

Pott Creek II Stream Restoration Project Mitigation Plan



June 2, 2005

Prepared By:



**Mid - Atlantic
Mitigation, LLC
(AN EARTHMARK COMPANY)**

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Mitigation Plan for Pott Creek II Stream Mitigation site

1. Introduction

The Pott Creek II Stream Restoration Project (Project) is located in Catawba County approximately five miles west of Maiden and eight miles southwest of Newton, North Carolina. The Project was built by Mid-Atlantic Mitigation, LLC (MAM) under contract to the North Carolina Department of Transportation (NCDOT) dated December 16, 2003 and amended by supplemental contract #1 dated October 14, 2004 (included as Attachment C). It is located approximately 1 mile west of the intersection of Hickory-Lincolnton Hwy and Paint Shop Road on either side of Paint Shop Road. It is part of the Hydrologic Unit Code (HUC) 03050102 (See Attachment A). The goal of this project is to provide the NCDOT with 10,054 Stream Mitigation Units (SMUs) by restoring dimension, pattern, and profile of a degraded and straightened stream channel located in a cattle pasture. This project aims to provide a stable network of stream channels that neither aggrade nor degrade while maintaining their dimension, pattern, and profile with the capacity to transport the watershed's water and sediment load. The objective of the restoration plan is to reestablish the primary stream function and values associated with nutrient removal and transport, sediment retention, flood-flow attenuation, wildlife (both aquatic and terrestrial) habitat, and also to provide restoration of riparian zones that have been historically used for pasture. Ultimately, the Project will improve the overall downstream water quality by reducing the amount of sediment being produced by bank erosion and increased scour. It will also improve fish and aquatic habitat by providing both natural material stabilization structures (rootwads, rock vanes, and riparian buffer) and by reducing the silt and clay fines in the streambed. Additional water quality benefits will be generated by removing cattle from the riparian corridor. Degraded agricultural/pasture wetlands and existing bottomland hardwood wetlands immediately adjacent to the stream corridor will be preserved.

2. Summary

Project Description

Construction of the Pott Creek II Stream Mitigation Project began in October of 2004 and was completed in April of 2005. Pott Creek enters from the north and runs the entire length of the project crossing under Paint Shop Road and continuing south. Pott Creek was severely degraded due to several occurrences of past channelization, removal and on-going maintenance of the riparian buffer, and continuous cattle grazing. Unnamed Tributary 1 (UT 1) enters from the west and had been heavily degraded by cattle traffic and grazing. UT2, UT3, and UT5 enter from the east and were severely entrenched. UT 4 enters from the west, south of the confluence of Pott Creek and Rhodes Mill, and was also severely degraded by cattle traffic and grazing and also showed evidence of past channelization. Approximately 7209 linear feet of the channel on Pott Creek was restored and relocated consistent with C-type stream channels, approximately 1827 linear feet of channel were restored on the perennial tributaries, and approximately 1018 linear feet of channel on Rhodes Mill Creek were restored by construction of a channel with proper dimension, pattern, and profile.

Methodologies Utilized

The restoration of Pott Creek utilized a combination of natural channel design methodologies with limited soil bio-engineering applications and methods consistent with a Rosgen Priority Level II-type restoration. Along Pott Creek and Rhodes Mill Creek Level II restoration involved constructing a new channel at the existing elevation. Pott Creek was constructed to the west of the existing channel and Rhodes Mill Creek was constructed to the north of the existing channel. A Priority Level I restoration (reconnecting the channel to its historical floodplain) was not feasible due to limited relief across the site and controlling outfall and inflow elevations. Advantages of the Priority II restoration include a decrease in bank height and improved stream pattern geometry resulting in reduced streambank erosion, establishment of riparian vegetation to help stabilize the banks, establishment of a floodplain to help remove stress from the channel during flood events, improvement of aquatic habitat, abatement of wide-scale flooding of original land surface, and reduction of sediment as well as a gentle downstream grade transition. The Level II restoration, over time, will stabilize pattern and the channel profile, reduce overall shear, restore natural dimension, and reduce sedimentation. A Priority Level I restoration was utilized on the largest of the five tributaries, UT1. Level I restoration is advantageous because it promotes re-connection to the floodplain and a stable channel. It also reduces bank height and streambank erosion, reduces overall land loss, decreases sediment, and raises the water table. The slope of the new channel was reduced until its bankfull elevation was consistent with the adjacent floodplain on either side.

Watershed Map

For a location of the site in the watershed context refer to Attachment A.

Plan View

Please refer to the As-built Plan in Attachment B.

Vegetation

In order to stabilize the newly constructed stream channel and flood plain areas both temporary and permanent grass seed was applied to all disturbed areas. The types of seeds used were: Albruzzi Rye grain, Hallmark Orchardgrass, Weeping Lovegrass, Southeast Wildflower Mix (IKEX SEMX084) and Annual Rye. The Annual Rye was planted only on the floodplains. After the initial seeding was completed two different planting zones for woody vegetation were established throughout the Project. Zone 1 consisted of the stream banks of Pott Creek, Rhodes Mill Creek, and its tributaries and Zone 2 consisted of the floodplain areas of Pott Creek and its unnamed tributaries. Zone 1 was planted with livestakes of the following species: *Betula nigra*, *Platanus occidentalis*, *Salix nigra*, *Salix sericea*, *Sambucus Canadensis*, and *Cornus amomum*. Zone 2 was planted with bareroot seedlings and tublings of the following species: *Betula nigra*, *Cornus amomum*, *Cephalanthus occidentalis*, *Lindera benzoin*, *Sambucus canadensis*,

Quercus bicolor, Quercus palustris, Quercus phellos, Quercus nigra, Quercus lyrata, Platanus occidentalis, Fraxinus pennsylvanica, and Diospyros virginiana. In Zone 1, livestake density varied throughout the project depending on location on the streambanks. On average livestakes were planted randomly approximately 2 feet apart and differed in sizes ranging from .25” to 2” in diameter and 2’ to 3’ in length. In Zone 2, the bareroot seedlings and tublings were planted randomly 3’ to 10’ apart throughout the project. The Original planting plans included a Zone 3, which was merged with Zone 2 during planting. Therefore, Zone 3 was planted with bareroot seedlings and tublings and not livestaked. The contractor was able to avoid damaging or removing many of the existing mature trees along the original Pott Creek channel and throughout the site, where possible. A summary showing number of species planted and estimated total number of livestakes is presented in the Table 1.

Table 1. Approximate number of Planted species

Planted Species	Bareroot Seedling	Tublings	Livestakes
<i>Quercus nigra</i>	2,000		
<i>Quercus phellos</i>	2,000	1,000	
<i>Quercus palustris</i>	2,000	1,000	
<i>Quercus bicolor</i>		1,000	
<i>Quercus lyrata</i>	2,500		
<i>Fraxinus pennsylvanica</i>	2,000		
<i>Platanus occidentalis</i>	1,000		1,000
<i>Celtis laevigata</i>	1,050		
<i>Diospyros virginiana</i>	200		
<i>Cornus amomum</i>	1,000	1,000	3,000
<i>Lindera benzion</i>	1,500		
<i>Betula nigra</i>	1,000		400
<i>Cephalanthus occidentalis</i>	525		
<i>Salix nigra</i>			3,000
<i>Salix sericea</i>			600
<i>Sambucus canadensis</i>			1,025
	16,775	4,000	9,025

Total Planted Species= 20,775 Total Livestakes planted= 9,025

Design Firm and Construction Firm

Design firm name: Mulkey Engineers and Consultants, contact Lane Sauls (919) 858-1911, Jenny Flemming (919) 858-1830

Construction firm name: Shamrock Environmental Corporation, contact Bill Wright (336) 375-1989

3. Success Criteria

Hydrological

Success of the stream restoration will be determined by observation of no substantial aggradation, degradation or bank erosion within the permanent cross-sections and longitudinal profiles with supporting photo documentation as well as the integrity of all structures installed. Any significant evidence of instability (down-cutting, deposition, bank erosion, increase in sands and finer substrate material) will also be documented within the permanent cross-sections and longitudinal profiles with supporting photo documentation, and pebble counts. Overall flow patterns, water levels and in-stream depositional characteristics will be monitored for the main channel of Pott Creek, Rhodes Mill Creek, and all five tributaries.

Comparison of restored site to reference site

Due to existing unstable nature of most second, third, and fourth order streams in the Piedmont physiographic province; only one reference reach was identified. The reference reach (UT to Fourth Creek) is situated in Iredell County, approximately 3 miles from Statesville. Morphological Tables comparing characteristics of As-Built streams with those of the reference reaches are provided in Attachment B.

Vegetation

Vegetative success will be defined as tree survival to meet 320 stems per acre after 3 years and 260 stems per acre after 5 years inside the permanent vegetative plots. Herbaceous cover will be evaluated with photos and dominant species noted showing 75% coverage after 5 years.

Soil

Chewacla and Congaree soils dominate the site while the stream terraces and uplands consists mainly of Hiwassee soils. Chewacla soils are classified by the Natural Resources Conservation Service (NRCS) as fine-loamy, mixed active, thermic Fluvaquentic Dystrudepts. These soils are somewhat poorly drained soils formed in recent alluvium on nearly level floodplains along streams that drain from the Mountains and Piedmont physiographic provinces. Chewacla soils are classified as Hydric B soils with inclusions of Wedhadkee soils (Hydric A) in areas that are flooded for longer periods and exhibit anaerobic conditions. Congaree soils are classified as fine-loamy, mixed active, nonacid, thermic Oxytaquic Udiifluvents. They are deep. Well to moderately well drained, moderately permeable loamy soils that formed in fluvial sediments. Congaree soils do not have a Hydric classification. Because we will not be monitoring the wetlands on the Pott Creek II site we will not be including soils analysis in our success criteria.

Organic Matter Accumulation

Detritus quality and quantity affect aquatic macroinvertebrate productivity and distribution in many freshwater ecosystems which can be used as a water quality indicator. The leaves that fall into streams accumulate in packs behind branches, rocks and other obstructions in the stream, forming natural leaf packs. Many freshwater macroinvertebrates directly consume leaf litter and also build their cases from leaf litter. The presence and amount of leaf litter found throughout the Pott Creek II project will be noted each year.

Other Physical Features

The conditions at the confluence of all the Unnamed tributaries and Rhodes Mill Creek will be noted each year as well as the conditions around and under the bridge on Paint Shop Road that crosses Pott Creek.

