

Richland-Hyatt-Raccoon Creeks Restoration Project

319 Program Grant Final Report

March 2013



Sponsor: Southwestern NC Resource Conservation & Development Council

DWQ Contract: #2843, FY 2009

Contract Period: January 1, 2010 – December 31, 2012; Extension: March 31, 2013

Federal Dollar Amount: \$184,888.00

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ACKNOWLEDGEMENTS

The Richland-Hyatt-Raccoon Creeks Restoration Project was funded under a US Environmental Protection Agency Section 319 Grant. The partnering organizations and personnel were:

- Haywood County Commissioners
- Haywood County Environmental Health Department: Garron Braddish, Adam Jones, Steve Valentine
- Haywood County Erosion & Sediment Control: Marc Pruett
- Haywood Soil and Water Conservation District: Ryan Manning, Leslie Smathers, Duane Vanhook, Bill Yarborough
- Haywood Waterways Association: Jane Falkenstein, Christine O'Brien, Eric Romaniszyn
- NC Clean Water Management Trust Fund:
- NC Department of Environment and Natural Resources
 - Division of Environmental Health: Stephen Brinson, Chuck Cranford, Terrell Jones
 - Division of Water Quality: Ted Campbell, Bryn Tracy, Ed Williams
- NC Department of Transportation: Owen Anderson
- NC State University: Jason Zink
- NC Wildlife Resources Commission: Scott Loftis, Dave McHenry
- Community Foundation of Western North Carolina Pigeon River Fund
- Southwestern NC Resource Conservation & Development Council: David Dudek, James Ferguson
- Tennessee Valley Authority: Martha Podren
- Town of Waynesville
- University of Tennessee-Knoxville: Joyce Coombs
- USDA Natural Resources Conservation Service: Kara Cassals
- Western Carolina University: Jerry Miller

TABLE OF CONTENTS

Acknowledgements	ii
List of Tables	iii
List of Figures	iii
List of Acronyms.....	iv
Executive Summary	v
1.0 Introduction	1
2.0 Purpose and Goals	1
3.0 Deliverables.....	2
4.0 Methodology/Execution.....	6
5.0 Outputs and Results	9
5.1 BMP Implementation	9
5.2 Instream Water Quality Measurements	9
5.3 Measurable Results	10
6.0 Outcomes and Conclusions	11
7.0 Budget	13
8.0 References	14
Appendix A. Photos	15
Appendix B. Richland Creek Watershed Best Management Practices Project Site Maps	18
Appendix C. Photographs of Pollutant Sources	22

List of Tables

Table 1. BMPs and Project Locations.	10
Table 2. Fecal Coliform Bacteria Data (2010).....	10
Table 3. Farmers Branch ISCO Stormwater Data	12
Table 4. Richland-Hyatt-Raccoon Creeks Restoration Project budget.....	13

List of Figures

Figure 1. Location of the Richland Creek Watershed	2
Figure 2. Richland Creek Watershed Monitoring Sites	7

List of Acronyms

BMP	Best Management Practice
DWQ	NC Division of Water Quality
NCSU	NC State University
RC&D Council	Southwestern NC Resource Conservation & Development Council
TSS	Total suspended solids
TVA	Tennessee Valley Authority
USEPA	US Environmental Protection Agency
WaDE	Wastewater Discharge Elimination
WAP	Watershed Action Plan

EXECUTIVE SUMMARY

The Richland Creek watershed in Haywood County, NC contains streams of high quality water. However, there are several streams on the list of impaired waterways, which have been attributed to nonpoint source pollution impacts associated with urbanization, erosion and sedimentation. Richland Creek is not supporting its uses due to impaired biological integrity (benthos, fish) and fecal coliform bacteria. Raccoon Creek is not supporting its uses due to impaired biological integrity (fish). The Lake Junaluska reservoir is not supporting its uses due to high pH.

The **Richland-Hyatt-Raccoon Creeks Restoration Project** is a collaborative effort by the Richland Creek Restoration Group, a partnership of multiple stakeholders working to improve water quality in the Richland Creek watershed and remove streams from the impaired waterways list. Other goals address protecting water quality for downstream landowner uses, supporting fish populations in Richland Creek, reducing water quality and economic impacts to the watershed; and providing clean water for recreation. Early in this project, a 1.6 mile section of Richland Creek was delisted, which is a tribute to the efforts of partners and stakeholders and an indication of their commitment to improving water quality.

The purposes of this project were to create a Watershed Action Plan to guide future restoration efforts, begin implementing best management practices (BMPs) that lead to restored stream uses, gather public support, and collect stream water quality data. The monitoring efforts helped characterize the watershed and identify BMPs to address nonpoint source pollution issues, which aided in WAP development. Monitoring was also used to document water quality improvements from the three BMP projects.

Project deliverables and outcomes included:

- (1) Creation of the Richland Creek Watershed Action Plan;
- (2) Stabilizing 3,428 linear feet of stream banks; reductions in sediment loads were found at the primary BMP site as TSS was reduced 11.3% and turbidity 39.3%;
- (3) Constructing 2,628 linear feet of stormwater controls;
- (4) Planting 4,628 linear feet of riparian vegetation;
- (5) Completing 29 septic repairs with three more in progress; when complete these repairs will eliminate as much as 11,520 gallons of untreated wastewater from flushing into streams each day;
- (6) Completing 30 press releases;
- (7) Giving 97 presentations, including several to public officials;
- (8) Promoting multiple efforts towards floodplain protection and ordinances that protect water quality;
- (9) Issuing 13 quarterly and two annual reports; and
- (10) Completing a final project report to project partners and sponsors.
- (11) Other outreach successes include an informational webpage, stream signage, newsletter articles, radio program, rain barrel construction workshop, and public displays.
- (12) Other BMP successes include DWQ starting fish reintroductions to Richland Creek, DWQ completing a study of potential impacts from septic systems on wells, creation of the Lake Junaluska Assembly Stormwater Management Plan, and initiating geologic stability mapping.

