth (ft)				No pattern of riffles and pools due to straightening activties			30	40	35	35	58	45	20	39	26	20	39	26
Radius of Curvature (ft)							12.5	25	18	10	32	16	13	65	20	13	65	20
Meander Wavelength (ft)							25	70	45	65	128	81	39	78	55	39	78	55
Meander Width ratio							2.9	3.9	3.4	3.7	6.1	4.7	3	8	4	3	8	4
Profile																		
Riffle length (ft)				No pattern of riffles and pools due to straightening activties					===			===			===	5	26	11
Riffle slope (ft/ft)							0.30%	0.36%	0.34%	0.34%	4.31%	2.48%	0.22%	0.33%	0.28%	0.00%	1.59%	0.22%
Pool length (ft)									===			===			===	7	21	13
Pool spacing (ft)							22	62	39	29	103	60	20	52	26	20	52	26
Substrate																		
d50 (mm)						===			===			===			===			===
d84 (mm)						===			===			===			===			===
Additional Reach Parameters																		
Valley Length (ft)						===			===			===			===			.
Channel Length (ft)						===			===			===			===			743
Sinuosity						1.01			1.4			1.4			1.2			1.2
Water Surface Slope (ft/ft)						0.40%			0.28%			1.27%			0.11%			0.12%
BF slope (ft/ft)						===			===			===			===			===
Rosgen Classification						Fc 5/6			E 4/5			E 4/5			Ec4/5			C 4/5

*UT to Catawba River Reference Site includes measurements from a stream measured in 2008.

Table 6A. Morphology and Hydraulic Monitoring Summary
Herman Dairy - Stream and Wetland Restoration Site

Parameter	Cross Section 1 Pool (UT 1)						Cross Section 2 Pool (UT 1)						Cross Section 3 Riffle (UT 1)						Cross Section 4 Pool (UT 1)					
Dimension	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	20.9						16.9						16.4						16.8					
Floodprone Width (ft)	----						----						250						----					
BF Cross Sectional Area (ft2)	19.9						16.3						16.7						14.4					
BF Mean Depth (ft)	1.0						1.0						1.0						0.9					
BF Max Depth (ft)	2.3						1.4						1.4						2.1					
Width/Depth Ratio	----						----						16.1						----					
Entrenchment Ratio	----						----						15.2						----					
Bank Height Ratio	----						----						1						----					
Wetted Perimeter (ft)	21.7						17.2						16.8						17.6					
Hydraulic Radius (ft)	0.9						0.9						1						0.8					
Substrate																								
d50 (mm)	----						----						----						----					
d84 (mm)	----						----						----						----					

Parameter	MY-00 (2012)			MY-01 (2012)			MY-02 (2013)			MY-03 (2014)			MY-04 (2015)			MY-05 (2016)		
	Min	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Pattern																		
Channel Beltwidth (ft)	50	101	67															
Radius of Curvature (ft)	34	168	50															
Meander Wavelength (ft)	50	101	67															
Meander Width Ratio	3	6	4															
Profile																		
Riffle Length (ft)	23	65	36															
Riffle Slope (ft/ft)	0.00%	1.50%	0.64%															
Pool Length (ft)	10	54	32															
Pool Spacing (ft)	50	134	67															
Additonal Reach Parameters																		
Valley Length (ft)	1757																	
Channel Length (ft)	2,108																	
Sinuosity	1.2																	
Water Surface Slope (ft/ft)	0.0053																	
BF Slope (ft/ft)	------																	
Rosgen Classification	C/E 4/5																	

Table 6B. Morphology and Hydraulic Monitoring Summary
Herman Dairy - Stream and Wetland Restoration Site

Parameter	Cross Section 5 Riffle (UT 1)						Cross Section 6 Pool (UT 1)						Cross Section 7 Riffle (UT 1)						Cross Section 8 Pool (UT 1)					
Dimension	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	16.1						20						15.5						16.1					
Floodprone Width (ft)	250						----						250						----					
BF Cross Sectional Area (ft2)	18.2						20.3						14						15.5					
BF Mean Depth (ft)	1.1						1.0						0.9						1.0					
BF Max Depth (ft)	1.6						2.3						1.2						1.9					
Width/Depth Ratio	14.2						----						17.2						----					
Entrenchment Ratio	15.5						----						16.1						----					
Bank Height Ratio	1						----						1						----					
Wetted Perimeter (ft)	16.8						21						15.9						16.8					
Hydraulic Radius (ft)	1.1						1						0.9						0.9					
Substrate																								
d50 (mm)	----						----						----						----					
d84 (mm)	----						----						----						----					

Parameter	MY-00 (2012)			MY-01 (2012)			MY-02 (2013)			MY-03 (2014)			MY-04 (2015)			MY-05 (2016)		
	Min	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Pattern																		
Channel Beltwidth (ft)	50	101	67															
Radius of Curvature (ft)	34	168	50															
Meander Wavelength (ft)	50	101	67															
Meander Width Ratio	3	6	4															
Profile																		
Riffle Length (ft)	23	65	36															
Riffle Slope (ft/ft)	0.00%	1.50%	0.64%															
Pool Length (ft)	10	54	32															
Pool Spacing (ft)	50	134	67															
Additonal Reach Parameters																		
Valley Length (ft)	1757																	
Channel Length (ft)	2,108																	
Sinuosity	1.2																	
Water Surface Slope (ft/ft)	0.0053																	
BF Slope (ft/ft)	------																	
Rosgen Classification	C/E 4/5																	

Table 6C. Morphology and Hydraulic Monitoring Summary
Herman Dairy - Stream and Wetland Restoration Site

Parameter	Cross Section 9 Pool (UT 1)						Cross Section 10 Riffle (UT 1)						Cross Section 11 Riffle (UT2)						Cross Section 12 Pool (UT2)					
Dimension	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	18.7						16						7.9						5.5					
Floodprone Width (ft)	----						250						150						----					
BF Cross Sectional Area (ft2)	15.7						16						2.3						2.3					
BF Mean Depth (ft)	0.8						1.0						0.3						0.4					
BF Max Depth (ft)	2						1.3						0.5						0.8					
Width/Depth Ratio	----						16.0						27.1						----					
Entrenchment Ratio	----						15.6						19.0						----					
Bank Height Ratio	----						1						1						----					
Wetted Perimeter (ft)	19.5						16.5						8						5.8					
Hydraulic Radius (ft)	0.8						1						0.3						0.4					
Substrate																								
d50 (mm)	----						----						----						----					
d84 (mm)	----						----						----						----					

Parameter	MY-00 (2012)			MY-01 (2012)			MY-02 (2013)			MY-03 (2014)			MY-04 (2015)			MY-05 (2016)		
	Min	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Pattern																		
Channel Beltwidth (ft)	50	101	67															
Radius of Curvature (ft)	34	168	50															
Meander Wavelength (ft)	50	101	67															
Meander Width Ratio	3	6	4															
Profile																		
Riffle Length (ft)	17	111	51															
Riffle Slope (ft/ft)	0.43%	4.80%	1.54%															
Pool Length (ft)	26	78	46															
Pool Spacing (ft)	76	176	126															
Additonal Reach Parameters																		
Valley Length (ft)	1757																	
Channel Length (ft)	2,108																	
Sinuosity	1.2																	
Water Surface Slope (ft/ft)	0.0053																	
BF Slope (ft/ft)	------																	
Rosgen Classification	C/E 4/5																	

Table 6D. Morphology and Hydraulic Monitoring Summary
Herman Dairy - Stream and Wetland Restoration Site

Parameter	Cross Section 13 Riffle (UT 2)						Cross Section 14 Pool (UT 2)						Cross Section 15 Riffle (UT2)						Cross Section 16 Pool (UT2)					
Dimension	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	6.9						6.6						6.8						5.7					
Floodprone Width (ft)	150						----						150						----					
BF Cross Sectional Area (ft2)	2.4						2.4						2.2						2.3					
BF Mean Depth (ft)	0.3						0.4						0.3						0.4					
BF Max Depth (ft)	0.5						0.7						0.5						0.8					
Width/Depth Ratio	19.8						----						21.0						----					
Entrenchment Ratio	21.7						----						22.1						----					
Bank Height Ratio	1						----						1						----					
Wetted Perimeter (ft)	7.1						6.8						7						6					
Hydraulic Radius (ft)	0.3						0.3						0.3						0.4					
Substrate																								
d50 (mm)	----						----						----						----					
d84 (mm)	----						----						----						----					

Parameter	MY-00 (2012)			MY-01 (2012)			MY-02 (2013)			MY-03 (2014)			MY-04 (2015)			MY-05 (2016)		
	Min	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Pattern																		
Channel Beltwidth (ft)	17	34	23															
Radius of Curvature (ft)	11	57	17															
Meander Wavelength (ft)	34	68	49															
Meander Width Ratio	3	6	4															
Profile																		
Riffle Length (ft)	6	44	14															
Riffle Slope (ft/ft)	0.00%	1.25%	0.39%															
Pool Length (ft)	6	32	13															
Pool Spacing (ft)	17	46	23															
Additonal Reach Parameters																		
Valley Length (ft)	1413																	
Channel Length (ft)	1,696																	
Sinuosity	1.2																	
Water Surface Slope (ft/ft)	0.004																	
BF Slope (ft/ft)	------																	
Rosgen Classification	C/E 4/5																	

Table 6E. Morphology and Hydraulic Monitoring Summary
Herman Dairy - Stream and Wetland Restoration Site

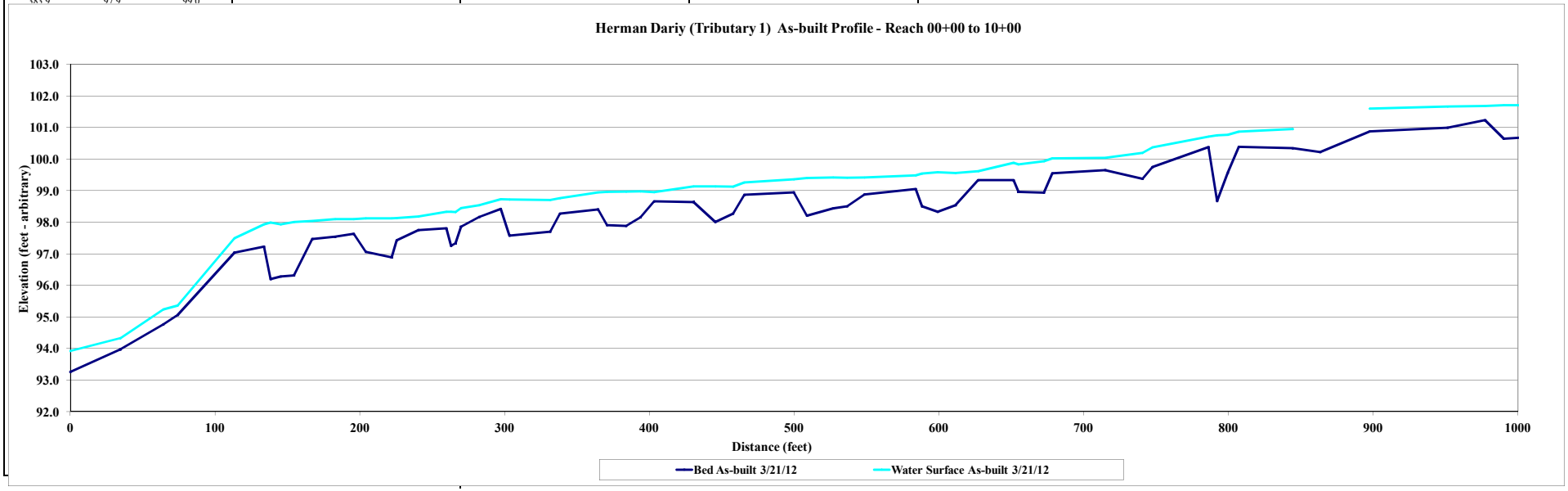
Parameter	Cross Section 17 Riffle (UT 3)						Cross Section 18 Pool (UT 3)						Cross Section 19 Pool (UT3)						Cross Section 20 Riffle (UT3)					
Dimension	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY 0**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	8.5						6.2						6.8						9.5					
Floodprone Width (ft)	150						----						----						150					
BF Cross Sectional Area (ft2)	3.1						3.8						3						3.2					
BF Mean Depth (ft)	0.4						0.6						0.4						0.3					
BF Max Depth (ft)	0.5						1						0.9						0.6					
Width/Depth Ratio	23.3						----						----						28.2					
Entrenchment Ratio	17.6						----						----						15.8					
Bank Height Ratio	1						----						----						1					
Wetted Perimeter (ft)	8.7						6.7						7.2						9.7					
Hydraulic Radius (ft)	0.4						0.6						0.4						0.3					
Substrate																								
d50 (mm)	----						----						----						----					
d84 (mm)	----						----						----						----					

Parameter	MY-00 (2012)			MY-01 (2012)			MY-02 (2013)			MY-03 (2014)			MY-04 (2015)			MY-05 (2016)		
	Min	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Pattern																		
Channel Beltwidth (ft)	20	39	26															
Radius of Curvature (ft)	13	65	20															
Meander Wavelength (ft)	39	78	55															
Meander Width Ratio	3	6	4															
Profile																		
Riffle Length (ft)	5	26	11															
Riffle Slope (ft/ft)	0.00%	1.59%	0.22%															
Pool Length (ft)	8	21	13															
Pool Spacing (ft)	20	52	26															
Additonal Reach Parameters																		
Valley Length (ft)	619																	
Channel Length (ft)	743																	
Sinuosity	1.2																	
Water Surface Slope (ft/ft)	0.0012																	
BF Slope (ft/ft)	------																	
Rosgen Classification	C/E 4/5																	

Project Name	Herman Dairy - As-built (2012) Profile
Reach	Tributary 1
Feature	Profile
Date	3/21/12
Crew	Perkinson, Thomas

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	93.3	93.9									
34.6	94.0	94.3									
64.3	94.8	95.2									
74.2	95.1	95.4									
113.3	97.0	97.5									
133.7	97.2	97.9									
138.4	96.2	98.0									
145.3	96.3	97.9									
154.5	96.3	98.0									
167.2	97.5	98.0									
182.9	97.5	98.1									
195.8	97.6	98.1									
204.1	97.1	98.1									
221.9	96.9	98.1									
225.5	97.4	98.1									
240.5	97.8	98.2									
259.8	97.8	98.3									
263.0	97.3	98.3									
266.2	97.3	98.3									
269.8	97.9	98.4									
282.4	98.2	98.5									
297.4	98.4	98.7									
303.3	97.6	98.7									
331.6	97.7	98.7									
338.2	98.3	98.8									
364.5	98.4	98.9									
370.8	97.9	99.0									
383.9	97.9	99.0									

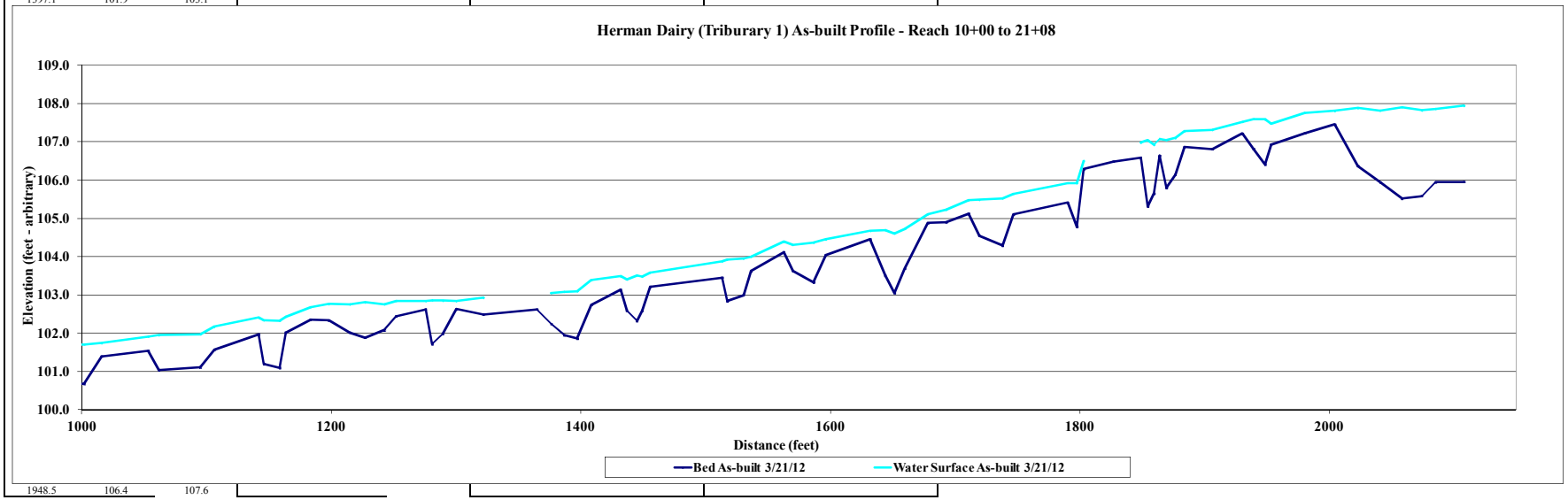
	As-built	2012	2013	2014
Avg. Water Surface Slope	0.0053			
Riffle Length	36			
Avg. Riffle Slope	0.0064			
Pool Length	32			



Project Name	Herman Dairy - As-built (2012) Profile
Reach	Tributary 1
Feature	Profile
Date	3/21/12
Crew	Perkinson, Thomas

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
990.2	100.6	101.7									
1001.8	100.7	101.7									
1015.7	101.4	101.7									
1053.0	101.5	101.9									
1061.5	101.0	101.9									
1094.8	101.1	102.0									
1106.1	101.6	102.2									
1141.7	102.0	102.4									
1145.7	101.2	102.3									
1158.5	101.1	102.3									
1163.3	102.0	102.4									
1183.3	102.4	102.7									
1197.8	102.3	102.8									
1214.6	102.0	102.8									
1226.9	101.9	102.8									
1242.5	102.1	102.8									
1251.9	102.4	102.8									
1275.5	102.6	102.8									
1280.7	101.7	102.9									
1289.3	102.0	102.9									
1300.0	102.6	102.8									
1321.8	102.5	102.9									
1364.7	102.6										
1376.2	102.2	103.0									
1386.5	102.0	103.1									
1397.1	101.9	103.1									
1948.5	106.4	107.6									

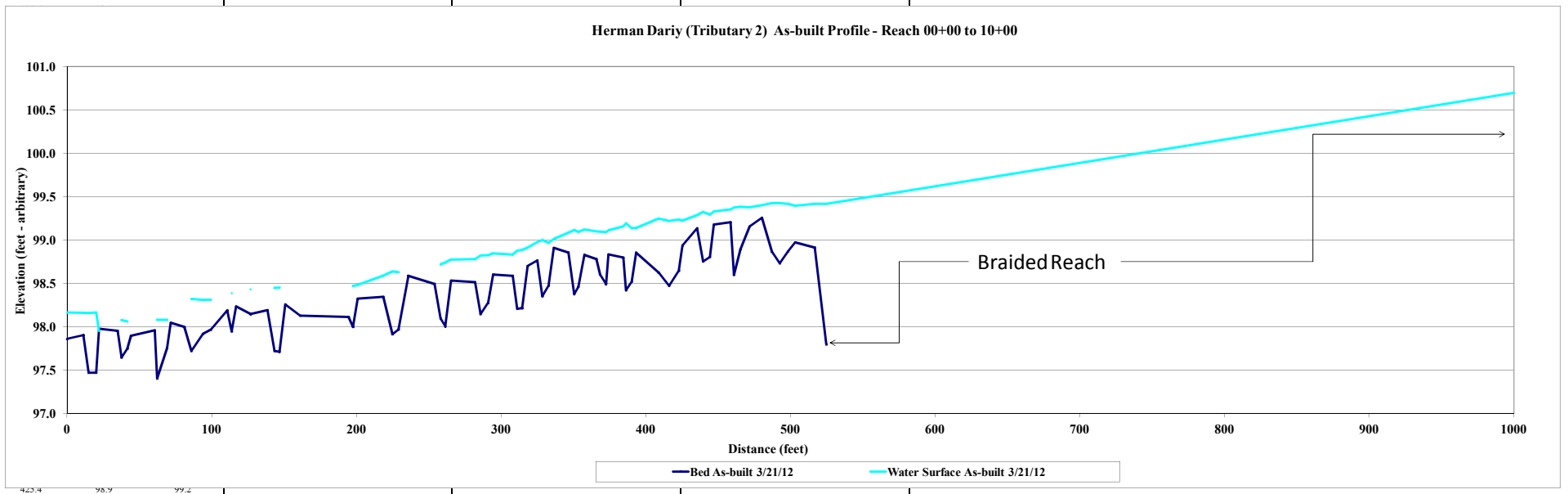
	As-built	2012	2013	2014
Avg. Water Surface Slope	0.0053			
Riffle Length	36			
Avg. Riffle Slope	0.0064			
Pool Length	32			