4. Monitoring Schedule and Methods

The Project will be monitored once a year for the next five years (October 2005 through October 2009) by Mid-Atlantic Mitigation, LLC (MAM). MAM will be monitoring Pott Creek II every year and will submit a monitoring report to NCEEP/NCDOT by end of the calendar year. The Project will be monitored in regard to overall channel stability and vegetative survival. Permanent vegetative plots have been established at 11 random locations, which sample both Planting Zones 1 and 2. All vegetative plots are 2,500 square feet in size, vegetative plots 1-4, and 6-11 are all 50 foot by 50 foot squares, while vegetative plot 5 is a 100 foot by 25 foot rectangle due to limited space along UT1. Vegetative plots are marked on the As-built Plan. Living woody stems will be counted in each plot and analyzed for species diversity and survival. Dominant native herbaceous vegetation will be noted in the vegetative plots. Overall coverage of each plot for herbaceous and woody species will be documented photographically and included in the Photolog. Pictures for subsequent reports will be taken from the survey point within each vegetative plot, the orientation was randomized and each subsequent photo will be taken in the orientation shown in the Photolog. Noxious species will be identified and controlled so that none become dominant species or alter the desired community structure of the site. There are six permanent cross-sections throughout Pott Creek (four on the upstream side of the bridge and two on the downstream side). Cross-sections on Pott Creek are 50% riffles and 50% pools. There are two permanent cross-sections on Rhodes Mill Creek, one riffle, one pool; and one cross-section on unnamed tributaries (1 thru 4). Each permanent cross-section is shown on the As-built plan and will be surveyed each year to monitor changes in the dimension, pattern and profile of the restored stream(s), photographic documentation of each cross-section will also be made. Due to vegetative conditions the Photolog shows current conditions from the survey point marking each cross-section, for subsequent reports, photos will ideally be taken after herbaceous vegetation has died back and from each bank and a longitudinal photo will be taken to include both banks of each cross-section. Longitudinal profiles will be monitored as follows: 1000 linear feet on Pott Creek, Station 25+00 to Station 35+00, 500 linear feet on Rhodes Mill Station 2+00 to Station 7+00, and the entire lengths of UT1 thru UT4. Unnamed tributary 5 is only 30 feet long and will not be included in the profile monitoring. The total longitudinal profile will exceed 3000 linear feet. Longitudinal

profile beginning and ending points on Pott Creek and Rhodes Mill Creek are marked on the As-built Plans as are each of the 12 permanent cross-sections. Longitudinal profiles will be observed to monitor the riffle-run-pool-glide sequences and overall stability of the restored stream. Pebble Counts will be done to monitor any unacceptable increase in sand or finer substrate material.

5. Mitigation

Because streams are a dynamic system, restoration is achieved by restoring the channel to a stable dimension, pattern, and profile such that, over time, the stream features (riffle-run-pool-glide) are maintained and the channel does not aggrade or degrade significantly. Minor morphological adjustments from the designed stream are anticipated based on the correlation of reference reach data, excessive sediment deposition from upstream sources, and on-going changes in land use within the watershed. All of the proposed 10,054 linear feet of stream mitigation have been generated through site implementation. A Stream Mitigation Unit (SMU) is defined by using the formula $[SMU=(Restoration/1.0)+(Enhancement\ Level\ I/1.5+(Enhancement\ Level\ II/2.5)+(Preservation/5.0)]$. All mitigation on site was restoration (Rosgen Level I and II), therefore yielding 10,054 total SMU's. A summary of the deliverables is presented in the Table 2 below.

Table 2. Summary of Stream Mitigation Types

Mitigation Type	Linear Feet	SMU Formula
Stream Restoration (Pott Creek main channel)	7209.0	7209.0
Stream Enhancement –Category I (Pott Creek main channel)	0	0
Stream Restoration (Rhodes Mill Creek)	1018.0	1018.0
Stream Restoration (Pott Creek unnamed tributaries)	1827.0	1827.0
TOTALS		10,054.0

6. Maintenance and Contingency Plans

If standards are not met appropriate remedial activities to satisfy NCDOT, NCEEP and the regulatory agencies will be developed, approved, and performed. Long term stewardship of the property has already been achieved by transfer of land title to the state of NCDOT. The site will be monitored for longer than five years should success criteria not be met within the original monitoring period. The site will be monitored for at least 5 years and through at least 2 bankfull events.

7. References

Mulkey Engineers and Consultants. Pott Creek II Stream Restoration Plans, 7/23/04. Sealed by Jenny Flemming, PE #25506.

Natural Resources Conservation Service (NRCS), 2000. Official Soil Series Description Query Facility. Available: <http://www.ortho.ftw.nrcs.usda.gov>.

North Carolina Department of Environment and Natural Resources (NCDENR), 2003. Basinwide Information Management System. Available: <http://www.h2o.enr.state.nc.us/bims/Reports>.

North Carolina Department of Environment and Natural Resources (NCDENR), 1999. Catawba River Basinwide Water Quality Plan. Prepared by the North Carolina Division of Water Quality, Water Quality Section.

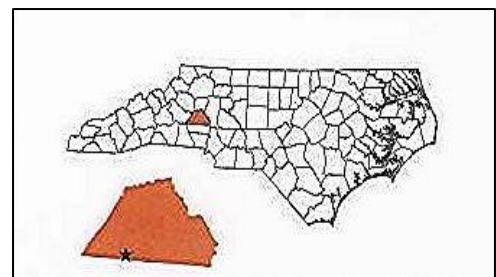
Rosgen, D.L. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

ATTACHMENT A
WATERSHED and LOCATION MAP

WATERSHED AND LOCATION MAP



Mid-Atlantic
Mitigation, LLC



ATTACHMENT B

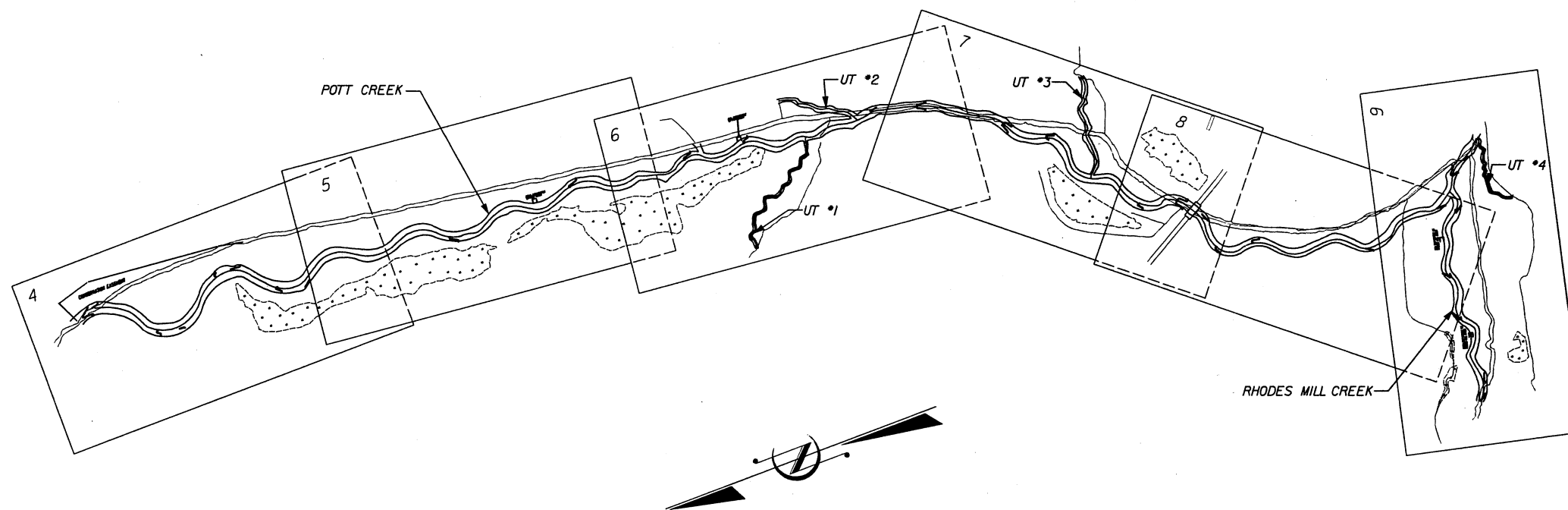
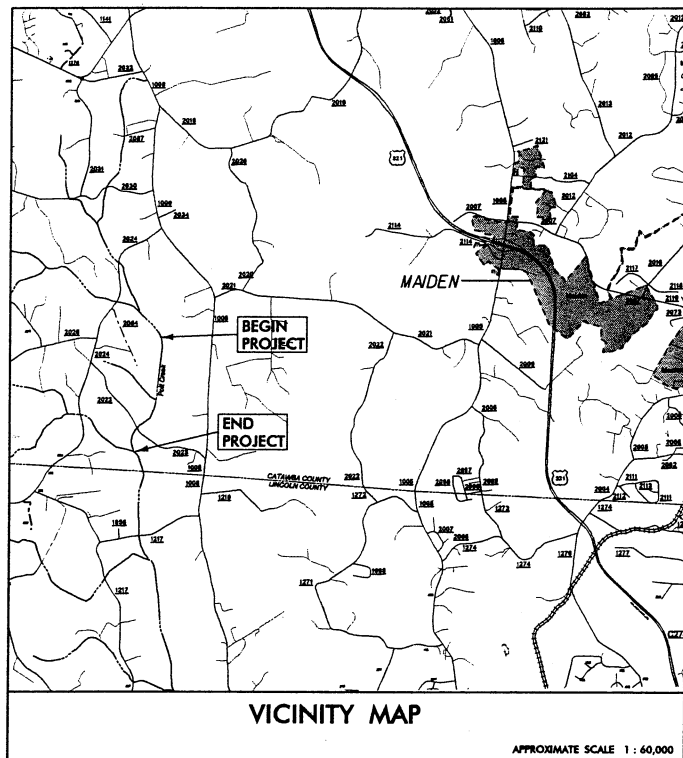
AS-BUILT PLAN DRAWINGS
And
MORPHOLOGICAL CHARACTERISTICS

CATAWBA COUNTY

POTT CREEK II STREAM RESTORATION PROJECT

LOCATION: POTT CREEK II RESTORATION SITE NORTH & SOUTH OF SR 2023 (PAINT SHOP ROAD) WEST OF MAIDEN, NORTH CAROLINA

AS BUILT PLANS



INDEX OF SHEETS	
SHEET NUMBER	SHEET
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4 - 9	PLAN SHEETS

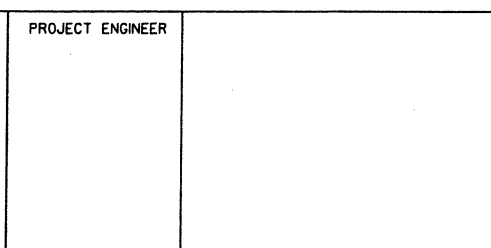
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SCALE AS SHOWN	
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PROJECT ENGINEER

PROJECT MANAGER
RICHARD K. MOGENSEN, PWS






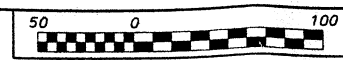
EARTHMARK COMPANIES
9301 AVIATION BOULEVARD
SUITE CE1
CONCORD, NC 28027
(704) 782-4133