Watershed work is an iterative process. During this project, the partnership developed considerable skills and resources that will make it successful in future restoration efforts. The Richland Creek Watershed Action Plan will guide that work and will ultimately lead to delisting of the impaired waterways. Several BMP projects are already in development; efforts to eliminate sources of bacteria will be a primary objective along with reduction of stormwater impacts and sediment loads.

1.0 INTRODUCTION

The Richland Creek Watershed is in southwest Haywood County (Figure 1) and is a major tributary in the Pigeon River Watershed (8-digit HUC = 06010106). Richland Creek is a fifth-order stream that is nearly thirteen miles long and has over 170 miles of perennial and intermittent tributaries. The watershed contains 43,638 acres (68 mi²) and is mostly forested with some agriculture. Developed areas in the watershed are mainly confined to the city of Waynesville along Richland Creek. Many commercial enterprises are present. Paved and unpaved roads are abundant with new ones being constructed to accommodate new residences, second-home communities, and a growing tourism industry.

The watershed has significant implications for Haywood County, the Town of Waynesville and the Lake Junaluska Assembly. Its' streams provide aesthetic value and high quality water for drinking, recreation, agriculture, and industry. Richland Creek flows through Waynesville and into Lake Junaluska, a popular recreation center and retreat that provides over \$40 million per year to the local economy. Streams in the watershed support good populations of trout, which attracts thousands of visitors each year. Richland Creek is managed as Hatchery Supported Trout Waters and the Waynesville is a "Mountain Heritage Trout Water" city by the NC Wildlife Resources Commission. The lower Richland Creek watershed also carries the NC Division of Water Quality's (DWQ) Tr classification (trout waters).

The NC Ecosystem Enhancement Program identified Richland Creek as one of 29 targeted local watersheds in the French Broad River basin with the greatest need and opportunity for stream and wetland restoration efforts (EEP 2009). Richland Creek is also one of the US Environmental Protection Agency (USEPA) Region Four's Restoration Watersheds and is a priority stream for the Tennessee Valley Authority (TVA). TVA identifies Richland Creek as a sensitive waterbody with potential to ecologically improve; they support local organizations and encourage efforts to improve and maintain water quality.

Even though the watershed contains streams of high quality water, there are several streams on the list of impaired waterways, which have been attributed to long-term nonpoint source pollution impacts associated with urbanization, erosion and sedimentation (DWQ 2005). Richland Creek is not supporting its uses due to impaired biological integrity (benthos, fish) and fecal coliform bacteria (DWQ 2011). Sources of bacteria include failing septic systems, municipal sewer systems, and livestock waste. Raccoon Creek is not supporting its uses due to impaired biological integrity (fish). The Lake Junaluska reservoir is not supporting its uses due to high pH, which has been partially attributed to eutrophication of the lake and subsequent algal blooms. When this project began, Hyatt Creek was also on the list. However, the stream was delisted in 2010 but continues to be on the "watch list" by local agencies and organizations.

The **Richland-Hyatt-Raccoon Creeks Restoration Project** is a collaborative effort by the Richland Creek Restoration Group, a partnership of multiple stakeholders working to improve water quality in the Richland Creek watershed. Group members include Southwestern NC Resource Conservation & Development Council (RC&D) Haywood Soil & Water Conservation District, Haywood Waterways Association, Haywood County Environmental Health Department, Lake Junaluska Assembly, NC DWQ-Asheville Regional Office, TVA, Haywood County Commissioners, and the Town of Waynesville.

2.0 PURPOSE AND GOALS

The ultimate goals of the Richland Creek Restoration Group are to have listed streams meet NC water quality standards and be removed from the list of impaired waterways. The other long-term goals are to: (1) protect water quality for downstream landowner uses; (2) support fish populations; (3) reduce water quality and economic impacts to Richland Creek and its' tributaries; and (4) provide clean water for recreation.