Project Name	Herman Dairy - As-built (2012) Profile
Reach	Tributary 2
Feature	Profile
Date	3/21/12
Crew	Perkinson, Thomas

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
0.0	97.9	98.2									
11.2	97.9	98.2									
14.9	97.5	98.2									
20.1	97.5	98.2									
22.2	98.0	98.0									
34.9	98.0										
37.6	97.6	98.1									
41.7	97.7	98.1									
44.1	97.9										
60.6	98.0										
62.3	97.4	98.1									
69.1	97.8	98.1									
71.7	98.0										
81.1	98.0										
85.9	97.7	98.3									
93.8	97.9	98.3									
99.3	98.0	98.3									
110.8	98.2										
113.8	97.9	98.4									
116.9	98.2										
126.7	98.1	98.4									
138.4	98.2										
143.4	97.7	98.4									
146.8	97.7	98.5									
150.8	98.3										
161.2	98.1										
423.4	98.9	99.2									
435.5	99.1	99.3									

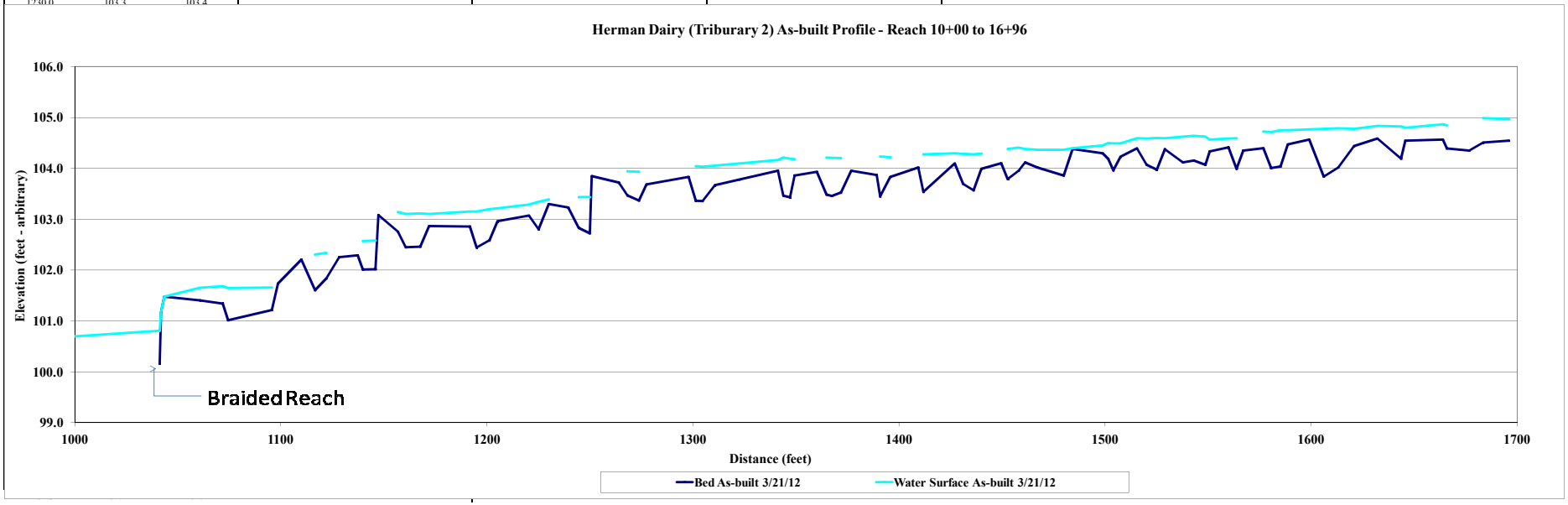
	As-built	2012	2013	2014
Avg. Water Surface Slope	0.0040			
Riffle Length	14			
Avg. Riffle Slope	0.0039			
Pool Length	13			



Project Name	Herman Dairy - As-built (2012) Profile
Reach	Tributary 2
Feature	Profile
Date	3/21/12
Crew	Perkinson, Thomas

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation
524.8		99.4									
1041.2	100.2	100.8									
1041.8	101.2	101.2									
1043.5	101.5	101.5									
1060.7	101.4	101.7									
1071.8	101.3	101.7									
1074.4	101.0	101.6									
1095.6	101.2	101.7									
1098.7	101.7										
1110.0	102.2										
1116.6	101.6	102.3									
1122.1	101.8	102.3									
1128.3	102.3										
1137.3	102.3										
1139.8	102.0	102.6									
1146.0	102.0	102.6									
1147.4	103.1										
1156.8	102.8	103.1									
1160.6	102.4	103.1									
1167.7	102.5	103.1									
1172.0	102.9	103.1									
1191.8	102.9	103.2									
1195.0	102.4	103.2									
1201.3	102.6	103.2									
1205.2	103.0	103.2									
1220.4	103.1	103.3									
1225.1	102.8	103.3									
1230.0	103.3	103.4									

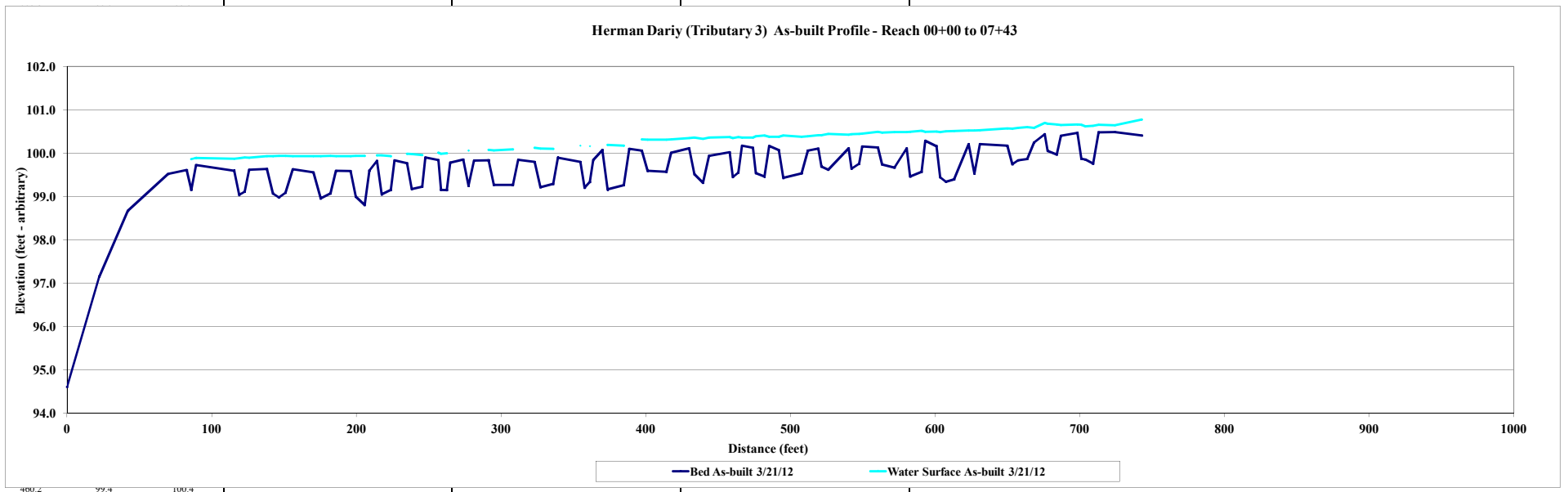
	As-built	2012	2013	2014
Avg. Water Surface Slope	0.0040			
Riffle Length	14			
Avg. Riffle Slope	0.0039			
Pool Length	13			



Project Name	Herman Dairy - As-built (2012) Profile
Reach	Tributary 3
Feature	Profile
Date	3/21/12
Crew	Perkinson, Thomas

2012 As-built Survey			2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
0.0	94.6										
22.2	97.1										
42.1	98.7										
69.9	99.5										
82.7	99.6										
85.8	99.2	99.9									
89.2	99.7	99.9									
115.5	99.6	99.9									
119.0	99.0	99.9									
122.7	99.1	99.9									
125.8	99.6	99.9									
138.2	99.6	99.9									
142.3	99.1	99.9									
146.4	99.0	99.9									
151.0	99.1	99.9									
156.1	99.6	99.9									
170.2	99.6	99.9									
175.3	99.0	99.9									
182.1	99.1	99.9									
185.9	99.6	99.9									
196.0	99.6	99.9									
199.5	99.0	99.9									
205.7	98.8	99.9									
208.9	99.6										
214.2	99.8	100.0									
217.5	99.0	100.0									
460.2	99.4	100.4									
464.1	99.6	100.4									

	As-built	2012	2013	2014
Avg. Water Surface Slope	0.0012			
Riffle Length	11			
Avg. Riffle Slope	0.0022			
Pool Length	13			

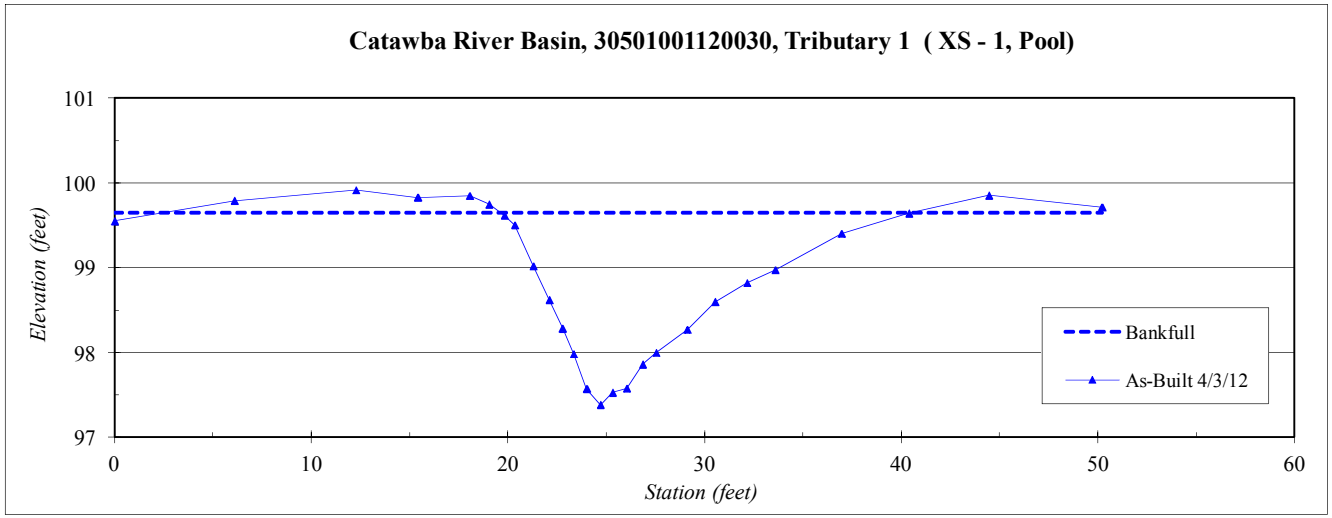


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 1, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.00	99.55
6.10	99.79
12.27	99.92
15.42	99.83
18.06	99.85
19.04	99.75
19.83	99.62
20.36	99.50
21.29	99.02
22.11	98.62
22.77	98.28
23.35	97.98
24.01	97.57
24.71	97.38
25.33	97.53
26.04	97.58
26.9	97.86
27.54	98.00
29.12	98.27
30.55	98.60
32.16	98.82
33.60	98.97
37.0	99.40
40.4	99.6
44.5	99.9
50.2	99.7

SUMMARY DATA	
Bankfull Elevation:	99.7
Bankfull Cross-Sectional Area:	19.9
Bankfull Width:	20.9
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	1.0
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E

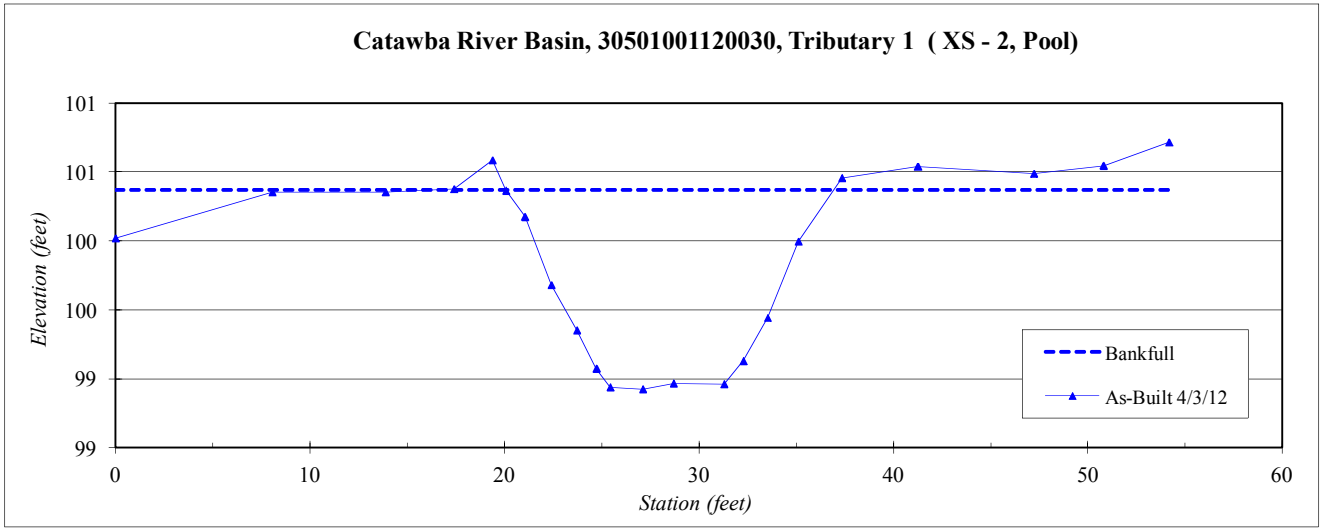


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 2, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.00	100.02
8.05	100.35
13.87	100.35
17.39	100.38
19.37	100.59
20.08	100.37
21.04	100.17
22.41	99.68
23.72	99.35
24.72	99.07
25.44	98.94
27.11	98.93
28.69	98.97
31.28	98.96
32.29	99.13
33.5	99.44
35.1	100.00
37.4	100.46
41.25	100.54
47.21	100.49
50.80	100.55
54.18	100.72

SUMMARY DATA	
Bankfull Elevation:	100.4
Bankfull Cross-Sectional Area:	16.3
Bankfull Width:	16.9
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	1.0
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E

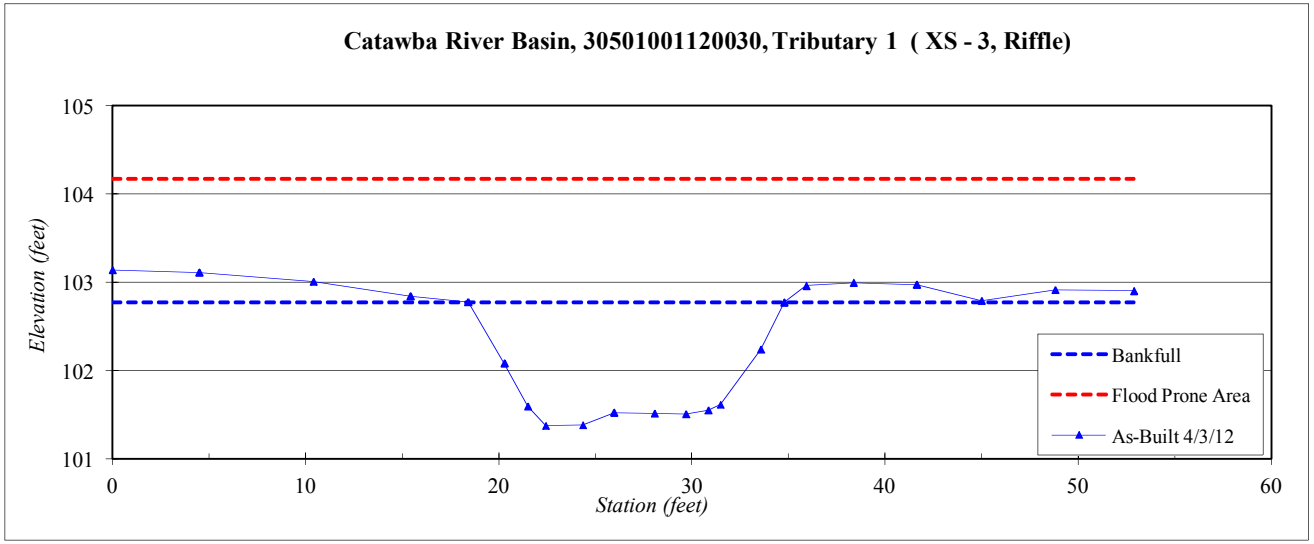


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 3, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.00	103.14
4.48	103.11
10.40	103.01
15.42	102.84
18.40	102.77
20.29	102.08
21.51	101.60
22.43	101.38
24.35	101.38
25.96	101.52
28.06	101.52
29.70	101.51
30.84	101.55
31.48	101.61
33.6	102.24
34.8	102.77
35.9	102.96
38.4	102.99
41.6	102.97
45.0	102.79
48.8	102.91
52.9	102.90

SUMMARY DATA	
Bankfull Elevation:	102.8
Bankfull Cross-Sectional Area:	16.7
Bankfull Width:	16.4
Flood Prone Area Elevation:	104.2
Flood Prone Width:	>80
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	1.0
W / D Ratio:	16.1
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

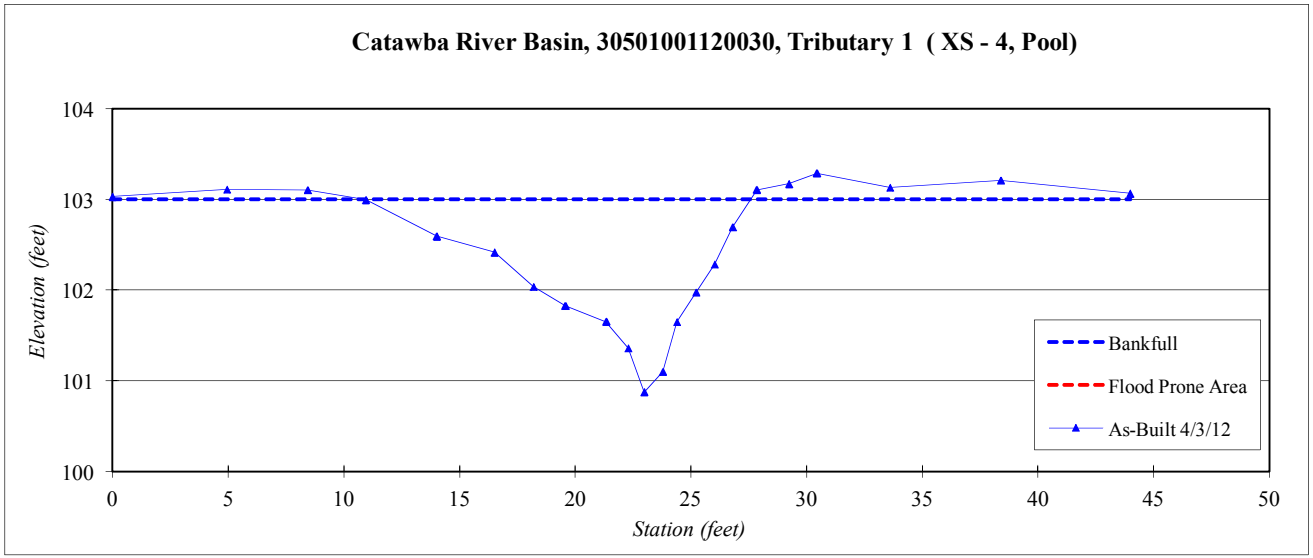


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 4, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	103.0
4.9	103.1
8.4	103.1
10.9	103.0
14.0	102.6
16.5	102.4
18.2	102.0
19.6	101.8
21.3	101.7
22.3	101.4
23.0	100.9
23.8	101.1
24.4	101.6
25.2	102.0
26.0	102.28
26.8	102.69
27.8	103.11
29.2	103.17
30.4	103.29
33.6	103.13
38.4	103.21
44.0	103.06

SUMMARY DATA	
Bankfull Elevation:	103.0
Bankfull Cross-Sectional Area:	14.4
Bankfull Width:	16.8
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.1
Mean Depth at Bankfull:	0.9
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E