PLANS PREPARED FOR

TITLE SHEET

1 SHEET OF 7

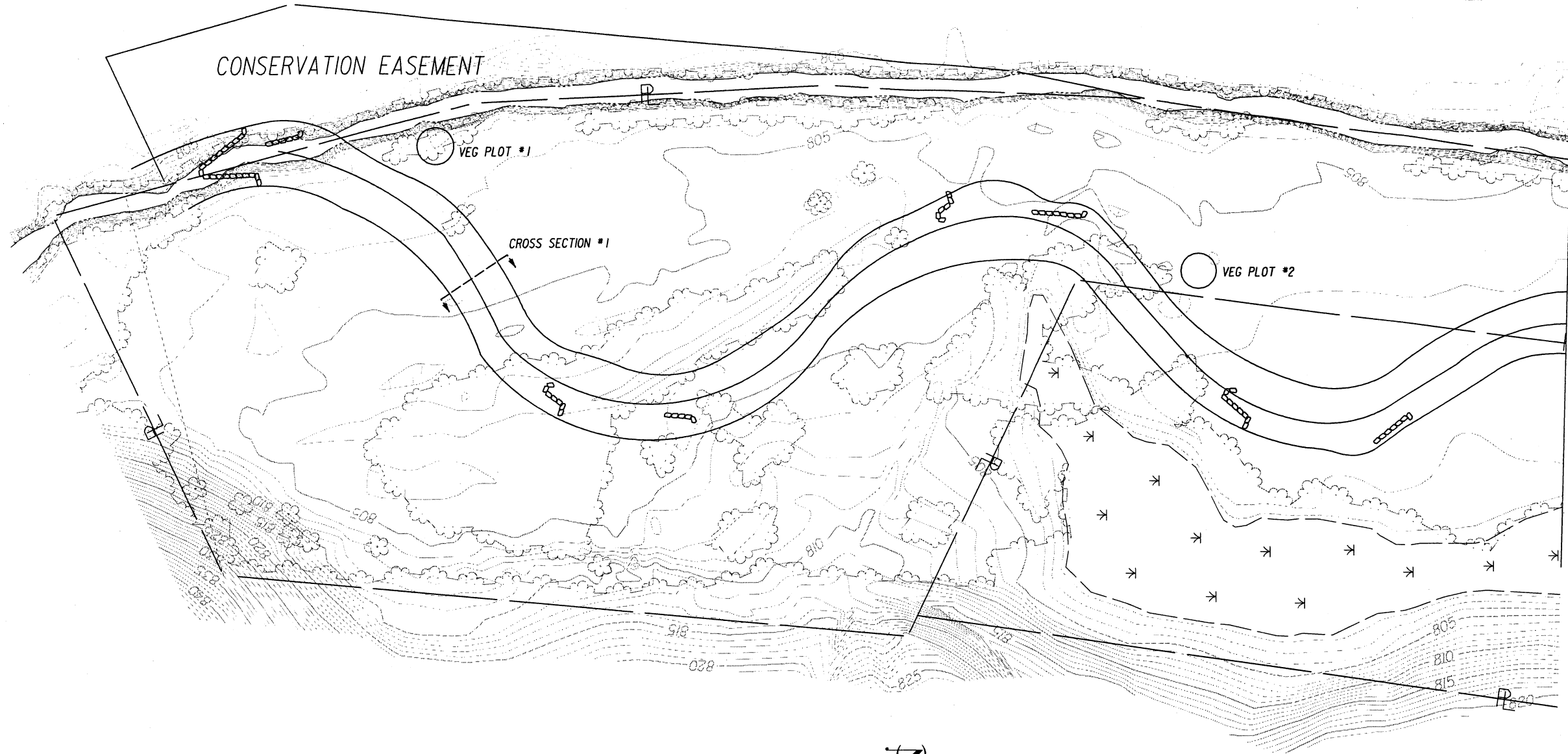
 ROCK CROSSVANE  ROCK VANE
 J HOOK



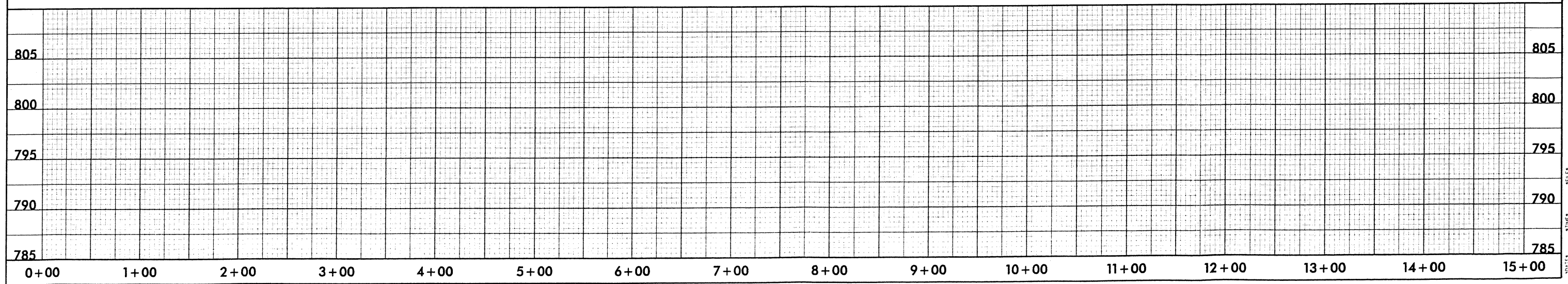
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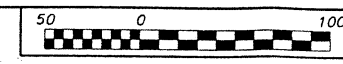
PLAN & PROFILE



MATCH TO SHEET 5

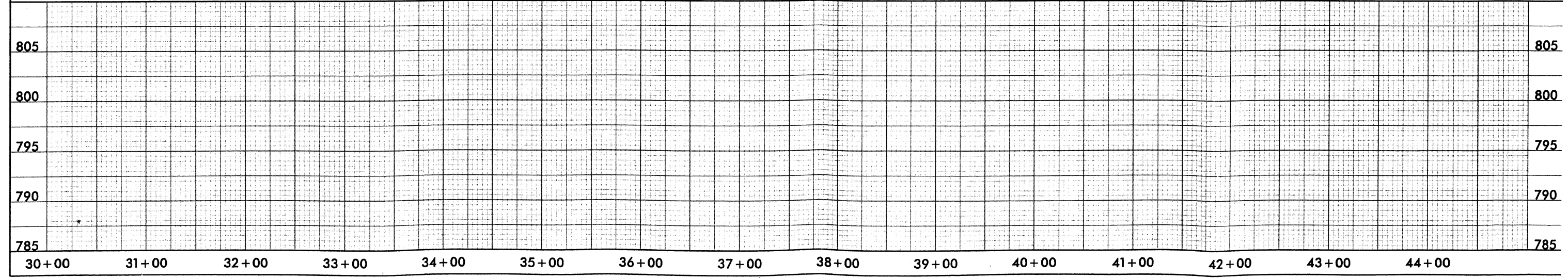
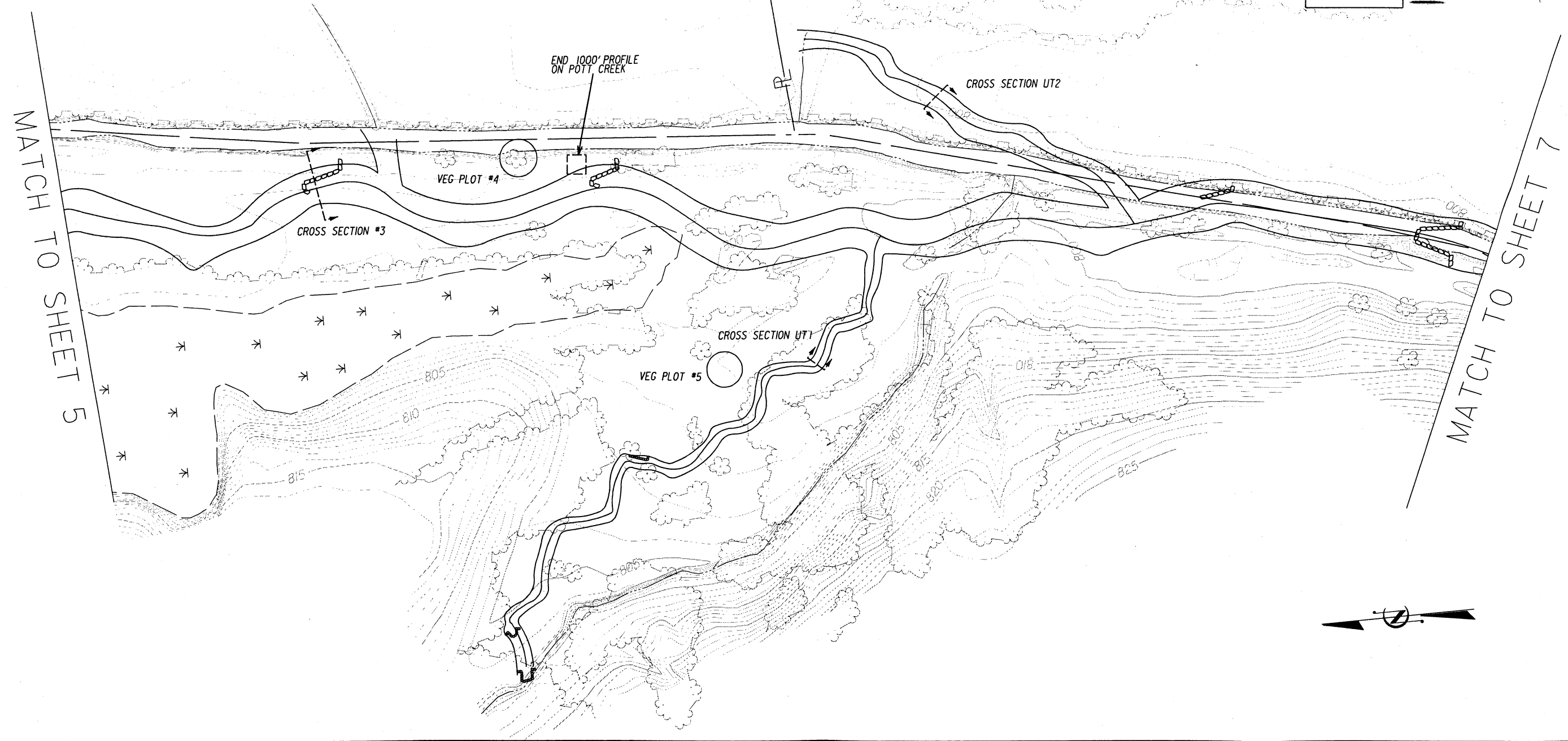


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ROCK VANE
J HOOK

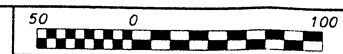


PROJECT ENGINEER
PROJECT REFERENCE NO. SHEET NO.
POTT CREEK II STREAM RESTORATION 6

PLAN & PROFILE
EarthMark
companies



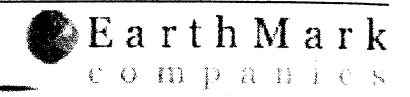
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PROJECT ENGINEER