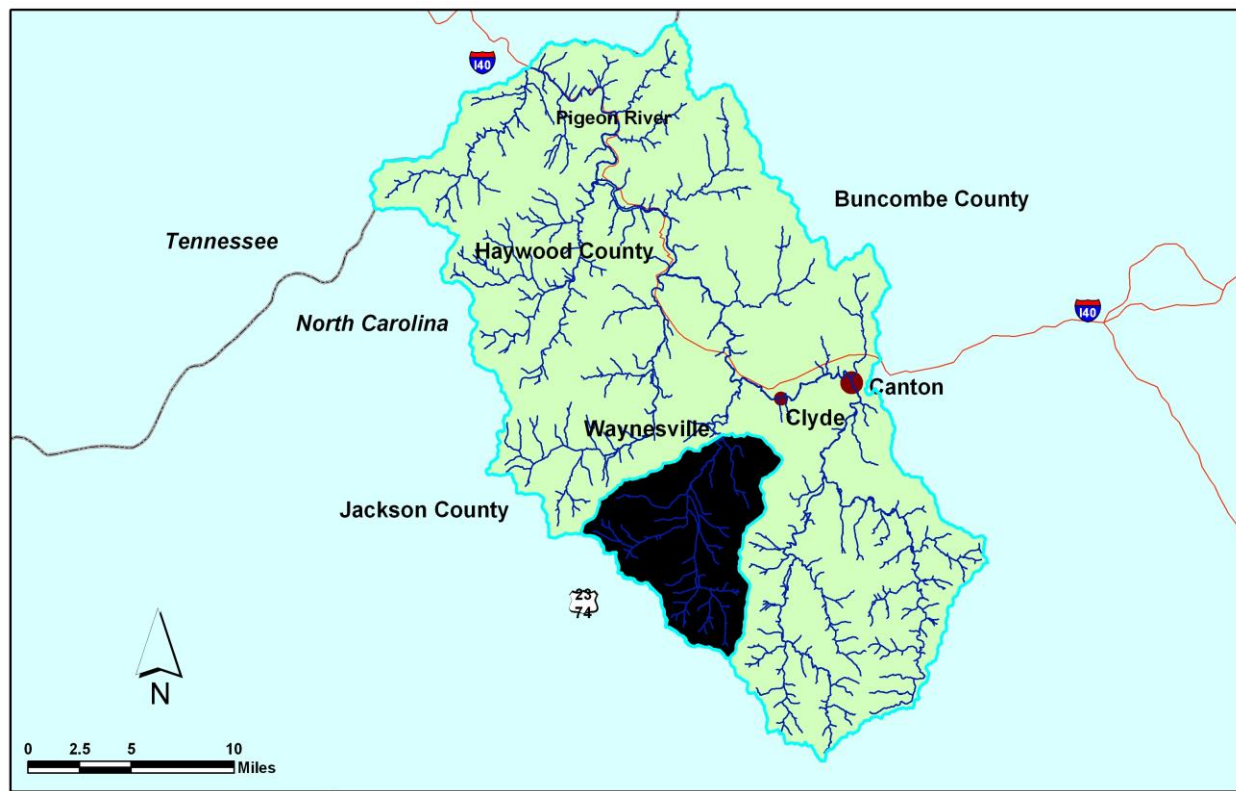


Figure 1. Location of the Richland Creek Watershed

The group began this effort through acquisition of an US Environmental Protection Agency Section 319 Grant as administered by DWQ. There were two primary objectives of this grant.

1. Develop a watershed action plan (WAP) to guide restoration efforts in the Richland Creek watershed; a watershed containing two impaired streams, Richland Creek and Raccoon Creek, as well as Lake Junaluska, an impaired reservoir.
2. Begin implementing best management practices (BMPs) that lead to restored uses to Richland Creek. The practices focused on (1) public education, (2) stream bank erosion, (3) limited riparian vegetation, (4) stormwater erosion, and (5) untreated wastewater. Specific BMPs included planting riparian vegetation, slope modifications, instream benches, and repairing failing septic systems.

The partnership also collected water quality data to document baseline conditions for the WAP and water quality improvements for the BMP projects.

3.0 DELIVERABLES

(1) Create the Richland Creek Watershed Action Plan:

- The plan was completed and will guide restoration efforts throughout the watershed.
- Project partners will continue to collect information about the water and revise the plan as necessary.

(2) Stabilize 2,400 lf of stream banks:

- Total = 3,428 lf.
- Project #1 (Farmers Branch) = 2,400 lf.

- Project #3 (Shelton Branch) = 1,028 lf. This project differed from the original grant application. Projects #3 and #4 in that application did not occur; those projects would have planted 520 linear feet of riparian vegetation. After the 319 grant was submitted, the town expedited those projects to take advantage of available resources. The partnership then identified one replacement location along Shelton Branch.

(3) Construct stormwater controls along 2,400 lf of stream:

- Total = 2,628 lf
- Project #1 (Farmers Branch) = 1,600 lf.
- Project #3 (Shelton Branch) = 1,028 lf of instream benches and slope modifications; also included 500 gallon cistern to help control storm water runoff from town maintenance building. This project differed from the original grant application. Projects #3 and #4 in that application did not occur; those projects would have planted 520 linear feet of riparian vegetation. After the 319 grant was submitted, the town expedited those projects to take advantage of available resources. The partnership then identified one replacement location along Shelton Branch.

(4) Plant riparian vegetation along 2,020 lf of stream:

- Total = 4,628 linear lf.
- Project #1 (Farmers Branch) = 2,400 lf.
- Project #2 (business along Richland Creek) = 1,200 lf.
- Project #3 (Shelton Branch) = 1,028 linear feet. This project differed from the original grant application. Projects #3 and #4 in that application did not occur; those projects would have planted 520 linear feet of riparian vegetation. After the 319 grant was submitted, the town expedited those projects to take advantage of available resources. The partnership then identified one replacement location along Shelton Branch.

(5) Survey properties for septic system discharges and gray water discharges, and provide corrective measure as necessary:

- 4 repairs were completed with funds from the 319 Program grant.
- 12 repairs were completed by the state's Wastewater Discharge Elimination Program.
- 13 repairs were completed with funds from the Pigeon River Fund (four grants) and TVA (two grants); three more are in progress.
- The violations included 28 blackwater to surface or stream and one graywater. The three repairs in progress are blackwater issues.

(6) Complete three initial press releases regarding water quality issues and the Richland-Hyatt-Raccoon Creeks Restoration Project. Continue publishing one press release per quarter throughout project period

- Haywood Waterways published 30 press releases. Topics included:
 - Stormwater impacts,
 - River-friendly farming,
 - Riparian vegetation,
 - Preventing erosion and sedimentation at the home,
 - Septic system maintenance and signs of failure,
 - Proper well maintenance,
 - Home water conservation tips,
 - Fish relocations to Richland Creek,
 - Proper car maintenance,
 - Conservation-minded car washing techniques,
 - Proper disposal of pet waste,

- Stream and watershed signage,
 - Drinking water awareness and protection,
 - Stream clean-ups, and
 - Completion of the Green Valley Mobile Home Park package treatment plant upgrades.
- Other outreach efforts included:
 - Four articles in Haywood Waterways' membership newsletter;
 - Four articles in Waynesville's town newsletter;
 - TVA's Insider newsletter published an article about work in the Hyatt Creek subwatershed;
 - US Fish & Wildlife Service did a Creature Feature radio program on the fish reintroductions.
- Additional media outreach efforts will be pursued as the strategies of the Richland Creek Watershed Action Plan are implemented.

(7) Create a Richland-Hyatt-Raccoon Creeks informational webpage that will be linked to Haywood Waterway's website and available to the public:

- Haywood Waterways' completed their new website, which includes a page dedicated to the Richland Creek Restoration Project.
- The page will be updated as watershed restoration progress is made.