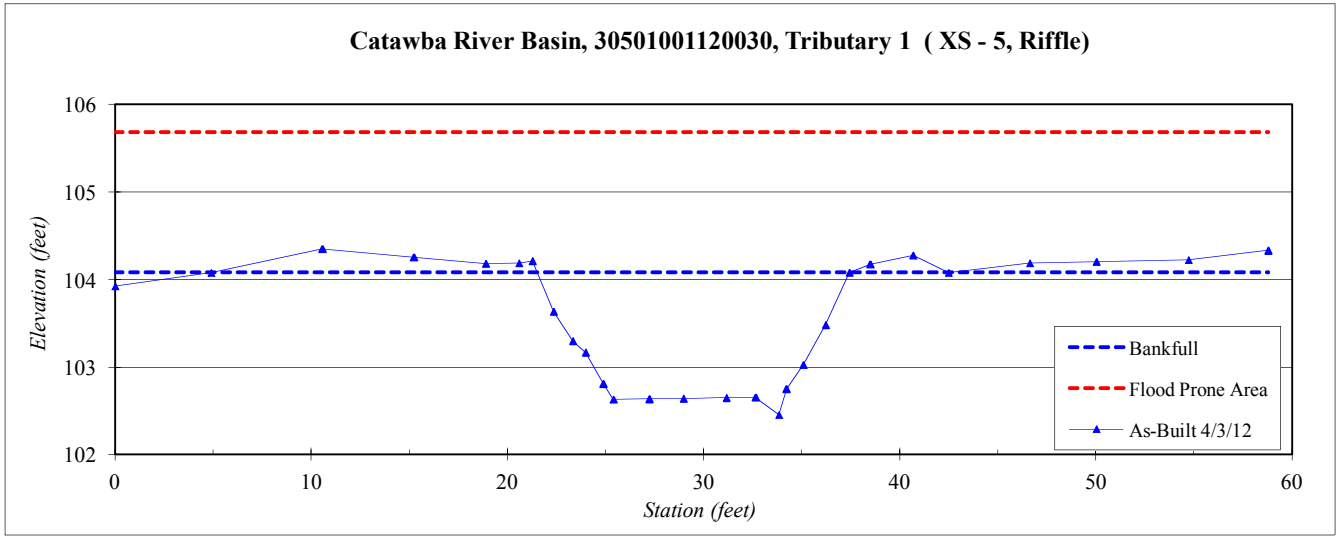


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 5, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	103.9
4.9	104.1
10.6	104.3
15.2	104.3
18.9	104.2
20.6	104.2
21.3	104.2
22.4	103.6
23.3	103.3
24.0	103.2
24.9	102.8
25.4	102.6
27.2	102.6
29.0	102.64
31.2	102.65
32.7	102.65
33.9	102.45
34.2	102.75
35.1	103.03
36.2	103.48
37.4	104.08
38.5	104.17
40.7	104.27
42.5	104.08
46.6	104.19
50.0	104.20
54.7	104.22
58.8	104.33

SUMMARY DATA	
Bankfull Elevation:	104.1
Bankfull Cross-Sectional Area:	18.2
Bankfull Width:	16.1
Flood Prone Area Elevation:	105.7
Flood Prone Width:	>80
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	1.1
W / D Ratio:	14.2
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

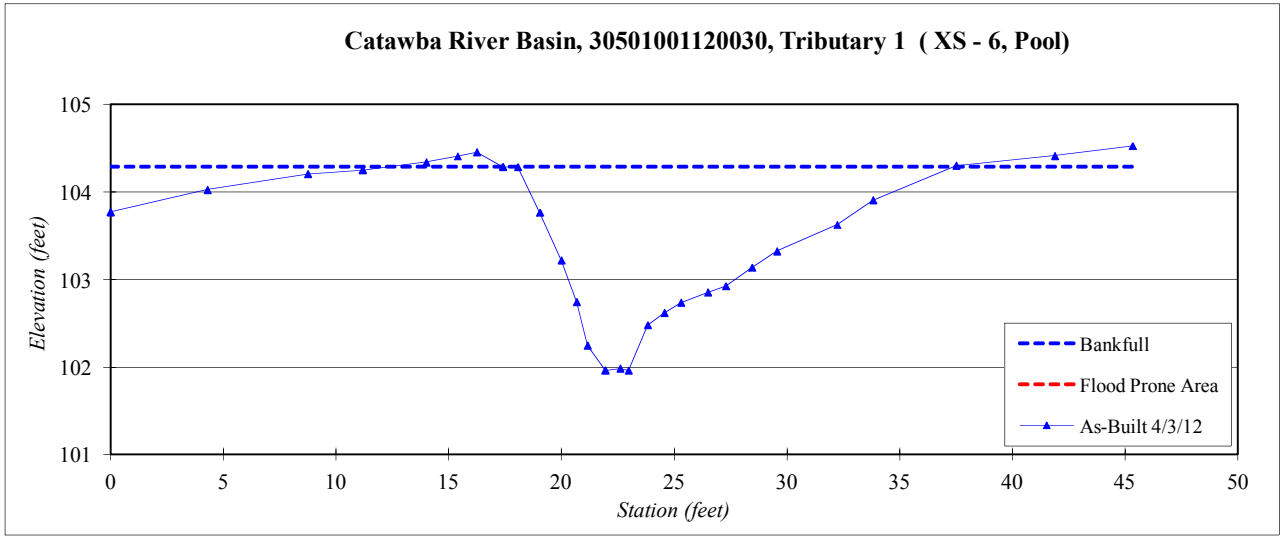


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 6, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	103.8
4.3	104.0
8.7	104.2
11.2	104.3
14.0	104.3
15.4	104.4
16.2	104.5
17.4	104.3
18.1	104.3
19.0	103.8
20.0	103.2
20.7	102.7
21.1	102.2
21.9	102.0
22.6	102.0
23.0	102.0
23.8	102.5
24.6	102.6
25.3	102.7
26.5	102.9
27.3	102.9
28.4	103.1
29.6	103.3
32.2	103.6
33.8	103.9
37.5	104.3
41.9	104.4
45.3	104.5

SUMMARY DATA	
Bankfull Elevation:	104.3
Bankfull Cross-Sectional Area:	20.3
Bankfull Width:	20.0
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	1.0
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

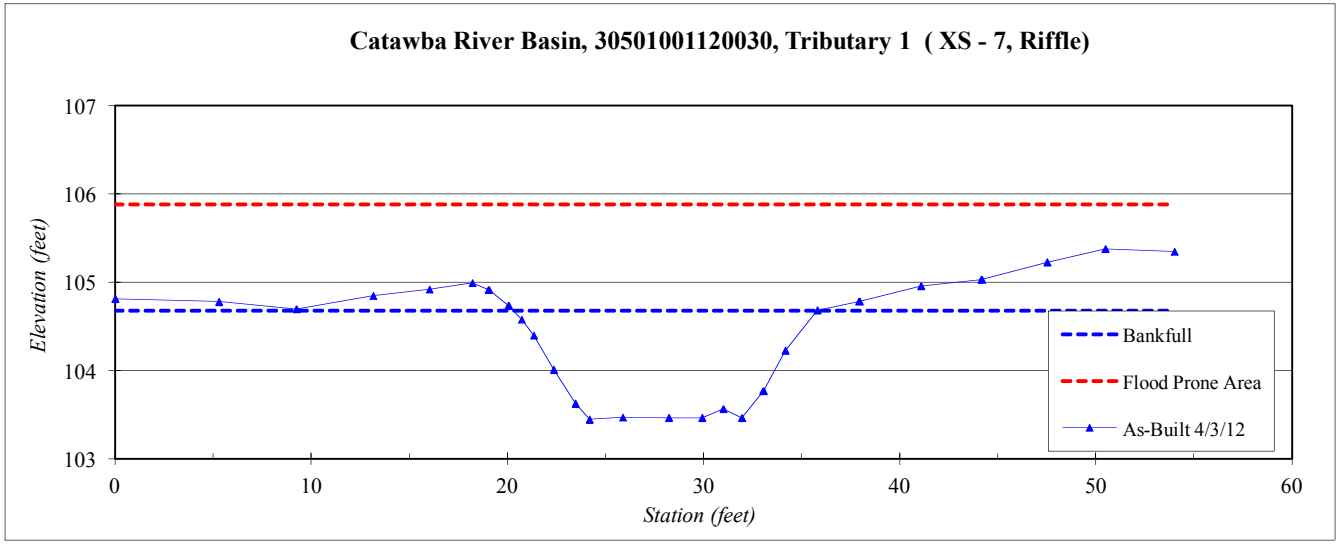


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 7, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	104.8
5.3	104.8
9.2	104.7
13.2	104.8
16.0	104.9
18.2	105.0
19.0	104.9
20.1	104.7
20.7	104.6
21.3	104.4
22.4	104.0
23.5	103.6
24.2	103.4
25.9	103.47
28.2	103.47
29.9	103.47
31.0	103.57
32.0	103.46
33.0	103.77
34.2	104.23
35.8	104.68
37.9	104.78
41.1	104.96
44.2	105.03
47.5	105.23
50.5	105.38
54.0	105.35

SUMMARY DATA	
Bankfull Elevation:	104.7
Bankfull Cross-Sectional Area:	14.0
Bankfull Width:	15.5
Flood Prone Area Elevation:	105.9
Flood Prone Width:	>80
Max Depth at Bankfull:	1.2
Mean Depth at Bankfull:	0.9
W / D Ratio:	17.2
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

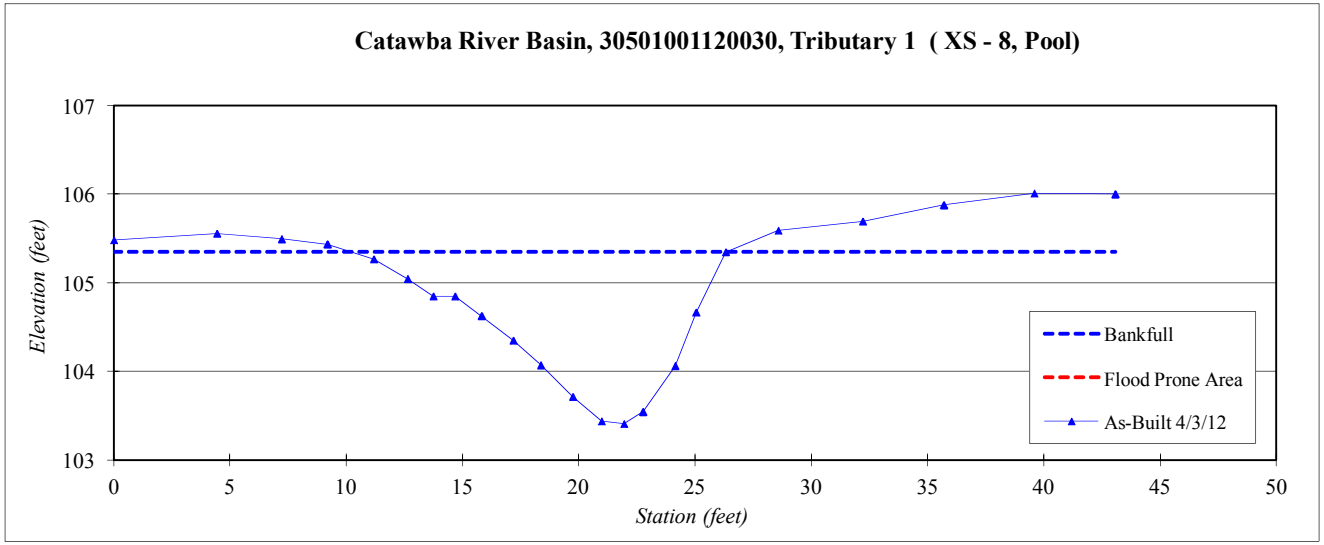


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 8, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	105.5
4.4	105.6
7.2	105.5
9.2	105.4
11.2	105.3
12.6	105.0
13.7	104.8
14.7	104.8
15.8	104.6
17.2	104.3
18.4	104.1
19.8	103.7
21.0	103.4
21.9	103.41
22.8	103.54
24.1	104.06
25.0	104.67
26.3	105.35
28.6	105.59
32.2	105.69
35.7	105.88
39.6	106.01
43.1	106.00

SUMMARY DATA	
Bankfull Elevation:	105.4
Bankfull Cross-Sectional Area:	15.5
Bankfull Width:	16.1
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.9
Mean Depth at Bankfull:	1.0
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

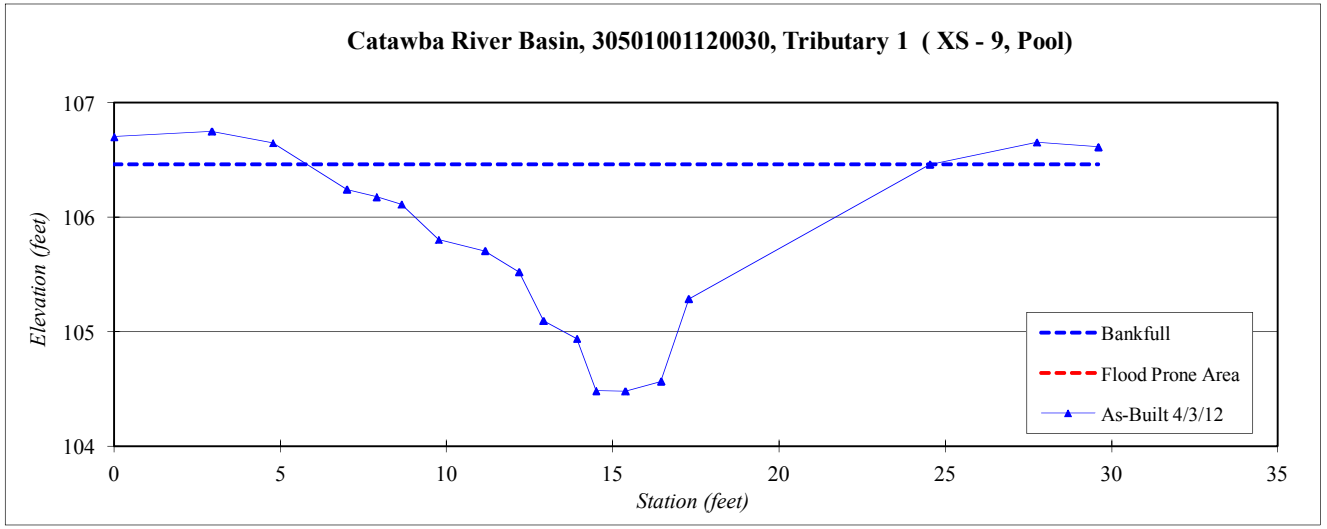


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 9, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	106.7
2.9	106.7
4.8	106.6
7.0	106.2
7.9	106.2
8.6	106.1
9.8	105.8
11.2	105.7
12.2	105.5
12.9	105.1
13.9	104.9
14.5	104.5
15.4	104.5
16.4	104.57
17.3	105.29
24.5	106.46
27.7	106.65
29.6	106.61

SUMMARY DATA	
Bankfull Elevation:	106.5
Bankfull Cross-Sectional Area:	15.7
Bankfull Width:	18.7
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.0
Mean Depth at Bankfull:	0.8
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

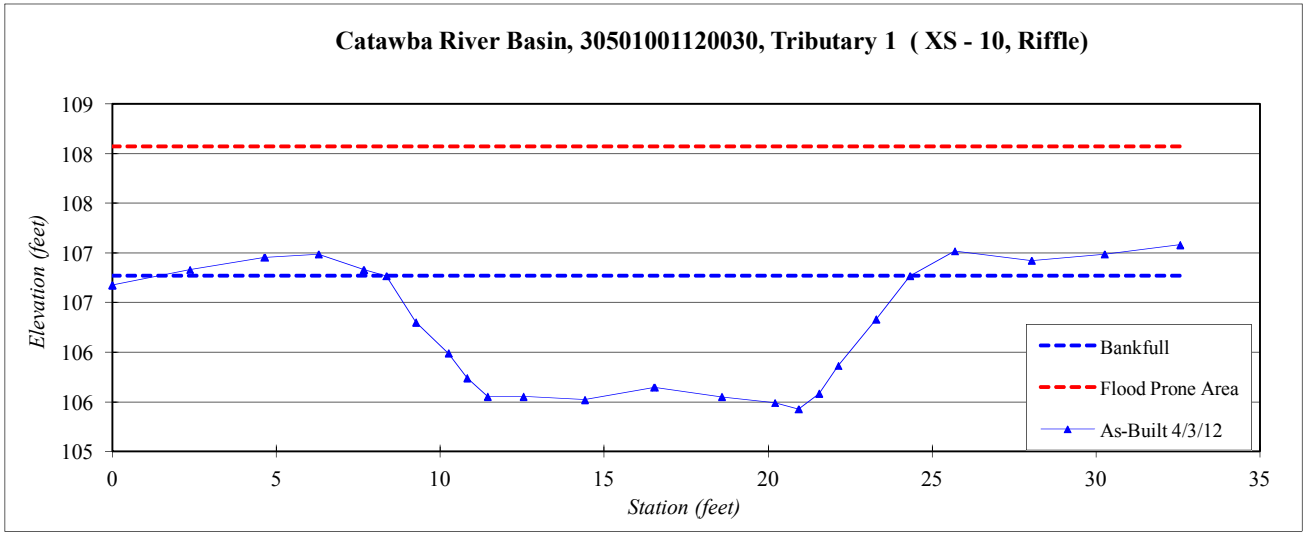


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 1 (XS - 10, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	106.7
2.4	106.8
4.6	107.0
6.3	107.0
7.7	106.8
8.4	106.8
9.3	106.3
10.3	106.0
10.8	105.7
11.4	105.6
12.5	105.6
14.4	105.5
16.5	105.6
18.6	105.55
20.2	105.49
20.9	105.43
21.5	105.58
22.1	105.86
23.3	106.33
24.3	106.77
25.7	107.02
28.0	106.9
30.3	107.0
32.6	107.1

SUMMARY DATA	
Bankfull Elevation:	106.8
Bankfull Cross-Sectional Area:	16.0
Bankfull Width:	16.0
Flood Prone Area Elevation:	108.1
Flood Prone Width:	>80
Max Depth at Bankfull:	1.3
Mean Depth at Bankfull:	1.0
W / D Ratio:	16.0
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

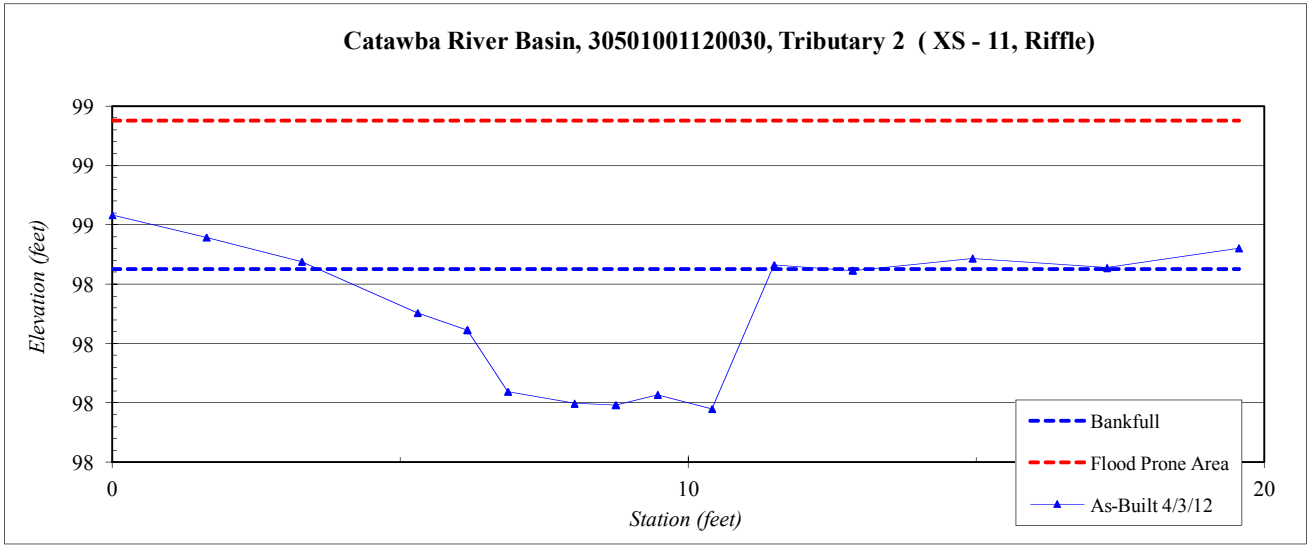


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 11, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	98.6
1.6	98.6
3.3	98.5
5.3	98.3
6.2	98.2
6.9	98.0
8.0	98.0
8.7	98.0
9.5	98.0
10.4	98.0
11.5	98.5
12.9	98.4
14.9	98.5
17.3	98.46
19.6	98.52

