Richland Creek Stream
Restoration Monitoring Report
EEP Project # 304
Monitoring Year – 01
2005

Submitted to:

Ecosystem Enhancement PROGRAM

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EXECUTIVE SUMMARY

The Richland Creek Stream Restoration site is located adjacent to the RBC Center in Wake County, North Carolina. The project is broken up into three separate reaches. Two reaches are associated with the two sides of Richland Creek as it flows under Collector Road and the other reach is located immediately upstream of the Edwards Mill Road Extension culvert on Richland Creek. The watershed is located within USGS 14-digit HUC 03020201080020 and NCDWQ Sub-basin 03-04-02 of the Neuse River Basin. The restoration was designed to correct problems concerning lack of habitat, an unstable streambed, and debris blockages. This site is made up of three small reaches; therefore traditional stream monitoring has been replaced by visual monitoring and the establishment of two (2) vegetation monitoring plots. This report is a description of the findings of the first year monitoring that took place in 2005.

The restoration consisted of replanting measures along the stream banks, within the riparian buffer, and along the adjacent slopes. The first year vegetation monitoring plots were established in October of 2005. The two plots are not surveyed, but their approximate locations are depicted in the monitoring plan view. The corners of these plots were marked with metal conduit, three-foot (3') wooden stakes, and flagging. The first year monitoring counted an average of 709 stems per acre.

A visual inspection of the stream reaches found them to be functioning well. The cross vanes appeared to be working as designed, although the cross vane in reach 2 had some bank scour around the vane. The conditions of the stream can be evaluated by comparing the yearly monitoring photos from the established photo stations and the tables within the report. These photo stations were not surveyed, but their approximate locations are depicted in the monitoring plan view.

1.0 PROJECT BACKGROUND

1.1 Location and Setting

This project is located within Wake County, North Carolina. From Interstate I-40 take exit 289 for Edwards Mill Rd. Turn south on Edwards Mill Rd. Approximately 1,200 feet on the left where Richland Creek flows under Edwards Mill Rd. is one part of the site. To access the second part of the site, continue on Edwards Mill Rd. and take the first left onto Collector Rd. There is a small parking lot for the greenway on the left. From this parking lot, there is access to Richland Creek, before and after it flows under Collector Rd. The other part of the project can be accessed by walking back out to Edwards Mill Rd., or by parking along the shoulder of Edwards Mill Rd. where the creek flows under the road. Refer to Figure 1.

1.2 Structure and Objectives

Previously unstable and debris clogged Richland Creek was restored where the stream flows into and out of a culvert under Collector Road and before flowing through a culvert under Edward's Mill Road. Channel profile is maintained through the use of rock cross vanes.

Table 1. Project Structure Table
Project Number and Name: 304 – Richland Creek

Segment/Reach ID	Linear Feet or Acerage
Richland Creek	approx. 415 feet

Table 2. Project Objectives Table
Project Number and Name: 304 – Richland Creek

Segment/Reach ID	Objectives	Linear Feet or Acerage	Comment
Richland Creek - Reach 1	Restoration	approx. 100 feet	Installation of 1 rock cross vane and adjustments to stream cross section
Richland Creek - Reach 2	Restoration	approx. 140 feet	Installation of 1 rock cross vane and adjustments to stream cross section
Richland Creek - Reach 3	Restoration	approx. 175 feet	Installation of 2 rock cross vanes and adjustments to stream cross section
Richland Creek - Riparian Area	Establish / improve habitat	N/A	Complete replanting and streamside stabilization