(8) Host two public meetings on water quality issues and the Richland-Hyatt-Raccoon Creeks Restoration Project. Special presentations to update our County Commissioners and Town of Waynesville will also be given annually

- Haywood Waterways gave 97 presentations throughout this project. This included five to County Commissioners and one to Town of Waynesville at their public meetings. Other target audiences included schools, community clubs, summer camps, and churches.
- The typical focus of the presentations was water quality issues of the county with emphasis of the Richland-Hyatt-Raccoon Creeks Project. Many focused solely on the Richland Creek project.
- Other topics included:
 - BMP solutions,
 - Water conservation,
 - Riparian vegetation,
 - Developer certification process,
 - Fish reintroductions to Richland Creek,
 - Benthic macroinvertebrate monitoring, and
 - Landslide hazard mapping program.
- Other public outreach efforts included:
 - Rain barrel construction workshop to raise awareness of stormwater issues,
 - Special display for the Waynesville Public Library about water quality and stormwater, and
 - Stream and watershed signage.
- Additional public meetings and outreach will be held as the strategies of the Richland Creek Watershed Action Plan are implemented.

(9) Promote floodplain protection and ordinances that protect water quality:

- Several partners are participating in a Regional Erosion & Sediment Control Initiative, which is working to create ongoing, affordable, and comprehensive erosion and sediment control training in western NC. Several counties have ordinances requiring contractors attend periodic trainings. This is not required in Haywood County. The project partners are promoting mandatory trainings in all counties. As a supplemental effort, Haywood Waterways is promoting a developer certification program that would help ensure erosion and sediment control measures are installed and maintained correctly.

- A Clear Water Contractor training was sponsored by several partners. The program is eight-hour training on erosion and sediment control for contractors, equipment operators, developers, excavators, and anyone else clearing land. Part of the program includes special precautions to take when working near water (ex. riparian buffers).
- Haywood Waterways worked with three local businesses develop Green Sustainability Plans that focus on protecting and improving water quality. This was part of the Haywood County Chamber of Commerce's Green Initiative that worked with businesses to protect the environment. The program is currently on hiatus while attempting to recruit new businesses.
- Haywood Waterways is serving on the Technical Advisory Committee to the Mountain Resources Commission, a commission sponsored by the NC General Assembly to address the various issues of the mountain region. Much of the focus is on steep slope development and water quality and includes recommendations for protective ordinances. The Committee completed a Western North Carolina Vitality Index (www.wncvitalityindex.org) that will be a decision-support tool for local leaders regarding development issues.
- The Southwestern NC RC&D Council and Haywood Waterways have privately funded the creation of landslide hazard maps for Haywood County. The project is based on the state program recently cut from the budget. The County and many others support this initiative as the maps will help raise awareness of proper construction techniques for the mountain region. Once completed, the maps may be included in county and municipal construction ordinances.
- Several partners are participating in GROWNC, a Sustainable Communities Initiative funded by the U.S. Department of Housing and Urban Development. GROWNC is focused on economic competitiveness and job creation for western NC with regards to several key parameters, including preservation and enhancement of natural resources. The goal is to demonstrate what future economic growth looks like for the region and make recommendations that will help sustain the key parameters. Two of the objectives will be promotion of legislation and policies that help sustain the region's values.
- Several partners are working on the Linking Lands and Communities initiative, an effort that "works with leaders from across our region to develop a strategic plan for conservation and development. The project brings together data from public, private, and non-profit sources, resulting in a series of maps and other tools that can be used to help guide land use decisions across the landscape.

(10) Issue quarterly and annual progress reports to project partners and sponsors:

- The Southwestern NC Resource Conservation & Development Council and Haywood Waterways completed 13 quarterly reports and two annual reports.
- All reports were sent to project partners and sponsor.

(11) Issue a final project report to project partners and sponsors:

- This report completes this deliverable.

(12) Present the outcomes of the project at a regionally or nationally recognized meeting:

- The partnership is pursuing this deliverable.
- Options include Stream Restoration in the Southeast (NCSU, offered in 2014), Mid Atlantic Stream Restoration Conference (Resource Institute, Inc.), and River Rally (River Network).

4.0 METHODOLOGY/EXECUTION

The Richland Creek Restoration Group was formed to draft the Watershed Action Plan and lead the stream restoration efforts. The partnership received a \$226,820 grant from the DWQ Section 319 Non-Point Source Pollution Control Grant program. The partnership also received fourteen supplemental grants; these include NC Clean Water Management Trust Fund (2), Pigeon River Fund (6), Haywood County Community Foundation, TVA (2), Toolbox Implementation Fund of the Mountain Landscapes Initiative, Foundation for the Carolinas, and New Belgium Brewing.

The WAP was developed by local agencies and organizations with knowledge of the issues facing the watershed. The partnership used DWQ (2007) and USEPA (2008) as guidance tools. Bimonthly meetings provided the partnership with the venue for discussions. Meeting minutes and quarterly and annual reports kept the partnership up to date on project progress.

The WAP will guide future restoration efforts. The plan documents current water quality conditions, watershed stressors, strategies to improve water quality, and technical and financial resources available to implement the strategies. The strategies address stormwater, eroding streambanks, riparian vegetation, and sources of animal and human waste. The partnership will continue to meet on a regular basis to revise the plan as changes in the watershed occur.