SUMMARY DATA	
Bankfull Elevation:	98.5
Bankfull Cross-Sectional Area:	2.3
Bankfull Width:	7.9
Flood Prone Area Elevation:	99.0
Flood Prone Width:	>80
Max Depth at Bankfull:	0.5
Mean Depth at Bankfull:	0.3
W / D Ratio:	27.1
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

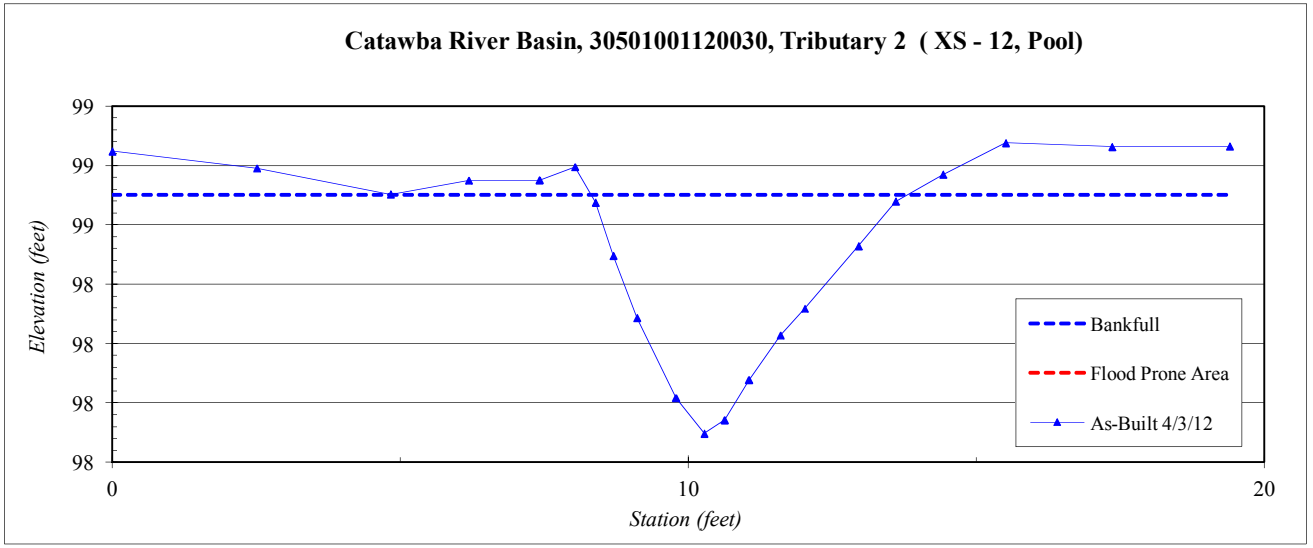


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 12, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	98.8
2.5	98.8
4.8	98.7
6.2	98.7
7.4	98.8
8.0	98.8
8.4	98.7
8.7	98.5
9.1	98.3
9.8	98.0
10.3	97.9
10.6	97.9
11.0	98.1
11.6	98.23
12.0	98.32
13.0	98.53
13.6	98.68
14.4	98.77
15.5	98.88
17.4	98.86
19.4	98.86

SUMMARY DATA	
Bankfull Elevation:	98.7
Bankfull Cross-Sectional Area:	2.3
Bankfull Width:	5.5
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	0.8
Mean Depth at Bankfull:	0.4
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

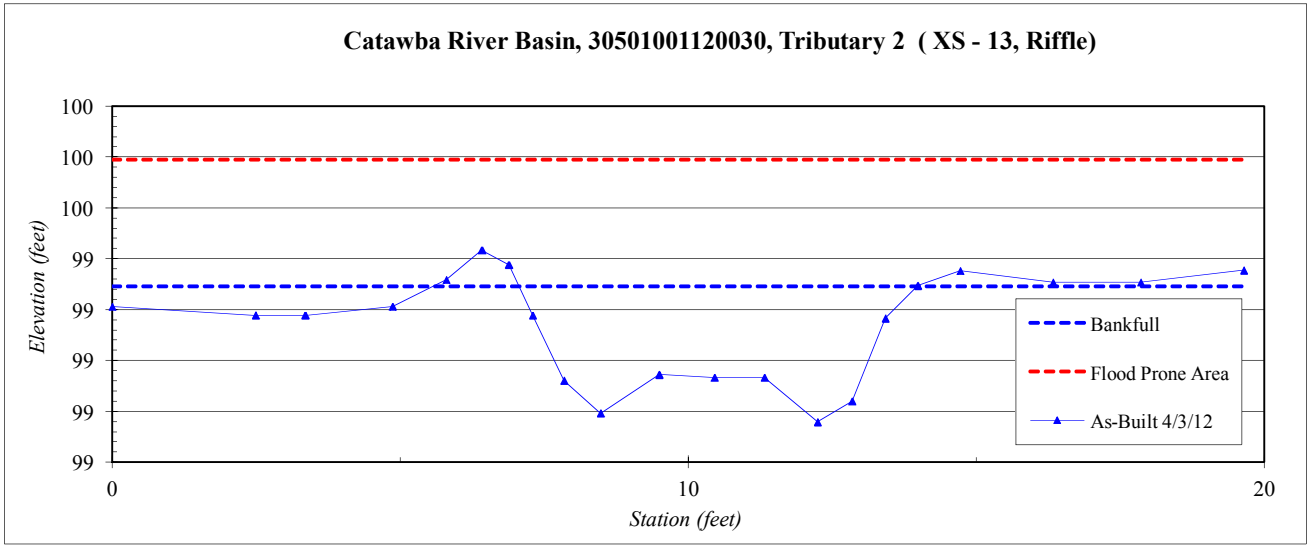


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 13, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	99.2
2.5	99.2
3.3	99.2
4.9	99.2
5.8	99.3
6.4	99.4
6.9	99.4
7.3	99.2
7.8	98.9
8.5	98.8
9.5	98.9
10.5	98.9
11.3	98.9
12.2	98.76
12.8	98.84
13.4	99.17
14.0	99.29
14.7	99.35
16.3	99.31
17.9	99.31
19.6	99.35

SUMMARY DATA	
Bankfull Elevation:	99.3
Bankfull Cross-Sectional Area:	2.4
Bankfull Width:	6.9
Flood Prone Area Elevation:	99.8
Flood Prone Width:	>80
Max Depth at Bankfull:	0.5
Mean Depth at Bankfull:	0.3
W / D Ratio:	19.8
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

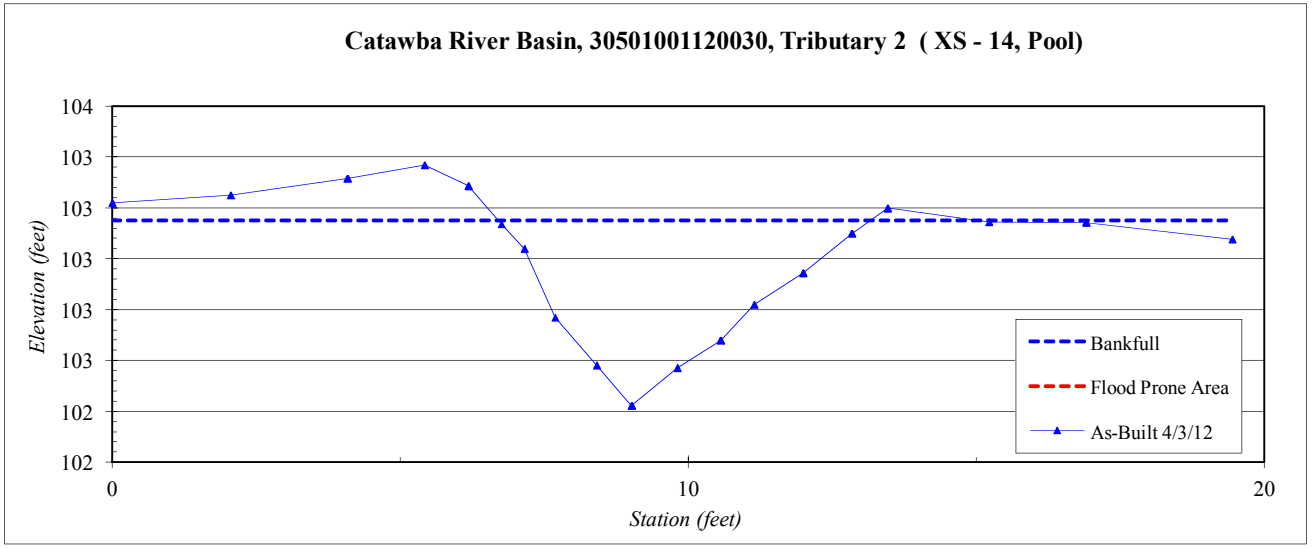


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 14, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	103.2
2.1	103.2
4.1	103.3
5.4	103.4
6.2	103.3
6.8	103.1
7.2	103.0
7.7	102.8
8.4	102.6
9.0	102.4
9.8	102.6
10.6	102.7
11.1	102.8
12.0	102.94
12.8	103.10
13.5	103.20
15.2	103.14
16.9	103.14
19.4	103.08

SUMMARY DATA	
Bankfull Elevation:	103.2
Bankfull Cross-Sectional Area:	2.4
Bankfull Width:	6.6
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	0.7
Mean Depth at Bankfull:	0.4
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

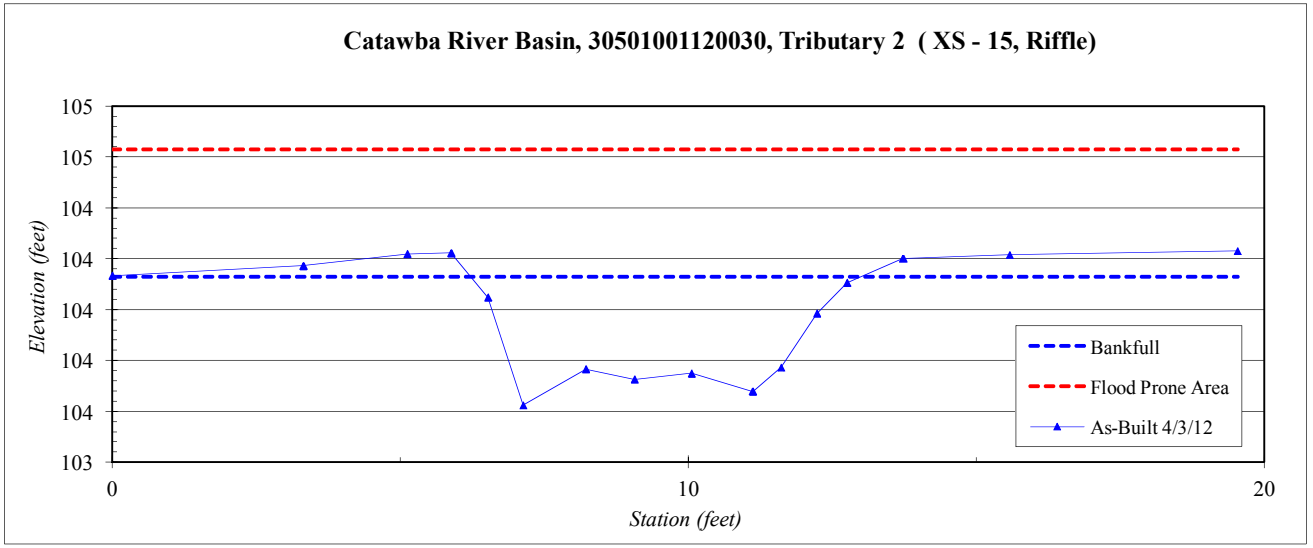


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 15, Riffle)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	104.1
3.3	104.2
5.1	104.2
5.9	104.2
6.5	104.0
7.1	103.6
8.2	103.8
9.1	103.7
10.1	103.7
11.1	103.7
11.6	103.8
12.2	104.0
12.8	104.1
13.7	104.20
15.6	104.22
19.5	104.23

SUMMARY DATA	
Bankfull Elevation:	104.1
Bankfull Cross-Sectional Area:	2.2
Bankfull Width:	6.8
Flood Prone Area Elevation:	104.6
Flood Prone Width:	>80
Max Depth at Bankfull:	0.5
Mean Depth at Bankfull:	0.3
W / D Ratio:	21.0
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

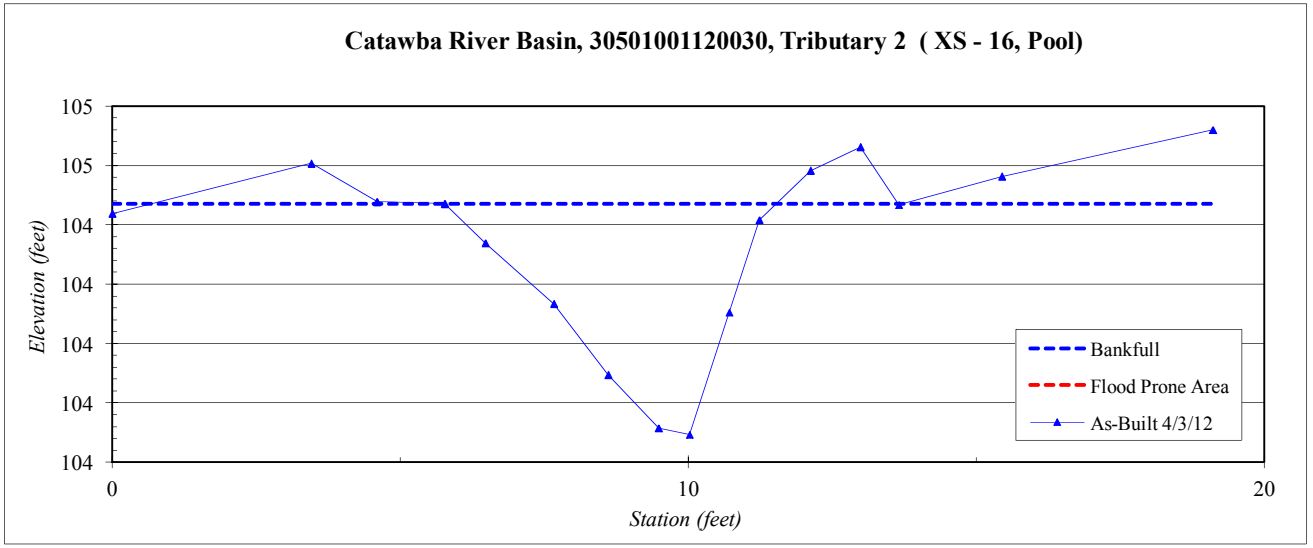


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 2 (XS - 16, Pool)
Drainage Area (sq mi):	1.01
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	104.4
3.5	104.6
4.6	104.5
5.8	104.5
6.5	104.3
7.7	104.1
8.6	103.9
9.5	103.7
10.0	103.7
10.7	104.1
11.2	104.4
12.1	104.6
13.0	104.7
13.7	104.47
15.4	104.56
19.1	104.72

SUMMARY DATA	
Bankfull Elevation:	104.5
Bankfull Cross-Sectional Area:	2.3
Bankfull Width:	5.7
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	0.8
Mean Depth at Bankfull:	0.4
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

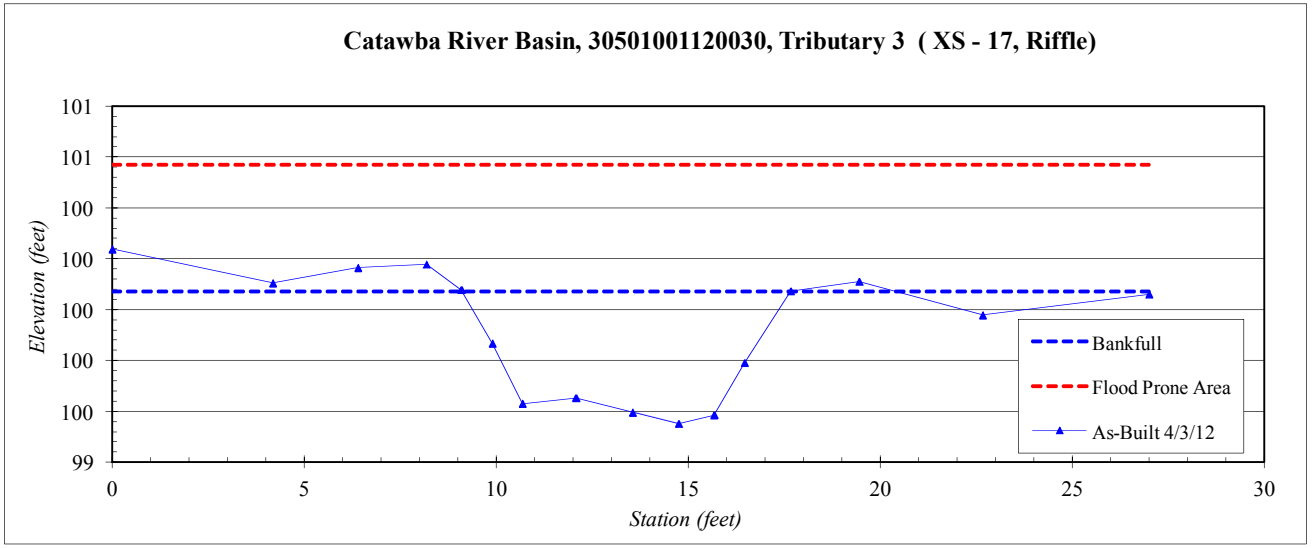


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 3 (XS - 17, Riffle)
Drainage Area (sq mi):	0.06
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	100.2
4.2	100.1
6.4	100.2
8.2	100.2
9.1	100.1
9.9	99.9
10.7	99.6
12.1	99.7
13.6	99.6
14.8	99.6
15.7	99.6
16.5	99.8
17.7	100.1
19.5	100.11
22.7	99.98
27.0	100.06

SUMMARY DATA	
Bankfull Elevation:	100.1
Bankfull Cross-Sectional Area:	3.1
Bankfull Width:	8.5
Flood Prone Area Elevation:	100.6
Flood Prone Width:	>80
Max Depth at Bankfull:	0.5
Mean Depth at Bankfull:	0.4
W / D Ratio:	23.3
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C

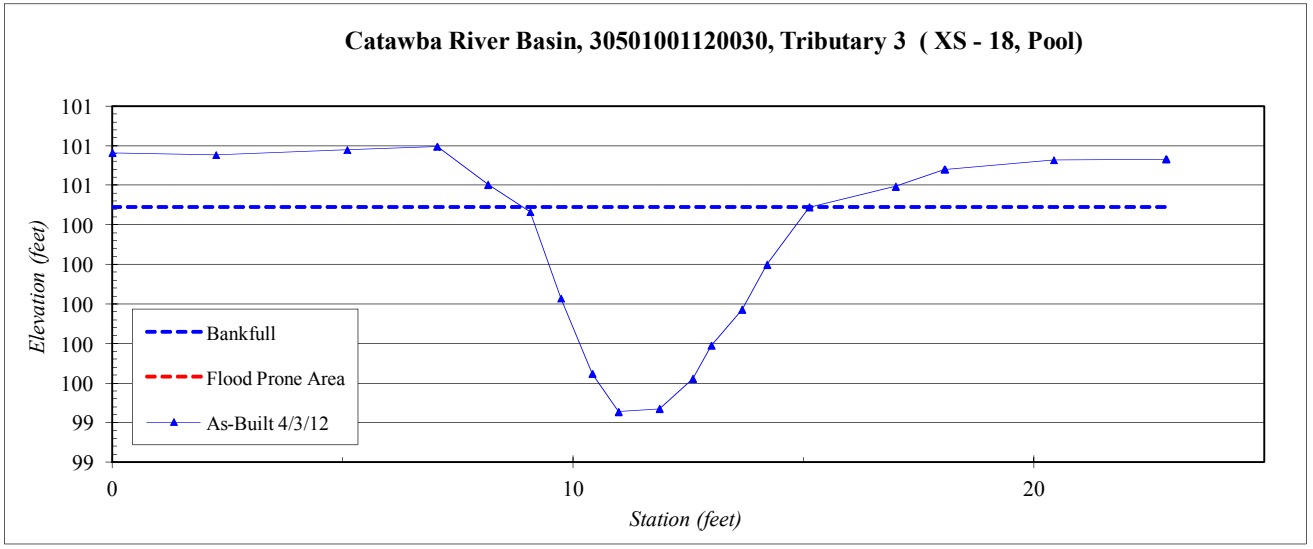


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 3 (XS - 18, Pool)
Drainage Area (sq mi):	0.06
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	100.8
2.2	100.8
5.1	100.8
7.0	100.8
8.1	100.6
9.1	100.5
9.7	100.0
10.4	99.6
11.0	99.5
11.9	99.5
12.6	99.6
13.0	99.8
13.7	100.0
14.2	100.20
15.1	100.49
17.0	100.59
18.1	100.68
20.4	100.73
22.9	100.73