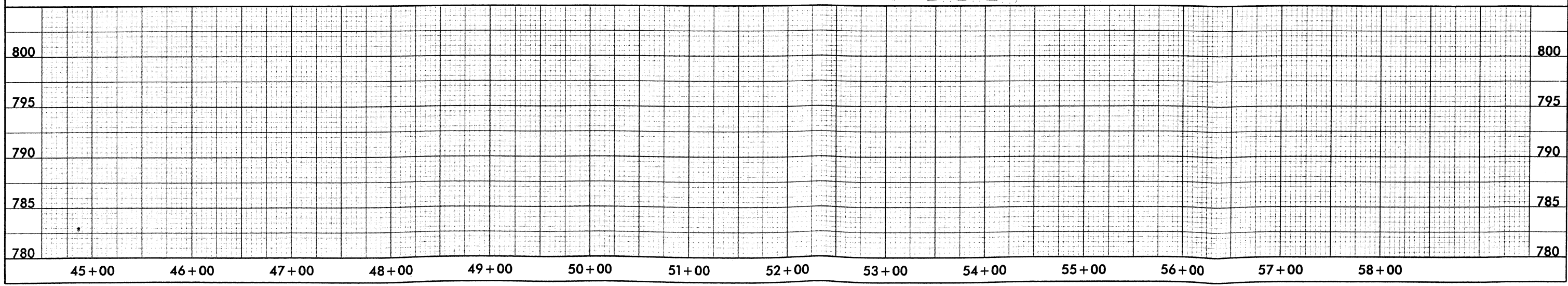
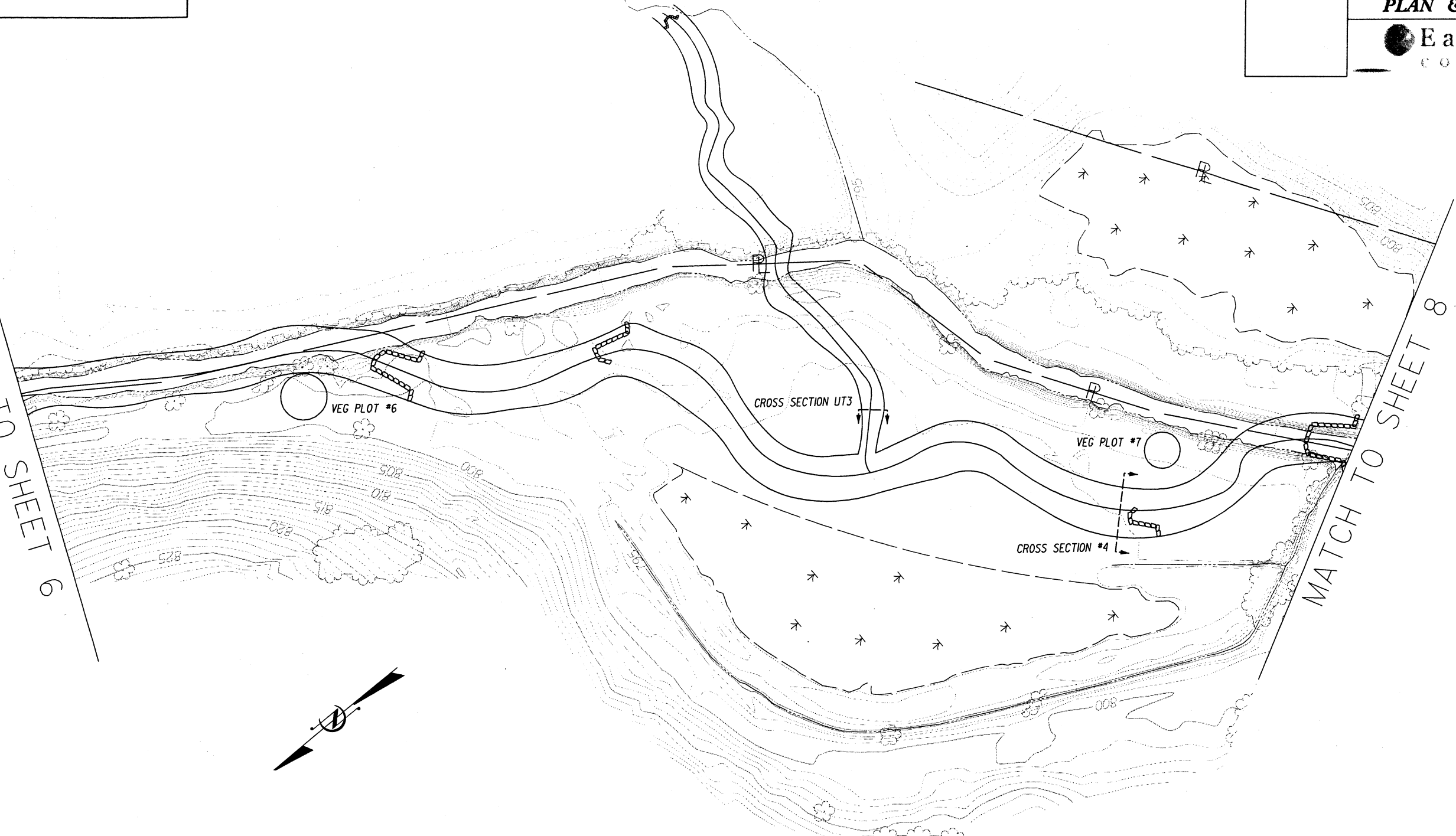
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PLAN & PROFILE



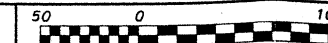
MATCH TO SHEET 6

MATCH TO SHEET 8



J HOOK

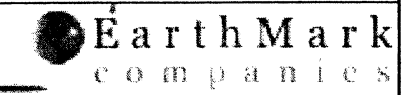
ROCK VANE



PROJECT ENGINEER

PROJECT REFERENCE NO.	SHEET NO.
POTT CREEK II STREAM RESTORATION	8

PLAN & PROFILE



MORPHOLOGICAL CHARACTERISTICS OF THE EXISTING AND PROPOSED CHANNEL WITH REFERENCE REACH DATA

(Adapted from Rosgen, 1996)

Restoration Site: Pott Creek II, Catawba County
 USGS Gage Station: None
 Reference Reach: UT to Fourth Creek
 Surveyors:

MORPHOLOGICAL CHARACTERISTICS OF THE EXISTING AND PROPOSED CHANNEL WITH REFERENCE REACH DATA

(Adapted from Rosgen, 1996)

Restoration Site: Pott Creek II, Catawba County
 USGS Gage Station: None
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 Surveyors:

MORPHOLOGICAL CHARACTERISTICS OF THE EXISTING AND PROPOSED CHANNEL WITH REFERENCE REACH DATA

(Adapted from Rosgen, 1996)

Restoration Site: Pott Creek II, Catawba County
 USGS Gage Station: None
 Reference Reach: UT to Fourth Creek
 Surveyors:

Variables	As-Built Channel (Pott Creek)	Proposed Reach (Pott Creek)	Variables	As-Built Channel (Rhodes Mill Crk.)	Proposed Reach (Rhodes Mill Crk.)	Variables	As-Built Channel (UT#1 to Pott Creek)	Proposed Reach (UT#1 to Pott Creek)
1. Stream Type	C5	C5	1. Stream Type	G4	C4	1. Stream Type	C5	E5
2. Drainage Area (sq. mi)	15	15	2. Drainage Area (sq. mi)	4.9	4.9	2. Drainage Area (sq. mi)	0.38	0.38
3. Bankfull Width (Wbkf) ft	Mean: 37.25 Range: 33.3 - 41.2	Mean: 38 Range:	3. Bankfull Width (Wbkf) ft	Mean: 32 Range:	Mean: 24.5 Range:	3. Bankfull Width (Wbkf) ft	Mean: 10.5 Range:	Mean: 9.0 Range:
4. Bankfull Mean Depth (dbkf) ft	Mean: 3.2 Range: 3.1 - 3.3	Mean: 3.4 Range:	4. Bankfull Mean Depth (dbkf) ft	Mean: 2.19 Range:	Mean: 2.04 Range:	4. Bankfull Mean Depth (dbkf) ft	Mean: 0.97 Range:	Mean: 0.9 Range:
5. Width/Depth Ratio (Wbkd/dbkf)	Mean: 11.6 Range: 10.7 - 12.5	Mean: 11.2 Range:	5. Width/Depth Ratio (Wbkd/dbkf)	Mean: 14.6 Range:	Mean: 12.0 Range:	5. Width/Depth Ratio (Wbkd/dbkf)	Mean: 10.8 Range:	Mean: 10.0 Range:
6. Bankfull Cross-Sectional Area (Abkf) sq ft	Mean: 120.5 Range: 105 - 136	Mean: 130 Range:	6. Bankfull Cross-Sectional Area (Abkf) sq ft	Mean: 70 Range:	Mean: 50 Range:	6. Bankfull Cross-Sectional Area (Abkf) sq ft	Mean: 10.2 Range:	Mean: 8.0 Range:
7. Bankfull Mean Velocity (Vbvf) fps	Mean: Range:	Mean: 4.61 Range: 4.4 - 5.0	7. Bankfull Mean Velocity (Vbvf) fps	Mean: Range:	Mean: 5.76 Range:	7. Bankfull Mean Velocity (Vbvf) fps	Mean: Range:	Mean: 3.67 Range:
8. Bankfull Discharge, (Qbvf) cfs	Mean: Range:	Mean: 600 Range: 572 - 650	8. Bankfull Discharge, (Qbvf) cfs	Mean: Range:	Mean: 290 Range:	8. Bankfull Discharge, (Qbvf) cfs	Mean: Range:	Mean: 30 Range:
9. Maximum Bankfull Depth (dmax) ft	Mean: 4.82 Range: 4.5 - 5.1	Mean: 5.00 Range:	9. Maximum Bankfull Depth (dmax) ft	Mean: 3.15 Range:	Mean: 3.00 Range:	9. Maximum Bankfull Depth (dmax) ft	Mean: 1.9 Range:	Mean: 1.35 Range:
10. Ratio of Low Bank Height to Max. Bankfull Depth (Bhlow/dmax)	Mean: 1.0 Range:	Mean: 1.0 Range:	10. Ratio of Low Bank Height to Max. Bankfull Depth (Bhlow/dmax)	Mean: 1.0 Range:	Mean: 1.0 Range:	10. Ratio of Low Bank Height to Max. Bankfull Depth (Bhlow/dmax)	Mean: 1.0 Range:	Mean: 1.0 Range:
11. Width of Flood Prone Area (Wfpa) ft	Mean: 300 Range:	Mean: 300 Range:	11. Width of Flood Prone Area (Wfpa) ft	Mean: 300 Range:	Mean: 300 Range:	11. Width of Flood Prone Area (Wfpa) ft	Mean: 175 Range:	Mean: 175 Range:
12. Entrenchment Ratio (Wfpa/Wbkf) sq ft	Mean: 8.05 Range: 7.2 - 9.0	Mean: 7.7 Range:	12. Entrenchment Ratio (Wfpa/Wbkf) sq ft	Mean: 9.38 Range:	Mean: 12.2 Range:	12. Entrenchment Ratio (Wfpa/Wbkf) sq ft	Mean: 16.7 Range:	Mean: 19.4 Range:
13. Meander Length (Lm) ft	Mean: 393 Range: 285 - 578	Mean: 312 Range: 161 - 576	13. Meander Length (Lm) ft	Mean: 189.8 Range: 168 - 210	Mean: 198.7 Range: 166.3 - 244.7	13. Meander Length (Lm) ft	Mean: 75.4 Range: 59 - 93	Mean: 82.25 Range: 69.6 - 98.7
14. Ratio of Meander Length to Bankfull Width (Lm/Wbkf)	Mean: 10.6 Range: 7.65 - 15.5	Mean: 8.2 Range: 4.2 - 15.2	14. Ratio of Meander Length to Bankfull Width (Lm/Wbkf)	Mean: 5.9 Range: 5.25 - 6.56	Mean: 8.1 Range: 6.7 - 9.9	14. Ratio of Meander Length to Bankfull Width (Lm/Wbkf)	Mean: 7.2 Range: 5.6 - 8.9	Mean: 9.1 Range: 7.7 - 10.9
15. Radius of Curvature (Rc) ft	Mean: 117.4 Range: 67 - 180	Mean: 111.4 Range: 70 - 160	15. Radius of Curvature (Rc) ft	Mean: 85.7 Range: 54 - 136	Mean: 66.8 Range: 50 - 85	15. Radius of Curvature (Rc) ft	Mean: 29.0 Range: 23.0 - 37.0	Mean: 26.0 Range: 18.0 - 36.0
16. Ratio of Radius of Curvature to Bankfull Width (Rc/Wbkf)	Mean: 3.15 Range: 1.8 - 4.8	Mean: 2.9 Range: 1.8 - 4.2	16. Ratio of Radius of Curvature to Bankfull Width (Rc/Wbkf)	Mean: 2.68 Range: 1.7 - 4.25	Mean: 2.7 Range: 2.0 - 3.5	16. Ratio of Radius of Curvature to Bankfull Width (Rc/Wbkf)	Mean: 2.76 Range: 2.2 - 3.5	Mean: 2.89 Range: 2.0 - 4.0
17. Belt Width (Wbtl) ft	Mean: 140.6 Range: 97 - 225	Mean: 102.7 Range: 63 - 243	17. Belt Width (Wbtl) ft	Mean: 130 Range:	Mean: 67.1 Range: 56.4 - 77.4	17. Belt Width (Wbtl) ft	Mean: 42.8 Range: 38 - 47	Mean: 31.2 Range: 19.7 - 45.6
18. Meander Width Ratio (Wbtl/Wbkf)	Mean: 3.77 Range: 2.6 - 6.04	Mean: 2.7 Range: 1.6 - 6.4	18. Meander Width Ratio (Wbtl/Wbkf)	Mean: 3.82 Range:	Mean: 2.7 Range: 2.3 - 3.1	18. Meander Width Ratio (Wbtl/Wbkf)	Mean: 4.07 Range: 3.6 - 4.5	Mean: 3.46 Range: 2.18 - 5.07
19. Sinuosity (Stream length/valley distance) (K)	Mean: 1.14 Range:	Mean: 1.14 Range:	19. Sinuosity (Stream length/valley distance) (K)	Mean: 1.14 Range:	Mean: 1.14 Range:	19. Sinuosity (Stream length/valley distance) (K)	Mean: 1.22 Range:	Mean: 1.23 Range:
20. Valley Slope (ft/ft)	Mean: 0.0015 Range:	Mean: 0.0015 Range:	20. Valley Slope (ft/ft)	Mean: 0.0036 Range:	Mean: 0.0036 Range:	20. Valley Slope (ft/ft)	Mean: 0.0094 Range:	Mean: 0.0094 Range:
21. Average Water Surface Slope or Bankfull for Reach (Sbvf or Savg)=(Svalley/k) ft / ft	Mean: 0.00133 Range:	Mean: 0.00133 Range: 0.0008 - 0.00134	21. Average Water Surface Slope or Bankfull for Reach (Sbvf or Savg)=(Svalley/k) ft / ft	Mean: 0.00312 Range:	Mean: 0.00312 Range: 0.003 - 0.0032	21. Average Water Surface Slope or Bankfull for Reach (Sbvf or Savg)=(Svalley/k) ft / ft	Mean: 0.0077 Range:	Mean: 0.00767 Range: 0.00407 - 0.00867
22. Pool Slope (Spool) ft / ft	Mean: Range:	Mean: 0.00013 Range: 0.0 - 0.0002	22. Pool Slope (Spool) ft / ft	Mean: Range:	Mean: 0.000312 Range: 0.0 - 0.00062	22. Pool Slope (Spool) ft / ft	Mean: Range:	Mean: 0.0007 Range: 0.0 - 0.0014
23. Ratio of Pool Slope to Average Slope (Spool/Sbvf)	Mean: Range:	Mean: 0.1 Range: 0.0 - 0.2	23. Ratio of Pool Slope to Average Slope (Spool/Sbvf)	Mean: Range:	Mean: 0.1 Range: 0.0 - 0.2	23. Ratio of Pool Slope to Average Slope (Spool/Sbvf)	Mean: Range:	Mean: 0.1 Range: 0.0 - 0.2
24. Maximum Pool Depth (dpool) ft	Mean: 7.3 Range:	Mean: 9.00 Range:	24. Maximum Pool Depth (dpool) ft	Mean: 3.54 Range:	Mean: 5.00 Range:	24. Maximum Pool Depth (dpool) ft	Mean: 2.52 Range:	Mean: 2.6 Range:
25. Ratio of Maximum Pool Depth to Bankfull Depth (dpool/dbkf)	Mean: 2.28 Range:	Mean: 2.6 Range:	25. Ratio of Maximum Pool Depth to Bankfull Depth (dpool/dbkf)	Mean: 1.62 Range:	Mean: 2.45 Range:	25. Ratio of Maximum Pool Depth to Bankfull Depth (dpool/dbkf)	Mean: 2.60 Range:	Mean: 2.89 Range:
26. Pool Width (Wpool) ft	Mean: 40 Range:	Mean: 40.5 Range:	26. Pool Width (Wpool) ft	Mean: 37.5 Range:	Mean: 30 Range:	26. Pool Width (Wpool) ft	Mean: 10.7 Range:	Mean: 11.0 Range:
27. Ratio of Pool Width to Bankfull Width (Wpool/Wbkf)	Mean: 1.07 Range:	Mean: 1.07 Range:	27. Ratio of Pool Width to Bankfull Width (Wpool/Wbkf)	Mean: 1.17 Range:	Mean: 1.22 Range:	27. Ratio of Pool Width to Bankfull Width (Wpool/Wbkf)	Mean: 1.02 Range:	Mean: 1.2 Range:
28. Bankfull Cross-sectional Area at Pool (Apool) sq ft	Mean: 152 Range:	Mean: 185 Range:	28. Bankfull Cross-sectional Area at Pool (Apool) sq ft	Mean: 50 Range:	Mean: 72.5 Range:	28. Bankfull Cross-sectional Area at Pool (Apool) sq ft	Mean: 17.4 Range:	Mean: 15.0 Range:
29. Ratio of Pool Area to Bankfull Area	Mean: 1.26 Range:	Mean: 1.42 Range:	29. Ratio of Pool Area to Bankfull Area	Mean: 0.72 Range:	Mean: 1.45 Range:	29. Ratio of Pool Area to Bankfull Area	Mean: 1.70 Range:	Mean: 1.87 Range:
30. Pool to Pool Spacing (p-p) ft	Mean: Range:	Mean: 172 Range: 73 - 340	30. Pool to Pool Spacing (p-p) ft	Mean: Range:	Mean: 108.6 Range: 85 - 133	30. Pool to Pool Spacing (p-p) ft	Mean: Range:	Mean: 48.2 Range: 38 - 57
31. Ratio of Pool-to-Pool Spacing to Bankfull (p-p/Wbkf)	Mean: Range:	Mean: 4.5 Range: 1.9 - 8.9	31. Ratio of Pool-to-Pool Spacing to Bankfull (p-p/Wbkf)	Mean: Range:	Mean: 4.4 Range: 3.5 - 5.4	31. Ratio of Pool-to-Pool Spacing to Bankfull (p-p/Wbkf)	Mean: Range:	Mean: 5.35 Range: 4.2 - 6.3
32. Pool Length (Lp) ft	Mean: Range:	Mean: 101.3 Range: 42 - 240	32. Pool Length (Lp) ft	Mean: Range:	Mean: 70.2 Range: 50 - 100	32. Pool Length (Lp) ft	Mean: Range:	Mean: 28.8 Range: 20 - 38
33. Ratio of Pool Length to Bankfull Width (Lp/Wbkf)	Mean: Range:	Mean: 2.7 Range: 1.1 - 6.3	33. Ratio of Pool Length to Bankfull Width (Lp/Wbkf)	Mean: Range:	Mean: 2.9 Range: 2.04 - 4.08	33. Ratio of Pool Length to Bankfull Width (Lp/Wbkf)	Mean: Range:	Mean: 3.2 Range: 2.2 - 4.2
34. Riffle Slope (Srff) ft / ft	Mean: Range:	Mean: 0.00146 Range: 0.00133 - 0.00159	34. Riffle Slope (Srff) ft / ft	Mean: Range:	Mean: 0.0034 Range:	34. Riffle Slope (Srff) ft / ft	Mean: Range:	Mean: 0.0084 Range:
35. Ratio of Riffle Slope to Average Slope (Srff/Sbvf)	Mean: Range:	Mean: 1.1 Range: 1.0-1.2	35. Ratio of Riffle Slope to Average Slope (Srff/Sbvf)	Mean: Range:	Mean: 1.1 Range:	35. Ratio of Riffle Slope to Average Slope (Srff/Sbvf)	Mean: Range:	Mean: 1.1 Range:
36. Maximum Riffle Depth (driff) ft	Mean: 4.82 Range: 4.5 - 5.1	Mean: 5.00 Range:	36. Maximum Riffle Depth (driff) ft	Mean: 3.15 Range:	Mean: 3.00 Range:	36. Maximum Riffle Depth (driff) ft	Mean: 1.90 Range:	Mean: 1.35 Range:
37. Ratio of Riffle Depth to Bankfull Mean Depth (driff/dbkf)	Mean: 1.51 Range: 1.41 - 1.60	Mean: 1.47 Range:	37. Ratio of Riffle Depth to Bankfull Mean Depth (driff/dbkf)	Mean: 1.44 Range:	Mean: 1.47 Range:	37. Ratio of Riffle Depth to Bankfull Mean Depth (driff/dbkf)	Mean: 1.95 Range:	Mean: 1.5 Range:
38. Run Slope (Srun) ft/ft	Mean: Range:	Mean: 0.0074 Range: 0.0057 - 0.0092	38. Run Slope (Srun) ft/ft	Mean: Range:	Mean: 0.01747 Range: 0.0134 - 0.0215	38. Run Slope (Srun) ft/ft	Mean: Range:	Mean: 0.043 Range: 0.033 - 0.053
39. Ratio of Run Slope to Average Slope (Srun/Sbvf)	Mean: 5.6 Range: 4.3 - 6.9	Mean: 5.6 Range: 4.3 - 6.9	39. Ratio of Run Slope to Average Slope (Srun/Sbvf)	Mean: Range:	Mean: 5.6 Range: 4.3 - 6.9	39. Ratio of Run Slope to Average Slope (Srun/Sbvf)	Mean: Range:	Mean: 5.6 Range: 4.3 - 6.9
40. Maximum Run Depth (drun) ft	Mean: 5.38	Mean: 5.45	40. Maximum Run Depth (drun) ft	Mean: 3.2	Mean: 3.21	40. Maximum Run Depth (drun) ft	Mean:	Mean: 1.65