Monitoring of several water quality parameters was completed as part of WAP development and to document water quality improvements after BMP implementation. Site locations are found in Figure 2. The partnership wrote a Quality Assurance Project Plan to guide these efforts. The parameters included:

- Water chemistry (Volunteer Water Information Network parameters: alkalinity, turbidity, TSS, conductivity, copper, lead, zinc, ortho-phosphate, ammonia-nitrogen, and nitrate/nitrite-nitrogen),
- Water temperature,
- Substrate analysis (particle size distribution, percent substrate composition),
- Single-stage stormwater sediment,
- Stormwater sediment and nutrient loadings,
- Fecal coliform bacteria, and
- Biological communities (benthic macroinvertebrates, fish).
- Integrated Pollutant Source Identification data set, which is a GIS-based non-point source loading model that the partnership is using to identify potential pollution sources, plan restoration efforts, and model pollutant load reductions.

Data for WAP development can be found in the Richland Creek WAP; it includes data from stakeholder sources or prior projects where available. Data pertaining to BMP projects is found within this document.

Along with the WAP, several BMP projects were completed to begin the water quality improvement process. These included bank stabilization, riparian vegetation, and wastewater treatment projects. The stream work was coordinated by the Haywood Soil & Water Conservation District, which included engineering plans, permitting, and construction oversight. The projects were managed on a 75-25 cost-share basis, with the property owners contributing 25% of the cost.

Before being defunded by the state, the Wastewater Discharge Eliminations (WaDE) Program worked with Mountain Projects Community Action Agency of Haywood County and Haywood County Environmental Health Department when completing septic system repairs. Staff from the WaDE Program identified projects through door-to-door

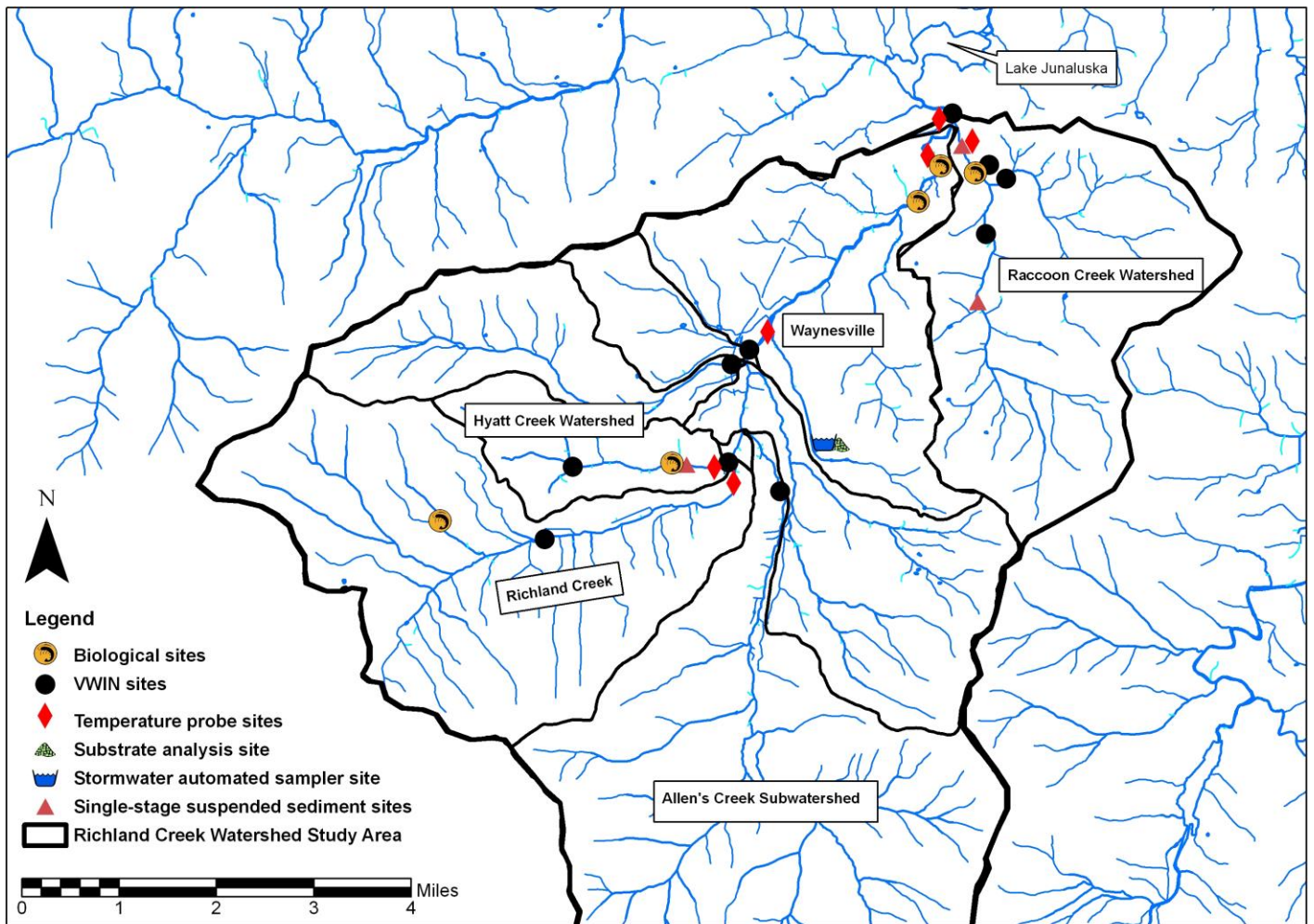


Figure 2. Richland Creek Watershed Monitoring Sites

solicitation. When a failing system was identified, the Wade Program provided up to 100% repair or replacement cost to qualified low-income homeowners. Mountain Projects coordinated this funding through grants and/or forgivable deferred loans. Non-qualifying homeowners were eligible for 75-25 cost-share funds from the 319 Program, Pigeon River Fund, and TVA grants, with the homeowner responsible for 25% of total cost. All repairs were put out to bid on by local contractors known to have extensive experience.