SUMMARY DATA	
Bankfull Elevation:	100.5
Bankfull Cross-Sectional Area:	3.8
Bankfull Width:	6.2
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	1.0
Mean Depth at Bankfull:	0.6
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

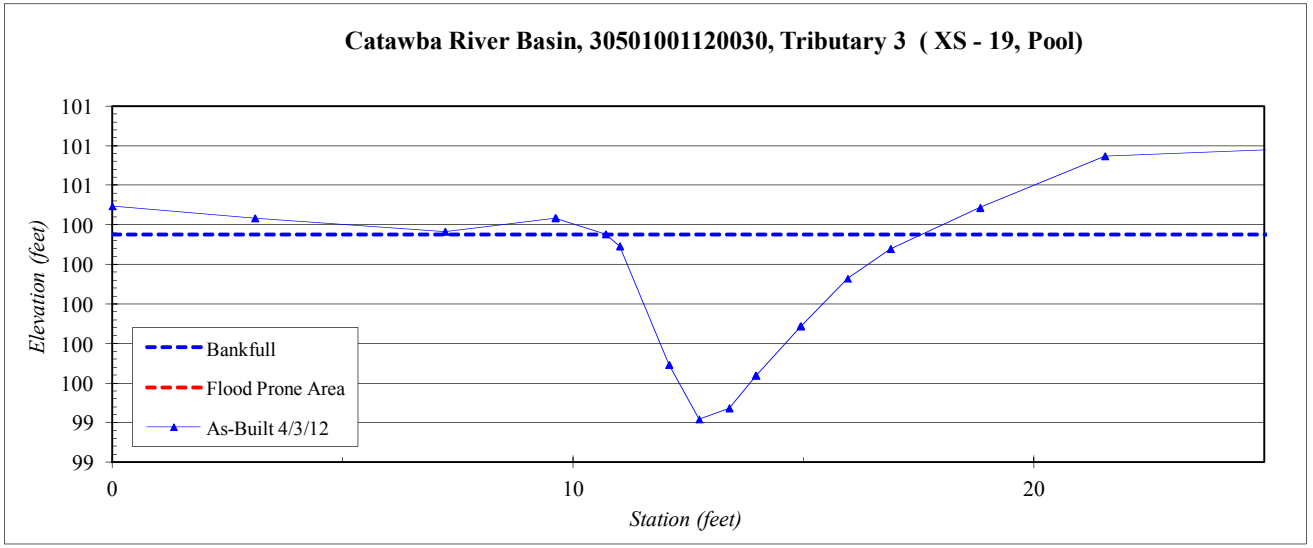


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 3 (XS - 19, Pool)
Drainage Area (sq mi):	0.06
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	100.5
3.1	100.4
7.2	100.4
9.6	100.4
10.7	100.4
11.0	100.3
12.1	99.7
12.7	99.4
13.4	99.5
14.0	99.6
14.9	99.9
16.0	100.1
16.9	100.3
18.8	100.49
21.5	100.75
25.8	100.79

SUMMARY DATA	
Bankfull Elevation:	100.4
Bankfull Cross-Sectional Area:	3.0
Bankfull Width:	6.8
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	0.9
Mean Depth at Bankfull:	0.4
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	E/C

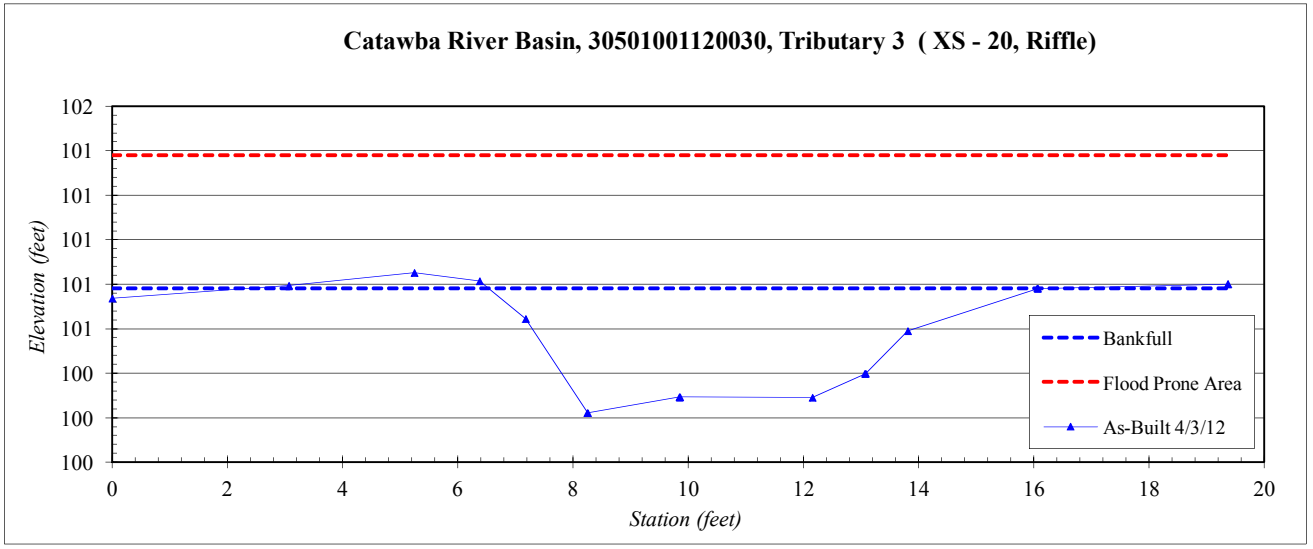


River Basin:	Catawba
Watershed:	30501001120030
XS ID	Tributary 3 (XS - 20, Riffle)
Drainage Area (sq mi):	0.06
Date:	4/3/2012
Field Crew:	Perkinson, Thomas

Station	Elevation
0.0	100.7
3.1	100.8
5.2	100.9
6.4	100.8
7.2	100.6
8.2	100.2
9.8	100.3
12.2	100.3
13.1	100.4
13.8	100.6
16.1	100.8
19.4	100.8

SUMMARY DATA	
Bankfull Elevation:	100.8
Bankfull Cross-Sectional Area:	3.2
Bankfull Width:	9.5
Flood Prone Area Elevation:	101.4
Flood Prone Width:	>80
Max Depth at Bankfull:	0.6
Mean Depth at Bankfull:	0.3
W / D Ratio:	28.2
Entrenchment Ratio:	>5
Bank Height Ratio:	1.0

Stream Type	E/C



Herman Dairy
Baseline Fixed Station Photographs
Taken May 2012

Photo Point 1

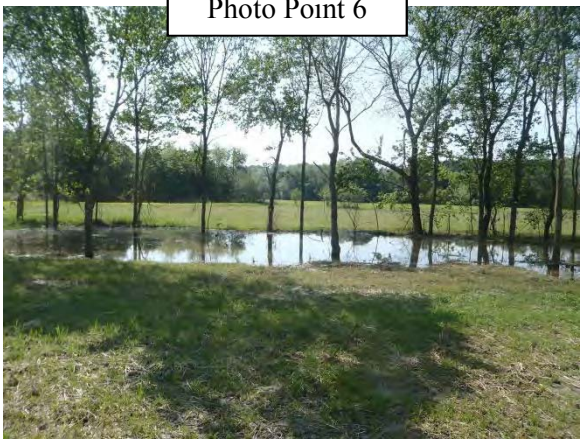
Photo Point 2

Photo Point 3

Photo Point 4

Photo Point 5

Photo Point 6



Herman Dairy
Baseline Fixed Station Photographs (continued)
Taken May 2012

Photo Point 7

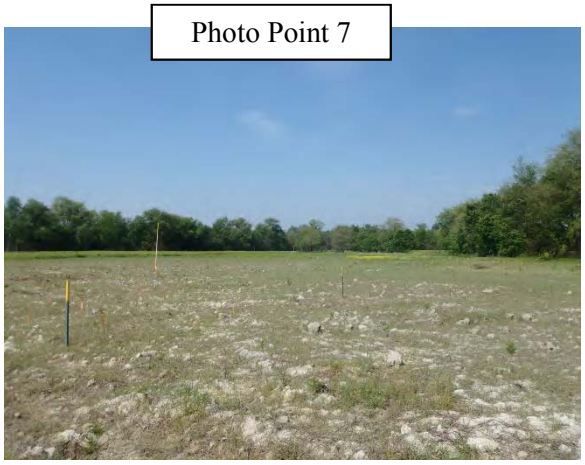


Photo Point 8

Photo Point 9a

Photo Point 9b

Photo Point 10a

Photo Point 10b

Appendix C.
Vegetation Data

Table 7. Planted Woody Vegetation
Table 8. Total Planted Stems by Plot and Species
Vegetation Plot Photographs

Table 7. Planted Bare Root Woody Vegetation

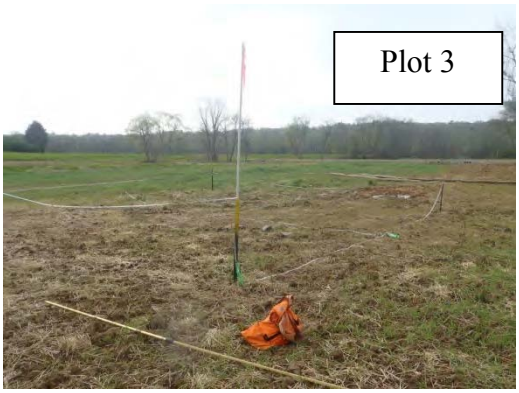
Species	Quantity
Cherrybark oak (*Quercus pagoda*)	3600
Green ash (*Fraxinus pennsylvanica*)	3600
Ironwood (*Carpinus caroliniana*)	2500
Shagbark hickory (*Carya ovata*)	2900
River birch (*Betula nigra*)	4000
Silky dogwood (*Cornus amomum*)	3500
Tulip poplar (*Liriodendron tulipifera*)	3600
American elm (*Ulmus americana*)	3800
TOTAL	**27,500**

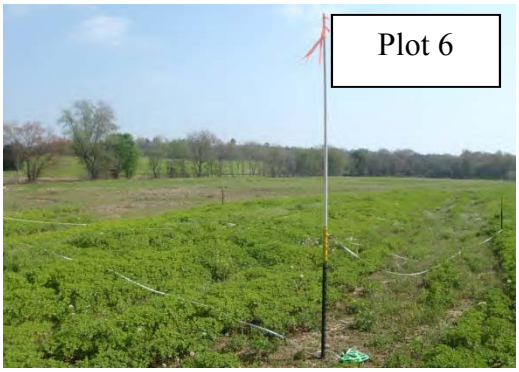
Table 8. Planted Stems by Plot and Species

Species	CommonName	Total Planted Stems*	Total Planted Stems/Acre	# plots	avg# stems	1	2	3	4	5	6	7	8	9	10
Betula nigra	river birch	41	607	9	4.56	4	4	10	2	7	3		3	2	6
Carpinus caroliniana	American hornbeam	3	445	3	1				1	1	1				
Cornus amomum	silky dogwood	2	728	1	2	2									
Fraxinus pennsylvanica	green ash	32	445	10	3.2	1	1	4	2	1	2	4	4	10	3
Liriodendron tulipifera	tuliptree	25	809	7	3.57	3	2		2		6	4		5	3
Platanus occidentalis	American sycamore	1	688	1	1		1								
Quercus	oak	6	405	3	2					2	2				2
Quercus pagoda	cherrybark oak	23	283	8	2.88	4	2	3	4	5		2		1	2
Ulmus americana	American elm	2	728	2	1	1				1					
Unknown		10	728	5	2		1	1		3	3				2
10	**9**	**145**	**587**	**10**		**15**	**11**	**18**	**11**	**20**	**17**	**10**	**7**	**18**	**18**

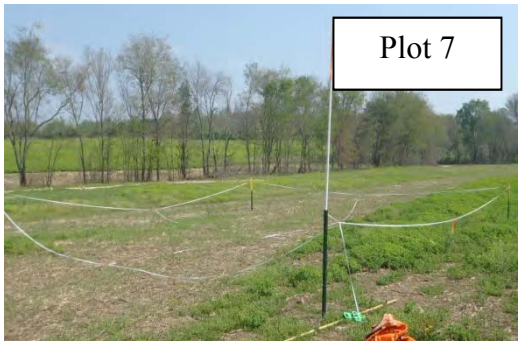
* All stems reported are planted bare root stems, no livestakes occur within the plots.

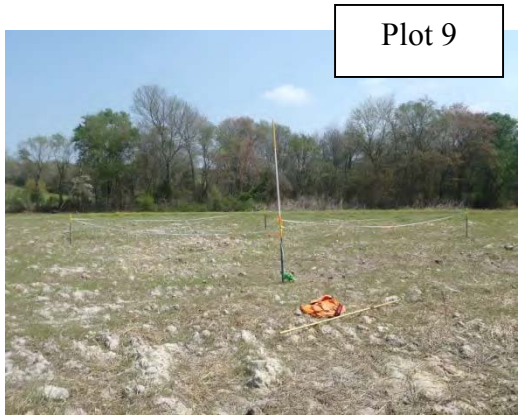
Herman Dairy
Baseline Vegetation Monitoring Photographs
Taken March-April 2012

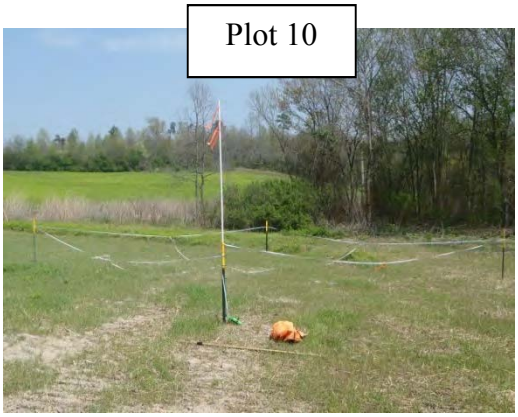




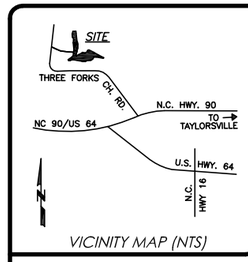
Herman Dairy
Baseline Vegetation Monitoring Photographs
Taken April 2012
(continued)







Appendix D.
As-built Plan Sheets



VICINITY MAP (NTS)

DEED REFERENCE(S):

BEING A PORTION OF THE PROPERTIES RECORDED IN D.B. 2400, PG. 241 AND D.B. 445, PG. 808 OF THE ALEXANDER COUNTY REGISTRY OF DEEDS.

MAP REFERENCE(S):

P.B. 8, PG. 67

CONSERVATION EASEMENT REFERENCE(S):

P.B. 12, PG. 247, SHEETS 1 & 2

ACREAGE DATA:

CONSERVATION EASEMENT "A"
4.65 ACRES± EXCLUDING THE ACCESS EASEMENT 3 AND EXCLUDING THE 100' UTILITY EASEMENT BY COMPUTER

CONSERVATION EASEMENT "B"
3.01 ACRES± EXCLUDING THE ACCESS EASEMENTS 1, 2 & 3 AND EXCLUDING THE 100' UTILITY EASEMENT BY COMPUTER

CONSERVATION EASEMENT "C"
23.46 ACRES± EXCLUDING THE ACCESS EASEMENTS 1 & 2 AND EXCLUDING THE 100' UTILITY EASEMENT BY COMPUTER

TOTAL CONSERVATION EASEMENT
31.12 ACRES± EXCLUDING THE ACCESS EASEMENTS 1, 2 & 3 AND EXCLUDING THE 100' UTILITY EASEMENT BY COMPUTER

METADATA CORNER DESCRIPTIONS

CORNER #	DESCRIPTION
①	MAG NAIL 0.1' BELOW GRADE
② THRU ④	No. 4 REBAR FLUSH WITH GRADE
⑤	No. 5 REBAR 0.1' BELOW GRADE
⑥	3/4" O.D. IRON PIPE 0.1' BELOW GRADE
⑦	1" O.D. IRON PIPE 0.4' ABOVE GRADE
⑧	1" O.D. IRON PIPE 0.1' ABOVE GRADE
⑨	1" O.D. IRON PIPE 0.1' ABOVE GRADE
⑩	1" O.D. IRON PIPE 0.4' ABOVE GRADE
⑪	1.5" IRON PIPE 1.5' ABOVE GRADE WITNESSED BY OLD FENCE POST
⑫	1.5" IRON PIPE 0.1' BELOW GRADE (DISTURBED)

LEGEND:

- EIS – Existing Iron Stake
- EIP – Existing Iron Pipe
- NMC – Non Monumented Corner
- ECM – Existing Concrete Monument
- R/W – Right-Of-Way
- UP – Utility Pole
- EOP – Edge Of Pavement
- N/F – Now or Formerly
- ECRM – Existing Concrete R/W Monument
- EPK – Existing PK Nail
- PKS – PK Nail Set
- IPS – Iron Pipe Set
- W.B. – Will Book
- CC – Control Corner
- D.B. – Deed Book
- PG. – Page
- NCDOT – North Carolina Department of Transportation
- ISS – Iron Stake Set
- NCSR – North Carolina Secondary Road
- HWY – Highway
- RCP – Reinforced Concrete Pipe
- CL – Center Line
- PPS – Pump Pipe Set
- o – Non Monumented Corner Unless Otherwise Noted
- CMP – Corrugated Metal Pipe
- Property Line
- Adjoiner Line
- Tie Down Line
- E Electric Line
- x Fence
- ● No. 5 Rebar Set Flush with Grade with 2" Plastic Cap Inscribed: "Conservation Easement"
- MONITORING REACH
- MODIFIED MONITORING REACH
- UT UNNAMED TRIBUTARY
- HYDRIC SOIL AREA

NORTH NC GRID NAD'83(2007)

NCGS MARKER "WHITE AZ MK" GRID FACTOR: 0.999897433 N=803,425.175' E=1,344,535.977' HORIZONTAL GROUND DISTANCES USED UNLESS OTHERWISE NOTED.

"A" — S20°30'14"E 1464.81' (GRID) (TIE DOWN)

"B" ① EMN — NC GRID COORDINATE N=802,054.099' E=1,343,048.6059'

S65°42'24"E 312.72' — P.B. 8, PG. 067

N.C.S.R. 1313 THREE FORKS CHURCH ROAD (60' R/W PAVED PUBLIC)

PITTS D.B. 537, PG. 1988

S65°42'37"E 359.40'

S82°52'48"E 483.46'

S86°23'16"E 422.36'

APPROXIMATE PROPERTY LINE

EIP ⑫ — S84°05'08"E 415.21' (PROPERTY LINE TIE DOWN)

MOOSE D.B. 530, PG. 954

HERMAN DAIRY FARM, INC. D.B. 2400, PG. 241

HERMAN DAIRY FARM, INC. D.B. 411, PG. 215

HERMAN DAIRY FARM, INC. D.B. 445, PG. 808 — P.B. 8, PG. 067

HERMAN D.B. 375, PG. 1872

WATTS D.B. 202, PG. 38

HERMAN ETAL D.B. 516, PG. 648

MUDDY FORK

UNNAMED TRIBUTARIES OF MUDDY FORK

EXISTING WIRE FENCE OWNERSHIP UNKNOWN

EXISTING WIRE FENCE MEANDERS ALONG PROPERTY LINE

EXISTING WIRE FENCE

EXISTING SOIL ROAD MEANDERS OUTSIDE OF ACCESS EASEMENT 1

ACCESS EASEMENT 1 NEW 10' INGRESS, EGRESS & REGRESS EASEMENT (0.37 ACRES ± BY COMPUTER)

ACCESS EASEMENT 2 NEW 20' INGRESS, EGRESS & REGRESS EASEMENT (0.03 ACRES ± BY COMPUTER)

ACCESS EASEMENT 3 NEW 10' INGRESS, EGRESS & REGRESS EASEMENT (0.03 ACRES ± BY COMPUTER)

100' R/W AND EASEMENT (50' ON EACH SIDE OF UTILITY LINE) FOR CRESCENT EMC. SEE D.B. 186, PG. 808 AND D.B. 186, PG. 810 (SEE GENERAL NOTES)

CONSERVATION EASEMENT "A" *4.65 ACRES± EXCLUDING THE ACCESS EASEMENT 3 AND EXCLUDING THE 100' UTILITY EASEMENT BY COMPUTER P.B. 12, PG. 247*

CONSERVATION EASEMENT "B" *3.01 ACRES± EXCLUDING THE ACCESS EASEMENTS 1, 2 & 3 AND EXCLUDING THE 100' UTILITY EASEMENT BY COMPUTER P.B. 12, PG. 247*

CONSERVATION EASEMENT "C" *23.46 ACRES± EXCLUDING THE ACCESS EASEMENTS 1 & 2 AND EXCLUDING THE 100' UTILITY EASEMENT BY COMPUTER P.B. 12, PG. 247*

UT1 SEE SHEET 2 OF 3 AND SHEET 3 OF 3

UT2 SEE SHEET 3 OF 3

UT3 SEE SHEET 3 OF 3

UT1A

S07°34'28"E 117.80'

S78°10'34"W 181.35' (TIE DOWN ONLY) (NOT A PROPERTY LINE)

S20°44'21"W 10.33'

S09°18'36"W 50.84'

SURVEYORS CERTIFICATION(S)

Surveyor's disclaimer: No attempt was made to locate any cemeteries, wetlands, hazardous material sites, underground utilities or any other features above, or below ground other than those shown. However, no visible evidence of cemeteries or utilities, aboveground or otherwise, was observed by the undersigned.