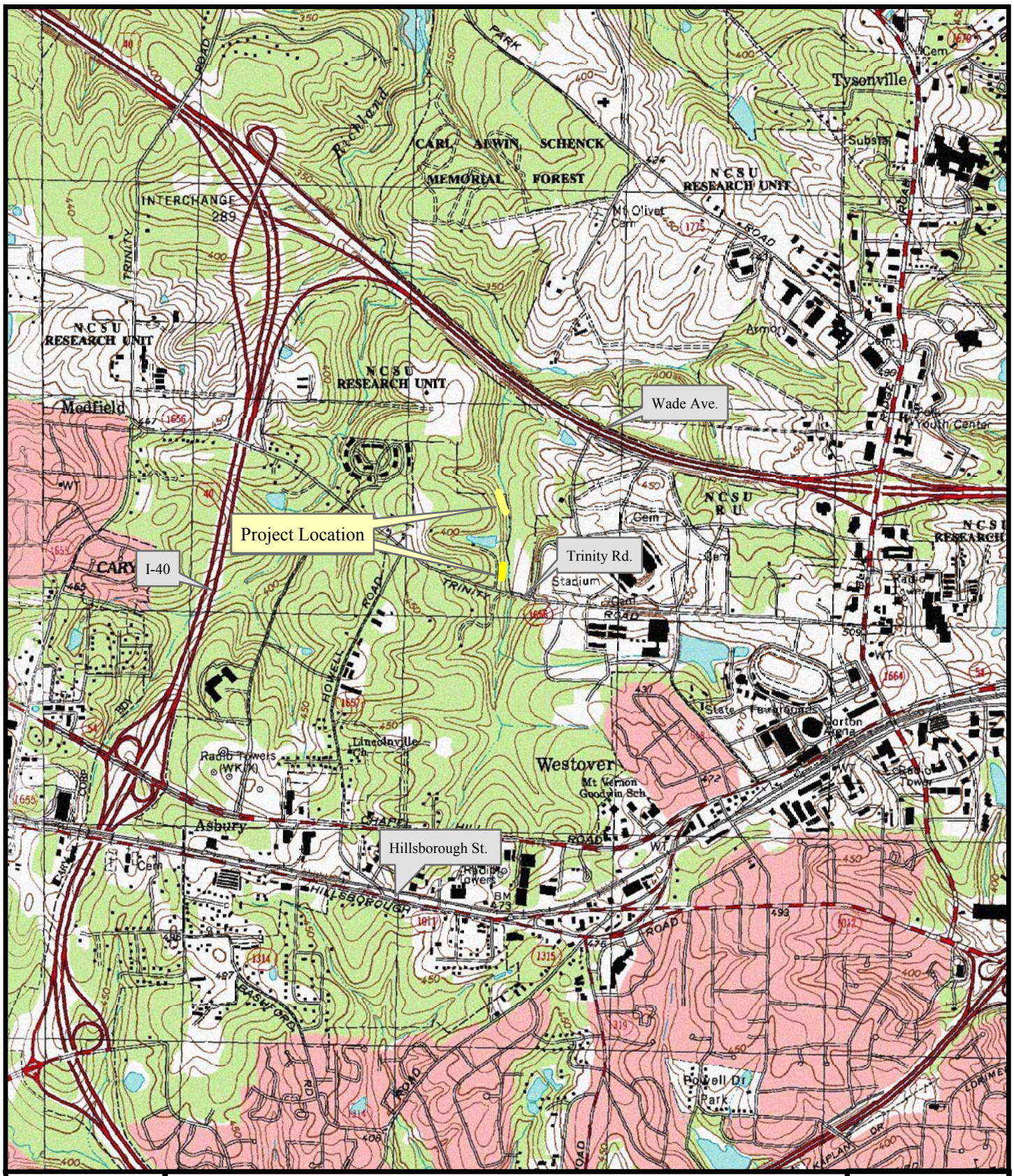

Figure 1. Site Vicinity Map
Richland Creek, Wake County, EEP Project # 304 - MY01

0.25 0.125 0 0.25 0.5 Miles

N

Date: 10/24/05

Source: USGS Topo Quads
Raleigh West, 1987
Cary, 1987.

Ecosystem Enhancement Program

KCI Associates of North Carolina, PA

1.3 Project History and Background

Table 3. Project Activity and Reporting History Project Number and Name: 304 – Richland Creek		
Activity or Report	**Calendar Year of Completion or Planned Completion**	**Actual Completion Date**
Restoration Plan	N/A	N/A
Construction	2002	2002
Riparian Buffer Planting	2003	2003
Stream Maintenance and Planting	N/A	N/A
Year 1 Monitoring	N/A	2005

Table 4. Project Contact Table Project Number and Name: 304 – Richland Creek
Design Firm
Earth Tech
701 Corporate Center Dr., Suite 475
Raleigh, North Carolina 27607
Contact: Ms. Jan Patterson and Mr. George Lankford
Phone: (919) 854-6200
Fax: (919) 854-6259
Construction Contractor
North State Environmental, Inc.
2889 Lowery St., Suite B
Winston Salem, North Carolina 27101
Contact: Mr. Darrell Westmoreland
Phone: (336) 725-2010
Fax: (336) 725-2405
Monitoring Performers
MY-01
KCI Associates of NC
Suite 220
4602 Six Forks Rd.
Raleigh, NC 27609
Contact: Mr. Adam Spiller
Phone: (919) 783-9214
Fax: (919) 783-9266