For non-WaDE funded wastewater treatment projects were coordinated by Haywood Waterways Association and the Haywood County Environmental Health Department. The Environmental Health Department was responsible for locating potential septic repair sites. Project partners then prioritized projects with the greatest need. Two criteria were used, proximity to stream and severity of failure. Those considered blackwater adjacent to a waterway received the highest priority. The Environmental Health Department then evaluated the sites and issued repair permits, provided construction oversight, and inspected final installations. Repairs included construction of standard systems but alternative systems were used depending on depth of water, proximity to other property owners, and slope. For two projects, the wastewater system was connected to the Town of Waynesville sewer line.

Repairs were managed on a 75-25 cost-share basis, with the property owners contributing 25% of the cost. Homeowners were required to obtain three bids and work with project partners to select the best

contractor. Once the final inspection passed, Haywood Waterways was responsible for issuing payments directly to the contractors for all grants except the 319 Program; the RC&D Council was responsible for issuing those payments.

Haywood Waterways was responsible for education and outreach with assistance from project partners and watershed stakeholders. A variety of methods were used to build support for the Richland Creek restoration work, increase citizen awareness of water quality issues and solutions, and recruit willing landowners to participate in future water quality improvement work. These methods included press releases, public meetings, community organization meetings, watershed signs, an informational webpage (http://www.haywoodwaterways.org/richland_creek.html), newsletter articles (Town of Waynesville and Haywood Waterways), and special publications. The special publications were Haywood Waterways' *It's Not Just Dirt; Stewardship Begins in Our Backyards*, *A Landowner's Guide to Protecting Our Land and Streams*; *State of the Watershed*; *Haywood County Growth Readiness Roundtable, Final Report and Recommendations*; *Innovative Stormwater Controls Case Study: Bethel Elementary School*; and *What Regulations Affect Land Disturbing, Land Clearing, Development, and Construction Projects*.

As a tribute to the significance of this project and contributions from the partnership, several projects developed that were not part of the original plan:

- DWQ is leading an effort to reintroduce several fish species back to Richland Creek. These are species that were once present in the stream but disappeared due to poor water quality and the Lake Junaluska dam. Between 2010 and 2012, DWQ released warpaint shiner, river chub, mirror shiner, saffron shiner, mottled sculpin, rock bass, fantail darter, greenfin darter and Tuckasegee darter. Follow-up sampling found several species dispersing upstream and downstream on their own. Project partners believe the reintroductions are going very well. Additional reintroductions will occur in 2013 with continued monitoring over the next five years.
- Due to the number of septic systems repaired in the Hyatt Creek watershed, DWQ completed a study of the potential impact of septic systems on ground water quality in a mildly sloped, fractured rock setting. No significant impacts were found.
- The Lake Junaluska Assembly worked with Haywood Waterways to create a stormwater management plan for the property. The plan (1) documents existing stormwater infrastructure, (2) identifies areas where stormwater is negatively impacting LJA property and its natural resources, (3) recommends BMPs to reduce or eliminate impacts, (4) prioritizes BMP locations, and (5) provides maps of the proposed improvements. Recommended BMPs include bio-retention, constructed wetlands, bio swales, and extended detention and filtration chambers. The BMPs, if implemented, will treat up to 90% of runoff. The plan will be used to acquire funds to implement the stormwater BMPs.
- RC&D Council and Haywood Waterways initiated mapping of landslide hazards in the Richland Creek watershed. When complete, the maps will identify areas that have questionable geologic stability and require further study to determine the appropriate engineering practices necessary for construction of homes, roads, and/or other land clearing purposes. As a result of the maps, there will be greater understanding and acceptance of building to the suitability of the land. Haywood Waterways has data identifying mountainside roads as the #1 source of sediment to local streams. The map information will help prevent erosion and stream sedimentation if house sites and roads are less erosive. Project partners will use the information in Resource Assessment for Mountainside Developments projects, which have been shown to save developers money by reducing the amount of unnecessary infrastructure and maintenance of poorly designed construction or unstable property.
- The Pigeon River Fund provided financial support for repairing failing septic systems.

The partnership will use the results of this project to guide on-going efforts to improve the Richland Creek watershed as well as other impaired waterways. Watershed work is an iterative process. During this project, the partnership continued to develop considerable skills that will make it successful in future restoration efforts. The high degree of collaboration between the partners continues to demonstrate what

can be achieved when like-minded organizations cooperate. It also provides the local support, stakeholder buy in, and financial resources necessary to improve and protect degraded watersheds. These are critical characteristics for any group wanting to improve and protect water quality.

5.0 OUTPUTS AND RESULTS

5.1 BMP Implementation

Three stream restoration projects were completed. Information for each is found in Table 1 and site maps are found in Appendix B. In addition, multiple septic repairs were completed throughout the watershed.

Project #1, as identified in the original grant application, restored 2,400 linear feet of streambanks along Farmers Branch. Improvements included riparian vegetation, slope enhancements, and some bank hardening with boulders. Two historical detention ponds were retained as wetlands. The business owners also refurbished a third detention pond that will provide some stormwater controls.

Project #2 set 100 plants along 1,200 linear feet of riparian vegetation along Richland Creek. Plants included winterberry holly, blueberries, beautyberry, and spirea. In-kind matching donations were provided by business staff and Haywood Waterways.

In the original grant application, Projects #3 and #4, which planned to plant 520 linear feet of riparian vegetation, did not occur. After the 319 grant was submitted, the town expedited those projects to take advantage of available resources. The partnership then identified one replacement location along Shelton Branch (new Project #3). The project stabilized 1,028 linear feet of streambanks with riparian vegetation, it also included instream benches, and slope modifications. Plans were created by NCSU through a grant from the USEPA. The Town of Waynesville completed construction with oversight from the Haywood Soil & Water Conservation District. Included in the project was placement of a 500 gallon cistern to help control storm water runoff and provide water for the town's landscaping services.

There were 28 septic repairs completed with a mix of funding from the 319 Program, Pigeon River Fund, and TVA. The violations included 27 blackwater to surface or stream and one graywater. There are also three more repairs in progress; all are blackwater issues. Two of the repairs connected the home to the Town of Waynesville sewer system due to the severity of the repair and proximity to the stream and town infrastructure. An additional blackwater issue was also repaired with TVA funds. This involved a cracked residential sewer line directly over a stream.