I certify that the survey is of another category (as-built), such as the recombination of existing parcels, a court-ordered survey, or other exception to the definition of subdivision.

I certify that the GPS control tie down for this survey (from "A" to "B") was performed to class AA specifications per 21 NCAC 56.1603 and that static GPS field procedures and coordinates were obtained by least squares adjustment using Ashtech Solutions version 2.60. That the GPS control tie down was performed on November 21st, 2010 using three Thales Navigation Promark II receivers. All coordinates are based on NCGS Monument "WHITE AZ MK" referenced to NCSPC NAD 1983(2007).

(1) Class of survey: AA
(2) Positional accuracy: 1:20,000
(3) Type of GPS field procedure: Static
(4) Dates of survey: November 4th, 2009
(5) Datum/Epoch: NCSPC 1983(2007)
(6) Published/Fixed-control use: NCGS "WHITE AZ MK"
(7) Geiod model: Geiod 99 for U.S.
(8) Combined grid factor(s): 0.999897433
(9) Units: U.S. Survey Feet

I JOHN A. RUDOLPH, certify that this plat was drawn under my supervision from (an actual survey made under my supervision) (deed description recorded in Book SEE, Page , etc.) (other); that the ratio of precision as calculated by latitudes and departures is 1/10,000+; that the boundaries not surveyed are shown as broken lines plotted from information found in Book ---, Page --- (All lines surveyed); that this plat was prepared in accordance with G.S. 47-30 as amended. Witness my original signature, registration number, and seal this 16th day of May, A.D. 2012.

SEAL OR STAMP

Surveyor L-4194

"PRELIMINARY PLAT" NOT FOR RECORDATION, CONVEYANCES OR SALES

FIRM LICENSE No.: C-2111

DRAWN BY: FGR
DATE: 5/16/12
DWG. NO.: RSS083AB12
SURVEYED BY: J.A.R.

K2 DESIGN GROUP, P.A.
5688 U.S. Hwy. 70 East
Goldsboro, NC 27534
Tel.: (919) 751-0075
Fax: (919) 778-9087
k2design@suddenlink.net

RESTORATION SYSTEMS, LLC
1101 HAYNES STREET
SUITE 211
RALEIGH, NC 27604

SHEET 1 OF 3

AS-BUILT SURVEY

FOR

STATE OF NORTH CAROLINA, ECOSYSTEM ENHANCEMENT PROGRAM

EEP PROJECT ID 94642

HERMAN DAIRY FARM SITE

SPO FILE No. 02-K
CONTRACT No. 003271

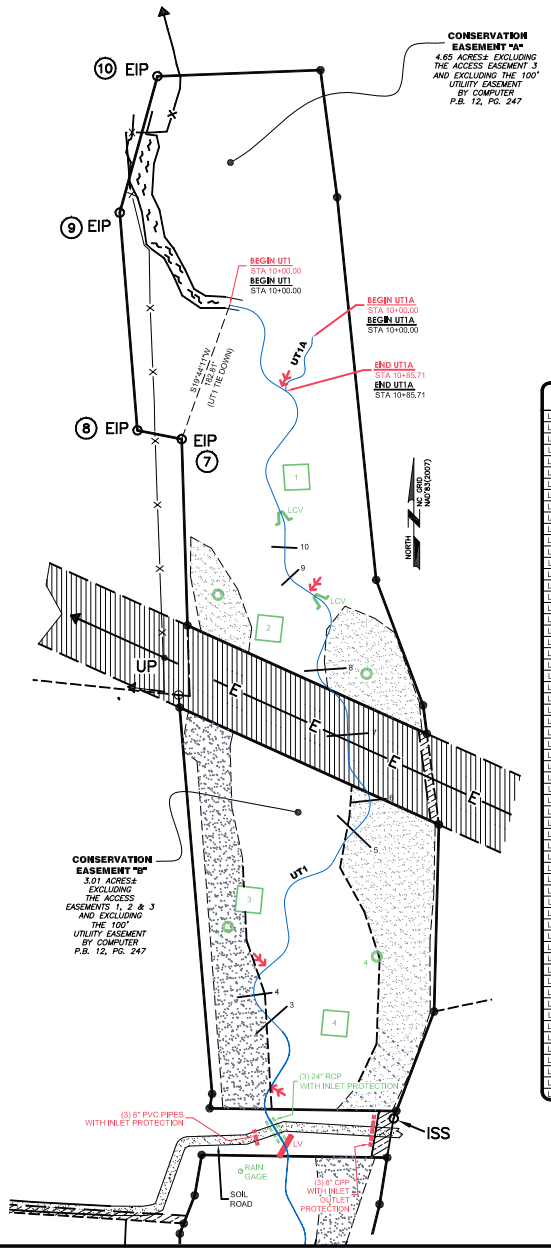
TAYLORSVILLE TOWNSHIP ALEXANDER COUNTY NORTH CAROLINA

200 100 0 200 400 600

GRAPHIC SCALE 1" =200'

LEGEND:

EIS – Existing Iron Stake
EIP – Existing Iron Pipe
UP – Utility Pole
RCP – Reinforced Concrete Pipe
CPP – Corrugated Plastic Pipe
PPS – Pump Pipe Set
o – Non Monumented Corner Unless Otherwise Noted
——— Property Line
— — Adjoiner Line
—/—/— Tie Down Line
—E— Electric Line
—x— Fence
● – No. 5 Rebar Set Flush with Grade with 2" Plastic Cap inscribed: "Conservation Easement"
ISS – Iron Stake Set
CROSS-SECTION
GROUNDWATER GAUGES
VEG PLOT AREA
HYDRIC SOIL AREA
MONITORING REACH
MODIFIED MONITORING REACH
LOG VANE
ROCK CROSS-VANE
LOG CROSS-VANE
NOT ON LINE
ADDED LOG VANE
ADDED ROCK CROSS-VANE
ADDED LOG CROSS-VANE
ADDED STEP POOL DROP STRUCTURE
BEGIN TRIB. STA 10+00.00 – PRE-CONSTRUCTION STATIONS
BEGIN TRIB. STA 10+00.00 – POST-CONSTRUCTION STATIONS
UT – UNNAMED TRIBUTARY
ADDED FLOODPLAIN INTERCEPTOR
TERRACELL



COORDINATES OF GROUNDWATER GAUGES

NORTHING	EASTING	GAUGE I.D.
802048.6566	1346669.6232	GROUNDWATER GAUGE 1
802475.0088	1346656.8394	GROUNDWATER GAUGE 2
802373.5985	1346847.4212	GROUNDWATER GAUGE 3
802010.6979	1346860.7459	GROUNDWATER GAUGE 4
801609.8338	1347270.2304	GROUNDWATER GAUGE 5
801512.2806	1347459.2467	GROUNDWATER GAUGE 6
801672.3145	1347605.2923	GROUNDWATER GAUGE 7
801388.2894	1347661.8135	GROUNDWATER GAUGE 8
801507.8668	1347766.6790	GROUNDWATER GAUGE 9
801413.0761	1348154.0788	GROUNDWATER GAUGE 10

NOTE: ONLY CORNER #1 IS A TRUE NORTH CAROLINA STATE PLANE COORDINATE (SHEET 1 OF 3). COORDINATES SHOWN ARE BASED ON GROUND DISTANCES TO MATCH PLAT.

COORDINATES OF VEG PLOT AREAS

NORTHING	EASTING	VEG PLOT I.D.
802625.7825	1346757.6317	VEG PLOT 1
802431.9434	1346722.6233	VEG PLOT 2
802083.5309	1346696.6713	VEG PLOT 3
801924.8794	1346807.1052	VEG PLOT 4
801581.4455	1346707.5587	VEG PLOT 5
801194.2483	1346940.4128	VEG PLOT 6
801391.6394	1347327.4689	VEG PLOT 7
801201.9747	1347493.6236	VEG PLOT 8
801478.2370	1347727.5386	VEG PLOT 9
801714.7691	1347664.4470	VEG PLOT 10

NOTE: ONLY CORNER #1 IS A TRUE NORTH CAROLINA STATE PLANE COORDINATE (SHEET 1 OF 3). COORDINATES SHOWN ARE BASED ON GROUND DISTANCES TO MATCH PLAT.

LINE DATA ALONG UT1

LINE	LENGTH	BEARING
L77	19.92'	S77°17'18"E
L78	23.12'	S11°10'22"W
L79	16.35'	S58°58'47"E
L80	44.30'	S37°46'09"W
L81	52.28'	S22°18'50"E
L82	42.71'	S00°23'07"W
L83	36.71'	S56°02'45"E
L84	36.23'	S21°51'59"W
L85	23.40'	S47°21'55"E
L86	55.19'	S01°38'01"E
L87	23.30'	S37°46'58"E
L88	31.74'	S43°14'17"W
L89	22.95'	S26°23'13"W
L90	23.48'	S71°36'36"W
L91	35.08'	S08°18'57"E
L92	28.16'	S49°20'22"W
L93	40.41'	S43°29'04"E
L94	41.52'	S31°57'56"W
L95	39.79'	S31°00'27"E
L96	32.46'	S05°04'54"W
L97	37.49'	S27°37'59"E
L98	36.50'	S26°13'58"W
L99	34.56'	S14°01'55"E
L100	29.97'	S65°57'53"W
L101	39.10'	S05°38'38"E
L102	30.20'	S50°36'26"W
L103	26.05'	S14°02'10"E
L104	27.96'	S60°26'20"W
L105	32.94'	S41°56'14"W
L106	23.33'	N78°56'16"W
L107	93.39'	S64°14'23"W
L108	26.71'	S73°23'57"W

CURVE DATA ALONG UT1

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST.
C1	88°27'40"	33.00	N33°03'28"W	46.04
C2	70°09'09"	33.00	S23°54'12"E	37.93
C3	96°44'55"	33.00	N10°36'19"W	49.34
C4	60°04'59"	33.00	S07°43'39"W	33.04
C5	22°41'57"	33.00	N10°57'52"W	12.99
C6	56°25'52"	33.00	S27°49'49"E	31.20
C7	77°54'44"	33.00	N17°05'23"W	41.50
C8	69°13'54"	33.00	S12°44'58"E	37.49
C9	45°43'54"	33.00	N24°29'58"W	25.65
C10	36°08'57"	33.00	S19°42'30"E	20.48
C11	81°01'15"	33.00	N02°43'39"E	42.87
C12	14°51'04"	33.00	S35°48'45"W	8.53
C13	43°13'24"	33.00	N49°59'55"E	24.31
C14	79°55'33"	33.00	S31°38'50"W	42.39
C15	57°39'19"	33.00	N20°30'43"E	31.82
C16	92°49'26"	33.00	S02°55'39"W	47.80
C17	75°26'59"	33.00	N86°45'34"W	40.38
C18	62°58'22"	33.00	S00°28'44"W	34.47
C19	36°05'21"	33.00	N12°57'46"W	20.44
C20	32°42'54"	33.00	S11°16'32"E	18.59
C21	53°51'58"	40.00	N80°42'01"W	36.24
C22	40°15'54"	33.00	S06°08'02"W	22.72
C23	79°59'48"	33.00	N25°57'59"E	42.42
C24	71°36'03"	33.00	S30°09'38"W	38.61
C25	56°15'03"	33.00	N22°28'54"E	31.11
C26	64°38'36"	33.00	S18°17'08"W	35.29
C27	74°28'31"	33.00	N23°12'05"E	39.94
C28	18°30'07"	33.00	S51°11'17"W	10.61
C29	59°04'30"	33.00	N71°28'29"E	32.54
C30	42°26'52"	47.81	S62°32'56"W	34.61
C31	16°42'25"	87.26	N47°41'31"E	25.35

LINE DATA ALONG UT3

LINE	LENGTH	BEARING
L169	8.79'	S00°19'30"E
L170	10.94'	S80°27'58"W
L171	9.22'	S76°09'23"W
L172	7.28'	N78°43'14"W
L173	8.52'	S20°22'43"W
L174	6.51'	S81°00'35"W
L175	12.16'	S12°25'10"W
L176	12.67'	S54°22'16"W
L177	10.59'	S17°07'54"W
L178	11.67'	N69°30'48"W
L179	11.23'	S87°21'10"W
L180	13.75'	N53°50'28"W
L181	19.02'	S58°05'46"W
L182	11.20'	N60°05'06"W
L183	9.68'	S58°13'36"W
L184	17.73'	N84°18'19"W
L185	13.60'	S29°23'16"W
L186	11.43'	N61°35'33"W
L187	10.50'	S77°17'40"W
L188	9.39'	N65°46'51"W
L189	9.39'	S51°24'00"W
L190	7.28'	N78°40'54"W
L191	13.60'	S49°02'29"W
L192	16.86'	N69°05'22"W
L193	16.08'	S37°55'27"W
L194	31.65'	S70°27'03"W
L195	0.00'	S53°07'48"W
L196	13.37'	S48°19'04"W
L197	22.37'	S39°10'20"W
L198	18.04'	S38°41'29"W
L199	5.58'	S26°37'51"W

LINE DATA ALONG CONSERVATION EASEMENT "C"

LINE	LENGTH	BEARING
L19	38.60'	N21°18'16"E
L20	52.71'	N09°42'45"E
L21	238.05'	S89°10'40"E
L22	60.63'	S09°18'36"W
L23	50.89'	S13°28'51"W
L24	256.18'	S14°25'37"W
L25	231.45'	N62°16'45"E
L26	231.45'	N62°16'45"E
L27	71.78'	N36°24'10"E
L28	218.55'	S79°46'57"E
L29	137.32'	N58°36'39"E
L30	115.28'	N14°22'53"E
L31	79.81'	N75°57'50"E
L32	138.29'	S63°22'14"E
L33	472.37'	S63°33'42"E
L34	577.96'	S63°30'35"E
L35	62.93'	S20°13'29"W
L36	400.66'	N79°29'06"W
L37	297.46'	N88°52'36"W
L38	120.01'	S16°56'49"W
L39	184.19'	S52°02'52"W
L40	292.79'	S85°48'09"W
L41	81.93'	S63°00'50"W
L42	55.64'	S63°00'50"W
L43	55.55'	N79°35'54"W
L44	28.98'	N85°04'00"W
L45	51.20'	S80°01'04"W
L46	104.03'	N78°09'38"W
L47	32.44'	N62°50'00"W
L48	135.86'	N80°56'37"W
L49	75.40'	N82°38'16"W
L50	63.38'	N80°20'03"W
L51	60.05'	N83°22'52"W
L52	73.65'	N80°42'46"W
L53	116.19'	N78°45'13"W
L54	62.27'	N87°16'30"W
L55	44.61'	S89°45'28"W
L56	15.73'	S86°48'17"W
L57	23.56'	S66°56'09"W
L58	46.02'	S70°25'43"W
L59	53.07'	S66°04'01"W
L60	61.01'	S86°02'19"W
L61	50.81'	N89°21'40"W
L62	28.19'	N83°18'12"W
L63	43.11'	N21°55'28"W
L64	30.77'	N21°55'28"W
L65	273.69'	N57°53'27"E
L66	183.98'	N43°10'39"E
L67	218.50'	N00°10'17"E
L68	14.15'	N21°18'16"E

LINE DATA ALONG SOUTHERN BELL R/W SITE EASEMENT AND ACCESS EASEMENT 1

LINE	LENGTH	BEARING
L70	25.10'	S65°43'48"E
L71	15.02'	N10°50'13"E
L72	25.02'	N65°43'48"W
L73	20.00'	S16°01'56"W

LINE DATA ALONG TIE DOWN LINES

LINE	LENGTH	BEARING
L11	14.41'	S84°05'08"E
L12	12.81'	N01°47'17"W
L69	30.30'	S65°43'48"E
L74	15.97'	N04°49'18"W
L75	44.55'	N01°47'17"W
L76	33.41'	N01°47'17"W

LINE DATA ALONG UT2

LINE	LENGTH	BEARING
L109	8.38'	S71°56'09"W
L110	15.57'	S73°03'26"W
L111	8.87'	S64°38'27"W
L112	10.21'	N81°57'02"W
L113	8.93'	S33°51'33"W
L114	7.72'	S88°50'36"W
L115	6.77'	S13°20'51"W
L116	9.33'	S81°00'34"W
L117	6.32'	S64°24'04"W
L118	6.79'	N84°09'13"W
L119	6.85'	S10°26'52"W
L120	8.37'	S71°53'11"W
L121	9.82'	S02°32'17"W
L122	10.96'	S50°27'54"W
L123	11.58'	S10°30'44"W
L124	12.84'	N77°06'20"W
L125	10.46'	S79°30'33"W
L126	12.42'	N57°10'20"W
L127	18.66'	S50°55'45"W
L128	11.59'	N57°10'49"W
L129	9.15'	S49°30'04"W
L130	16.44'	N87°56'16"W
L131	19.93'	S30°09'03"W
L132	9.21'	N71°47'54"W
L133	8.14'	S50°31'39"W
L134	9.59'	N34°15'44"W
L135	5.69'	N31°04'34"W
L136	14.38'	N03°30'55"E
L137	28.18'	N31°23'53"W
L138	18.28'	N76°09'58"W
L139	48.15'	S60°19'59"W
L140	125.66'	N86°19'51"W
L141	96.79'	S57°24'04"W
L142	90.75'	S53°18'40"W
L143	65.65'	S49°38'53"W
L144	36.36'	S28°02'40"W
L145	16.48'	S09°17'31"W
L146	9.55'	S00°38'16"W
L147	6.49'	S21°21'32"W
L148	10.11'	S25°39'01"E
L149	10.13'	S52°40'11"W
L150	10.59'	S02°31'11"W
L151	11.62'	N76°10'06"W
L152	10.19'	S60°27'20"W
L153	9.19'	N81°23'24"W
L154	9.82'	S36°21'16"W
L155	8.43'	S84°42'41"W
L156	12.65'	S34°06'47"W
L157	17.01'	N85°27'39"W
L158	18.65'	S37°02'21"W
L159	9.89'	N63°48'14"W
L160	9.31'	N77°07'53"W
L161	14.39'	N61°12'05"W
L162	20.01'	S44°00'06"W
L163	21.36'	N70°40'46"W
L164	12.37'	S74°52'28"W
L165	11.28'	N23°03'42"W
L166	15.38'	N74°59'03"W
L167	12.63'	N25°47'41"W
L168	17.46'	S83°49'45"W

CURVE DATA ALONG UT2

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST.
C32	14°47'57"	104.15	S30°12'38"W	26.83
C33	38°20'17"	31.38	S03°54'16"W	20.61
C34	104°26'50"	11.40	S45°49'32"W	18.02
C35	64°11'25"	11.40	S65°57'15"W	12.11
C36	54°59'03"	11.40	S61°21'05"W	10.53
C37	75°29'46"	11.40	S51°05'44"W	13.96
C38	67°39'43"	11.40	S47°10'42"W	12.69
C39	16°36'30"	11.40	S72°42'19"W	3.29
C40	31°26'43"	11.40	S80°07'25"W	6.18
C41	85°23'55"	11.40	S53°08'50"W	15.46
C42	61°26'18"	11.40	S41°10'01"W	11.65
C43	69°20'54"	11.40	S37°12'44"W	12.97
C44	47°55'37"	11.40	S26°30'05"W	9.26
C45	39°57'10"	11.40	S30°29'19"W	7.79
C46	92°22'55"	11.40	S56°42'12"W	16.45
C47	23°23'07"	11.40	N88°47'54"W	4.62
C48	43°19'07"	11.40	N78°49'54"W	8.42
C49	71°53'55"	11.40	S86°52'42"W	13.39
C50	71°53'26"	11.40	S86°52'28"W	13.38
C51	73°19'07"	11.40	S86°09'38"W	13.61
C52	42°33'40"	11.40	S70°46'54"W	8.27
C53	61°54'41"	11.40	S61°06'23"W	11.73
C54	78°03'02"	11.40	S69°10'34"W	14.36
C55	57°40'26"	11.40	S79°21'52"W	11.00
C56	95°12'37"	11.40	N50°38'59"W	16.84
C57	55°58'25"	22.19	N31°30'56"W	20.82
C58	94°20'05"	13.00	S21°31'01"W	19.07
C59	78°19'12"	11.40	S13°30'35"W	14.40
C60	50°08'59"	11.40	S27°35'41"W	9.66
C61	101°18'43"	11.40	S53°10'33"W	17.63
C62	43°22'34"	11.40	S82°08'37"W	8.43
C63	38°09'16"	11.40	S79°31'58"W	7.45
C64	62°15'20"	11.40	S67°28'56"W	11.79
C65	48°21'26"	11.40	S60°31'59"W	9.34
C66	50°35'55"	11.40	S59°24'44"W	9.74
C67	60°25'34"	11.40	S64°19'34"W	11.47
C68	57°30'00"	11.40	S65°47'21"W	10.97
C69	79°09'25"	11.40	S76°37'04"W	14.53
C70	13°19'39"	11.40	N70°28'03"W	2.65
C71	15°55'48"	11.40	N69°09'50"W	3.16
C72	74°47'49"	11.40	S81°24'01"W	13.85
C73	65°19'08"	11.40	S76°39'40"W	12.30
C74	34°26'46"	11.40	N87°54'09"W	6.75
C75	82°03'51"	11.40	N64°05'37"W	14.97
C76	51°55'22"	11.40	N49°01'23"W	9.98
C77	49°11'22"	11.40	N50°23'22"W	9.49
C78	70°22'34"	11.40	N60°58'56"W	13.14