MORPHOLOGICAL CHARACTERISTICS OF THE EXISTING AND PROPOSED CHANNEL WITH REFERENCE REACH DATA

(Adapted from Rosgen, 1996)

Restoration Site: Pott Creek II, Catawba County
 USGS Gage Station: None
 Reference Reach: UT to Fourth Creek
 Surveyors:

MORPHOLOGICAL CHARACTERISTICS OF THE EXISTING AND PROPOSED CHANNEL WITH REFERENCE REACH DATA

(Adapted from Rosgen, 1996)

Restoration Site: Pott Creek II, Catawba County
 USGS Gage Station: None
 Reference Reach: UT to Fourth Creek
 Surveyors:

MORPHOLOGICAL CHARACTERISTICS OF THE EXISTING AND PROPOSED CHANNEL WITH REFERENCE REACH DATA

(Adapted from Rosgen, 1996)

Restoration Site: Pott Creek II, Catawba County
 USGS Gage Station: None
 Reference Reach: UT to Fourth Creek
 Surveyors:

Variables	As-Built Channel (Pott Creek)	Proposed Reach (Pott Creek)	Variables	As-Built Channel (Rhodes Mill Crk.)	Proposed Reach (Rhodes Mill Crk.)	Variables	As-Built Channel (UT#1 to Pott Creek)	Proposed Reach (UT#1 to Pott Creek)
41. Ratio of Run Depth to Bankfull Mean Depth (drun/dbkf)	Range: 1.68 Mean: 1.68	Range: 5.07 - 5.83 Mean: 1.6	41. Ratio of Run Depth to Bankfull Mean Depth (drun/dbkf)	Range: 1.46 Mean: 1.46	Range: 3.04 - 3.38 Mean: 1.57	41. Ratio of Run Depth to Bankfull Mean Depth (drun/dbkf)	Range: 1.39 - 1.87 Mean: 1.83	Range: 1.54 - 2.08 Mean: 1.83
42. Slope of Glide (Sgl) ft / ft	Range: 0.0008 Mean: 0.0008	Range: 0.0008 Mean: 0.0008	42. Slope of Glide (Sgl) ft / ft	Range: 0.0014 Mean: 0.0014	Range: 0.0014 Mean: 0.0014	42. Slope of Glide (Sgl) ft / ft	Range: 0.003 Mean: 0.003	Range: 0.003 Mean: 0.003
43. Ratio of Glide Slope to Average Water Slope (Sgl/Sws)	Range: 0.72 Mean: 0.72	Range: 0.72 Mean: 0.72	43. Ratio of Glide Slope to Average Water Slope (Sgl/Sws)	Range: 0.5 Mean: 0.5	Range: 0.5 Mean: 0.5	43. Ratio of Glide Slope to Average Water Slope (Sgl/Sws)	Range: 0.5 Mean: 0.5	Range: 0.5 Mean: 0.5
44. Maximum Glide Depth (dgl) ft	Range: 5.4 Mean: 5.4	Range: 5.5 Mean: 5.5	44. Maximum Glide Depth (dgl) ft	Range: 3.4 Mean: 3.4	Range: 3.25 - 3.75 Mean: 3.50	44. Maximum Glide Depth (dgl) ft	Range: 1.75 - 2.0 Mean: 1.85	Range: 1.75 - 2.0 Mean: 1.85
45. Ratio of Glide Depth to Bankfull Mean Depth (dgl/dbkf)	Range: 1.69 Mean: 1.69	Range: 1.6 Mean: 1.6	45. Ratio of Glide Depth to Bankfull Mean Depth (dgl/dbkf)	Range: 1.55 Mean: 1.55	Range: 1.59 - 1.84 Mean: 1.71	45. Ratio of Glide Depth to Bankfull Mean Depth (dgl/dbkf)	Range: 1.94 - 2.2 Mean: 2.06	Range: 1.94 - 2.2 Mean: 2.06

Materials:			Materials:			Materials:		
Particle Size Distribution of Channel Material (mm)			Particle Size Distribution of Channel Material (mm)			Particle Size Distribution of Channel Material (mm)		
D16		<0.1	D16		<0.1	D16		0.2
D35		0.65	D35		4.5	D35		0.3
D50		1.8	D50		8.5	D50		0.6
D84		8.5	D84		13.0	D84		5.2
D95		11	D95		18.2	D95		9.0
Particle Size Distribution of Bar Material	Pavement	Sub-Pavement	Particle Size Distribution of Bar Material	Pavement	Sub-Pavement	Particle Size Distribution of Bar Material	Pavement	Sub-Pavement
D16		<2.0	D16		<2.0	D16		<2.0
D35		<2.0	D35		<2.0	D35		<2.0
D50		<2.0	D50		<2.0	D50		<2.0
D84		7.3	D84		12.2	D84		3.1
D95		16	D95		24.3	D95		12.6
Largest Size Particle on Bar		27	Largest Size Particle on Bar		34.0	Largest Size Particle on Bar		18

MORPHOLOGICAL CHARACTERISTICS OF THE EXISTING AND PROPOSED CHANNEL WITH REFERENCE REACH DATA

(Adapted from Rosgen, 1996)

Restoration Site: Pott Creek II, Catawba County
 USGS Gage Station: None
 Reference Reach: UT to Fourth Creek
 Surveyors:

Restoration Site: Pott Creek II, Catawba County
 USGS Gage Station: None
 Reference Reach: UT to Fourth Creek
 Surveyors:

Restoration Site: Pott Creek II, Catawba County
 USGS Gage Station: None
 Reference Reach: UT to Fourth Creek
 Surveyors:

Restoration Site: Pott Creek II, Catawba County
 USGS Gage Station: None
 Reference Reach: UT to Fourth Creek
 Surveyors:

Variables	Reference Reach	Variables	As-Built Channel (UT#2 to Pott Creek)	Proposed Reach (UT#2 to Pott Creek)	Variables	As-Built Channel (UT#3 to Pott Creek)	Proposed Reach (UT#3 to Pott Creek)	Variables	As-Built Channel (UT#4 to Pott Creek)	Proposed Reach (UT#4 to Pott Creek)
1. Stream Type	C5	1. Stream Type	E5	E5	1. Stream Type	C5	C5	1. Stream Type	E5	E5
2. Drainage Area (sq. mi)	0.37 (236 Ac.)	2. Drainage Area (sq. mi)	0.1 (60 Acres)	0.1 (60 Acres)	2. Drainage Area (sq. mi)	0.11 (65 Acres)	0.11 (65 Acres)	2. Drainage Area (sq. mi)	0.11 (65 Acres)	0.11 (65 Acres)
3. Bankfull Width (Wbkf) ft	Mean: 19.2 Range: 19.1 - 19.3	3. Bankfull Width (Wbkf) ft	Mean: 13.7 Range:	Mean: 4.2 Range:	3. Bankfull Width (Wbkf) ft	Mean: 13.9 Range:	Mean: 8.0 Range:	3. Bankfull Width (Wbkf) ft	Mean: 13.2 Range:	Mean: 4.6 Range:
4. Bankfull Mean Depth (dbkf) ft	Mean: 1.1 Range: 0.8 - 1.4	4. Bankfull Mean Depth (dbkf) ft	Mean: 1.5 Range:	Mean: 1.0 Range:	4. Bankfull Mean Depth (dbkf) ft	Mean: 1.3 Range:	Mean: 0.625 Range:	4. Bankfull Mean Depth (dbkf) ft	Mean: 1.47 Range:	Mean: 0.52 Range:
5. Width/Depth Ratio (Wbkf/dbkf)	Mean: 17 Range: 13.8 - 23.8	5. Width/Depth Ratio (Wbkf/dbkf)	Mean: 9.1 Range:	Mean: 4.2 Range:	5. Width/Depth Ratio (Wbkf/dbkf)	Mean: 10.7 Range:	Mean: 12.8 Range:	5. Width/Depth Ratio (Wbkf/dbkf)	Mean: 8.98 Range:	Mean: 8.8 Range:
6. Bankfull Cross-Sectional Area (Abkf) sq ft	Mean: 21.7 Range: 15.5 - 27.9	6. Bankfull Cross-Sectional Area (Abkf) sq ft	Mean: 21.0 Range:	Mean: 4.2 Range:	6. Bankfull Cross-Sectional Area (Abkf) sq ft	Mean: 18.3 Range:	Mean: 5.0 Range:	6. Bankfull Cross-Sectional Area (Abkf) sq ft	Mean: 19.4 Range:	Mean: 2.4 Range:
7. Bankfull Mean Velocity (Vbkf) fps	Mean: 1.8 Range:	7. Bankfull Mean Velocity (Vbkf) fps	Mean: Range:	Mean: 3.37 Range:	7. Bankfull Mean Velocity (Vbkf) fps	Mean: Range:	Mean: 5.2 Range:	7. Bankfull Mean Velocity (Vbkf) fps	Mean: Range:	Mean: 2.9 Range:
8. Bankfull Discharge, (Qbkf) cfs	Mean: 40 Range:	8. Bankfull Discharge, (Qbkf) cfs	Mean: Range:	Mean: 10 Range:	8. Bankfull Discharge, (Qbkf) cfs	Mean: Range:	Mean: 26 Range:	8. Bankfull Discharge, (Qbkf) cfs	Mean: Range:	Mean: 6.9 Range:
9. Maximum Bankfull Depth (dmax) ft	Mean: 1.9 Range: 1.5 - 2.2	9. Maximum Bankfull Depth (dmax) ft	Mean: 2.79 Range:	Mean: 1.5 Range:	9. Maximum Bankfull Depth (dmax) ft	Mean: 2.68 Range:	Mean: 1.00 Range:	9. Maximum Bankfull Depth (dmax) ft	Mean: 2.37 Range:	Mean: 0.8 Range:
10. Ratio of Low Bank Height to Max. Bankfull Depth (Bhlow/dmax)	Mean: 1.0 Range:	10. Ratio of Low Bank Height to Max. Bankfull Depth (Bhlow/dmax)	Mean: Range:	Mean: 1.0 Range:	10. Ratio of Low Bank Height to Max. Bankfull Depth (Bhlow/dmax)	Mean: Range:	Mean: 1.0 Range:	10. Ratio of Low Bank Height to Max. Bankfull Depth (Bhlow/dmax)	Mean: Range:	Mean: 1.0 Range:
11. Width of Flood Prone Area (Wfpa) ft	Mean: 125 Range: 75 - 175	11. Width of Flood Prone Area (Wfpa) ft	Mean: Range:	Mean: 80 Range:	11. Width of Flood Prone Area (Wfpa) ft	Mean: Range:	Mean: 250 Range:	11. Width of Flood Prone Area (Wfpa) ft	Mean: Range:	Mean: 115 Range:
12. Entrenchment Ratio (Wfpa/Wbkf) sq ft	Mean: 6.5 Range: 3.91 - 9.1	12. Entrenchment Ratio (Wfpa/Wbkf) sq ft	Mean: Range:	Mean: 19 Range:	12. Entrenchment Ratio (Wfpa/Wbkf) sq ft	Mean: Range:	Mean: 31.3 Range:	12. Entrenchment Ratio (Wfpa/Wbkf) sq ft	Mean: Range:	Mean: 20.5 Range:
13. Meander Length (Lm) ft	Mean: 90 Range: 75 - 95	13. Meander Length (Lm) ft	Mean: 80 Range: 64 - 89	Mean: 46.2 Range: 31.6 - 61.1	13. Meander Length (Lm) ft	Mean: 95 Range: 64 - 157	Mean: 62.7 Range: 50.4 - 81.0	13. Meander Length (Lm) ft	Mean: 43 Range: 31 - 77	Mean: 28.7 Range: 18.1 - 38.5
14. Ratio of Meander Length to Bankfull Width (Lm/Wbkf)	Mean: 4.7 Range: 3.9 - 4.9	14. Ratio of Meander Length to Bankfull Width (Lm/Wbkf)	Mean: 5.8 Range: 4.7 - 6.5	Mean: 11.0 Range: 7.4 - 14.5	14. Ratio of Meander Length to Bankfull Width (Lm/Wbkf)	Mean: 6.83 Range: 4.6 - 11.3	Mean: 7.8 Range: 6.3 - 10.1	14. Ratio of Meander Length to Bankfull Width (Lm/Wbkf)	Mean: 3.3 Range: 2.3 - 5.8	Mean: 6.2 Range: 3.9 - 8.4
15. Radius of Curvature (Rc) ft	Mean: 16.5 Range: 11 - 17.5	15. Radius of Curvature (Rc) ft	Mean: 42.6 Range: 26.2 - 71.4	Mean: 17.35 Range: 12 - 24	15. Radius of Curvature (Rc) ft	Mean: 23.8 Range: 16.3 - 36	Mean: 21.1 Range: 16.0 - 26.0	15. Radius of Curvature (Rc) ft	Mean: 22.1 Range: 12.4 - 42	Mean: 9 Range: 7 - 13
16. Ratio of Radius of Curvature to Bankfull Width (Rc/Wbkf)	Mean: 0.9 Range: 0.6 - 0.9	16. Ratio of Radius of Curvature to Bankfull Width (Rc/Wbkf)	Mean: 3.1 Range: 1.9 - 5.2	Mean: 4.13 Range: 2.8 - 5.7	16. Ratio of Radius of Curvature to Bankfull Width (Rc/Wbkf)	Mean: 1.71 Range: 1.2 - 2.6	Mean: 2.6 Range: 2.0 - 3.25	16. Ratio of Radius of Curvature to Bankfull Width (Rc/Wbkf)	Mean: 1.67 Range: 0.9 - 3.2	Mean: 1.96 Range: 1.5 - 2.8
17. Belt Width (Wblt) ft	Mean: 43 Range: 25 - 90	17. Belt Width (Wblt) ft	Mean: 62 Range:	Mean: 14.6 Range: 11.1 - 17.9	17. Belt Width (Wblt) ft	Mean: 58 Range:	Mean: 23.2 Range: 16.6 - 32.0	17. Belt Width (Wblt) ft	Mean: 24 Range: 20 - 28	Mean: 12.5 Range: 7.2 - 16.1
18. Meander Width Ratio (Wblt/Wbkf)	Mean: 2.2 Range: 1.3 - 4.7	18. Meander Width Ratio (Wblt/Wbkf)	Mean: 4.5 Range:	Mean: 3.5 Range: 2.6 - 4.3	18. Meander Width Ratio (Wblt/Wbkf)	Mean: 4.2 Range:	Mean: 2.9 Range: 2.1 - 4.0	18. Meander Width Ratio (Wblt/Wbkf)	Mean: 1.8 Range: 1.5 - 2.1	Mean: 2.7 Range: 1.56 - 3.5
19. Sinuosity (Stream length/valley distance) (K)	Mean: 1.5 Range:	19. Sinuosity (Stream length/valley distance) (K)	Mean: Range:	Mean: 1.11 Range:	19. Sinuosity (Stream length/valley distance) (K)	Mean: Range:	Mean: 1.22 Range:	19. Sinuosity (Stream length/valley distance) (K)	Mean: Range:	Mean: 1.24 Range:
20. Valley Slope (ft/ft)	Mean: 0.00517 Range:	20. Valley Slope (ft/ft)	Mean: Range:	Mean: 0.0033 Range:	20. Valley Slope (ft/ft)	Mean: Range:	Mean: 0.0037 Range:	20. Valley Slope (ft/ft)	Mean: Range:	Mean: 0.0037 Range:
21. Average Water Surface Slope or Bankfull for Reach (Sbkf or Savg)=(Svalley/k) ft / ft	Mean: 0.00346 Range:	21. Average Water Surface Slope or Bankfull for Reach (Sbkf or Savg)=(Svalley/k) ft / ft	Mean: Range:	Mean: 0.003 Range:	21. Average Water Surface Slope or Bankfull for Reach (Sbkf or Savg)=(Svalley/k) ft / ft	Mean: Range:	Mean: 0.003 Range:	21. Average Water Surface Slope or Bankfull for Reach (Sbkf or Savg)=(Svalley/k) ft / ft	Mean: Range:	Mean: 0.003 Range:
22. Pool Slope (Spool) ft / ft	Mean: 0.000346 Range: 0.0000 - 0.00069	22. Pool Slope (Spool) ft / ft	Mean: Range:	Mean: 0.0003 Range: 0.0 - 0.0006	22. Pool Slope (Spool) ft / ft	Mean: Range:	Mean: 0.0003 Range: 0.0 - 0.0006	22. Pool Slope (Spool) ft / ft	Mean: Range:	Mean: 0.0003 Range: 0.0 - 0.0006
23. Ratio of Pool Slope to Average Slope (Spool/Sbkf)	Mean: 0.1 Range: 0.0 - 0.2	23. Ratio of Pool Slope to Average Slope (Spool/Sbkf)	Mean: Range:	Mean: 0.1 Range: 0.0 - 0.2	23. Ratio of Pool Slope to Average Slope (Spool/Sbkf)	Mean: Range:	Mean: 0.1 Range: 0.0 - 0.2	23. Ratio of Pool Slope to Average Slope (Spool/Sbkf)	Mean: Range:	Mean: 0.1 Range: 0.0 - 0.2
24. Maximum Pool Depth (dpool) ft	Mean: 3.3 Range:	24. Maximum Pool Depth (dpool) ft	Mean: Range:	Mean: 2.5 Range:	24. Maximum Pool Depth (dpool) ft	Mean: Range:	Mean: 1.75 Range:	24. Maximum Pool Depth (dpool) ft	Mean: Range:	Mean: 1.6 Range:
25. Ratio of Maximum Pool Depth to Bankfull Depth (dpool/dbkf)	Mean: 2.9 Range:	25. Ratio of Maximum Pool Depth to Bankfull Depth (dpool/dbkf)	Mean: Range:	Mean: 2.5 Range:	25. Ratio of Maximum Pool Depth to Bankfull Depth (dpool/dbkf)	Mean: Range:	Mean: 2.8 Range:	25. Ratio of Maximum Pool Depth to Bankfull Depth (dpool/dbkf)	Mean: Range:	Mean: 3.2 Range:
26. Pool Width (Wpool) ft	Mean: 20.3 Range:	26. Pool Width (Wpool) ft	Mean: Range:	Mean: 5.0 Range:	26. Pool Width (Wpool) ft	Mean: Range:	Mean: 9.6 Range:	26. Pool Width (Wpool) ft	Mean: Range:	Mean: 5.5 Range:
27. Ratio of Pool Width to Bankfull Width (Wpool/Wbkf)	Mean: 1.1 Range:	27. Ratio of Pool Width to Bankfull Width (Wpool/Wbkf)	Mean: Range:	Mean: 1.2 Range:	27. Ratio of Pool Width to Bankfull Width (Wpool/Wbkf)	Mean: Range:	Mean: 1.2 Range:	27. Ratio of Pool Width to Bankfull Width (Wpool/Wbkf)	Mean: Range:	Mean: 1.2 Range:
28. Bankfull Cross-sectional Area at Pool (Apool) sq ft	Mean: 32.0 Range:	28. Bankfull Cross-sectional Area at Pool (Apool) sq ft	Mean: Range:	Mean: 6.5 Range:	28. Bankfull Cross-sectional Area at Pool (Apool) sq ft	Mean: Range:	Mean: 8.4 Range:	28. Bankfull Cross-sectional Area at Pool (Apool) sq ft	Mean: Range:	Mean: 4.0 Range:
29. Ratio of Pool Area to Bankfull Area	Mean: 1.5 Range:	29. Ratio of Pool Area to Bankfull Area	Mean: Range:	Mean: 1.5 Range:	29. Ratio of Pool Area to Bankfull Area	Mean: Range:	Mean: 1.68 Range:	29. Ratio of Pool Area to Bankfull Area	Mean: Range:	Mean: 1.67 Range:
30. Pool to Pool Spacing (p-p) ft	Mean: 39 Range: 19 - 66	30. Pool to Pool Spacing (p-p) ft	Mean: Range:	Mean: 24.6 Range: 18 - 33	30. Pool to Pool Spacing (p-p) ft	Mean: Range:	Mean: 37.1 Range: 29 - 44	30. Pool to Pool Spacing (p-p) ft	Mean: Range:	Mean: 17 Range: 9 - 22
31. Ratio of Pool-to-Pool Spacing to Bankfull (p-p/Wbkf)	Mean: 2.0 Range: 1.0 - 3.4	31. Ratio of Pool-to-Pool Spacing to Bankfull (p-p/Wbkf)	Mean: Range:	Mean: 5.8 Range: 4.3 - 7.8	31. Ratio of Pool-to-Pool Spacing to Bankfull (p-p/Wbkf)	Mean: Range:	Mean: 4.6 Range: 3.6 - 5.5	31. Ratio of Pool-to-Pool Spacing to Bankfull (p-p/Wbkf)	Mean: Range:	Mean: 3.7 Range: 1.96 - 4.78
32. Pool Length (Lp) ft	Mean: 20 Range: 15 - 26	32. Pool Length (Lp) ft	Mean: Range:	Mean: 14.9 Range: 6 - 22	32. Pool Length (Lp) ft	Mean: Range:	Mean: 23.3 Range: 18 - 34	32. Pool Length (Lp) ft	Mean: Range:	Mean: 8.8 Range: 4 - 13
33. Ratio of Pool Length to Bankfull Width (Lp/Wbkf)	Mean: 1.0 Range: 0.8 - 1.4	33. Ratio of Pool Length to Bankfull Width (Lp/Wbkf)	Mean: Range:	Mean: 3.5 Range: 1.4 - 5.2	33. Ratio of Pool Length to Bankfull Width (Lp/Wbkf)	Mean: Range:	Mean: 2.9 Range: 2.25 - 4.2	33. Ratio of Pool Length to Bankfull Width (Lp/Wbkf)	Mean: Range:	Mean: 1.91 Range: 0.87 - 2.83
34. Riffle Slope (Sriff) ft / ft	Mean: 0.00373 Range: 0.00286 - 0.005	34. Riffle Slope (Sriff) ft / ft	Mean: Range:	Mean: 0.0033 Range:	34. Riffle Slope (Sriff) ft / ft	Mean: Range:	Mean: 0.0033 Range:	34. Riffle Slope (Sriff) ft / ft	Mean: Range:	Mean: 0.004 Range:
35. Ratio of Riffle Slope to Average Slope (Sriff/Sbkf)	Mean: 1.1 Range: 0.8 - 1.4	35. Ratio of Riffle Slope to Average Slope (Sriff/Sbkf)	Mean: Range:	Mean: 1.1 Range:	35. Ratio of Riffle Slope to Average Slope (Sriff/Sbkf)	Mean: Range:	Mean: 1.1 Range:	35. Ratio of Riffle Slope to Average Slope (Sriff/Sbkf)	Mean: Range:	Mean: 1.3 Range:
36. Maximum Riffle Depth (driff) ft	Mean: 2.1 Range: 1.65 - 2.42	36. Maximum Riffle Depth (driff) ft	Mean: Range:	Mean: 1.5 Range:	36. Maximum Riffle Depth (driff) ft	Mean: Range:	Mean: 1.0 Range:	36. Maximum Riffle Depth (driff) ft	Mean: Range:	Mean: 0.80 Range:
37. Ratio of Riffle Depth to Bankfull Mean Depth (driff/dbkf)	Mean: 1.9 Range: 1.5 - 2.2	37. Ratio of Riffle Depth to Bankfull Mean Depth (driff/dbkf)	Mean: Range:	Mean: 1.5 Range:	37. Ratio of Riffle Depth to Bankfull Mean Depth (driff/dbkf)	Mean: Range:	Mean: 1.6 Range:	37. Ratio of Riffle Depth to Bankfull Mean Depth (driff/dbkf)	Mean: Range:	Mean: 1.54 Range:
38. Run Slope (Srun) ft/ft	Mean: 0.0194 Range: 0.015 - 0.0238	38. Run Slope (Srun) ft/ft	Mean: Range:	Mean: 0.0168 Range:	38. Run Slope (Srun) ft/ft	Mean: Range:	Mean: 0.0168 Range:	38. Run Slope (Srun) ft/ft	Mean: Range:	Mean: 0.0168 Range:
39. Ratio of Run Slope to Average Slope (Srun/Sbkf)	Mean: 5.6 Range: 4.3 - 6.9	39. Ratio of Run Slope to Average Slope (Srun/Sbkf)	Mean: Range:	Mean: 5.6 Range:	39. Ratio of Run Slope to Average Slope (Srun/Sbkf)	Mean: Range:	Mean: 5.6 Range:	39. Ratio of Run Slope to Average Slope (Srun/Sbkf)	Mean: Range:	Mean: 5.6 Range:
40. Maximum Run Depth (drun) ft	Mean: 2.02	40. Maximum Run Depth (drun) ft	Mean:	Mean: 1.57	40. Maximum Run Depth (drun) ft	Mean:	Mean: 1.07	40. Maximum Run Depth (drun) ft	Mean:	Mean: 0.85