5.2 Instream Water Quality Measurements

Water quality data were collected by several project partners throughout the grant cycle. Project partners are working with USEPA to upload the data into the national STORET database. The data collected for development of the WAP are presented in the WAP. The data reported in this document were collected to document water quality improvements associated with BMP projects.

Stormwater loadings: Stormwater samples were collected by Haywood Waterways using an automated ISCO sampler. Multiple samples were collected prior to BMP construction and post-construction.

Fecal coliform bacteria: Fecal coliform bacteria samples were collected by DWQ throughout the watershed (Table 2). However, due to limited resources DWQ could only collect through the first three quarters of the grant and project partners did not have their own resources to continue monitoring. Haywood Waterways will be starting a fecal bacteria monitoring program in 2013.

Table 1. BMPs and Project Locations

Project	BMPs	Latitude/ Longitude	Drainage Area Captured (acres)
1	2,400 lft riparian vegetation 1,600 lft stormwater controls 2,400 lft riparian vegetation	35.4648 / 82.9898	240.2
2	1,200 lft riparian vegetation	35.5001 / 82.9795	4,623.2
3	1,028 lft riparian vegetation Slope modification Instream benches	35.5113 / 82.9748	1,243.9
4	29 Septic repairs	Multiple locations	All

Table 2. Fecal Coliform Bacteria Data (2010)

Stream	Location	Mean	Range
Richland Creek	UPS confluence with Hyatt Creek	452	200-730
Richland Creek	DWS confluence with Hyatt Creek	1,080	370-1,900
Richland Creek	At Elsynia Road	354	180-700
Richland Creek	At Water Street	428	120-730
Richland Creek	UPS Shelton Branch	390	120-700
Shelton Branch	Confluence with Richland Creek	638	180-1,000
Richland Creek	DWQ ambient, UPS confluence of Raccoon Ck and Lake Junaluska	430	280-800

5.3 Measurable Results / Load Reductions

Seven measurable results were anticipated from this project:

- (1) Creation of the Richland Creek Watershed Action Plan, a plan that will guide water quality improvement projects in the watershed.

Results: The plan was completed and will guide restoration efforts throughout the watershed. Project partners will continue to collect information about the water and revise the plan as necessary.

- (2) Stabilize 2,400 lf of stream banks.

Results: Two projects stabilized 3,428 lf of streambank.

- (3) Construct stormwater controls along 2,400 lf of stream.

Results: Two projects constructed stormwater controls along 2,628 lf of stream.

- (4) Reduce stormwater associated total suspended solids (TSS) and turbidity by 50% downstream of Project #1 on Farmers Branch, the site where stormwater controls and stream bank restoration will be implemented.

Results: The data indicate high total suspended sediment (TSS) concentrations and turbidity during rain events (Table 3). Reductions in sediment loads were noted as TSS was reduced 11.3% and turbidity 39.3%. The original goals were 50% reduction for both parameters. However, the project was completed out of the growing season. Once the vegetation is full established, they will provide additional stability to the streambanks and further reduce sediment loads to Farmers Branch.

- (5) Plant riparian vegetation along 2,020 lf of stream.

Results: Three projects planted 4,628 lf of riparian vegetation.

- (6) Repair all failing septic systems identified during the grant cycle.

Results: There were 29 repairs completed and three more in progress.

- (7) Reduce non-natural sources of fecal coliform contamination from Hyatt Creek and the section of Richland Creek upstream of the confluence with Hyatt Creek. Average fecal coliform counts will be reduced 10% by the 6th quarter and 25% by the 11th quarter.

Results: The 29 repairs eliminated as much as 10,440 gallons of untreated wastewater from flushing into streams each day; the three repairs in progress will eliminate another 1,080 gallons for a total of 11,520 gallons per day. No data on fecal coliform counts are available as no post-repair monitoring was completed.

6.0 OUTCOMES AND CONCLUSIONS

The primary goals of this project were to create the Richland Creek Watershed Action Plan and begin water quality improvements that will ultimately remove multiple streams from the state list of impaired waters. This project was an extension of the Hyatt Creek Restoration Project and ongoing efforts by project partners and watershed stakeholders. Early in this project, a 1.6 mile section of Richland Creek was delisted, which is a tribute to the efforts of partners and stakeholders and an indication of their commitment to improving water quality.

It is also an indication that progress is being made on the partnerships long-term goals. Implementing BMPs to reduce the impacts of stormwater, streambank erosion, and failing septic systems resulted in improved water quality, which is helping protect water quality for downstream users, support trout populations in Richland Creek, reduce water quality and economic impacts to Richland Creek and Lake Junaluska; and provide clean water for recreation. Since Richland Creek flows through Waynesville, these improvements will benefit a large proportion of Haywood County citizens and the tourism industry.

The partnership also implemented comprehensive monitoring and education programs. The water quality information was critical for characterizing watershed conditions and development of the WAP. The data provide the baseline conditions necessary to guide future restoration efforts. Some of the data was also critical for documenting water quality improvements associated with BMP implementation.

Table 3. Farmers Branch ISCO Stormwater Data

Table 3: Farmers Branch ISCC Stormwater Data				
Date	TSS (mg/L)	Runoff Estimate (ft ³)	TSS (pounds)	Turbidity (NTU)
<i>Pre-Construction</i>				
11/25/11	102.8	158,248	1,015.54	39.0
12/1/11	177.6	344,635	3,820.93	85.0
12/8/11	154.9	28,072	271.45	100.0
1/24/12	79.4	49,696	246.33	73.8
2/6/12	40.0	40,827	101.95	38.0
3/1/12	118.0	13,932	102.63	80.0
3/7/12	139.9	117,966	1,030.25	100.0
4/18/12	197.6	116,721	1,439.80	140.0
9/8/12	144.2	217,675	1,959.48	75.0
<i>Average Pre-Construction =</i>			1,109.82	81.2
11/30/2012	Farmers Branch Project Completed			
<i>Post-Construction</i>				
12/11/12	117.2	88,061	644.29	70.0
1/6/13	117.2	448,881	3,284.17	85.0
1/31/13	32.8	292,816	599.56	16.0
2/8/13	60.0	131,561	492.77	31.0
2/22/13	109.6	104,570	715.46	65.0
2/26/13	46.8	57,612	168.32	29.0
<i>Average Post-Construction =</i>			984.09	49.3
<i>Percent Reduction =</i>			11.3%	39.3%
Standard =	>100 considered high			10 Trout 50 General

Conversions: 1 ft³ = 28.31605 L; 1 g = 1,000 mg; 1 lb = 453.59237 g

The education campaign included press releases, newsletter articles, publications, presentations, informational webpage, and stream signage to raise awareness of water quality and instill environmentally responsible behaviors in the community. Supportive evidence for meeting this objective comes from the number of participants at public meetings, requests from other organizations for information and presentations on the project, and positive support from local public officials. The partnership understands and believes that education programs that change minds and behaviors provide the best long-term solution for protecting water quality.

There were several obstacles overcome in this project. At Project #1, the landowners had financial issues and were not able to provide the match estimated in the initial grant application. However, the actual cost estimate was less than original expected. While this meant some funding had to be returned to the 319 Program, it also meant significant cost savings and faster construction period.

Another obstacle was found at Project #3. In the original grant application, Projects #3 and #4, which planned to plant 520 linear feet of riparian vegetation, did not occur. After the 319 grant was submitted, the town expedited those projects to take advantage of available resources. The partnership then identified one replacement location along Shelton Branch (new Project #3), which was also on town property. This project is providing much greater benefit for water quality as it also includes several additional streambank stabilization techniques (benches, slope enhancements, cistern).

The final obstacle found in the project was the limited availability of funds for septic repairs, in part due to the state eliminating the WaDE Program in 2011. Due to the significant need for repairs in the

community, project partners had to acquire funding from other sources. The Pigeon River Fund and TVA were two sources that supplemented the 319 Program funds. Project partners will continue to seek support from other sources to continue these repairs, which are considered one of the best BMPs to have the most significant and direct improvements to water quality.

This report completes Phase II of the partnerships efforts, which was based on the successful Hyatt Creek Restoration Project. The USEPA watershed handbook discusses watershed work as an iterative process (USEPA 2008). It is the partnerships intention that there will be a Phase III, and with each phase the group can build from successes and lessons learned to ensure the long-term protection of water quality. Phase III will be focused on implementing the Richland Creek WAP. Several BMP projects are already in development; efforts to eliminate sources of bacteria will be a primary objective along with reduction of stormwater impacts and sediment loads.

7.0 BUDGET

Table 4. Richland-Hyatt-Raccoon Creeks Restoration Project Budget <i>Budget vs. Actual Expenses</i>					
Budget Categories	Section 319 Budget¹	Section 319 Actual Expenditures	Non-Federal Match * Budget	Non-Federal Match * Actual Expenditures	Justification
Salary and Benefits			\$59,656.00		
Travel			\$17,080.00		
Equipment	\$8,696.00	\$8,695.63	\$13,210.00	\$7,561.98	Temperature probes, ISCO automated sampler, Cistern
Supplies					
Monitoring (Contractual)	\$11,845.00	\$11,845.00		\$63,730.14	chemistry, biological, bacteria, stormwater, temperature, substrate, QA plan
Education (Contractual)	\$6,225.00	\$6,082.47		\$13,416.00	Presentations, press releases, webpage, newsletters, displays, meetings
Construction (Contractual)	\$135,687.00	\$108,000.00		\$57,304.00	BMP projects construction ²
Contractual Services	\$8,740.00	\$27,617.00	\$98,310.00	\$94,679.80	WAP development, travel, BMP projects
Other			\$315,050.00	\$156,250.00	
Total Direct	\$171,193.00	\$162,240.10		\$392,941.92	
Indirect	\$13,695.00	\$13,695.00			Project admin., audit, fidelity bond and reporting
Total	184,888.00	\$175,935.10	\$503,306.00	\$392,941.92	
	27%	31%	73%	69%	
*Note: Non-Federal match must be a minimum of 40% of the total project budget					

¹Based on approved budget revision January 2013

²Includes only septic system repairs and Farmers Branch project construction

8.0 REFERENCES

Ecosystem Enhancement Program. 2009. French Broad River Basin Restoration Priorities 2009. North Carolina Department of Environment and Natural Resources.

NC Division of Water Quality. 2005. French Broad River Basinwide Water Quality Plan.

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NCDWQ. 2007. Guidance for Preparing Watershed Plans.

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Appendix A. Photos



Photo 1. Stream signs



Photo 2. Richland Creek



Photo 3. Raccoon Creek



Photo 4. Farmers Branch (Project #1; note: additional riparian trees and shrubs to be planted in spring 2013)



Photo 5. Richland Creek riparian plantings (Project #2)



Photo 6. Shelton Branch (Project #3)

**Appendix B. Richland Creek Watershed
Best Management Practices Project Site Maps**



Figure B-1. Farmers Branch (Project #1)



Watershed Acreage- 4,623.2

All data in this map is in the State Plane coordinate system.
Datum: NAD 83 Units: feet

Figure B-2. Richland Creek Riparian Plantings (Project #2)



Figure B-3. Shelton Branch (Project #3)

Appendix C. Photographs of Pollutant Sources



Eroding streambanks



Channelization and inadequate riparian buffers



Poor pasture and animal access



Landslides



Wastewater infrastructure



Stormwater and litter