Table 5. Project Background Table **Project Number and Name: 304 – Richland Creek**	
Project County	Wake County
Drainage Area	N/A
Drainage Impervious Cover Estimate (%)	N/A
Stream Order	Second Order
Physiographic Region	Piedmont
Ecoregion	Northern Outer Piedmont
Rosgen Classification of As-built	N/A
Dominant Soil Types	Chewacla
Reference Site ID	N/A
USGS HUC for Project and Reference	03020201080020
NCDWQ Sub-basin for Project and Reference	03-04-02
NCDWQ Classification for Project and Reference	C-NSW
Any portion of the project segment 303d listed?	No - not rated
Any portion of the project segment upstream of a 303d listed segment?	N/A
Reasons for 303d Listing or Stressor	N/A
% of Project Easement Fenced	0%

-60 -30 0 30 60

GRAPHIC SCALE

EDWARDS MILL RD. EXT.

385'

NCDOT R-O-W

375'

370'

Reach 1

Reach 2

NCDOT R-O-W

Floodway

365'

10.00

Richland Creek

Floodway

ROCK CROSS VANE

Veg Plot #1

COLLECTOR ROAD

585'

580'

575'

570'

565'

Floodway

24.00

ROCK CROSS VANE

Richland Creek

Floodway

100yr Flood Plain

Greenway

MATCHLINE SHEET 2

SYM.	DESCRIPTION	DATE	APPROVED

REVISIONS

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ENGINEERS • PLANNERS • SCIENTISTS

460I SIX FORKS ROAD

RALEIGH, NORTH CAROLINA 27609

RICHLAND CREEK
MONITORING PLAN VIEW
WAKE COUNTY
EEP PROJECT NUMBER 304 - MY01

DATE: 12-29-2005

SCALE: SEE SHEET

MONITORING PLAN SHEET SHEET 1

MATCHLINE SEE SHEET 1

–60 –30 0 30 60

GRAPHIC SCALE

EDWARDS MILL RD.EXT.

Reach 3

ROCK CROSS VANE

14

12

11

10

9

13

30+00

35+00

100yr Flood Plain

ROCK CROSS VANE
Not on original base map,
location approximated.

Veg Plot #2

ROCK VANE
Not on original base map,
location approximated.

Richland Creek

Sanitary Sewer

NCDOT R-O-W

390

365

370

375

NO.	DESCRIPTION	DATE	APPROVED
STAL	REVISIONS		

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RALEIGH, NORTH CAROLINA 27609

RICHLAND CREEK
MONITORING PLAN VIEW
WAKE COUNTY
EEP PROJECT NUMBER 304 - MY01

DATE: **12-29-2005**
SCALE: **SEE SHEET**

MONITORING
PLAN VIEW
SHEET 2

SHEET 2 OF 2

2.0 PROJECT CONDITIONS AND MONITORING RESULTS

2.1 Vegetation Assessment

2.1.1 Soil Data

Table 6. Preliminary Soil Data
Project Number and Name: 304 – Richland Creek

Series	Max Depth (in.)	% Clay on Surface	K	T	% OM
Chewacla	72	10-27	0.28	5	1-4

2.1.2 Vegetative Problem Areas

Table 7. Vegetative Problem Areas
Project Number and Name: 304 – Richland Creek

Feature/Issue	Station # / Range	Probable Cause	Photo #
N/A	N/A	See Photo Log and Narrative	

2.1.3 Vegetative Problem Area Plan View

N/A

2.1.4 Stem Counts

Table 8. Stem counts for each species arranged by plot
Project Number and Name: 304 – Richland Creek

Species	Plots		Initial Totals	Year 1 Totals	Survival %
	1	2			
Shrubs					
Sambucus canadensis	2	7	N/A	9	
Cornus amomum	9	9	N/A	18	
Alnus serrulata		5	N/A	5	
Trees					
Betula nigra	3		N/A	3	

Both vegetation plots are located within the streamside assemblage planting zones. The streamside assemblage zone is the only part of the planting plan that appeared to be planted at a density aimed at a successful number of stems per acre. The hardwood zones are made up of only balled and burlap trees that are not planted at a density high enough to attain traditional success criteria. The monitoring plots are rectangular in shape (measuring 5 meters by 20 meters) due to their location in the streamside assemblage zone. Within the streamside area, the plants appear to be in good condition. Some of the streamside vegetation along reach 3 appears to have been grazed on by beavers, but there was no evidence of a beaver dam in the immediate stream area.

The hardwood ball and burlap trees were stressed because of dry summer conditions. All of the trees had watering Treegator devices attached to them, but it did not appear that these had been used recently. Volunteer trees noted throughout the site include a large number of sweetgum (*Liquidambar styraciflua*) and loblolly pine (*Pinus taeda*) and a smaller number of yellow poplar (*Liriodendron tulipifera*). Invasive species did not appear to be a major problem at the site, but multiflora rose (*Rosa multiflora*), Chinese privet (*Ligustrum sinense*), and Russian olive (*Elaeagnus angustifolia*) were scattered throughout.