MORPHOLOGICAL CHARACTERISTICS OF THE EXISTING AND PROPOSED CHANNEL WITH REFERENCE REACH DATA

(Adapted from Rosgen, 1996)

Restoration Site: Pott Creek II, Catawba County
 USGS Gage Station: None
 Reference Reach: UT to Fourth Creek
 Surveyors:

Restoration Site: Pott Creek II, Catawba County
 USGS Gage Station: None
 Reference Reach: UT to Fourth Creek
 Surveyors:

Restoration Site: Pott Creek II, Catawba County
 USGS Gage Station: None
 Reference Reach: UT to Fourth Creek
 Surveyors:

Restoration Site: Pott Creek II, Catawba County
 USGS Gage Station: None
 Reference Reach: UT to Fourth Creek
 Surveyors:

Variables	Reference Reach	Variables	As-Built Channel (UT#2 to Pott Creek)	Proposed Reach (UT#2 to Pott Creek)	Variables	As-Built Channel (UT#3 to Pott Creek)	Proposed Reach (UT#3 to Pott Creek)	Variables	As-Built Channel (UT#4 to Pott Creek)	Proposed Reach (UT#4 to Pott Creek)
41. Ratio of Run Depth to Bankfull Mean Depth (drun/dbkf)	Range: 1.83 - 2.16 Mean: 1.84 Range: 1.67 - 1.96	41. Ratio of Run Depth to Bankfull Mean Depth (drun/dbkf)	Range: Mean: Range:	Range: 1.54 - 1.6 Mean: 1.57 Range: 1.54 - 1.6	41. Ratio of Run Depth to Bankfull Mean Depth (drun/dbkf)	Range: Mean: Range:	Range: 1.05 - 1.1 Mean: 1.7 Range: 1.68 - 1.76	41. Ratio of Run Depth to Bankfull Mean Depth (drun/dbkf)	Range: Mean: Range:	Range: Mean: 1.63 Range:
42. Slope of Glide (Sgl) ft / ft	Mean: 0.004 Range: 0.0 - 0.008	42. Slope of Glide (Sgl) ft / ft	Mean: Range:	Mean: 0.033 Range: 0.0 - 0.0066	42. Slope of Glide (Sgl) ft / ft	Mean: Range:	Mean: 0.0033 Range: 0.0 - 0.0066	42. Slope of Glide (Sgl) ft / ft	Mean: Range:	Mean: 0.0003 Range: 0.0 - 0.0006
43. Ratio of Glide Slope to Average Water Slope (Sgl/Sws)	Mean: 1.15 Range: 0.0 - 2.3	43. Ratio of Glide Slope to Average Water Slope (Sgl/Sws)	Mean: Range:	Mean: 1.1 Range: 0.0 - 2.2	43. Ratio of Glide Slope to Average Water Slope (Sgl/Sws)	Mean: Range:	Mean: 1.1 Range: 0.0 - 2.2	43. Ratio of Glide Slope to Average Water Slope (Sgl/Sws)	Mean: Range:	Mean: 0.1 Range: 0.0 - 0.2
44. Maximum Glide Depth (dgl) ft	Mean: 2.42 Range: 2.1 - 3.13	44. Maximum Glide Depth (dgl) ft	Mean: Range:	Mean: 2.0 Range: 1.98 - 2.04	44. Maximum Glide Depth (dgl) ft	Mean: Range:	Mean: 1.4 Range:	44. Maximum Glide Depth (dgl) ft	Mean: Range:	Mean: 1.3 Range:
45. Ratio of Glide Depth to Bankfull Mean Depth (dgl/dbkf)	Mean: 2.2 Range: 1.9 - 2.85	45. Ratio of Glide Depth to Bankfull Mean Depth (dgl/dbkf)	Mean: Range:	Mean: 2.0 Range: 1.98 - 2.04	45. Ratio of Glide Depth to Bankfull Mean Depth (dgl/dbkf)	Mean: Range:	Mean: 2.24 Range:	45. Ratio of Glide Depth to Bankfull Mean Depth (dgl/dbkf)	Mean: Range:	Mean: 2.5 Range:

Materials:			Materials:			Materials:			Materials:		
Particle Size Distribution of Channel Material (mm)			Particle Size Distribution of Channel Material (mm)			Particle Size Distribution of Channel Material (mm)			Particle Size Distribution of Channel Material (mm)		
D16	<0.1		D16	0.1		D16	0.05		D16	0.05	
D35	0.13		D35	0.4		D35	0.07		D35	0.07	
D50	0.2		D50	0.6		D50	0.10		D50	0.10	
D84	0.9		D84	1.5		D84	0.20		D84	0.15	
D95	4.3		D95	2.4		D95	0.23		D95	0.20	
Particle Size Distribution of Bar Material	Pavement	Sub-Pavement	Particle Size Distribution of Bar Material	Pavement	Subpavement	Particle Size Distribution of Bar Material	Pavement	Subpavement	Particle Size Distribution of Bar Material	Pavement	Subpavement
D16	<0.1	0.18	D16		0.1	D16		0.05	D16		0.05
D35	0.16	0.33	D35		0.4	D35		0.07	D35		0.07
D50	0.21	0.56	D50		0.6	D50		0.10	D50		0.10
D84	3.9	1.8	D84		1.5	D84		0.20	D84		0.15
D95	10.0	7.5	D95		2.4	D95		0.23	D95		0.20
Largest Size Particle on Bar	Sub-pavement	11	Largest Size Particle on Bar		5	Largest Size Particle on Bar		0.5	Largest Size Particle on Bar		0.5

ATTACHMENT C

NCDOT CONTRACT and SUPPLEMENTAL CONTRACT #1

Vegetative Plots



VP #1 Facing North (Slightly Northeast)



VP #2 Facing North



VP #3 Facing Southeast



VP #4 Facing North



VP #5 Along UT1 Facing West



VP #6 Facing North



VP #7 Facing Northeast



VP #8 Facing South (Slightly West)



VP# 9 Facing North



VP #10 Facing North



VP #11 Along Rhodes Mill Creek Facing North

Cross Sections



Pott Creek Cross Section 1 from West Bank



Pott Creek Cross Section 2 from West Bank



Pott Creek Cross Section 3 from West Bank



Pott Creek Cross Section 4 from West Bank



Pott Creek Cross Section 5 from West Bank



Pott Creek Cross Section 6 from West Bank



Rhodes Mill Creek Cross Section 1 from North Bank



Rhodes Mill Creek Cross Section 2 from North Bank



Cross Section UT1 from North Bank



Cross Section UT 2 from North Bank



Cross Section UT3 from South Bank



Cross Section UT4 from North Bank