CURVE DATA ALONG UT3

CURVE	DELTA	RADIUS	CH. BRG.	CH. DIST.
C79	49°20'24"	11.40	S24°20'43"W	9.52
C80	80°47'28"	11.40	S40°04'14"W	14.78
C81	4°18'35"	11.40	S78°18'41"W	0.86
C82	25°07'23"	11.40	S88°43'05"W	4.96
C83	80°54'03"	11.40	S60°49'45"W	14.79
C84	60°37'52"	11.40	S30°41'39"W	11.51
C85	68°39'25"	11.40	S46°42'52"W	12.85
C86	41°57'07"	11.40	S33°23'43"W	8.16
C87	37°14'22"	11.40	S35°45'05"W	7.28
C88	93°21'18"	11.40	S63°48'33"W	16.59
C89	23°08'02"	11.40	N81°04'49"W	4.57
C90	38°48'22"	11.40	N73°14'39"W	7.57
C91	68°03'46"	11.40	N87°52'21"W	12.76
C92	71°49'08"	11.40	N85°59'40"W	13.37
C93	71°41'18"	11.40	N85°55'45"W	13.35
C94	37°28'05"	11.40	S76°57'36"W	7.32
C95	66°18'25"	11.40	S62°22'26"W	12.47
C96	89°01'11"	11.40	S73°53'51"W	15.98
C97	41°06'47"	11.40	N82°08'56"W	8.01
C98	36°55'29"	11.40	N84°14'36"W	7.22
C99	62°49'08"	11.40	S82°48'34"W	11.88
C100	49°50'06"	11.40	S76°21'33"W	9.62
C101	52°16'38"	11.40	S75°10'48"W	10.04
C102	61°52'09"	11.40	N79°58'33"E	11.72
C103	72°59'11"	11.40	S74°25'03"W	13.56
C104	32°31'36"	11.40	S54°11'15"W	6.39
C105	20°43'10"	11.40	S60°05'26"W	4.10

LINE DATA ALONG CONSERVATION EASEMENT "A"

LINE	LENGTH	BEARING
L1	239.22'	N01°47'17"W
L2	57.77'	N78°47'17"W
L3	280.45'	N04°39'45"W
L4	181.45'	N15°26'51"E
L5	209.44'	N87°50'24"E
L6	184.43'	S07°27'23"E
L7	493.59'	S05°49'04"E
L8	171.94'	S20°31'15"E
L9	36.75'	S07°34'28"E
L10	337.12'	N65°40'13"W

LINE DATA ALONG CONSERVATION EASEMENT "B"

LINE	LENGTH	BEARING
L13	365.31'	S65°40'13"E
L14	239.86'	S01°29'16"W
L15	136.42'	S20°44'21"W
L16	239.68'	N89°10'40"W
L17	18.74'	N09°42'45"E
L18	497.71'	N04°49'18"W

'PRELIMINARY PLAT'
NOT FOR RECORDATION, CONVEYANCES OR SALES

SHEET 2 OF 3

CONSERVATION EASEMENT
FOR

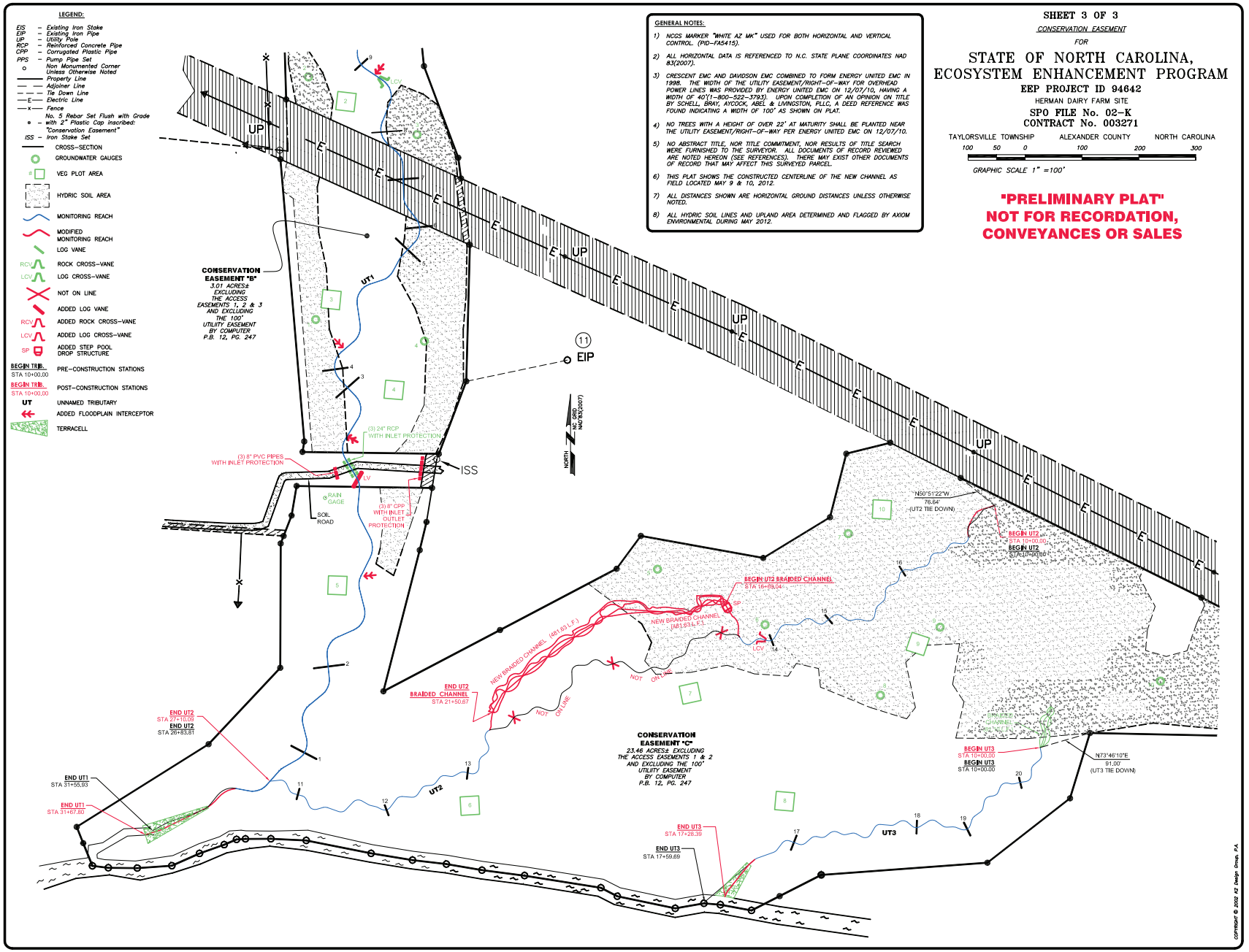
STATE OF NORTH CAROLINA, ECOSYSTEM ENHANCEMENT PROGRAM

EEP PROJECT ID 94642
HERMAN DAIRY FARM SITE
SPO FILE No. 02-K
CONTRACT No. 003271

TAYLORSVILLE TOWNSHIP ALEXANDER COUNTY NORTH CAROLINA

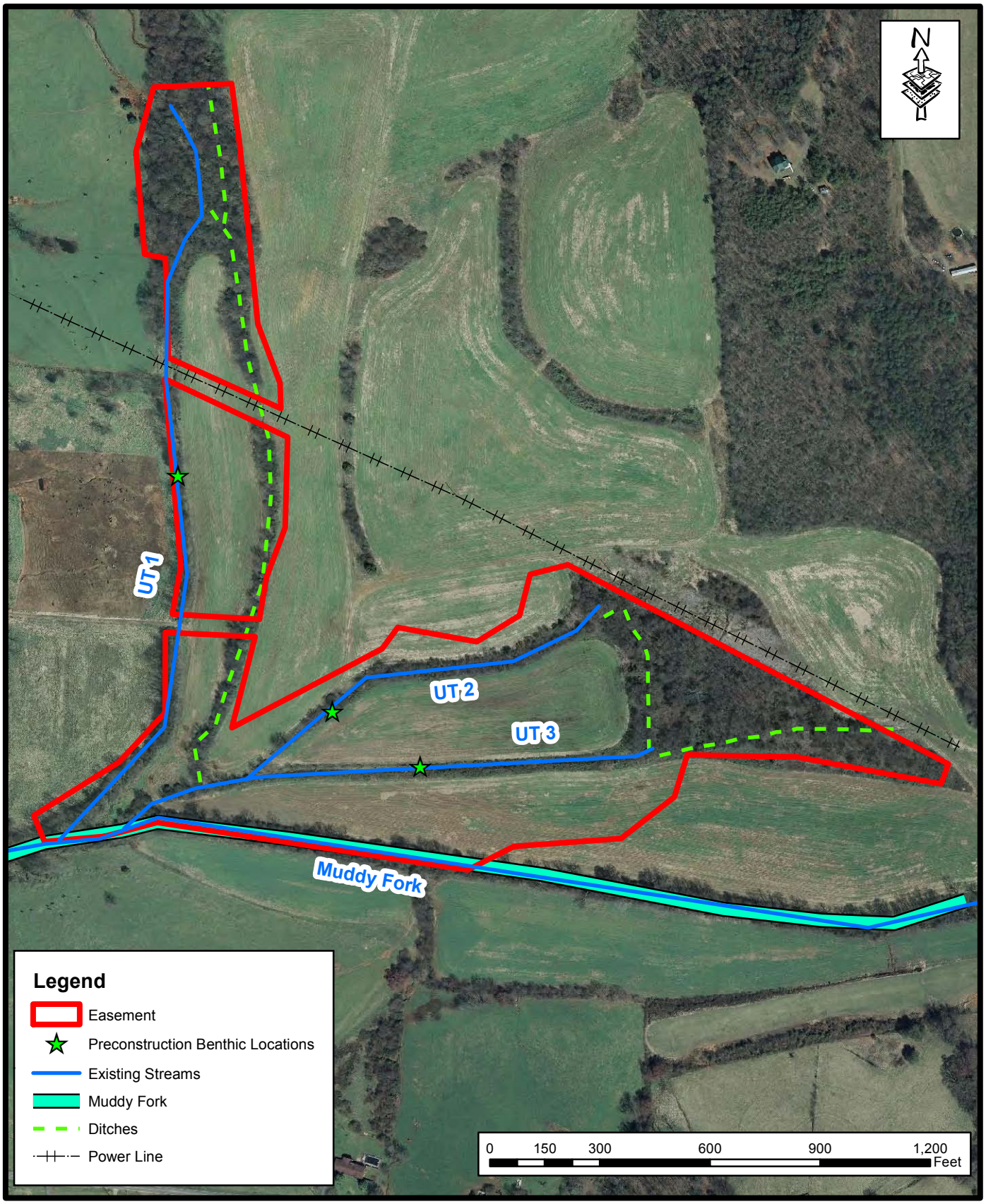
100 50 0 100 200 300

GRAPHIC SCALE 1" =100'



Appendix E.
Preconstruction Benthic Data

Figure E1. Preconstruction Benthic Station Locations
Preconstruction Benthic Sample Results
Habitat Assessment Field Datasheets



Axiom Environmental
218 Snow Avenue
Raleigh, NC 27603
(919) 215-1693
Axiom Environmental, Inc.

HERMAN DAIRY
STREAM AND WETLAND MITIGATION SITE
PRECONSTRUCTION BENTHIC LOCATIONS
Alexander County, North Carolina

Dwn. By:	CLF
Date:	Jan 2012
Project:	10-016

FIGURE
E1

HERMAN DAIRY PRECONSTRUCTION BENTHICS
October 18, 2011

SPECIES	T.V.	F.F.G.	UT 1	UT 2	UT 3
PLATYHELMINTHES					
Turbellaria					
Tricladida					
Dugesiidae					
Girardia (Dugesia) tigrina	**7.2**				1
MOLLUSCA					
Bivalvia					
Veneroida					
Sphaeriidae	***8**	**FC**			1
Pisidium sp.	**6.5**	**FC**	1		
Gastropoda					
Basommatophora					
Ancylidae		**SC**			
Ferrissia rivularis	***6**	**SC**	7	4	
Physidae					
Physella sp.	**8.8**	**CG**	7	1	
ANNELIDA					
Oligochaeta	***10**	**CG**			
Tubificida					
Naididae	***8**	**CG**	1		
Tubificidae w.h.c.	**7.1**	**CG**	5		
Tubificidae w.o.h.c.	**7.1**	**CG**	1		
Limnodrilus hoffmeisteri	**9.5**	**CG**	1		
Lumbriculida					
Lumbriculidae	7	**CG**	5	1	2
ARTHROPODA					
Crustacea					
Ostracoda				1	19
Copepoda					
Harpacticola					1
Cladocera					
Chydoridae					
Chydorus sp.			1		
Isopoda					
Asellidae		**SH**			
Caecidotea sp.	**9.1**	**CG**		6	36
Insecta					
Colelmbola					1
Ephemeroptera					
Baetidae	***4**	**CG**			
Baetis sp.	***4**	**CG**	1		
Pseudocloeon sp.	**4**	**CG**	1		
Heptageniidae		**SC**			
Maccaffertium (Stenonema) sp.	***4**	**SC**	5		
Leptophlebiidae		**CG**			
Leptophlebia sp.	**6.2**	**CG**		1	
Paraleptophlebia sp.	**0.9**	**CG**	2		
Odonata					
Calopterygidae		**P**			

SPECIES	T.V.	F.F.G.	UT 1	UT 2	UT 3
Calopteryx sp.	**7.8**	**P**	4	2	
Hemiptera					
Corixidae	**9**	**PI**		2	
Veliidae		**P**			
Microvelia sp.		**P**		1	
Megaloptera					
Corydalidae		**P**			
Nigronia serricornis	**5**	**P**	2		
Sialidae		**P**			
Sialis sp.	**7.2**	**P**	1	1	1
Trichoptera					
Hydropsychidae		**FC**			
Cheumatopsyche sp.	**6.2**	**FC**	7		
Diplectrona modesta	**2.2**	**FC**	1		
Hydropsyche betteni gp.	**7.8**	**FC**	9		
Phryganeidae		**SH**			
Ptilostomis sp.	**6.4**	**SH**	2		
Coleoptera					
Dytiscidae	***5**	**P**	1	6	1
Ilybius sp.					2
Neoporus sp.	**8.6**				1
Hydrophilidae		**P**			
Cymbiodyta sp.		**CG**			3
Scirtidae		**SC**			
Scirtes sp.					1
Staphylinidae		**P**			1
Diptera					
Chironomidae					
Chironomus sp.	**9.6**	**CG**	3	1	
Clinotanypus sp.	***6**	**P**		1	
Parametriocnemus sp.	**3.7**	**CG**	1		
Polypedilum aviceps	**3.7**		4	1	
Polypedilum flavum (convictum)	**4.9**	**SH**	1	1	
Procladius sp.	**9.1**	**P**		2	
Thienemannimyia gp.	***6**	**P**	1		
Tribelos jucundum	**6.3**		2	2	
Simuliidae		**FC**			
Simulium sp.	**6**	**FC**		1	
Tipulidae		**SH**			
Ptychoptera sp.			2		
TOTAL NO. OF ORGANISMS			**79**	**35**	**71**
TOTAL NO. OF TAXA			**28**	**18**	**14**
EPT			**8**	**1**	**0**
NCBI			**6.32**	**6.90**	**8.38**

3/06 Revision 6

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

UT 1

Biological Assessment Unit, DWQ **TOTAL SCORE** 45

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream UT Muddy Fork Location/road: Three Forks Church Rd (Road Name) **County** Alexander

Date 10/18/11 **CC#** 030501011200 30 Basin Catawba Subbasin 03-08-32

Observer(s) Fay-m/DMS Type of Study: ☐ Fish ☒ Benthos ☐ Basinwide ☐ Special Study (Describe) _____

Latitude 35.9316 Longitude -81.2069 Ecoregion: ☒ MT ☐ P ☐ Slate Belt ☐ Triassic Basin

Water Quality: Temperature _____ °C DO _____ mg/l Conductivity (corr.) _____ µS/cm pH _____

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 5 %Forest (disturbed) _____ %Residential 45 %Active Pasture 45 % Active Crops
_____ %Fallow Fields _____ % Commercial _____ %Industrial 5 %Other - Describe: Animal operations - Dairy/Veal Farm

Watershed land use : ☒ Forest ☒ Agriculture ☐ Urban ☒ Animal operations upstream

Width: (~~meters~~ feet) Stream 5-6 ft Channel (at top of bank) 10 ft **Stream Depth:** (~~m~~ ft) Avg 2-2.5 ft Max 3 ft
☐ Width variable ☐ Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (~~m~~) 3 ft

Bank Angle: 75 ° or ☐ NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

☒ Channelized Ditch
☐ Deeply incised-steep, straight banks ☐ Both banks undercut at bend ☒ Channel filled in with sediment
☐ Recent overbank deposits ☐ Bar development ☐ Buried structures ☐ Exposed bedrock
☒ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐ Green tinge ☒ Sewage smell
Manmade Stabilization: ☒ N ☐ Y: ☐ Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐ Berm/levee
Flow conditions : ☐ High ☒ Normal ☐ Low
Turbidity: ☐ Clear ☒ Slightly Turbid ☐ Turbid ☐ Tannic ☐ Milky ☐ Colored (from dyes)
Good potential for Wetlands Restoration Project?? ☒ **YES** ☐ **NO Details** currently proposed.

Channel Flow Status

Useful especially under abnormal or low flow conditions.

A. Water reaches base of both lower banks, minimal channel substrate exposed	☒
B. Water fills >75% of available channel, or <25% of channel substrate is exposed	☐
C. Water fills 25-75% of available channel, many logs/snags exposed	☐
D. Root mats out of water	☐
E. Very little water in channel, mostly present as standing pools	☐

Weather Conditions: Mid 70° sunny **Photos:** ☐ N ☒ Y ☐ Digital ☐ 35mm

Remarks: _____

I. Channel Modification UT1

	Score
A. channel natural, frequent bends	5
B. channel natural, infrequent bends (channelization could be old)	4
C. some channelization present	3
D. more extensive channelization, >40% of stream disrupted	(2)
E. no bends, completely channelized or rip rapped or gabioned, etc	0

☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream ☒Banks of uniform shape/height

Remarks _____ Subtotal 2

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as **R**are, **C**ommon, or **A**bundant.

R Rocks C **Macrophytes** C **Sticks and leafpacks** R **Snags and logs** R **Undercut banks or root mats**

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score	20-40% Score	<20% Score
4 or 5 types present	20	16	12	8
3 types present	19	15	(11)	7
2 types present	18	14	10	6
1 type present	17	13	9	5
No types present	0			

☐ No woody vegetation in riparian zone Remarks very little woody veg in riparian zone (25-10 ft of disturbed veg) Subtotal 11

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

	Score
A. substrate with good mix of gravel, cobble and boulders	
1. embeddedness <20% (very little sand, usually only behind large boulders)	15
2. embeddedness 20-40%	12
3. embeddedness 40-80%	8
4. embeddedness >80%	3
B. substrate gravel and cobble	
1. embeddedness <20%	14
2. embeddedness 20-40%	11
3. embeddedness 40-80%	6
4. embeddedness >80%	2
C. substrate mostly gravel	
1. embeddedness <50%	8
2. embeddedness >50%	4
D. substrate homogeneous	
1. substrate nearly all bedrock	3
2. substrate nearly all sand	3
3. substrate nearly all detritus	2
4. substrate nearly all silt/ clay	(1)

Remarks _____ Subtotal 1

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

	Score
A. Pools present	
1. Pools Frequent (>30% of 200m area surveyed)	
a. variety of pool sizes	10
b. pools about the same size (indicates pools filling in)	8
2. Pools Infrequent (<30% of the 200m area surveyed)	
a. variety of pool sizes	6
b. pools about the same size	4
B. Pools absent	(0)

Subtotal 0

☐ Pool bottom boulder-cobble=hard ☐ Bottom sandy-sink as you walk ☒Silt bottom ☐ Some pools over wader depth

Remarks _____

Page Total 14

V. Riffle Habitats VT1

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.