2.1.5 Vegetation Plot Photos

See vegetation plot photos in Appendix A2.

2.2 Stream Assessment

2.2.1 Stream Problem Areas Plan View

N/A

2.2.2 Stream Problem Areas Table

Table 9a. Stream Problem Areas
Project Number and Name: 304 – Richland Creek
Segment/Reach: Reach 1

Feature Issue	Station numbers	Suspected Cause	Photo #
No Visible Problems	N/A	N/A	

Table 9b. Stream Problem Areas
Project Number and Name: 304 – Richland Creek
Segment/Reach: Reach 2

Feature Issue	Station numbers	Suspected Cause	Photo #
Cross Vane – back or arm scour	20+85	unknown	SP1

Table 9c. Stream Problem Areas
Project Number and Name: 304 – Richland Creek
Segment/Reach: Reach 3

Feature Issue	Station numbers	Suspected Cause	Photo #
No Visible Problems	N/A	N/A	

2.2.3 Stream Issue Photos

N/A

2.2.4 Fixed Station Photos

Stream photos from established photo stations in Appendix B

2.2.5 Stream Assessment Tables

Table 10a. Categorical Stream Feature Visual Stability Assessment
Project Number and Name: 304 – Richland Creek
Segment/Reach: Reach 1

Feature	Initial	MY - 01	MY - 02	MY - 03	MY - 04	MY - 05
A. Riffles	100%	100%				
B. Pools	100%	100%				
C. Thalweg	100%	100%				
D. Meanders	N/A	N/A				
E. Bed General	100%	100%				
F. Vanes	100%	100%				

Table 10b. Categorical Stream Feature Visual Stability Assessment
Project Number and Name: 304 – Richland Creek
Segment/Reach: Reach 2

Feature	Initial	MY - 01	MY - 02	MY - 03	MY - 04	MY - 05
A. Riffles	100%	100%				
B. Pools	100%	100%				
C. Thalweg	100%	100%				
D. Meanders	100%	100%				
E. Bed General	100%	100%				
F. Vanes	100%	75%				

Table 10c. Categorical Stream Feature Visual Stability Assessment
Project Number and Name: 304 – Richland Creek
Segment/Reach: Reach 3

Feature	Initial	MY - 01	MY - 02	MY - 03	MY - 04	MY - 05
A. Riffles	100%	100%				
B. Pools	100%	100%				
C. Thalweg	100%	100%				
D. Meanders	100%	100%				
E. Bed General	100%	100%				
F. Vanes	100%	100%				

2.2.6 Quantitative Measures Summary Tables

Table 11. Baseline Morphology and Hydraulic Summary
Project Number and Name: 304 – Richland Creek

N/A

Table 12. Morphology and Hydraulic Monitoring Summary **Project Number and Name: 304 – Richland Creek**
No cross sections established for monitoring

Appendix A
Vegetation Raw Data

App A1 - Vegetation Data Sheet

Richland Creek Stream Restoration
Date : 10/19/05
Crew : A. Spiller

Plot #	River Birch *Betula nigra*	Silky Dogwood *Cornus amomum*	Elderberry *Sambucus canadensis*	Tag Alder *Alnus serrulata*	Total (Year 1)	Density (Trees/Acre)
1	3	9	2		14	567
2		9	7	5	21	850
			Average		709	

App A2 - Vegetation Monitoring Plot Photos

Plot 1 Photo – Taken from photo station 3 looking to center of vegetation plot across stream. Note rock cross vane in foreground. 10/19/05 - MY 01.

Plot 2 Photo – Taken from photo station 14 looking to center of vegetation plot across stream. 10/19/05 - MY 01.

Appendix B
Geomorphologic Raw Data

App B1 –Representative Stream Problem Area Photos

SP 1 (Reach 2) – Back arm scour on left arm of cross vane.

App B2 –Stream Photo-Station Photos

Photo Station 1 (Reach 1) – View looking southwest at the left bank and the slope above.

Photo Station 1 (Reach 1) – View looking southeast at the right bank and vegetation monitoring plot 1.

Photo Station 1 (Reach 1) – View looking upstream with rock cross vane in center of photo.

Photo Station 2 (Reach 1) – View looking downstream with culvert under Collector Rd. in center of photo.

Photo Station 3 (Reach 1) – View looking northeast, towards culvert under Collector Rd.

Photo Station 3 (Reach 1) – View looking southeast, with rock cross vane in center of photo.

Photo Station 4 (Reach 1) – View looking upstream, with rock cross vane in center of photo.

Photo Station 5 (Reach 2) – View looking north.

Photo Station 5 (Reach 2) – View looking northeast, towards greenway trail and water impoundment.

Photo Station 6 (Reach 2) – View looking downstream, towards rock cross vane.

Photo Station 6 (Reach 2) – View looking upstream, towards culvert under Collector Rd.

Photo Station 7 (Reach 2) – View looking downstream, with rock cross vane in foreground of photo.

Photo Station 7 (Reach 2) – View looking upstream, towards culvert under Collector Rd.

Photo Station 8 (Reach 2) – View looking upstream at rock cross vane, note loss of back fill material in front of cross vane arm on right side of photo.

Photo Station 9 (Reach 3) – View looking downstream towards culvert under Edwards Mill Rd.

Photo Station 9 (Reach 3) – View looking upstream towards two rock cross vanes.

Photo Station 10 (Reach 3) – View looking upstream at rock cross vane.

Photo Station 11 (Reach 3) – View looking upstream at rock cross vane.

Photo Station 12 (Reach 3) – View looking downstream towards culvert under Edwards Mill Rd.

Photo Station 12 (Reach 3) – View looking upstream.

Photo Station 13 (Reach 3) – View looking southwest towards left bank with Edwards Mill Rd. at the top of the photo.

Photo Station 14 (Reach 3) – View looking east towards right bank with vegetation monitoring plot 2 in lower right corner of photo.

Photo Station 14 (Reach 3) – View looking south.

App B3 –Qualitative Visual Stability Assessment

Table B1. Qualitative Visual Stability Assessment
Project Number 304 – Richland Creek (415 ft.)

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total Number per As-built*	Total Number / feet in unstable state	% Perform. in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	6	6	N/A	100	
	2. Armor stable (e.g. no displacement)?	6	6	N/A	100	
	3. Facet grade appears stable?	6	6	N/A	100	
	4. Stable interval grade?	6	6	N/A	100	
	5. Feature spacing appropriate?	6	6	N/A	100	
	6. Minimal evidence of embedding/fining?	6	6	N/A	100	
	7. Depth appears appropriate for current discharge?	6	6	N/A	100	
	8. Length appropriate?	6	6	N/A	100	**100**
B. Pools	1. Present? (e.g. no severe aggradation)	7	7	N/A	100	
	2. Sufficiently deep (Dmax pool:Mean Bkf > 1.6?)	7	7	N/A	100	
	3. Thalweg located outer bend?	7	7	N/A	100	
	4. Feature spacing appropriate?	N/A	N/A	N/A	N/A	
	5. Non-aggrading?	7	7	N/A	100	
	6. Length appropriate?	N/A	N/A	N/A	N/A	**100**
C. Thalweg	1. Upstream of meander bend centering?	2	2	N/A	100	
	2. Downstream of meander centering?	2	2	N/A	100	**100**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	2	2	N/A	100	
	2. Of those eroding, # w/ concomitant point bar formation?	2	2	N/A	100	
	3. Apparent Rc within spec?	N/A	N/A	N/A	N/A	
	4. Sufficient floodplain access and relief?	2	2	N/A	100	**100**
E. Bed General	1.General channel bed aggradation areas (bar formation)	N/A	N/A	0/0	100	
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	0/0	100	**100**
F. Channel Capac / Dimen.	1. Channel width:depth appears out of design/type spec?	N/A	N/A	0/0	100	**100**
G. Banks	1. Apparent scour points from channel processes	N/A	N/A	0/0	0.0	
	2. Apparent cut points from overland flow	N/A	N/A	0/0	0.0	
	3. Apparent cut or scour from flood water re-entry to channel (e.g. inadequate floodplain access?)	N/A	N/A	0/0	0.0	
	4. Tension cracks	N/A	N/A	0/0	0.0	
	5. Unstable cantilever blocks (e.g. height/undercut/soil type versus vegetation penetration and extent)	N/A	N/A	0/0	0.0	
	6. Collapse/slumping	N/A	N/A	0/0	0.0	
	7. Ratio of bank height: bankfull height elevated	N/A	N/A	0/0	0.0	**100**
H. Vanes	1. Free of back or arm scour?	4	5	N/A	80	
	2. Height appropriate?	5	5	N/A	100	
	3. Angle and geometry appear appropriate?	5	5	N/A	100	
	4. Free of piping or other structural failures?	5	5	N/A	100	**95**