	Riffles **Frequent** Score	Riffles **Infrequent** Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	(16)	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	

Channel Slope: ☒Typical for area ☐Steep=fast flow ☐Low=like a coastal stream Subtotal 16

VI. Bank Stability and Vegetation

FACE UPSTREAM	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion..	7	7
B. Erosion areas present		
1. diverse **trees**, shrubs, grass; plants healthy with good root systems.....	6	6
2. few trees or small trees and **shrubs**; vegetation appears generally healthy.....	5	5
3. sparse **mixed** vegetation; plant types and conditions suggest poorer soil binding.....	(3)	(3)
4. mostly **grasses**, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0
		Total 6

Remarks _____

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with **good** canopy with some breaks for light penetration	10
B. Stream with **full canopy** - breaks for light penetration absent.....	8
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	(7)
D. Stream with **minimal** canopy - full sun in all but a few areas.....	2
E. **No canopy** and no shading.....	0

Remarks _____ Subtotal 7

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM Dominant vegetation: ☐ Trees ☒ Shrubs ☐ Grasses ☐ Weeds/old field ☐Exotics (kudzu, etc)	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
1. width > 18 meters.....	5	5
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	(1)	(1)
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0
		Total 2

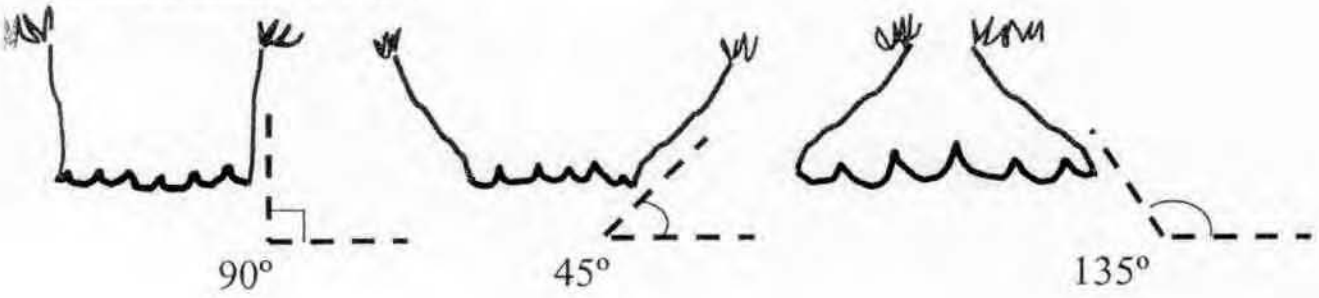
Remarks _____

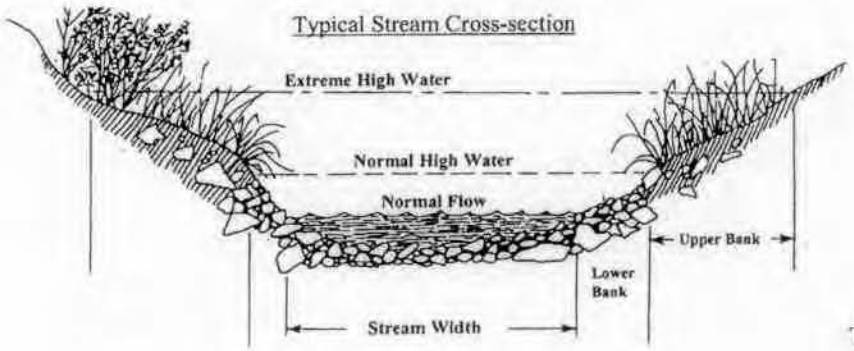
Page Total 31

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE** 45

Supplement for Habitat Assessment Field Data Sheet VT1

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

photos 1+2

Other comments:

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

UT 2

Biological Assessment Unit, DWQ **TOTAL SCORE** 36

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream UT Muddy Fork Location/road: Three Forks Church Rd. (Road Name) County Alexander

Date 10/18/11 **CC#** 03050101120030 Basin Catawba Subbasin 03-08-32

Observer(s) Fagan/ Davis Type of Study: ☐ Fish ☒ Benthos ☐ Basinwide ☐ Special Study (Describe) _____

Latitude 35.93116 Longitude -81.2069 Ecoregion: ☒ MT ☐ P ☐ Slate Belt ☐ Triassic Basin

Water Quality: Temperature _____ °C DO _____ mg/l Conductivity (corr.) _____ µS/cm pH _____

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 15 %Forest _____ %Residential _____ %Active Pasture 85 % Active Crops
_____ %Fallow Fields _____ % Commercial _____ %Industrial _____ %Other - Describe: _____

Watershed land use : ☒ Forest ☒ Agriculture ☐ Urban ☒ Animal operations upstream

Width: (~~meters~~) Stream 3 ft Channel (at top of bank) 4 ft **Stream Depth:** (~~m~~) Avg 0.5-1 Max 1-1.5 ft
☐ Width variable ☐ Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (~~m~~) 1.5 ft

Bank Angle: 15 ° or ☐ NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

☒ Channelized Ditch
☐ Deeply incised-steep, straight banks ☐ Both banks undercut at bend ☒ Channel filled in with sediment
☐ Recent overbank deposits ☐ Bar development ☐ Buried structures ☐ Exposed bedrock
☒ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐ Green tinge ☒ Sewage smell
Manmade Stabilization: ☒ N ☐ Y: ☐ Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐ Berm/levee
Flow conditions : ☐ High ☐ Normal ☒ Low
Turbidity: ☐ Clear ☒ Slightly Turbid ☐ Turbid ☐ Tannic ☐ Milky ☐ Colored (from dyes)
Good potential for Wetlands Restoration Project?? ☒ **YES** ☐ **NO Details** currently proposed

Channel Flow Status

Useful especially under abnormal or low flow conditions.

A. Water reaches base of both lower banks, minimal channel substrate exposed	☒
B. Water fills >75% of available channel, or <25% of channel substrate is exposed	☐
C. Water fills 25-75% of available channel, many logs/snags exposed	☐
D. Root mats out of water	☐
E. Very little water in channel, mostly present as standing pools	☐

Weather Conditions: mid 70's, sunny **Photos:** ☐ N ☒ Y ☐ Digital ☐ 35mm

Remarks: _____

I. Channel Modification VT2

	Score
A. channel natural, frequent bends	5
B. channel natural, infrequent bends (channelization could be old)	4
C. some channelization present	3
D. more extensive channelization, >40% of stream disrupted	(2)
E. no bends, completely channelized or rip rapped or gabioned, etc	0

☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream ☐Banks of uniform shape/height

Remarks _____ Subtotal 2

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as **R**are, **C**ommon, or **A**bundant.

/ **Rocks** C **Macrophytes** C **Sticks and leafpacks** R **Snags and logs** R **Undercut banks or root mats**

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score	20-40% Score	<20% Score
4 or 5 types present	20	(16)	12	8
3 types present	19	15	11	7
2 types present	18	14	10	6
1 type present	17	13	9	5
No types present	0			

☐ No woody vegetation in riparian zone Remarks _____ Subtotal 16

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

	Score
A. substrate with good mix of gravel, cobble and boulders	
1. embeddedness <20% (very little sand, usually only behind large boulders)	15
2. embeddedness 20-40%	12
3. embeddedness 40-80%	8
4. embeddedness >80%	3
B. substrate gravel and cobble	
1. embeddedness <20%	14
2. embeddedness 20-40%	11
3. embeddedness 40-80%	6
4. embeddedness >80%	2
C. substrate mostly gravel	
1. embeddedness <50%	8
2. embeddedness >50%	4
D. substrate homogeneous	
1. substrate nearly all bedrock	3
2. substrate nearly all sand	3
3. substrate nearly all detritus	2
4. substrate nearly all silt/ clay	(1)

Remarks _____ Subtotal 1

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

	Score
A. Pools present	
1. Pools Frequent (>30% of 200m area surveyed)	
a. variety of pool sizes	10
b. pools about the same size (indicates pools filling in)	8
2. Pools Infrequent (<30% of the 200m area surveyed)	
a. variety of pool sizes	(6)
b. pools about the same size	4
B. Pools absent	0

Subtotal 6

☐ Pool bottom boulder-cobble=hard ☒ Bottom sandy-sink as you walk ☐ Silt bottom ☐ Some pools over wader depth

Remarks _____

Page Total 25

UT2

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.

	Riffles **Frequent** Score	Riffles **Infrequent** Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	16	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	(3)
D. riffles absent.....	0	

Channel Slope: ☒Typical for area ☐Steep=fast flow ☐Low=like a coastal stream Subtotal 3

VI. Bank Stability and Vegetation

FACE UPSTREAM	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion..	7	7
B. Erosion areas present		
1. diverse **trees**, shrubs, grass; plants healthy with good root systems.....	6	6
2. few trees or small trees and **shrubs**; vegetation appears generally healthy.....	5	5
3. sparse **mixed** vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly **grasses**, few if any trees and shrubs, high erosion and failure potential at high flow..	(2)	(2)
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0
		Total 4

Remarks _____

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with **good** canopy with some breaks for light penetration	10
B. Stream with **full canopy** - breaks for light penetration absent.....	8
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	7
D. Stream with **minimal** canopy - full sun in all but a few areas.....	(2)
E. **No canopy** and no shading.....	0

Remarks _____ Subtotal 2

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM

Dominant vegetation: ☐ Trees ☒ Shrubs ☒ Grasses ☐ Weeds/old field ☐Exotics (kudzu, etc)

	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
1. width > 18 meters.....	5	5
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	(1)	(1)
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0
		Total 2

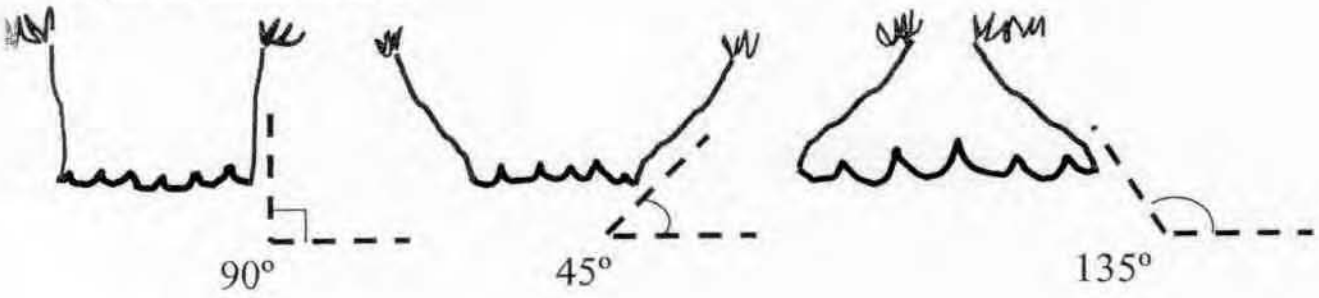
Remarks _____

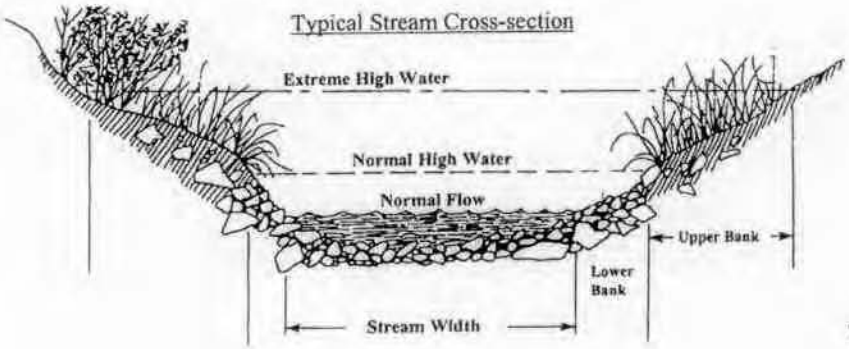
Page Total 11

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE** 36

Supplement for Habitat Assessment Field Data Sheet UT2

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch: photos 3+4

Other comments:

3 salamanders (~3/4-1 inch in length)

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

UT 3

Biological Assessment Unit, DWQ **TOTAL SCORE** 21

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream UT Muddy Fork Location/road: Three Forks Church Rd. (Road Name) County Alexander

Date 10/18/11 **CC#** 030501011 20030 Basin Catawba Subbasin 03-08-32

Observer(s) Fagan/ Davis Type of Study: ☐ Fish ☒ Benthos ☐ Basinwide ☐ Special Study (Describe) _____

Latitude 35.9316 Longitude -81.2069 Ecoregion: ☒ MT ☐ P ☐ Slate Belt ☐ Triassic Basin

Water Quality: Temperature _____ °C DO _____ mg/l Conductivity (corr.) _____ µS/cm pH _____

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 10 %Forest _____ %Residential _____ %Active Pasture 90 % Active Crops
_____ %Fallow Fields _____ % Commercial _____ %Industrial _____ %Other - Describe: _____

Watershed land use : ☒ Forest ☒ Agriculture ☐ Urban ☒ Animal operations upstream

Width: (meters) Stream 3 ft Channel (at top of bank) 5 ft **Stream Depth:** (m) Avg 0.5-1 ft Max 1-1.5 ft
☐ Width variable ☐ Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) 3 ft

Bank Angle: 75 ° or ☐ NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

☒ Channelized Ditch
☐ Deeply incised-steep, straight banks ☐ Both banks undercut at bend ☒ Channel filled in with sediment
☐ Recent overbank deposits ☐ Bar development ☐ Buried structures ☐ Exposed bedrock
☒ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐ Green tinge ☒ Sewage smell
Manmade Stabilization: ☒ N ☐ Y: ☐ Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐ Berm/levee
Flow conditions : ☐ High ☐ Normal ☒ Low
Turbidity: ☐ Clear ☐ Slightly Turbid ☒ Turbid ☐ Tannic ☐ Milky ☐ Colored (from dyes)
Good potential for Wetlands Restoration Project?? ☒ **YES** ☐ **NO Details** currently proposed

Channel Flow Status
Useful especially under abnormal or low flow conditions.

A. Water reaches base of both lower banks, minimal channel substrate exposed	☒
B. Water fills >75% of available channel, or <25% of channel substrate is exposed	☐
C. Water fills 25-75% of available channel, many logs/snags exposed	☐
D. Root mats out of water	☐
E. Very little water in channel, mostly present as standing pools	☐

Weather Conditions: mid-70's, sunny **Photos:** ☐ N ☒ Y ☐ Digital ☐ 35mm

Remarks: _____

I. Channel Modification UT3

	Score
A. channel natural, frequent bends	5
B. channel natural, infrequent bends (channelization could be old)	4
C. some channelization present	3
D. more extensive channelization, >40% of stream disrupted	(2)
E. no bends, completely channelized or rip rapped or gabioned, etc	0

☐ Evidence of dredging ☒ Evidence of desnagging=no large woody debris in stream ☐ Banks of uniform shape/height

Remarks _____ Subtotal 2

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

✓ **Rocks** C **Macrophytes** C **Sticks and leafpacks** ✓ **Snags and logs** ✓ **Undercut banks or root mats**

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score	20-40% Score	<20% Score
4 or 5 types present	20	16	12	8
3 types present	19	15	11	7
2 types present	18	(14)	10	6
1 type present	17	13	9	5
No types present	0			

☐ No woody vegetation in riparian zone Remarks _____ Subtotal 14

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

	Score
A. substrate with good mix of gravel, cobble and boulders	
1. embeddedness <20% (very little sand, usually only behind large boulders)	15
2. embeddedness 20-40%	12
3. embeddedness 40-80%	8
4. embeddedness >80%	3
B. substrate gravel and cobble	
1. embeddedness <20%	14
2. embeddedness 20-40%	11
3. embeddedness 40-80%	6
4. embeddedness >80%	2
C. substrate mostly gravel	
1. embeddedness <50%	8
2. embeddedness >50%	4
D. substrate homogeneous	
1. substrate nearly all bedrock	3
2. substrate nearly all sand	3
3. substrate nearly all detritus	2
4. substrate nearly all silt/ clay	(1)

Remarks _____ Subtotal 1

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

	Score
A. Pools present	
1. Pools Frequent (>30% of 200m area surveyed)	
a. variety of pool sizes	10
b. pools about the same size (indicates pools filling in)	8
2. Pools Infrequent (<30% of the 200m area surveyed)	
a. variety of pool sizes	6
b. pools about the same size	4
B. Pools absent	(0)

Subtotal 0

☐ Pool bottom boulder-cobble=hard ☒ Bottom sandy-sink as you walk ☐ Silt bottom ☐ Some pools over wader depth

Remarks _____

Page Total 17

VT3

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.

	Riffles **Frequent** Score	Riffles **Infrequent** Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	16	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	

Channel Slope: ☒Typical for area ☐Steep=fast flow ☐Low=like a coastal stream Subtotal 0

VI. Bank Stability and Vegetation

FACE UPSTREAM

	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion..	7	7
B. Erosion areas present		
1. diverse **trees**, shrubs, grass; plants healthy with good root systems.....	6	6
2. few trees or small trees and **shrubs**; vegetation appears generally healthy.....	5	5
3. sparse **mixed** vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly **grasses**, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0

Total 4

Remarks _____

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with **good** canopy with some breaks for light penetration	10
B. Stream with **full canopy** - breaks for light penetration absent.....	8
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	7
D. Stream with **minimal** canopy - full sun in all but a few areas.....	2
E. **No canopy** and no shading.....	0

Remarks _____ Subtotal 0

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM

Dominant vegetation: ☐ Trees ☐ Shrubs ☐ Grasses ☒ Weeds/old field ☐Exotics (kudzu, etc)

	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
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B. Riparian zone **not intact** (breaks)		
1. breaks rare		
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b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0

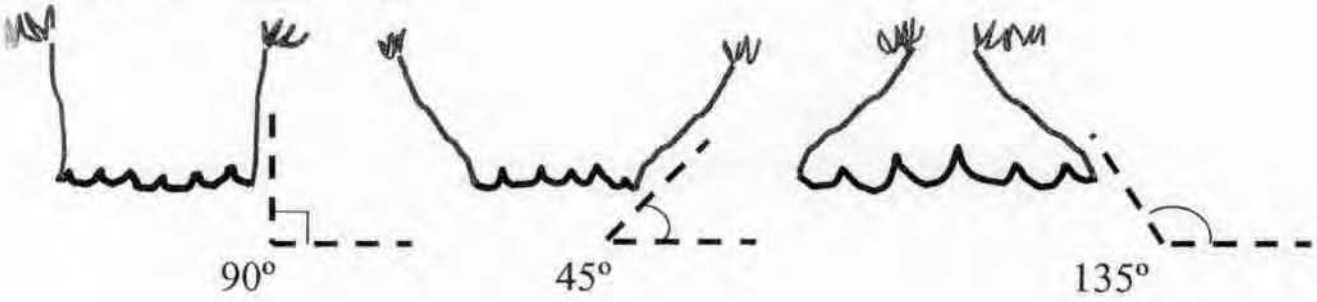
Remarks _____ Total 0

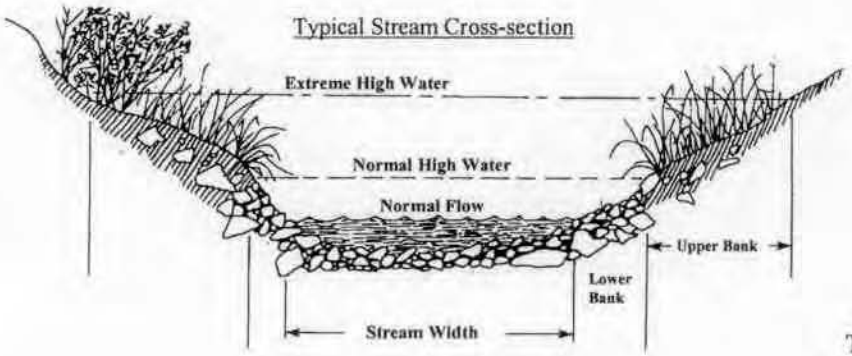
Page Total 4

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE** 21

Supplement for Habitat Assessment Field Data Sheet UT3

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

photos 5+6

Other comments: